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"Revisiting Beta Dynamics in Indian Stock Market: An Empirical CAPM Exploration"

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Abstract
In this article, the stock market of India is examined using the widely used CAPM asset pricing model in finance. Statistical methods like t-test, regression, and generalized methods of moments (GMM) were employed to compare actual and predicted returns and determine the coefficients. The model's accuracy and efficacy are confirmed using Gretl, EViews, and SPSS. The GRS p-value suggests that the market element is insufficient to explain the return, in accordance with the study's conclusions. This leads one to conclude that the beta is statistically significant based on the beta p-value. It follows that both small and large size portfolio results have been significantly influenced by thepremium of market risk. Because they have evidence to disqualify the null and accept the alternative hypothesis, the authors conclude that market risk significantly influences asset returns, as seen by the beta coefficient.

Keywords: Asset pricing models, Beta, Capital Asset Pricing Model, Indian stock Market, One factor model.

1. Introduction

Challenges have always been faced regarding the explanationof the decision process of the investors within the stock market. Referring to this context, the investor's behavior has a close association with the decisions of investments and the process of enriching (Riyadh and Ismayil 2015). Major issues in finance are "rate of return" (ROR) and its associated determinations. One of basic criteria is the ROR for resource allocation and analyzing the return and risk. Observation can be made of their importance, in the domain of corporate and personal finance while definingthe feasibility of an investment and making decisions regarding investments. Stock returns are always regarded as the primarily factor when investors going to invest their money in financial market. Involvements of higher profits are correlated with higher risk, and vice versa. Investors should take into account their decision of money investing in alignmentof risk-taking abilities. Developments of many models and theories have been done for guiding investors while making measurement of the proper risk related to a mentioned return level, which will help investors to easily make a decision. These kinds of models and theories have been practiced at all times in various markets. Anomalies can take place under various conditions of the market (RAMDY, 2011)

Over the past ten years or so, a boost in the number of students has been witnessed, researchers in academia and industry, approaches, and models (Costis& Skiadas, 2009). Investors prefer low risk, but may consider higher risk if profits are greater. Financial assets are susceptible to many events that can be related to the issuer, industry, country, or the world. Financial risks and returns are hard to quantify due to constantly changing external factors (Back 2017)(Silvestri 2015) Investors can take advantage of standard benefits if the asset is priced appropriately for them. The rate of return and its determination are the most important concerns in finance. Higher risk has resulted in more profit, and vice versa. (Riyadh &Ismayil, 2015). (Back 2017) Asset pricing theory states that riskier assets yield higher returns to compensate investors. Investors should buy more of high-return securities and less of low- return securities until they have equal returns. The choosing of assets within a portfolio is dependent on the return correlation between risky assetand themarket portfolio. As a result, covariance has become the relevant asset risk measure, determining the appropriate asset anticipated return of risky asset (Qadeer, De Moor, and Ahmad 2022). For over 50 years, asset pricing models have evolved since Harry Markowitz mean variance analysis in contemporary portfolio theory (1952) explained the risk return connection. Markowitz suggests selecting assets based on their expected return (average) and variation or standard deviation (risk). An efficient portfolio with large cap securities shows that the model can help with portfolio selection. Despite its adaptability to various portfolio situations, the Markowitz model has several barriers (Dhannur 2022). Return covariance between risky assets and the market portfolio determineschoosing of portfolio asset. Thus, covariance determines risky asset expected returns. Sharpe (1964),Treynor, Mossin (1966), and Lintner (1965) developed risk asset return models on the basis of this principle. "Capital Asset Pricing Model" (CAPM). CAPM formalizes the relationship between risk-return by setting price of assets as per portfolio risk (wijst, 2000).

