Validation of Asset Pricing Models with respect to Indian Capital Markets as a Developing Economy

Sinjini De Sarkar – A037
Gopal Goyal – B015
Jatin Khurana – B023
Khushi Agarwal – B029
Manan Vora – C018

ABSTRACT

The following research study focuses on the Indian capital market as a wider scope of developing economies. We understand the functioning of capital markets in general as well as the structure of the same in the Indian economy. We will look into differences between developing and developed economies. The paper makes a deeper analysis of whether the Capital Asset Pricing Model stands true for the Indian Capital Market over a duration of 10 years' data. Similarly a hypothetical portfolio was created to assess the validity of the Fama- French model. We also give an analysis of how the market capitalisation to GDP ratio could give any kind of insight to whether the CAPM model gets replicated in that country's capital market. The paper concludes with a real view analysis beyond the theory of the asset pricing models and verdict on a model which gives better results in the case of a developing economysuch as India.

Key words: *Asset Pricing Model, CAPM, Fama-French model, Buffett Indicator, Developing economies, Developed economies.*

INTRODUCTION

The CAPM model effectively establishes a relation between the risk-return paradigm involved in the capital markets. The formula for the same takes into the account market beta for gauging risk to reach the expected return from the intended investment. The CAPM model since its inception has been debated whether it can show a justifiable picture or not. However, ever since has become a widely accepted model forming the backbone of the capital markets and further study and modernisation of financial theories. One of the examples of the same is the Fama French model that was developed much later and has created a similar sense of satisfaction in financial academia as well as the industry for its efficiency in gauging the capital markets. A similar space for debate however stays for the viability of such pricing models in different kinds of functioning economies in the world today. Two of the very broadly distinguished labels in macro-economic terms are developed and developing economies. There lies considerable talk about how these models act to raw inputs catering to developing economies like India, since most of them were made with a more sophisticated market in mind.

Source: Marcellus.in/blogs

The Efficient Market Hypothesis (EMH), which contends that as share prices efficiently discount all the readily available information in the market, it is impossible to beat the market. This has formed part of vigour in the financial literature and comes under scanning radar as can be seen in many cases in the past and recent history, like the GameStop bull race which ran many investing firms dry. Past trends have often pointed out how these models are not always the most effective to gauge prices or establish an efficient correlation in trends between prices and risks borne. According to Fama and French creators of the model with the same name, what makes the Capital Asset Pricing Model (CAPM) attractive is that it offers strong and intuitive estimates about how risk and the relation could be measured in-between the likelihood of return and risk. Unfortunately, it was seen that the observed record of the model is not deemed satisfactory hence it invalidates the way the model is put to use in applications. Fama and French (1993) were the ones to come up with a more advanced structure or model for understanding market returns using the three factors, namely: market, book to market, and size. Hence we will understand the factors at play in the economy as well as the two most popular asset pricing models, i.e., CAPM and Fama French to understand how effectively they work for the Indian Capital market and give conclusions and suggestions based on the same.

SCOPE OF THE STUDY

The study has been conducted with reference to theory and quantitative data over a period of a maximum of 10 years. The understanding of effective mechanisms of different asset pricing models characterised by the basis of the economy as well as the capital market forms the basis of the study. The study covers the capital market of India for understanding the developing economy and effectiveness of namely two models, i.e., the fama french model and the CAPM. The study was conducted with the purview of online research aid and material found as on April' 21. The goal of the research paper is to dissect and understand the most suitable model for measuring the capital markets and its implications depending on the type of economic model it functions in. This helps to set steer for the direction of our study, thus making the purview suitably fit to encompass a valid conclusion but also not to make it too wide that it loses approachability for the readers as well as the researchers. The paper also tries to analyse market steering indicators such as the Buffett indicator of a country that affects how the CAPM holds valid or not in the said country.

LIMITATIONS OF THE STUDY

All research has limitations. However, it is important for us to acknowledge the same so the discussion is limited associated with the scope and objective under analysis.

- Limited purview of developed and developing countries.
- A maximum time horizon of 10 years.
- Possible outliers in data created by macro-economic and geo-political happenings.
- Constrained availability of same factor of data across countries.
- Questions the general industrial prowess of the asset pricing models, however they remain widely studied in academia.

LITERATURE REVIEW

In the HBR Article by David W. Mullins Jr. titled *'Does the Capital Asset Pricing Model Work?'*, the author describes how the CAPM in isolation may not be an ideal measure of asset pricing. But when coupled with modern financial techniques such as the Modern Asset Pricing (MAP) or the DCF method sheds a better light of pricing assets, coupled with an eye for financial understanding and judgement. Because of its shortfalls, finance professionals should not rely on CAPM as 100% reliable algorithm for estimating the cost of equity capital. This method of asset pricing over-simplifies the world of financial markets and its notion. It's key to changing the financial world was how it measures risk and allows for a wide applicability, with fairly objective standards for understanding how measurement of risk into estimates of return are expected. Along with the two basic assumptions of efficient market frontiers and investor rationality, the modern portfolio theory doesn't account for the following hurdles in the capital market. Namely, friction in markets in the form of transactional costs incurred, taxes, and restrictions which have been imposed on borrowing assets and short selling. It also limits few of the conventions cornering the statistical nature of returns earned as with assigned investors' portfolio liking. Investors are also assumed to be in agreement on asset return bearing and the risk borne by the securities likelihood, under a common time horizon. The author highlights the pragmatism that the correct bouquet of risky stocks in a portfolio could result in a net-net less vulnerable portfolio according the theory. Empirical studies have exhibited that beta or the unsystematic risk is possible to be near-about removed within 30 to 40 portfolios that erratically combines stocks. What CAPM patronises is popularly captured in the following equation, as per market norms in financial organisations:

$$R_s = R_f + \text{Risk Premium}$$

The incentive for stomaching CAPM's outlandish theory is in how it gives a measure for quantifying premium derived from risk and a method for calculating the market risk vis-à-vis the curve of the expected return. The above hypotheses and the efficiency provided by diversifying in risk-reducing of portfolio leads to an efficient but idealized financial market in which, to minimize risk, CAPM led investors may hold vastly diversified portfolios that are, according to them - sensitive only to market-related risk. This points out the author's cat on the wall approach to CAPM. (David W. Mullins, 1982)

In the paper titled *"Asset-Pricing Models: A case of Indian Capital Market"* by Khurshid Khudoykulov, the author assesses the applicability of three asset pricing models in the Indian Equity markets' context; namely:

i. Capital Asset Pricing Model
ii. Fama-French three-factor model
iii. Fama-French five-factor model

The study also does a cross-functional analysis to understand the effect and referencing of the size, profitability, value, investment, and market factors in explaining the average equity returns at the Indian equity markets. The empirical study also pointed to the inefficiency of the single factor model when compared with the Fama-French three-factor model and the Fama- French five-factor model. Key relationship to size and value factors when added in context to CAPM has been established with contexts of the Indian market. The author points out past research to highlight how the FF3FM and FF5FM model had overshadowed CAPM for its accuracy and validity for developed economies such as the US and Europe. The empirical models used in this paper are Time Series regression model for CAPM, and simple regression for FF3FM and FF5FM for a period from 2009 to 2018. The findings of the empirical conclusion suggests towards a lack of relationship to be observed between returns expected and the risk, i.e., beta. Thus, CAPM becomes an invalid model in the context of a developing economy such as India. In addition to that, the five-factor model (FF5FM) produces more ideal results than the CAPM or the Fama-French three factor model as reported by data crunching. It is important to highlight how investments and merit criterial are noteworthy detriments for the greatest number of asset portfolios. While opposite to the same, the size and ultimate profitability factors do not assume much of a commanding role in elucidating how the returns generated from stocks, average. (Khudoykulov, 2020)

In the paper *"Validity of the Capital Assets Pricing Model: Evidence from the Indian companies – the NSE India"* by M. Thomas Paul, the author points to how there have been wide discussion on the validity of the CAPM model since its inception in 1964, while still being a cornerstone for understanding the basic functioning in the world of capital markets. This study has done an empirical study with data from NSE for the period from 2005 to 2009. The paper states prior research to point at the reason behind the high betas which drives the stocks up, when the market goes up. Thus, higher beta translates to a higher ex-post effect, so during a period when the market goes up, high beta stocks will do better than that of low beta. This author runs a regression model using parameters such as market index, return of stock, Jensen's Alpha etc. The final model runs a comparison between regression model and the actual data to find much relationship between the two. The five companies considered in this study

are: The State Bank of India, Tata Motors Ltd., HDFC Bank Ltd., Reliance Ltd., Infosys Technologies Ltd. The final results supported the notion the CAPM theory's prediction that when a security's excess expected return is above the risk-free rate as the dependent variable, the Alpha value becomes statistically closer to zero. The final conclusion states that four out of five companies chosen have passed the CAPM hypotheses to understand the risk vis-à-vis return paradigm in the Indian capital market. (Paul, 2013)

In the paper titled *"Global Asset Pricing"* by Karen K. Lewis, the author lays the foundation for assessing the various shortcomings of existing asset pricing techniques with a global context. The author, with repeated empirical evidence throws light on how the prices of most globally traded assets have carried on to stay dependent upon niche risk factors. Some examples of the aforementioned factor are exchange rate risk, which is standardised across all market patterns. At the cumulative index level of the market, the reliance of returns generated by equity on more localised factors comes out as the most proliferating for growing markets, suggesting varied degrees of market division. This helps in highlighting the effect globalisation has on increased correlation between risk and return in global capital markets. Stocks that are cross- listed across political boundaries have experienced less-than-normal returns. However, if these inconsistencies are due to the explicit barriers established by political lines, there is a capital flow for more intrinsic effects like standardised information processing which can be drawn out over passage of time as and when the restrictions over capital market are removed. (Lewis,2011)

In a more recent study on Asset pricing models by Chinh Duc Pham and Le Tan Phuoc titled, *"An augmented capital asset pricing model using new macroeconomic determinants"*, they share insights on how macroeconomic factors should be considered for efficient models. Their model takes into account the opinion of "26 experienced scholars, managers, and professional stock traders in conjunction with findings of recent studies in economics". This gave the thought of the MAPM, a non-traded factor model which is more flexible than CAPM. The MAPM added three macroeconomic factors to common hypotheses, i.e., the U.S. prime rate, the U.S. government long-term bond rate, and the exchange rate of USD/EUR, to the existing CAPM model. This utilized the simplicity, availability, and ease of accessed data and the flexibility of the CAPM, APT, and IAPM. The formula for the MAPM constraints is as follows:

$$R_{it} - RF_t = \alpha_i + \beta_i\,(RM_t - RF_t) + \gamma_i\,(US_t - RF_t) + k_i\,(LTB_t - RF_t) + \lambda_i EX_t + \varepsilon_{it} \quad (1)$$

where,

- R_{it}: the return on the stock i at the time t,
- RM_t: the return of the market portfolio at the time t,
- RF_t: the risk-free rate at the time t,
- α_i: Jensen's alpha coefficient (alpha) of the stock i,
- β_i: the stock i's sensitivity to the market portfolio (beta),
- γ_i: the interest risk coefficient (gamma) that the stock i is bearing,
- US_t: the U.S. prime rate at the time t,
- k_i: the government long-term bond yield rate risk coefficient (kappa) that the stock i is bearing,
- LTB_t: the government long-term bond rate at the time t,
- λ_i: the exchange rate risk coefficient (lambda) that the stock i is bearing,
- EX_t: the exchange rate of USD/EUR at the time t,
- ε_{it}: the random error term that has mean zero and variance σ^2 (Sigma2).