As per the model, rewards are to be presented to investors in two means,like systematic risk and time value of money. The free rate is utilized for the measure of time value of money and the beta is the use for measuringthesystematic risk. Explanation is simply provided by the model about the link between return andriskrelated to an asset. The risk and return relationship is explained by the CAPM equation as follows:

$$Ri = Rf + \beta i \, (Rm - Rf) \quad \textbf{(1)}$$

Where:

Ri = The asset i expected return or cost of capital

Rf = the risk free rate

βi = the beta of asset i

Rm = the expected return on the market

This study's main objective is to evaluate the performance of CAPM models in order to identify the model power of explaining stock return and Beta relevance in Indian stock market and to ascertain whether any modifications to these models are necessary in order to enhance their performance. Furthermore, it involves thorough analysis of the literature that already exists and how they are utilized in the stock market of India. This will advance our knowledge of models related to asset pricing in the Indian context and provides insight on how well they predict stock return. In addition, it also provide empirical evaluation over the assessment and performance of CAPM. The study aims to reveal or understand the significance and influence of the beta coefficient in the context of the "Capital Asset Pricing Model" (CAPM). An effort to delve deeper into the understanding of beta's role. Hence, the entire study suggests a thorough investigation and analysis of CAPM in the Indian Context. This specifies that the primary focus of the exploration is the "Capital Asset Pricing Model" (CAPM), and it is applied within the specific context of the Indian financial market. The study seeks to understand how CAPM, particularly the role of beta, operates in the real-world conditions of the Indian financial landscape. In summary, the title suggests that the research aims to uncover and understand the practical impact and significance of beta in the application of CAPM in the Indian financial context, using real-world data to support its exploration and analysis. In summary, the research aims to uncover and understand the practical impact and significance of beta in the application of CAPM in the Indian financial context, using real-world data to support its exploration and analysis.

1.1 Research Objectives

1. Create a CAPM model for predicting stock returns and analyzing their performance in the stock market of India.
2. Compare the "capital asset pricing model" (CAPM) to real portfolio return

1.2 Research Hypothesis

Null Hypothesis

1. No prominent effect is there for the market factor on the portfolio associated with each of the six portfolios.

2. There is no significant predicting difference between return of each of the six portfolios

predicted by the CAPM

3. No significant forecasting accuracy is present, which differentiates between all of the six portfolios predicted by the "Fama and French" model and every six real portfolios return

2. Literature Review

The "Capital Asset Pricing Model" (CAPM), developed by William Sharpe, John Lintner and Jack Treynor in the 1960s, served as the basic framework for establishing the relationship between risk and expected returns (Fama and French 1996). (N. v. wijst 2012) It has been implied by CAPM that in equilibrium the excess return that is expected on any single risky asset is proportional to the expected excess returnon the market portfolio. CAPM assumes that the risk premium portion of a security's expected return is defined as a function of the systematic risk of the security, i.e. Beta. (AbhayRaj,Priyachocha,Nitalalakiya, Chocha, and Lalakiya 2017; Balakrishnan 2016; Basu and Chawla 2010; Chaudhary 2016; Dhankar and Singh 2005; jenetjyothi D souza an soumysshetty 2019; Ratra 2017) has tested the efficiency and validity of CAPM either in BSE or NSE in Indian stock market and results indicates that the CAPM fails and have negative relationship is displayed between beta and excess return and highlights that capital market is inefficient. The use of the CAPM model to choose the company's shares may result in incorrect predictions to potential investors. The cause of inapplicability of CAPM is difference between expected and actual result is potentially greater at normal levels of risk. There is not much explanatory power of CAPM and recommended for search of alternative models for the asset price in India. Even though

there is a weak correlation between realized excess return and expected return as per CAPM, It is indicated by higher R square that systematic factor have a significant contribution on stock returns and beta should be modified to better represent systemic factors. (Sreenu 2018) (Rabba 2018) results) that beta is unable the relation between return and risk hence, CAPM is invalid to determine whether a higher risk is covered by a higher expected return and whether the connection is linear between expected return and risk, if a complete measure of risk is beta. The outcomes highlight that the intercept is insignificantstatistically. (jenetjyothi D souza an soumysshetty 2019) examined CAPM in selected industries and except for "Power Grid Corporation Of India Ltd", "HCL Technologies Ltd", HCL Technologies Ltd, "Indusind Bank Ltd", "Bajaj Finance Limited", "Hindustan Unilever Ltd", "Bajaj Auto Ltd", "TATA Consultancy Services Ltd", "Hero Moto Corp Ltd", and "Maruti Suzuki India Ltd", In the majority of portfolios, results vary according to beta coefficient in these companies. CAPM is valid in PSU, oil & gas, IT industry, Automobile and CAPM is invalid in Metal, FMCG and consumer goods industry in BSE (Singh 2017).