With further testing this model yielded better results for smaller U.S. stocks and less efficient markets when compared with CAPM. (Pham & Phuoc, 2020)

According to "*The CAPM with Measurement Error: 'There's life in the old dog yet!*'", there's a myopic look taken towards the results of using a market index as a delegate for the lax returns generated from market as derived from the CAPM. More particularly, the consequential results of the two major sources of wrong specifications are scrutinised: (i) the use of weights that are inaccurate and (ii) the practice of the use of just one subset of the assets available from the universe is to construe the index. The series of events resulting when using of a poorly chosen market proxy that reaches from the parameters that are not consistent, estimates to a wrong interpretation of the test outcomes indicate towards the existence of returns that are superficial. This paper has successfully addressed the results of using the return derived from the capital market index which acts as a proxy for deriving the return of an efficient asset market portfolio for trying to estimate the CAPM. An optimised approach of minimum distance can be used in understanding the CAPM under a possibility of quantifiable error is created, which points out the CAPM factors by misusing the cross-equation cross-sectional limitations heading from a

usual quantifiable error. This approach creates for measuring the impact of errors and for analysing the occurrence of decanted unusual returns. Real life guidelines are put forth to reduce the occurrence of biases that are potential in the assessed CAPM parameters. (Simmet & Pohlmeier, 2020)

The paper "*An Empirical Testing of Capital Asset Pricing Model in India*", works on a period of 10 years beginning from January 1, 2004 to December 31, 2013 including daily closing price data. This paper focuses on understanding and testing the empirical study of the Capital Asset Pricing Model (CAPM) in the Indian capital market. This paper is analysed using the help of a rolling regression methodology, which is a statistical data analysis tool which helps in giving robust results. This method of regression is put to use on a sample rolling over a period of three years with a possibility of three years that moves close to a quarter. Furthermore, the model that was created for use in the stage two of regression is a inhibited model, in which the term of interception is taken to be zero. A line of comparison between the model for developed and that of traditional model, has been drawn. The final analysis shows that CAPM is still pretty significant to the Indian capital market and thus the model developed in this study, which inherently performs better than the conventional model. This paper provides notable reasons to actually use the CAPM model thus acts as a negation factor to the point of this research paper. This provides for genuine factors of using the CAPM against the critiques of the same model (Bajpai & Sharma, 2015)

As per "*CAPM for estimating the cost of equity capital: interpreting the empirical evidence*", the argument presented that the evidence derived from empirical data which has been used to negate the Capital Asset Pricing Model (CAPM) was formed on share returns which validate the practical use towards evaluating the cost of capital (Kc) used for assessments in analysing capital budgeting evaluations. Since shares are usually supported not exclusive with ventures in the market, but also the options to correct and redefine current projects and undertake newer ones, the assumed returns on shares need not satisfy the CAPM even when the assumed yields generated from the projects do. Once the option-adjusted betas of the firms make it orthogonal to a set of real option proxies (option moneyness, firm book-to-market ratio, and asset idiosyncratic volatility). Despite of the same, the option-adjusted beta matches the underlying project beta very well, which explains a huge part of the cross-sectional variation in option- adjusted firm risk premium. An empirical support is provided to support the arguments by developing a method for guessing an entities' project for CAPM betas and project returns. The

results thus justifies how the prolonged use of the CAPM by entities despite of the growing amount of evidence while it was foundational on the cross-section of stock returns. (Da, Guo, & Jagannathan, 2009)

As per "*Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*" by William Sharpe, "Modern academic finance is prepared on the proposition that markets are essentially rational". The initial model for rationalising market in the capital asset pricing model was developed by Sharpe (1964). The CAPM is still widely used in applications such as estimating the cost of capital for firms and evaluating the performance of managed portfolios. The CAPM builds on the model of portfolio choice developed by Markowitz (1952). Sharpe (1964) added two key assumptions to the Markowitz model to identify a portfolio that must be mean-variance efficient. The trade-off between risk and expected return for minimum variance portfolios is apparent. An investor who wants to achieve higher returns, needs to accept higher volatility as well. The expected return on any asset is the risk-free interest rate plus a risk premium, which is the asset's market beta (β) times the premium per unit of beta risk, E(RM) – Rf. It defines the way in which the values of beta are defined. This is the formula widely used in financial academia to estimate the cost of equity. The paper sets the base for a wide array of portfolio management terms like the investment opportunity curve, Beta, portfolio standard deviation, indifference curves in terms of portfolio, equilibrium in the capital markets etc. However, the original version of the CAPM (Sharpe-Lintner CAPM) is inadequate for explaining the risk-return trade off and the role that market risk plays in the determination of stocks' excess returns. Hence paper sets its purpose as to validate further the use of CAPM with respect to various markets. The later multifactor factor models of Fama-French and Carhart was also be used in the process. (Sharpe, 1964)

As per "*Testing the Stability of Beta Over Market Phases: An empirical study in the Indian context*" by Sromon Das, (CAPM) provides a standard risk-return hypothesis put to use by many academicians and practitioners. The basic context of CAPM is that investors according to this model are provided a reward for just the portion of risk which cannot be diversified. The subsequent non-diversifiable variance that is determined is the value termed as beta, where the returns expected are linked. The objective of the paper is to test the stability of betas of individual stocks over a predetermined time period using two econometric tests. The objective of the paper is to test the stability of the beta across bull and bear runs. The stability of beta has been tested by two methods - use of time as a variable and use of dummy variable to measure the change in beta over time. The data used is for the period pertaining from February 1999 to

September 2007 for aa list of 39 stocks from the NSE Nifty. The conclusion of the paper states that the betas are quite stable over the sample period. Hence, the hypothesis that betas are stable is valid for a major proportion of the stocks. (Das, 2008)

As per "*Testing the Fama-French Three-Factor Model and Its Variants for the Indian Stock Returns*" by Bhavna Bahl, Fama and French (2004), the highlight of the Capital Asset Pricing Model (CAPM) can be spelled as its offering as a very strong and smartly enhanced predictions regarding how risk is measured and how a relationship can be established as between the expected return from a portfolio and the construing risk (Beta). However, in the study it can be observed that the empirical record of the CAPM has been historically indigent as it nullifies its wider applications in the capital markets. Fama and French in the year 1993 gave us a model for providing an explanation for stock returns using a three factor model, i.e., the market, book to market value, and size of the entity. This paper tests the Fama-French model of asset pricing with respect to the Indian Equity markets. The paper checks for any seasonal effects that could be present in the sample and none have been found. The results found using the 3-factor model provide a good description of the cross-section of average returns and can be used in applications like portfolio selection, portfolio performance evaluation, measuring abnormal returns in event studies, and cost of capital estimation (Fama and French (1993)). In the way the Fama and French three-factor model is an extension of the CAPM, this model can be further extended into a four-factor model suggested by Carhart which includes an additional factor sorted on momentum. (Bahl, 2006)

According to "*Validity of Capital Asset Pricing Model & Stability of Systematic Risk (Beta):An Empirical Study on Indian Stock Market*" by Krishnendu Maji, the capital asset pricing model (CAPM) is the standard risk-return model used by many academicians and practitioners. The underlying concept of CAPM is that investors are rewarded for only that portion of risk which is non-diversifiable. This non-diversifiable risk is termed as beta, and the expected returns are linked to this. The objective of the study is to test the validity of thistheory in Indian capital market and the stability of this non-diversifiable risk (i.e., systematicrisk or beta). The study contains companies as represented in SENSEX on the day April 10, 2000. Whereas, the weekly data of the 91 days Treasury bill have been utilised as proxy for using the risk-free rate of return & BSE 30 (SENSEX) which again, were used as a proxy formarket portfolio price. The studies also provide the evidence against the stability of systematic risk. The paper states that though it lacks reality and is difficult to apply, the

CAPM makes some sense regarding the role of diversification and the type of risk that shouldbe considered in investment decisions making. The findings of this article did not support the theory's basic statement that higher risk (beta) is associated with higher levels of return. The results of these studies indicate that the CAPM probably cannot explain the risk return relations in the Indian capital market. Some of the more important factors which may cause CAPM to not be effective in the Indian context and has the potential to reduce the efficiency level of the India Capital Market are non-diversified portfolio holding, liquidity, insider trading and inadequate infrastructure. (Maji, 2010)

As per the paper "*Is the Capital Asset Pricing Model valid in the Indian context?*" by Khalid Ul Islam, CAPM has been an important landmark in history in asset pricing theory, explaining the risk-return characteristic of financial assets. However, over a number of decades the validity of CAPM has been put to test by a large number of researchers. In this study, the paper tests the validity of CAPM in India on the stocks listed on NSE by using Fama and McBeth (1973) two step procedure. The analysis has been carried out using the time series regression using monthly returns for estimating the beta coefficients of the stocks. The results show absence of any significant relationship between betas and risk premiums and therefore we conclude that CAPM is not a valid test in explaining the risk-return characteristics of assets listed on the National Stock Exchange over the sample period. The paper states that "it can be conclusively said that the CAPM does not seems to be a valid asset pricing model in the Indian context." The research suggests that the fundamentalist and the researchers, in order to forecast the returns approximately closer to the actual return of the stocks, should use the multifactor model which includes the other factors in addition to the ß as a risk measure for which the investor gets compensated. (Islam & Hussain, 2017)

As per "*Capital Asset Pricing Model: Should We Stop Using It?*" by Valeed Ansari, according to the capital asset pricing model, the assumed stock returns have been found out by their parallel level of systematic risk or the beta (ß). To put in other words, the market does not reward the risks that are taken unnecessarily. The paper also takes into consideration the behavioural factors, borrowing restrictions, characteristics as a compensation for factor risk and different biases. The evaluation of these studies questions if the evidence is sufficient to bury beta. The paper wasn't able to take a definitive stand on the CAPM debate. It states that CAPM has still not lost its purpose entirely and its exactly why CAPM survives and is still the most preferred tool in corporate finance. Another concerned issue by the paper is the issue if

returns are indeed based on risk or whether some other factors of behavioural finance are unrelated to risk is at work in the process of generating returns from the portfolio. Also, when returns are somehow catered to by characteristics and a characteristics-based model has been correct in explaining the possible returns, then this brings about a pretty different perspective towards corporate finance. (Ansari, 2000)

According to "*Is CAPM Still Alive for Sensex Stocks in Indian Stock Market? - an Empirical Analysis*" by Dr. Suraj. E.S, Jeena Antony, Nitha. K. P, Capital Asset Pricing Model (CAPM) is one of the valuation models used to calculate the expected stock return for individual company in the stock market. Investors in the Indian capital market have used this model extensively. This study mainly focused on the relevance and suitability of CAPM in BSE for Sensex stocks and to establish risk and return relationship for individual securities in this index. Using CAPM model in the Indian Stock Market, 30 stocks from Sensex were picked and hence evaluated. A correlation was sought out between Intrinsic value and Market price for testing if the CAPM is valid in this market. The results of the study proved that CAPM offers evidence in its favour for majority of the Sensex stocks in Indian Capital Market. There exists linear trend in the securities market line for most of the company in Indian stock market. This study hence proves that valuation validity of capital asset pricing model has been kept at high level and its use can be made more far reaching for predicting the intrinsic value of large market capitalised stocks. Finally, this paper suggests the undervalued stocks in Indian stock market to build a Portfolio. (E.S, Antony, & Nitha , 2020)

According to "*Testing of CAPM in Indian context*" by Pankaj Chaudhary, CAPM relates the return of the stocks and portfolios to the market factor captured by beta. The studies on asset pricing in initial years supported the CAPM (Fama-Macbeth, 1973). However, there were many studies conducted later such as by Stattman (1980), Banz (1981), Basu (1983) and Bhandari (1988) that found some anomalies such size effect, leverage, value effect etc. were not explained by CAPM. A test was conducted on the validity of CAPM in India with the help of data relating to the CNX S&P 500 index and its constituents. This study takes a comprehensive view of the CAPM of asset pricing by taking 15 years data from January 2001 to January 2015. The final data set included 250 companies for which full period data could be made available. The same companies are then used for portfolio formation and testing the model. The risk free rate for India is 91 days treasury bills rate, which is hence utilised and the data-points for the same is retrieved from the Reserve Bank of India website. Here test scans the applicability of

the model by splitting the data in 4 suitable sub periods which includes data sets from pre- and post-2008 financial crisis framework. The results suggest that CAPM does not have much explanatory power and we should search for the alternative models for the asset pricing in India. (Chaudhary, 2016)

In the research paper titled "*Testing capital asset pricing model (CAPM) on the emerging markets of the Europe*", the authors have used monthly stock returns for 5 countries from January 2008 to December 2013 in order to study whether the CAPM is enough for capital asset valuation in the European emerging markets. According to the CAPM theory, higher the beta (risk of the asset), higher is the expected return on that asset. However, the authors after their study using beta regression analysis on risk measurement were able to conclude that higher return is not higher beta and is hence not a valid measure of risk in emerging markets. In the authors' view, CAPM is rejected in the 5 countries' stock exchange market whereas other capital asset pricing models are verified. (Khamidov, 2015)

Semenyuk in his paper titled "*Pragmatics of using a modified CAPM model for estimating cost of equity on emerging markets*" talks about how the classical form of CAPM cannot be used to estimate cost of equity in emerging markets. According to the author these emerging markets have lower efficiency with low levels of liquidity and capitalization, making the data from these markets not completely reliable. Factors like size of the corporation and country associated with the country are not considered in the classical CAPM model. To construct a modified CAPM model, theoretical and methodological provisions were used. The modified CAPM model created by the author takes into consideration more factors in order to determine the cost of capital in markets that are emerging. It ensures a closer estimate of the equity value if reliable information is not present in emerging markets. The resulting model has practical uses in the process of assessing equity value. (Semenyuk, 2016)

In the research paper titled "*An empirical test of CAPM – the case of Indian Stock Market*" talks about how most of the tests on CAPM have been made based on developed markets which is not applicable to a country like India where risk-return relationship gains more significance. Growing and emerging markets are less analysed and are more volatile according to the authors. They use 10 portfolios that cover 50 stocks over a 5-year period from 1st January 2003 to 1st February 2008. The authors are able to conclude that CAPM fails completely in the Indian context and that there exists a negative relationship between beta and excess returns which is an indication of an inefficient capital market. Their regressions show poor explanatory power

and hence conclude that CAPM is not a suitable descriptor of asset prices in India over the chosen sample period. (Chawla & Basu, 2010)

In the paper titled "*CAPM on Post-Crisis Capital Markets of European Transition Countries*" the asset pricing model of CAPM is tested for the most liquid stocks on selected markets of European emerging countries, including Croatia in two post-crisis periods (2009-2013; 2011-2015). The official stock indices which are then observed in these countries do not mimic on the efficient frontier, and thus proves cannot serve as a substitute for the market portfolio. Finally, beta is not the appropriate computation of systematic risk, because returns and betas do not appear to move in lieu of each other. The test is carried out by using a regression analysis between expected returns and related betas as calculated based on the monthly prices of selected stock. A total of sixteen regressions were run, two for each of the eight selected European emerging economies. It was also found that higher returns do not always translate to a higher beta, so beta happens to be not a valid measure of risk in these markets. Furthermore, by applying the Markowitz portfolio theory, it can also be proved that the official stock index of the various observed transitional capital markets, with the exception of the Baltic stock index in post-crisis period 1 and Romania stock index in post-crisis period 2. These two in outcome are not effective and cannot be rendered as ancillary for an adequate market portfolio, since they do not lie on the efficient frontier. (Škalamera-Alilović, Dimitrić, & Bilić, 2016)

OBJECTIVES

1. To find whether Asset pricing model CAPM stands functional in a developing economy as well as it stands in theory.
2. To find whether Asset pricing model Fama-French stands functional in a developing economy as well as it stands in theory.
3. Suggest a comparison of aforementioned asset pricing model and find a better suited model in the Indian context.
4. Compare working of risk-return pay-out as per CAPM on the basis of countries with highest v. lowest Buffett Indicators

HISTORY OF INDIAN CAPITAL MARKETS

The capital markets, or more popularly known as the stock market, was started when world trade started to go global, with there being more movement in freight. While many ambitious merchants were looking to start cross-cultural entities, this had a requirement of a substantial leverage of capital that was not possible for a single merchant to raise alone. This concept originated by the Dutch, jointly owned companies became a suitable business model for a lot of businesses. In 1602, the Dutch East India Company issued their first paper shares. (Gelderblom, Jonker, & Jong, 2013) This exchangeable 'paper' at the coffeehouse which permitted shareholders to very easily trade-in their share paper with similarly interested shareholders or investors. Thus began the advent of the beginning of a concept of a stock market to trade small bits and pieces of a company, thus literally collecting drops to form the ocean.