3. Methodology

Via the utilization of methodology used in ("Fama and French 1993") we put the "Capital Asset Pricing Model" (CAPM) and to the Indian Stock. Gretl, EViews and SPSS software are used for analysis.

3.1 Data Description

This analysis covers the period from April 2000 to March 2023 (279 observations) using monthly stock prices for companies consisted in the S&P BSE 500 and the BSE 200 return are taken as a proxy for annual market return. The BSE 500 website, CMIE Prowess, Kenneth data library and the RBI's handbook of statistics on Indian economy are the sources of all the data applied in this study. 91 day Treasury bill issued by "Reserve bank of India" is used as proxy for risk free rate (Rf). Market Capitalization is used as proxy for size and Book – Equity /Market– Equity ratio is used as proxy for Value. Data of literature review is the review of CAPM, FF3FM their comparative study in Indian stock market.

3.2 Dependent and Independent variables

3.2.1 Dependent Variable

- **Monthly Return**

The following formula is used to translate the closing prices into monthly return data:

$$Rt = (Pt - Pt{-}1)\,/P\,t{-}1 \quad (2)$$

Where,

Rt = stock i's return in period t Pt is the stock i's closing price in period t

Pt-1 is the stock i's closing price in period t-1.

- **Dependent Variables Portfolios**

As per the model, the portfolio's return sensitivity is due to three factors—namely, (i) the excess return on a broad market portfolio (RM- Rf), (ii) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, small minus big), and (iii) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio ("Fama and French 1993"). At June's end, the portfolios are constructed. BEME is calculated as book value at the former calendar year's fiscal year end divided by ME at the end of December. Computations are performed on average monthly value-weighted returns for each portfolio from June of year t to July of year t+1. In each year's June, stocks that are sample are ranked based on the category of size (Market capitalization). In technique of single sorting, the "median sample size" is then utilized to divide the companies acting as sample into two categories: small (S) and big (B). We can use different breakpointstwo in number: first based on the market capitalization (10:90) and another, median based (50:50). Book equity to market equity (BE/ME) or Price to Book ratio (P/B) is proxy for value effect. It can also be highlightedthat the end of financial year in India is in March every yearfor all companies.

Further, based on three values, mimicking portfolios containing equal weightage are created in June every year (t) using a technique of single sort. ("Fama and French 1993") use 30%:40%:30% on BE/ME, bottom 30% (Low), middle 40% (Medium) and top 30% (Growth) of the ranked values breakpoints based on BE/ME or The BE/ME ratio lies below 30% is termed as value and above 70% is growth, in between called neutral. Through the use of technique of double sorting, two sets of 2 x 3, six portfolios in total, where each are constructed from the cross of portfolios received from single sort. Then construct six portfolios ("S/L, S/M, S/H, B/L, B/M, B/H") from the intersection of the two size and three BE/ME groups. For instance, the S/L portfolio consists of stocks that are present in the small size group and also in the low BE/ME group while B/H contains of big size stocks that are accompanied by highratios of BE/ME. Equally-weighted returns monthly on the six portfolios are quantified from the July of every year t to June of year t+1, and re-formation of the portfolios are done in June of year t+1 (Gregory Connor, Sanjay Sehgal 2001).

Table 1:

Variable description of CAPM

Variables	*Description*
R_p	Returnon portfolioi
R_f	RiskFreerateofreturn
R_p-R_f	Monthlyexcessreturn of theportfolio (returnon portfoliominusrisk freerate)
R_m	Returnon marketportfolio
R_m-R_f	Excessmarketreturn(returnonmarketfactorminusriskfree rate)
α_i	Intercept(constant)
β_i,	Regressionco-efficientformarketfactor(RM-Rf)
ε_i	Residualterm/error term

The ***dependent variables:***

R_p-R_f: is representative of the weighted average return of all the firms in each portfolio of the six portfolios are mentioned below.