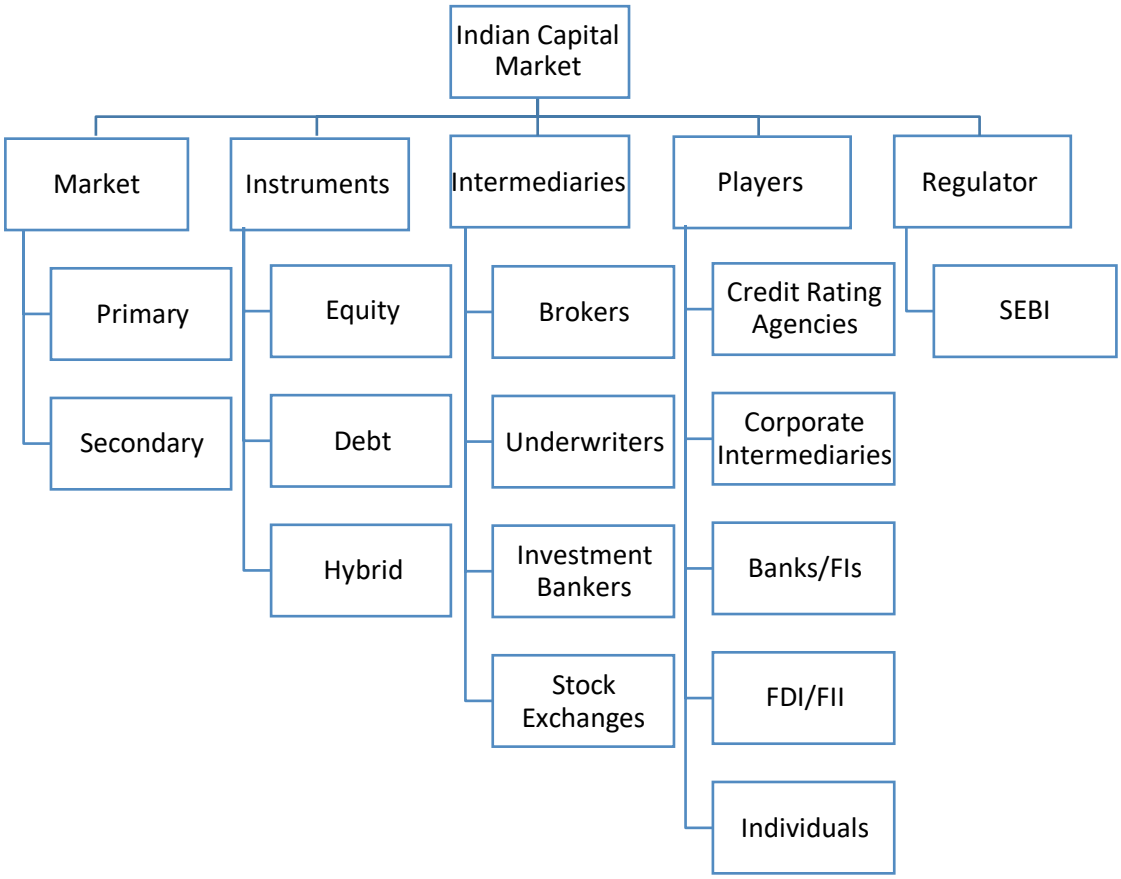
The dawn of the Indian Stock Market began informally in the mid-1850s in Mumbai, India with stories going around that a group of cotton traders would gather under a Banyan tree opposite the Town Hall of Bombay to trade shares of a company for profit. As this group grew in stature, they formed 'The Native Share and Stock Brokers Association. This was the beginning of the first official stock exchange not only in the country but also in Asia in 1875, which is today known as the Bombay Stock Exchange (BSE). The Indian capital market was pretty underdeveloped before Independence, with even the very few Indian companies willing to be listed, taking their business onto the London Stock Exchange. Actual developments and advancements were noticed post-independence, or more precisely the 1950s. () In the 1980s we saw an explosive growth of the securities market in India, with millions of investors having discovered several money-making opportunities. Many new investors entered the stock market. The biggest boom in the form of mass participation by retail investors happened in 1980, with the entry of Mr. Dirubhai Ambani as Reliance got listed in the Indian stock market mechanism. BSE was the sole comptroller till a number of scams costing the financial industry hundreds of crores shook the market to its core. This led to the rise of the National Stock Exchange (NSE) and the knee jerk reaction of the government in setting up the Securities Exchange Board of India (SEBI) and giving it autonomous power in the year 1992 in accordance with the provisions of the Securities and Exchange Board of India Act, 1992. (The Securities and Exchange Board of India, n.d.) The market has been through absolute technological changes and revolutions since. However its functioning stays deeply ingrained in its history.

ABOUT THE INDIAN CAPITAL MARKET

India currently has 8 active stock exchanges as listed by SEBI, (SEBI, n.d.) namely:

1. BSE Ltd.
2. Calcutta Stock Exchange Ltd.
3. Indian Commodity Exchange Limited
4. Metropolitan Stock Exchange of India Ltd.
5. Multi Commodity Exchange of India Ltd.
6. National Commodity & Derivatives Exchange Ltd.
7. National Stock Exchange of India Ltd.
8. NSE IFSC Ltd.

The market caters to all facilities and institutional arrangements for the purpose of borrowing and lending of different terms of fund. It conducts business not with capital goods however is concerned with raising of capital for investments in entities. In the capital market few of these suppliers of funds are individual savings, corporate savings, banks, insurance companies, specialized financing agencies and Government. Most of the demand in the market for long-term capital is headed from players in the private sector. Over times capital markets have observed various degrees of volatility of capital flows. Contributing to the financial developments in India, the markets have played an essential role in bringing industrialization to the forefront and help create the mobilization of capital for large investments. India's market capitalization as on 28th December, 2020 was at $2.5 trillion for the first time ever, as the markets saw a sharp upswing post the Covid bear market. (Ramarathinam, 2021) The immensely complex capital market structure, as can be seen in India, is charted out as below:



The financial products as which are commonly bought and sold in the Indian capital market consists of equities, derivatives, debt instruments, and hybrid products. The equity market by itself has products which mainly comprises of common stocks, Exchange-Traded Funds (ETFs), IPOs, etc. Derivative instruments involve futures contract, put as well as call options. NSE bond futures and Currency derivatives are few of the other prominent derivate products in the market. Few of the debt instruments available include government-backed securities and corporate bonds. Most of the financial transactions in the financial market are done via this exchange medium. An exchange is a platform which provides an intermediary medium to buy and sell shares electronically, along with facilitating issue and redemption of securities. (Imarticus, 2020)

The capital market forms a significant bedrock for the country's economy and rotation of capital. An outline of the factors are as follows (Juman & Irshad, 2015):

1. Mobilization of Savings and Acceleration of Capital Formation

   In a developing economy, the stock market helps to mobilize savings from various sectors of the population. The twin features of the return vis-a-vis liquidity in the

exchange are important incentives for the mass to invest in securities. Which in turn accelerates the capital formation in the country.

2. Raising Long - Term Capital

   Investors often cannot commit their funds for a permanent period for buying stocks, with no personal gain. But companies require a fixed rotation of investors to retain a fixed capitalisation. The stock exchange resolves this by providing an intermediary to provide efficient movement of capital.

3. Promotion of Industrial Growth

   The stock exchange largely transfers to the industrial sector of the economy. This asan institution encourages and helps people to put money into productive channels. Thus it helps the mass stimulate industrial growth and economic development of the country by efficiently mobilizing funds for investment in the corporate industrial securities.

4. Ready and Continuous Market

   Easy marketability as well as access, thanks to digitalisation makes investing in securities more easily available for liquidation as compared to other assets.

5. Assistance for Technical Infrastructure

   There has always been an ever present shortage of resource as faced by entrepreneurs for their enterprises in a number of developing economies in assistance in technical abilities. By creating advisory services like preparation of feasibility reports, identifying potential of growth as well as training Start-ups in the management of projects, the systemic intermediaries of the financial system in the developing economies' capital which market acts for an extremely important part.

6. Trustworthy Pilot of Execution

   The stock market of an economy has been serving in the manner of a reliant guide to the working and their financial stature of corporate, which effectively helps in promoting value.

7. Proper Channelization of Funds

   The current prevailing market prices and indices which consist of securities and relative yield which are used to guide factors for the mass and corporations to channelize their funds into the capital system. This ensures effective utilisation of funds in the interest of the economy.

8. Development of Backward Areas

   Capital Markets provide essential funds for projects in backward areas. This flow of funds facilitates economic development of many essential groups. Capital inflow and rotation becomes easier for people with lesser access to financial services.

9. Foreign Capital

   Capital markets make the process of rotation of funds as well as generate foreign capital across the globe possible. Indian firms use this mechanism to generate funds from markets abroad by way of bonds and other security products. Since the government liberalised in 1991 Foreign Direct Investment (FDI) in the country bringsin foreign capital but also foreign technology which stands important for economic and technological development of the country.

DIFFERENCE BETWEEN DEVELOPED AND DEVELOPING MARKETS

International exposure to global markets allows investors to reach out to various wealth growth opportunities, and *types* of industries and markets and explore elsewhere globally.

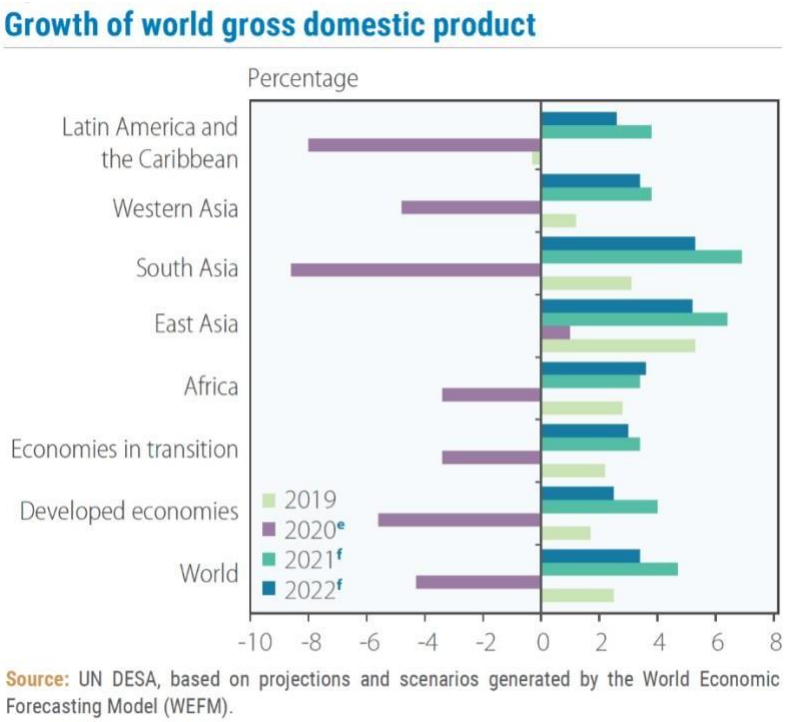
- Developed markets:

These are characterised by advanced economies, better-developed infrastructure, efficient capital markets, and higher standards of living. The higher standard of living can be seen in the huge gap between the per capita income levels in developed v/s developing economies. However, with all kinds of investment, there are a plethora of pros and cons that asset-holders should think about. Developed equity markets in such economies have valuations which are well above long-term averages over history, hence making it staggeringly difficult to retain shocks which have not been foreseen. The background of a slow growth of the economy which

can lead to a less supportive bunch that are a challenge for industry profits growth going forward. Developed economies tend to pile up on a cyclic mountain of loan over the past 100 years, which occur as an anchor to growth of the economy and gather more productive spending culture for the future. The benefits of investing in such an economy entail reliable accounting and financial reporting, avoiding direct forex and currency volatility risk and reduced risk of unexpected political and economic unreliability.

- Developing and/or Frontier markets:

Defining emerging and frontier markets is a tricky business. However, it can be categorised for convenience as a geography at the heart *of rapid growth and development* with per capita lower than global average incomes and less mature capital markets than the developed nations. Some of the countries in this strata are the BRICs, i.e., Brazil, Russia, India, and China; as well as the GIPSI (Portugal, Ireland, Italy, Greece, Spain). Similarly, a frontier market is a part of the set of the emerging market category. To brief, frontier markets are definitely emerging markets, but not all emerging markets are part of frontier markets. A *frontier market typically has much lesser market liquidity*, better developed capital markets, with a lower end of per capita incomes as compared with the more developed emerging markets like Brazil and China. However it goes without saying that the frontier markets are yet to undergo economic and social development. Similarly, these potentials for rapid development and large returns which make these capital markets lucrative to high-risk appetite investors. Developing countries with trends from macro-economic trends from the recent past tend to show an upward sloping economic growth rate typically driven by younger demographics, higher consumerism in populations, modernization of technological infrastructure, which moves along with the global economy. Additionally, there are few risks that can be rendered mindful of few developing countries which tend to experience higher intensities of political and economic tensions, which usually creates added risk for investors. (Nasdaq, 2012)



The above diagram shows us the way in which developed v/s developing economies have performed pertaining to the GDP in the wake of the Covid-19 pandemic. As can be observed most countries took a huge hit on their production ability. However the hit digested by developed countries stayed lesser than that of the developing countries. This shows a good estimation of how developed countries are thought of to bear lesser risk financially, since they are equipped with much more sophisticated technological, policy as well as structural infrastructure at place.

MARKET CAPITALISATION TO GDP RATIO (BUFFETT INDICATOR)

The Market Capitalisation to Gross Domestic Product Ratio (popularly referred to as the Buffett Indicator due to recent events) is a quantifiable degree of the sum total value of all publicly-traded stocks in a country, divided-by the same country's Gross Domestic Product (GDP). This is used in a similar way as using P/E for valuation of companies. Only that this is a broader way of analysing whether a country's capital market is overvalued or undervalued, as one often does with companies like the P/E ratio, as compared to a historical average. (CFI,n.d.)

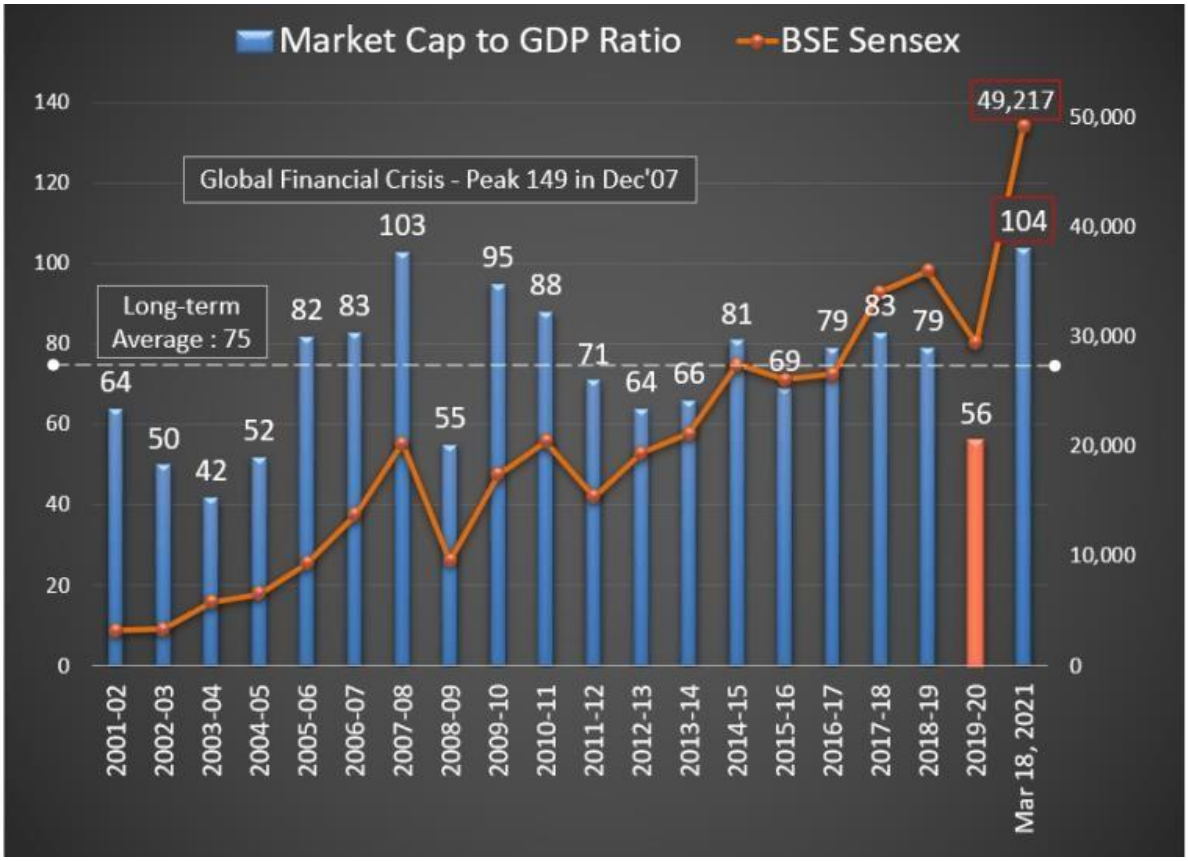
$$\text{Market Cap to GDP Ratio} = \frac{\text{Value of All Listed Companies in Country}}{\text{GDP of The Country}} * 100$$

The indicator recently gained a lot of traction since Warren Buffett made a comment to Fortune Magazine that he believes it is "probably the best single measure of where valuationsstand at any given moment."

The ratio can be analysed as follows:

1. When the value is between 50% to 75%, the capital market is analysed as sublimely undervalued.
2. When the value is between 75% to 90%, the capital market is analysed as fairly valued.
3. When the value is between 90% to 115%, the capital market is said to be close to being overvalued.

India by far has followed the gospels of the indicator as can be seen by the trends and the macro-economic trends as observed in the given graph. The historical simple average of India's Market Cap to GDP ratio has been around 74. (World Bank, 2020)



India's Market Cap to GDP ratio jumped 104 from 56 in March 2020, a leap well divisible to the pandemic and its effect on the financial market. Since the recent future, the rate is much higher than the average of 74 points, hence the market is functioning at euphoric valuations, along with strong optimistic views for future growth prospects. The ratio stands at greater than 100% for most better developed economies like the US, the UK, France, Australia, Hong Kong, Japan Canada, and Switzerland, whereas it is less than 100 per cent for Germany. India by far has one the maximum market capital to GDP ratios as per the emerging markets. The ratio is 75 per cent for China, 70 per cent for Brazil, and 47 per cent for Russia. Indonesia is another country which has a pretty similar demography as well as a per capita income similar to India's, which is around 49 per cent. (Kant, 2021) We will use this indicator to test out if overvalued or undervalued economies have a role to play in how well CAPM operates in the respective economies on a scale of those with the highest value to the lowest value as per ratio calculated globally.

ABOUT CAPITAL ASSET PRICING MODEL (CAPM)

The Capital Asset Pricing Model (CAPM) lays down the association between systematic risk (Beta) and the return for assets that can be expected, specifically shares. CAPM is widely used throughout finance for pricing risky securities and generating expected returns for assets given the risk of those assets and cost of capital. The formula for the same is as below:

$$ER_i = R_f + \beta_i(ER_m - R_f)$$

where:

ER_i = expected return of investment

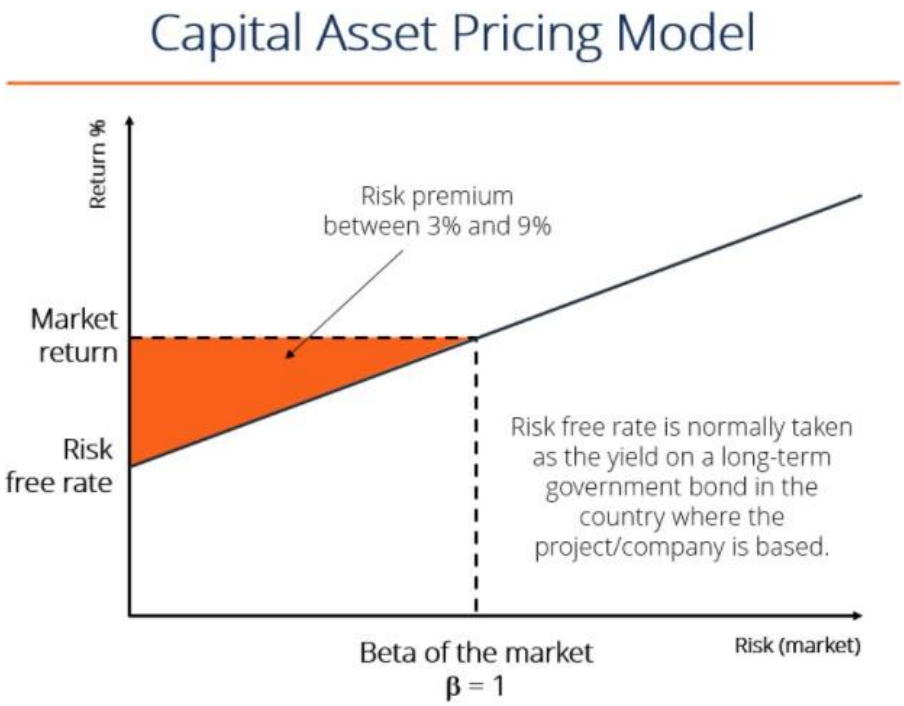
R_f = risk-free rate

β_i = beta of the investment

$(ER_m - R_f)$ = market risk premium

The CAPM was built on the model of portfolio theory as developed by Harry Markowitz in 1952. He provided the first truly rigorous justification for selecting and diversifying a portfolio with the publication of his paper titled “Portfolio Selection.” (Sullivan, 2006) He established in his paper that a portfolio typically has an expected return and risk. Expected return of a portfolio is correlated to the securities’ return expected while risk becomes inherently more complicated. Risk of a portfolio is related to the risks of the consisting individual components, i.e., the individual stocks which are the same as the correlations that make risk a complicated feature that was difficult to understand till then. When the evaluation of risk and return which is relevant to a given condition is funnelled into an efficient portfolio, this helps in generating more returns for a specific risk and lesser risk given from a fixed return. Markowitz also suggested against "placing all the eggs in the same basket". According to the same, portfolio selection is a “complicated and multidimensional problem of choice in relation to a great quantity of different assets” which can be reduced to a conceptually ordinary two-dimensional problem, more commonly known as mean-variance analysis. (Uni, 2020) The capital asset pricing model has been an historic development if not an achievement to understand and be able to quantify risk which was up to then not at all simple. Jack Treynor, a math and physics major at Haverford college developed the earliest version of the CAPM in his research notes in 1958 titled “Market Value, Time, and Risk”. The model was originated and then developed by economist William Sharpe (1964), Jack Treynor (1962), John Lintner (1965) and Jan

Mossin (1966). (Perold, 2004) CAPM ever since has gained a lot of acclamation, recognized, applauded, assessed, doubted and attacked by economists and finance professionals ever since. Nonetheless, in modern periods CAPM has been broadly recognized and utilised in its application of concept, ranging from business capital budgeting up until setting public utility rates. Due to the insights that CAPM provides, it provides with respect to the capital markets, it can be ascertained to be sufficiently important for industry wide applications.