R_f: risk free rate of return

1) ***RSH***, which is return of Portfolio for companies that are high Book-to-Market level and small group;

2) ***RSM***, which is return of Portfolio for companies that are medium Book-to-Market leveland small group;
3) ***RSL***, which is return of Portfolio for companies that are low Book-to-Market level and small group.
4) ***RBH***, which is return of Portfolio for companies that are high Book-to-Market level and big group;
5) ***RBM***, which is returnof Portfolio for companies that are medium Book-to-Market level and big group;
6) ***RBL***, which is return of Portfolio for companies that are low Book-to-Market level and big group

3.2.2 Independent Variable

- **Factor Portfolio Construction of Independent Variables**

The method used to create the portfolios of independent components is similar. The 30% breakpoint pertains to book-to-market, whereas the 70% and 50% breakpoints for size were taken into consideration. Thus, a variety of firms were included in each of the six value- weighted portfolios, "S/L, S/M, S/H, B/L, B/M", and B/H. "SMB = (RSL+RSM+RSH-RBL- RBM-RBH)/3" is the formula used to compute the SMB portfolio based on these portfolio results. As "RHML = (RSH +RBH-RSL-RBL)/2", the HML portfolio returns are defined. A second value-weighted portfolio was constructed, represented by Mkt, and it includes all of the firms in the portfolios.

The independent variables encompass the following:

(1) ***Market Portfolio - RM:***Borrowing and lending will be cancelled out to form the market return portfolio, which is the total portfolio of all individual investors. Stated otherwise, it is equivalent to the total wealth of the state economy. The weighted average return of each stock in the sample is what Fama and French use to calculate (Rm-Rf).

4. Analysis

In this study, the researcher hasevaluated two regressions for the returns of stock: the first regression that utilizes market return Rm to demonstrate the stock market return.

4.1 Summary statistics of Explanatory variables

The summary statistics of the explanatory variables like Mkt given below

Table 2: Summary Statistics, using the observations 2000:04 - 2023:03

SummaryStatisticsforMKT -RF	
Mean	6.6691
Median	10.720
Minimum	-38.340
Maximum	35.200
Std.Dev.	19.656
C.V.	2.9473
Skewness	-0.57714
5%Perc.	-35.224
95%Perc.	34.310
IQrange	30.510
t value	1.608

From the table 2, the authors has finds that the excess market return (Mkt – RF) has the highest mean of 6.6691 (t = 1.608) There's an increased likelihood of the association between Mkt - rf which is capable of accurately forecasting the portfolio return.

4.2. Summary Statistics of factor portfolio

Table 3: Summary Statistics, using the observations 2000:04 - 2023:03

Variable	Mean	Median	Min	Max	Std.Dev.	C.V.	Skewness	Ex. kurtosis
BL	1.3503	0.69684	-30.019	39.773	11.281	8.3547	0.28980	0.78354
BM	1.6197	1.7776	-29.841	36.398	9.2731	5.7251	0.21938	1.2616
BH	1.1893	1.0631	-28.142	32.828	7.1929	6.0478	-0.073151	2.1906
SL	1.8454	1.5172	-33.074	56.986	12.184	6.6022	0.47176	1.3383
SM	1.5143	1.7238	-33.421	52.527	9.9968	6.6015	0.24708	2.2509
SH	1.1631	2.0675	-32.375	50.143	9.1594	7.8753	0.044656	2.7315

Six test portfolios, arranged by size and book-to-market equity, as well as three factor portfolios, provide summary data covering the period from April 2000 to March 2023. The first column shows the test portfolios' and MKT's mean excess monthly returns (as a percentage), as well as the mean monthly returns on the SMB and HML risk factors established through the Fama-French (1993) method. From the table 6, the summary statistics of the factor portfolio returns are provided and among that the portfolio with small size and low BE/ME companies (SL or SV) have high Mean and S.D (1.8454, 12.184). But the t ratio, which is associated with the coefficients of the independent variables, is high for BN portfolio (4.885) i.e., Big size company and Medium of Neutral BE/ME ratio. That means there's a good chance the matching independent variable, RBN or RBM can accurately predict the dependent variable, all of the firms' returns in each of the six portfolios.

4.4. Unit root test

Hypotheses for the unit root tests of the variables are given below:

H0: an overall unit root exists in the series

H1: no overall unit root exists in the series

The study's variables can only be subjected to econometric analysis if the series are stationary, or there is no unit roots.

Table 4: Unit root test

Variables	AugmentedDickey-Fullertest (ADF)	
	Tstatistic	***Probability(P)***
RBG	-15.10923	0.0000
RBN	-16.10035	0.0000

RBV	-16.59127	0.0000
RSG	-15.50898	0.0000
RSN	-16.59015	0.0000
RSV	-16.07782	0.0000

The outcomes of the unit root test are shown in Table 8. The two test results show that there are no unit roots and that the variables are stationary as in all cases the low P-values (near to zero) suggest that you can discard the null hypothesis of a unit root, indicating that the data for these variables are stationary.

4.5. Empirical Execution of CAPM

Table 5: Regression analysis of CAPM

CAPMModel						
Portfolio Returns	**R^2**	**Adj.R^2**	**α**	**Pvalue**	**β**	**Pvalue**
RBG	0.395	0.610	0.000164	0.2847	1.566	0.0010
RBN	0.549	0.516	0.000295	0.6513	0.468	0.0000
RBV	0.789	0.702	0.00056	0.8047	0.580	0.0002
RSG	0.384	0.525	0.000684	0.5041	0.848	0.0000
RSN	0.794	0.903	-0.00027	0.8588	1.132	0.0000
RSV	0.336	0.738	0.000326	0.1402	0.455	0.0000
GRSStatisticsPvalue AverageAdjustedR^2						0.3250
						0.8324
						0.667

The above given table 5 is the applicability of the CAPM model for prediction of stock return and it can be concluded that as it is a single factor model, Mkt factor, the R^2, the value which is the percentage that the independent variable; market returns or the market risk premium, explains of the variation in the dependent variable; stock returns, is ranging from 0.336 to 0.794. The R^2 and Adjusted R^2 values suggest that the portfolios are moderately fitted by the CAPM It suggests that, in accordance with the CAPM, variations in stock returns is mostly explained by changes in market returns. Market returns or the market risk premium accounted for a greater proportion (in case of RSN) of the variation in stock returns. This also highlights that variables other than market risk are affecting stock returns as the R^2 is not 1. So the dependent variable is influencing by other factors than the market factor. Average adjusted R^2 is 0.667 and GRS test, evaluating the asset pricing models' performance through examining the statistical significance of variables to contribute for the variating in the asset returns, is 0.3250 indicates that market factor is not enough to explain the return and demands additional factors. 66.7% of the variance in portfolio returns among the portfolios can be explained by the CAPM on average, according to the average adjusted R^2 of 0.667. The high (0.8324) GRS p-value indicates that there may not be statistical evidence supporting the market factor's relevance across portfolios. This may lead to the exploration of different models.

Positive alphas indicate abnormal results that are not attributable to market risk. However, alphas for RBG, RBN, RBV, RSG, RSN, and RSV are around zero, indicating that their p-values do not support the hypothesis that they are statistically significant. According to the null hypothesis associated with the P-value, the market return has no significant effect on the portfolio return for any of the six aforementioned portfolios. The null hypothesis is to be discarded on the basis of p-value in relation to the 1% significance level. For minor portfolios, the market risk premium's coefficients are 0.45, 1.13, and 0.85. Additionally, the large portfolios' coefficients of the independent variable, the market return, are 1.57, 0.47, and 0.59. Researchers get the conclusion that the beta is statistically significant as a result of this. This implies that the market risk premium has a prominent impact on the small and big size portfolios returns. The authors conclude that market risk strongly influences asset returns, as indicated by the beta coefficient, since they have evidence to discard the null and accept the alternative hypothesis.