CAPM effectively splits the risk of determining an asset's foreseeable return into two groups, one group is that of unsystematic/ specific risk. The long-term average returns for such specific risk is usually zilch. The second group is due to lack of economic assurance, CAPM preaches that the risk is quantified by rational investors vis-a-vis systematic risk, since this risk cannot be eliminated by simply diversifying the portfolio when investors hold the market portfolio, each individual stock in the portfolio contains specific risk. Systematic risk is measured using beta of a stock. CAPM is a model that attempts to explain the relationship between the risk (Beta) and the expected return of an investment that is used to as correctly as possible an investment's market price. The CAPM model measures and tells that risks can also be weaponized in the capital market, whereby beta of a stock is bought, sold and then assessed. Similarly, the prices of assets with inherently more risk are adjusted to make portfolio assumptions and thus decisions become more corresponding to the proved hypothesis.

ABOUT THE FAMA-FRENCH MODEL

The Fama-French three factor model (FF3FM) was developed by the professors of the University of Chicago, Eugene Fama, and Kenneth French. It is said to be an annex for the CAPM (Capital Asset Pricing Model) and targets at describing the returns of a stock via three factors, namely:

- Systemic risk in the market.
- The out-performing of small-cap companies as compared to large-cap companies.
- The out-performance of companies with high book-to-market value as compared to companies with low book-to-market value.

The thinking that goes behind the model is that high value and small-cap companies tend to outperform the overall market on a regular basis. The original model included factors that were specific to only 4 countries: Canada, the USA, the UK, and Japan. However, Fama and French eventually adjusted the factors and made them applicable for other regions the included the Asia-Pacific region as well as Europe.

The image below shows the mathematical equation representation for the Fama-French model:

$$r = r_f + \beta_1(r_m - r_f) + \beta_2(SMB) + \beta_3(HML) + \varepsilon$$

Where:

- r = Expected rate of return
- r_f = Risk-free rate
- β = Factor's coefficient (sensitivity)
- $(r_m - r_f)$ = Market risk premium
- ***SMB (Small Minus Big)*** = Historic excess returns of small-cap companies over large-cap companies
- ***HML (High Minus Low)*** = Historic excess returns of value stocks (high book-to-price ratio) over growth stocks (low book-to-price ratio)
- ε = Risk

The following formula shows a simple version of the Fama-French formula for an understanding of the concept and the components:

As mentioned above, the Fama-French model takes into consideration 3 factors to calculate the expected rate of return

1. Factor 1 - Market risk premium

   It is the difference between the expected return of the market and the risk-free rate. Excess return, i.e., the premium is provided to the investor as compensation for additional volatility of returns over the risk-free rate.

2. Factor 2 - SMB (Small minus Big)

   SMB or small minus big represents the size effect based on the market capitalisation of a company. It measures the historic excess of small-cap companies over large-cap

companies. Once the SMB is identified, the beta coefficient (β) is determined by using linear regression. The value of the beta coefficient can be positive as well as negative. The main logic or rationale behind this factor of the Fama-French model is that in the long term, small-cap companies tend to bag higher returns as compared to large-cap companies.

3. Factor 3 - HML (High minus Low)

This factor represents the value premium, i.e., the spread in the returns between companies having high book-to-market ratio value (value stocks) and companies having low book-to-market ratio value (growth stocks). Just like in the SMB factor, once the HML factor value is determined, the value of the beta coefficient is found out using linear regression. Here as well, the beta coefficient can have positive as well as negative values. The HML factor indicates that in the long term, value stocks provide higher returns than that of growth stocks.

In the year 1993, Jegadeesh and Titman had added a fourth factor or layer to the model, i.e., momentum of the market, as compared to the market-style-size model which has proven to improve the portfolio returns when there is a constant or given level of risk. To calculate this factor, Momentum uses putting money in companies which have seen a boost in market price when the firm is sold, which had formerly reduced in the price offered. This is thus called Winners Minus Losers (WML).

FAMA-FRENCH FIVE FACTOR MODEL

In the year 2014, two professors at the University of Chicago Booth School of Business, Fama and French developed and took up a notch in their model by include a total of five factors, in place of the previous three. Alongside the original pre-existing aspects, the new 5 factor model includes the underline that the entities which report higher future earnings give higher or better returns in the stock market. This factor is referred to as profitability. The other factor explains the concept of internal investment and returns. This factor is referred as investment and suggests that companies that direct profit towards major growth projects are likely to experience losses in the stock market.

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + e_{it}$$

Where:

R_{it} is the return in month t of one of the portfolios

R_{Ft} is the riskfree rate

Rm-Rf is the return spread between the capitalization weighted stock market and cash.

SMB is the return spread of small minus large stocks (i.e. the size effect).

HML is the return spread of cheap minus expensive stocks (i.e. the value effect).

RMW is the return spread of the most profitable firms minus the least profitable.

CMA is the return spread of firms that invest conservatively minus aggressively (AQR, 2014).

Results as generated by the Five factor model has been described by the authors as returning better explanation for stock returns as compared to the three factor model. However three factor remains to be the much more widely used model, and this remains to be used as a way of advancing financial modelling for the academia and proving ways to open more ways to understand and constantly develop more ways to create asset pricing models.

IMPORTANCE OF THE CAPM

Firstly the ease of use of this model is a major advantage. The calculations in this model are simple and can be very easily stress-tested in order to derive a range of possible outcomes to provide confidence around the required rates of return. CAPM model assumes that the investors have a diversified portfolio which is similar to the market portfolio and eliminates the unsystematic risk or the specific risk. This model takes into consideration the beta which is the systematic risk and is left out in other return models (for example the dividend discount model). Systematic risk is also referred to as the beta or the market risk and is a very important variable as it is unforeseen and for the very same reason cannot be mitigated. WACC or weighted average cost of capital cannot be used in scenarios when businesses seek opportunities and they mix and their financing differs from the pre-existing one. However, CAPM can still be used which is another advantage.

DRAWBACKS OF THE CAPM

Like many other scientific models, CAPM has its drawbacks too. They mainly lie in the input and assumptions on the model. First and foremost the risk free rate. The risk free rate that is generally accepted is the yield on short term government securities. The issue here is that the yield actually changes on a daily basis which creates volatility in the market. Next is the rate of return of the market. The sum of the capital gains and dividends for the market together form the rate of return of the market. The issue here occurs when the market returns actually go negative. A long term market return is used to smoothen out the return. It is also noteworthy to point out that these market returns are backward looking and cannot truly represent the future returns of the market. One of the major assumptions of the capital asset pricing model is that investors can borrow and lend money at a risk free rate. This reflects an unrealistic world picture and is not attainable in reality. The minimum required return line might actually be less steep (lower return due to higher cost) than what the model calculates. Many businesses use CAPM to assess their investments and need to find the beta that accurately reflects the project or investment. For this, many a time, a proxy beta is used. However, it is very difficult to properly determine a proxy beta that assesses the project rightly. If not selected or calculated well, the beta can negatively impact the reliability of the outcome affecting the project or investment as a whole.

IMPORTANCE OF THE FAMA FRENCH MODEL

As previously mentioned, the Fama-French 3 factor model is an extension of the capital asset pricing model (CAPM). The model is adjusted for outperformance tendencies. In addition, the two extra risk factors make the Fama-French model more flexible as compared to CAPM.

As per the Fama-French 3 factor model, over the long term, small-cap companies outperform large-cap companies and value companies outperform growth companies. Fama and French by their studies were able to point out the fact that investors must be able to ride out the additional short-term volatility and periodic underperformance that takes place in the short term. Investors that have a long-term investment horizon of 15 years or above are rewarded for the losses suffered in the short term. Fama and French's study included using thousands of random stock portfolios to test their model and concluded that when size and value factors were combined

with the beta factor, they could explain as much as about 95% of the return in a diversified stock portfolio.

Since the model has the ability to explain almost 95% of the portfolio's returns as compared to that of the market as a whole, it can be used by investors to construct a portfolio that provides an annual expected average return relative to the risks they assume in their portfolios. Sensitivity to the market, size and value stocks are the main factors driving unexpected returns. Any additional average expected returns may be associated with unsystematic risk.

DRAWBACKS OF THE FAMA FRENCH MODEL

Just like any other scientific model, Fama-French has some drawbacks as well. When researchers took the data of the three market factors and assessed the continuously rolling bivariate regressions among the three series to understand how the two factors relate over a period of time, they found out that there are extended periods in where the factors are close to relation and similarly, periods where not much relationship is observed. The relationship between the factors is does not follow a linear path and has changed signs in some periods. The results of this study suggest that endogeneity as can be noticed between a number of factors should be put under consideration for the duration of certain sub-periods. This has been further confirmed by non-parametric tests such as the independence of the series against the predictions obtained from pairwise OLS regression. This revealed a significant relationship between Rm-Rf and SMB. The RESET test has also given a revelation as a non-linear relationship between HML and Rm-Rf. Empirical evidence suggests that endogeneity is a complication in the linear time series estimates of factor loadings in a multiple regression context. Such practical outcomes suggest that the use of these variables in linear-regression analysis, as has been suggested by Fama and French in the year 2018, like a process of scanning for factor relevance; the same stands to be problematic as the standard errors are pretty sensitive to the correct model specification, in both the initial estimation of the factor loadings and in the subsequent panel data tests, whereby clusters caused by error is possible to have been a grave matter.