4.6. Comparison between CAPM model and Real returns of Portfolios

4.6.1. Measuring the coefficients from the GMM Regression Results Capital Asset Pricing Model

"Rp-Rf = αi + βi (RM-Rf)" **(3)**

Table 6: Intercept and Coefficient of CAPM using GMM regression

	Model		Coefficients	TValue	Pvalue	DW	AIC
1	RBG=α+β*RM	Intercept	0.0711	0.254	0.0409	1.987	
		RMβ	0.8989	15.109	0		6.347
2	RBN=α+β*RM	Intercept	0.0719	0.261	0.0095	1.996	5.863
		RMβ	0.9607	16.1	0		
3	RBV=α+β*RM	Intercept	0.0754	0.275	0.0063	1.997	5.871
		RMβ	0.9891	16.591	0		
4	RSG=α+β*RM	Intercept	0.0989	0.261	0.0093	1.977	6.513
		RMβ	0.9272	15.508	0		
5	RSN=α+β*RM	Intercept	0.0103	0.298	0.0031	1.966	6.333
		RMβ	0.9927	16.59	0		
6	RSV=α+β*RM	Intercept	0.0709	0.169	0.0907	1.941	6.731
		RMβ	0.9607	16.077	0		

Table 6 shows the intercept and the coefficient six portfolios. Based on the low p-values (typically < 0.05) for the RM coefficients, it appears that the RM variable is significant statistically in explaining the variability in each of the dependent variables (RBG, RBN, RBV, RSG, RSN, and RSV).The "Akaike Information Criterion", or AIC, assessesthe model's goodness of fit by taking intoconsideration both the model's probability and the numeric value of parameters. When the value of AIC is lower, likeliness of the model being better.

Then, model RBN= α+β*RM is the better model.

4.2.2 Paired Sample t Test Results

Table 7 exhibits the results of comparison between measures of forecast accuracy as perCAPM model GMM Regression, and comparison results between forecast curacy measures according to CAPM model using GMM regression and the real returns associated with the six portfolios. The outcome in table no 7 displays that we can't discard the null hypothesis:

There is no prominent difference in forecasting accuracy between return of each of the six portfolios forecasted by the CAPM model via (GMM) and each of the real six portfolios returns because the P Value is greater than 10% significant level for the six portfolios.

Table 7: Comparison result based on T test

Comparison	T value	df	P Value	Null Hypothesis
GMMCAPM&RealPortfoliosReturns ofBG Portfolio	1.172	1	0.450	Accept
GMM CAPM & Real Portfolios Returns of BN Portfolio	1.162	1	0.452	Accept
GMM CAPM & Real Portfolios Returns of BV Portfolio	1.438	1	0.387	Accept
GMM CAPM & Real Portfolios Returns of SGPortfolio	1.439	1	0.432	Accept
GMMCAPM&RealPortfoliosReturnsofSNPortfolio	1.021	1	0.493	Accept
GMMCAPM &Real PortfoliosReturns ofSV Portfolio	1.159	1	0.453	Accept

The above provided table outlines the results of hypothesis testing, comparing GMM CAPM (Generalized Method of Moments "Capital Asset Pricing Model") with the real portfolio returns for various portfolios. The interpretation based on the p-values and "degrees of freedom" (df);

1. With a p-value of 0.450 and df of 1, the null hypothesis is accepted. This suggests that there is no significant statisticaldifference between GMM CAPM and the real portfolio returns for the BG Portfolio.

2. Similar to the BG Portfolio, the p-value of 0.452 with df of 1 leads to the acceptance of the null hypothesis. There is no significant statisticaldifference between GMM CAPM and the real portfolio returns for the BN Portfolio.

3. With a p-value of 0.387 and df of 1, the null hypothesis is accepted. There is no significant statisticaldifference between GMM CAPM and the real portfolio returns for the BV Portfolio.

4. As seen in BV Portfolio, the p-value of 0.432 with df of 1 leads to the acceptance of the null hypothesis. There is no significantstatistical difference between GMM CAPM and the real portfolio returns for the SG Portfolio.

5. With a p-value of 0.493 and df of 1, the null hypothesis is accepted. There is no significant statistical difference between GMM CAPM and the real portfolio returns for the SN Portfolio.

6. Similar to other portfolios, the p-value of 0.453 with df of 1 leads to the acceptance of the null hypothesis. There is no significantstatistically difference between GMM CAPM and the real portfolio returns for the SV Portfolio.

In each case, the p-values are larger than common significance levels (e.g., 0.05), leading to the acceptance of the null hypothesis.

This implies that, based on the test results, there is no significantstatistical difference between the GMM CAPM and the real portfolio returns for the specified portfolios.

5. Conclusion and Practical Implications

The asset pricing model's performance can be determined in context to how the model performs while explaining the returns variations over time of an underlying asset. The most well-known and practical model is the "Capital Asset Pricing Model" (CAPM; one factor model: market return), which was developed in the 1960s by Sharp and others. The classic CAPM, which proposed that predicted returns were purely based on a stock's beta, a measure of its susceptibility to market fluctuations. The GRS (Gibbons, Ross, and Shanken) p-value indicates that the market element alone is inadequate to account for the observed returns, aligning with the study's findings. Consequently, it is inferred that the beta is significant statistically based on its associated p-value. This implies that both small and large-size portfolio outcomes have been notably impacted by the market risk premium. The authors, having proof to discard the null hypothesis and the alternative hypothesis is accepted, draw the conclusion that market risk performs a vital role in influencing asset returns, as evidenced by the beta coefficient.

This data can facilitate investors make better decisions about their investments and better manage their portfolios. Through this study, financial institutions and investors can have a better understanding the risks involved with trading on Indian stock markets. The study can assist investors in creating more effective risk management strategies by identifying the variables that affect asset values. Investors may be capable of achieving higher returns and reduced risk by including these aspects in their investment strategies. By doing this, investors are able to recognize the factors responsible for influencing asset values and thereby optimize their portfolios. This study might can assist regulators in developing better rules and regulations to support stability and transparency in Indian stock markets by identifying the factors that affect asset pricing. Either through factor-based investing, where investors can build portfolios based on the different factors that influence asset values, investors can include asset pricing models into their investment strategies. Portfolios can be built using value, momentum, or quality factors. Models for asset pricing can be used by investors to build factor-based portfolios by assisting in the identification of the factors most likely to influence returns. Investors can reduce their risks and create more effective risk management strategies by knowing the factors. On the basis of current market conditions, tactical asset allocation can be done using asset price models. An investor may devote more of their portfolio to investments that are exposed to a certain factor if a model predicts that factor will likely perform well in the present market environment. Understanding the models and the variables that affect asset prices in detail is necessary in order to incorporate asset pricing models into investment strategies. Factors inclusion in asset pricing models will helps to investors to improve their risk management and help to protect investor’s portfolio from potential losses.

6. Further Scope of Action

Asset pricing models might perform differently throughout a range of time periods. Future studies can assess the model’s performance in variety of market conditions and time frames and understand the variables that affect the performance. Researchers can conduct further study to examine ways to include macroeconomic variables into asset pricing models with reference to Indian stock markets. This can help get a better idea of how the economy affects the prices of assets and make the models more accurate. The impact of sustainability and social responsibility on asset prices can be better understood by including environmental, social, and governance (ESG) aspects into asset pricing models in stock markets of India. The asset prices in Indian stock markets can be significantly impacted by political and economic events like elections and changes in policy. Future studies can assess how asset pricing models perform in such situations and identify the variables that affects their performance.

Further, Asset pricing models in the Indian stock markets can use “machine learning” (ML) techniques like“support vector machines”, “deep learning”, “neural networks”, random forests etc. These methods can help find complex patterns and connections in the data and make the models quite effective. Financial time series data from Indian stock markets can be analysed using “artificial intelligence” (AI) and techniques of deep learning like “convolutional neural networks” and “recurrent neural networks”.

Studies can also compare the performance of each model using various evaluation techniques, such as Mean Squared Error (MER), Sharpe ratio, Jensen's alpha, Bayesian Information Criteria (BIC), etc. to ascertain which model is the most effective at estimating stock returns in the Indian context. When comparing the performance of various models, the model selection will be based on the research question, available data, and factors like sample size, robustness, data quality, market conditions, transaction cost, complexity, sample selection bias, etc. which can affect the performance significantly and should be carefully considered when evaluating the predictive power of the models along with considering limitations and assumptions of each models to interpret the results in the context of Indian market.

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