RESEARCH METHODOLOGY

With the huge influx of foreign institutional investors (FIIs) into the Indian capital market, the requirement for understanding a suitable a model to be applied universally in this market thus explaining the returns that can be expected from stocks in the Indian market has become essential for drawing comparisons and creating analysis globally. There are two models being tested out in this paper:

1. Capital Asset Pricing Model

The data has been taken for the period from February 2010 to February 2020, which are the monthly closing prices for the 30 companies belonging to the S&P BSE SENSEX. For analysing the effectiveness of CAPM in the context of the Indian capital markets. The data analysis for our hypothesis is using two-fold evidence.

1.1 Part 1:

The returns for all the 30 companies in the S&P BSE SENSEX are calculated. Consequently, the companies are ranked on the basis of returns they have generated over a period of 2, 5, and 10 years. The betas of the top 10 stocks for each of the selected periods are noted. Then the average of the betas are calculated for the same periods. The resulting averages provide insights into whether the beta for the same ten companies follows the market, i.e., how near about it is to the beta (risk) of 1 and follow EMH.

1.2 Part 2:

In this part, the stocks are again taken for the three-time period, i.e., 2, 5, and 10 years. Within these three groups of ten stocks each of the lowest beta stocks in the S&P BSE SENSEX. Then the average of the returns as well betas are calculated for each of the cohorts. To test out CAPM's risk-return hypothesis, a correlation is run between the 10 companies' risk and return.

1.3 Part 3:

The closing prices of the Nifty low volatility index and the BSE Sensex for 10 years' duration from December 2012 to March 2021 are used for this part of the evidence. Simultaneously the absolute return, as well as the CAGR for the same

period, are calculated to compare if the low volatility actually spelled lesser returnthan the market velocity.

2. Fama-French Model

- Constructing the size and value sorted portfolios:

Some strong risk is categorized by dividing corporate shares into portfolios. This leads to estimates of more accurate betas so we created portfolios sorted by size and value for my analysis rather than using individual stocks. We will continue to discuss how positions are created.

For each sample period, shares are divided into two groups - large (B) and small (S) - depending on whether their market capitalization at the end of June each year in the sample period is higher or lower than the average stocked stock.

At the end of the financial year for Indian companies in March, the accounting for market prices is calculated this month for all companies. The stocks are now divided into three BE / ME- low (L) groups consisting of 30% low, medium (M) 40% medium and high (H) with a value of more than 30% of the BE / ME stock sampling.

The next step is to build six portfolios - S / L, S / M, S / H, B / L, B / M, and B / H - built from a cross-section of two dimensions with three BE / ME groups. For example the S / L portfolio has stocks in the small size group and the lowest BE / ME group, while the B / H has stocks in the large size group and the high BE / ME group.

The equally estimated monthly profit for all portfolios is calculated from July of year t to June of year t + 1. The process of dividing shares into six portfolios is carried out annually in June. At this time of year, details of last year's BE / ME accounting are made available through the annual reports published at the end of the financial year. Farm and French (1996) wrote that the three-dimensional model did a better job in terms of the size of the routes. The return of each portfolio each month is divided by the number of shares in the portfolio to determine the amount of return that is equally weighted.

- Factor Portfolios:

The Farm and French models use descriptive variables that define the stage at the crossroads of the stock recovery The first is the excessive market recovery feature the return market indicator eliminates harmless returns. This is calculated from the BSE-100 index (using the formula R = ln [y (t)] - ln [y (t - 1)] average of popular scrips depicting market movements at the national level. The second is the risk of size-related retrieval - small removes large (SMB). A simple monthly return for three large size portfolios (B / L, B / M, B / H) is deducted from the three small portfolios (S / L, S / M, S / H) to get a monthly return for the SMB feature. This item has no BE / ME effects as it has a fair amount of BE / ME.

The third factor is related to the value - high extensor volume (HML). Each month, the difference between the simple rate of return to the top two BE / ME portfolios (S / H and B / H) and two lower BE / ME (S / L and B / L) positions are calculated5. It has no size effects.

- Model specification and regressions:

Fama and French timeline series rated Rjt = aj + bjEXRETt + sjSMBt + hjHMLt + εt j = 1, ..., N; t = 1, ..., T where bj is sensitive to the excessive return factor in the market portfolio, sj is the same as the size portfolio, and hj is the value of the value portfolio. Rjt means excessive return to portfolio j per month t, deductions made for each of the six sizes and a fixed amount of the generated value. a j unusual return of position for portfolio j (assumed to be zero below the price model), and εt is a specific asset definition fund return j. The variability of this model is estimated using the step-by-step method of adding or subtracting one-time descriptive variables and checking if R2 increases with the inclusion of other variables. The standard square measure method is used for economic analysis. The remnants of all depressions are tested for heteroskedasticity, adaptability and no automatic adjustment.

3. Using Buffett Indicator to assess effect on risk-return pay-out (CAPM)

As mentioned before in the paper, the Buffett indicator is the ratio between the market capitalisation of a country and its GDP. In this paper, we found the indicator value globally from the data bank of The World Bank. The data was then filtered for the top three and the

bottom three countries according to the same. Since there is a dearth in the amount of data available freely for most of those economies' capital markets, we took the data from the MSCI minimum volatility index data available as compared to the usual MSCI index. Subsequently we drew the average returns of both the MSCI indices to check if the way both of these indices function are in lieu with that of CAPM. As well as, we tested if there can be a trend caught in how the difference in returns look in a developing v. developed country, since the values tend to coincide with the state of economic progress on a comparative basis globally. The data taken as reported by MSCI is for a period of May 2007 to February 2021. This helps to give our paper a peek into other countries aside from the detailed analysis of the capital markets of India. The links to all the respective MSCI reports country wise is mentioned in the excel file.

ANALYSIS AND INTERPRETATION

1. Capital Asset Pricing Model:

In our studies, we have explained how the *Capital Asset Pricing Model* doesn't work in the Indian context, as per the dataset we took over the two, five and 10 years period. This has been analysed as a three part evidence to put forth various circumstances. The evidences for the same is as follows:

1.1. Part 1:

The top 10 stocks of Sensex were shortlisted based on the highest returns generated. A portfolio was constructed for three different time periods, in other words three portfolios with the top ten return generating stocks were created from the Sensex for the time periods of two, five and ten years. The construing stocks were then compared with their beta in the portfolio. *In all the three cases the resulting beta were less than 1*. A beta less than 1 indicates that the stock/portfolio is less volatile than the market and doesn't move in line with the market, posing lesser risk. The stocks had high returns and low overall beta. This proves that higher returns do not always require a higher beta. We also calculated the correlation between the top ten stocks' return and their betas. None of them provided strong correlation to prove the CAPM hypothesis. The three portfolios were as follows:

1.1.1. Two Year

Stock	Returns	Rank	Beta
Bajaj Finance	171.79%	1	1.37
Nestle	103.11%	2	0.80
Bajaj Finserv	79.14%	3	1.43
HUL	65.22%	4	0.61
Asian Paints	60.72%	5	0.65
ICICI Bank	58.23%	6	1.14
Titan	53.78%	7	0.79
Kotak Mahindra Bank	48.76%	8	1.05
Reliance Ind	39.50%	9	1.07
TCS	31.72%	10	0.84
Average	**71.20%**		**0.97**

Correlation	0.43

Highest return generating stocks have an average beta of less than 1

The average beta for the top stocks selected on the basis of the returns for a duration of two years is 0.97. The average returns over this period in this portfolio was 71.2%. This shows how the stocks though performed exceedingly well, didn't necessarily have higher risk or Beta than the market, as the theory of CAPM suggests. The correlation calculated between the returns and the beta suggest a linear movement of 43%. However this figure is not significant enough to suggest any kind of relationship or draw parallels between these two independent variables. Thus again invalidating the application of CAPM for the portfolio construed as per our calculations following criterions as previously mentioned.

1.1.2. Five Year

Stock	Returns	Rank	Beta
Bajaj Finance	752.95%	1	1.35
Bajaj Finserv	562.51%	2	1.20
Titan	396.63%	3	0.82
Nestle	314.63%	4	0.82
ICICI Bank	287.19%	5	0.35
Reliance Ind	274.92%	6	1.27
HUL	262.10%	7	0.59
Kotak Mahindra Bank	256.99%	8	1.04
HDFC Bank	242.17%	9	0.98
Asian Paints	211.91%	10	0.73
Average	**356.20%**		**0.91**

Correlation	0.57

Highest return generating stocks have an average beta of less than 1

The average beta for the top stocks selected on the basis of the returns for a duration of five years is 0.91. The average returns over this period in this portfolio was 356.2%. This shows how the stocks though performed exceedingly well, didn't necessarily have higher risk or Beta than the market, as the theory of CAPM suggests. The correlation calculated between the returns and the beta suggest a linear movement of 57%. However this figure is not significant enough to suggest any kind of relationship or draw parallels between these two independent variables. Thus again invalidating the application of CAPM for the portfolio construed as per our calculations following criterions as previously mentioned.

1.1.3. Ten Year

Stock	Returns	Rank	Beta
Bajaj Finance	14754.72%	1	1.27
Bajaj Finserv	2517.04%	2	0.86
Titan	1334.82%	3	1.02
Asian Paints	893.73%	4	0.73
HUL	822.55%	5	0.52
Kotak Mahindra Bank	772.99%	6	1.05
IndusInd Bank	639.45%	7	1.52
HDFC Bank	590.80%	8	1.08
Nestle	501.47%	9	0.55
HCL Tech	481.41%	10	0.42
Average	**2330.90%**		**0.90**

Correlation	0.37

Highest return generating stocks have an average beta of less than 1

The average beta for the top stocks selected on the basis of the returns for a duration of ten years is 0.90. The average returns over this period in this portfolio was 2330.9%. This shows how the stocks though performed exceedingly well, didn't necessarily have higher risk or Beta than the market, as the theory of CAPM suggests. The correlation calculated between the returns and the beta suggest a linear movement of 37%. However this figure is not significant enough to suggest any kind of relationship or draw parallels between these two independent variables. Thus again invalidating the application of CAPM for the portfolio construed as per our calculations following criterions as previously mentioned.

What we observe from the three portfolios with a macroscopic lens is that as the duration of time increases, the beta of the portfolio decreases, however the returns increase staggeringly. Again providing an evidence of how CAPM may not be the ideal model to describe this

phenomenon. However it can also be noticed that CAPM loses its viability in a linear fashion (directly proportional) to the time period chosen, i.e., as time period increases, the beta and the market return seem to be less according to the risk-return hypothesis of CAPM. This could be an interesting avenue to examine in the Indian capital markets over different periods of data.

1.2. Part 2:

For the second perspective, the top 10 stocks were selected based on the lowest beta. The returns were obtained of the corresponding stocks. They were then compared to the returns of the market. The results obtained showed that the returns of the stocks are beating the market. This shows evidence that stocks with lower beta have historically provided returns above the market return average hence disproving that higher beta provides higher returns, and an event of causality.

1.2.1. Two Year

Stock	Beta	Return
Infosys	0.09	24.56%
Tech Mahindra	0.25	21.44%
Powergrid Corp	0.37	-8.54%
HCL Tech	0.50	13.60%
NTPC	0.53	-21.68%
HUL	0.61	65.22%
Sun Pharma	0.64	-30.34%
Asian Paints	0.65	60.72%
Titan	0.79	53.78%
Nestle	0.80	103.11%
Average	**0.52**	**28.19%**
BSE Sensex Average		**12.03%**

Correlation	0.43

Low beta stock has outperformed the market

The stocks with the lowest betas for the duration of two years were selected for this portfolio. The subsequent returns are noted down beside. Upon finding the average for the respective criterions, we find that the average beta for this duration of the ten stocks with lowest betas is 0.52. While the index beta is taken to be 1, since it moves in tandem with the market. The average return for the same period for our portfolio is 28.19%.

The average index return that is the Sensex returns for this period stands at 12.03%. This again gives us evidence to how these lowest volatility stocks have indeed beat the market for this time period by providing over more than double as much returns than what the wider market index has given its investors. The correlation between the two independent variables beta as well as the market return gives a value of 43%, again a value not satisfactory enough to prove linear relationship between these two factors.

1.2.2. Five Year

Stock	Beta	Return
Sun Pharma	0.23	-59.06%
Infosys	0.48	27.48%
HCL Tech	0.49	5.74%
Powergrid Corp	0.50	15.72%
Tech Mahindra	0.59	3.86%
NTPC	0.59	-17.91%
HUL	0.59	139.05%
Asian Paints	0.73	119.73%
Nestle	0.82	125.24%
Titan	0.82	198.39%
Average	**0.58**	**55.82%**
BSE Sensex Average		**30.43%**
Low beta stock has outperformed the market		

Correlation	0.83

The stocks with the lowest betas for the duration of five years were selected for this portfolio. The subsequent returns are noted down beside. Upon finding the average for the respective criterions, we find that the average beta for this duration of the ten stocks with lowest betas is 0.58. While the index beta is taken to be 1, since it moves in tandem with the market. The average return for the same period for our portfolio is 55.82%. The average index return that is the Sensex returns for this period stands at 30.43%. This again gives us evidence to how these lowest volatility stocks have indeed beat the market for this time period by providing over more than double as much returns than what the wider market index has given its investors. The correlation between the two independent variables beta as well as the market return gives a value of 83%. This value

provides significant reasons to believe that this portfolio is replicating the CAPM hypothesis, as both the variables move in a linear manner 83% of the times.

1.2.3. Ten Year

Stock	Beta	Return
HCL Tech	0.42	481.41%
TCS	0.47	425.87%
Sun Pharma	0.49	142.03%
HUL	0.52	822.55%
Nestle	0.55	501.47%
Powergrid Corp	0.56	69.47%
Infosys	0.59	124.89%
ITC	0.70	155.46%
Asian Paints	0.73	893.73%
Tech Mahindra	0.73	233.05%
Average	**0.58**	**384.99%**
BSE Sensex Average		**133.10%**
Low beta stock has outperformed the market		

Correlation	0.02

The stocks with the lowest betas for the duration of ten years were selected for this portfolio. The subsequent returns are noted down beside. Upon finding the average for the respective criterions, we find that the average beta for this duration of the ten stocks with lowest betas is 0.58. While the index beta is taken to be 1, since it moves in tandem with the market. The average return for the same period for our portfolio is 384.99%. The average index return that is the Sensex returns for this period stands at 133.1%. This again gives us evidence to how these lowest volatility stocks have indeed beat the market for this time period by providing over more almost three times as much returns than what the wider market index has given its investors. The correlation between the two independent variables beta as well as the market return gives a value of 2%. This value provides absolutely no evidence of these two constants having any kind of historical movement in the same direction.

From the three portfolios created in this manner, we again gain consistent results where the lowest beta stocks in fact beat the market in all the three chosen time periods. In the portfolio created using the time frame of five years, is the only time we observe evidence

where correlation factor is at 83% and the only factor that can negate our hypothesis that – CAPM does not work in the Indian Capital Market.

1.3. Part 3:

	Nifty Low Volatility Index	BSE Sensex
Absolute Return	194.56%	97.14%
CAGR	11.73%	9.81%
Low Volatility Index outperforms the market.		
Correlation	0.96	

For the third perspective, we considered the nifty volatility low index for a duration from December 2012 to March 2021. Returns of these stocks were compared to that of the market, i.e., the BSE Sensex, and they have consistently beat the market. This stands to provide historical evidence that shows that lower beta stocks have provided high returns. We calculated CAGR as well as absolute returns for both the indices as mentioned before. In both the types of returns we find that the Nifty Low Volatility Index has beat the wider market index. We also find the correlation for the monthly closing prices of both the indices and find a value of an impressive 96%, thus giving enough evidence that the Nifty Low Volatility Index moves in the same direction as the BSE Sensex. This does not invalidate the market index but provides that even with low volatility the prices move very much closer to the market. Thus in no way providing any evidence that high risk provides high returns to the investors in the Indian Capital Market.

Using these three critical pieces of evidence, we can interpret and thereby conclude that CAPM that is fully based on the risk-return fallacy, i.e., higher risk provides higher returns can be invalidated in the context of the Indian Capital Market. This acts as a leading example and scope for study of other developing economies and their capital markets.

2. Fama-French Model

The Fama-French model ideally consists of 3 factors that are risk, SML and HML, all of whichhave been explained in previous sections of the paper.

2.1. Since we disregarded systemic risk or beta previously, another factor was used in the calculation for the Fama-French model which is WML. WML is a momentum factor, i.e., it is the difference between portfolios of stocks with the highest and lowest returns in the previous year.

2.2. Fama-French was then tested on the Indian market. When the portfolio is constructed using WML, it provides positive alpha returns and WML seems to work with the conditions and factors seen in the Indian capital market scenario.

SMB

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.088
R Square	0.008
Adjusted R Square	-0.009
Standard Error	0.026
Observations	60

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.000	0.000	0.458	0.501
Residual	58	0.038	0.001		
Total	59	0.039			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.004	0.003	1.325	0.190	-0.002	0.011	-0.002	0.011
Rm-Rf %	-0.059	0.087	-0.677	0.501	-0.234	0.116	-0.234	0.116

HML

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.083
R Square	0.007
Adjusted R Square	-0.010
Standard Error	0.039
Observations	60

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001	0.001	0.405	0.527
Residual	58	0.089	0.002		
Total	59	0.089			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.008	0.005	-1.592	0.117	-0.018	0.002	-0.018	0.002
Rm-Rf %	0.084	0.133	0.636	0.527	-0.181	0.350	-0.181	0.350

WML

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.116
R Square	0.013
Adjusted R Square	-0.004
Standard Error	0.042
Observations	60

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001	0.001	0.788	0.378
Residual	58	0.102	0.002		
Total	59	0.103			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.021	0.005	3.956	0.0002	0.011	0.032	0.011	0.032
Rm-Rf %	-0.126	0.142	-0.888	0.378	-0.410	0.158	-0.410	0.158

As seen from the results above, after running the regression we found out that WML significantly impacts (i.e., p-value < 0.05) the returns of the portfolio and is hence an important factor in calculating the price of an asset which could occur as an alternative to factors of the CAPM. In our dataset the regression equation that is thus formed is as follows:

$$Y= 0.021-0.126x$$

With Y being the market return and x being the regression coefficient for the independent variable Rm-Rf %.

3. Buffett Indicator

As mentioned in the research methodology, we find three countries with high values of the indicator as well as the ones with lower value for the ratio. While the top three have been picked as per the countries with highest Ratio (except Switzerland was picked for third highest value, in place of South Africa). The same was picked according to the availability for the MSCI minimum volatility index availability since market data for few countries isn't available directly consistently for the various countries for the same factors as needed. The countries as picked according to the values for the year 2019 are as follows:

High Buffett Indicator	
Country Name	2019
Switzerland	260.92
Saudi Arabia	303.52
Hong Kong	1339.64

Low Buffett Indicator	
Country Name	2019
India	75.98
Brazil	64.54
China	59.63

The values have been reduced to the nearest two decimal points. They have been arranged in a descending order as per what our criterion dictates. The data points for all the six mentioned countries have been taken for a period of 2010 to 2020 for both the MSCI minimum volatility index as well as the usual MSCI index for the mentioned countries.

The values for the countries with a *high value of the Market capitalisation to GDP ratio* are:

Saudi Arabia (Annual returns %)		Source
	MSCI Saudi Arabia Domestic Minimum Volatility	MSCI Saudi Arabia Domestic Islamic
Average	8.62	7.43

Hong Kong (Annual Returns %)		Source
	MSCI Hong Kong Minimum Volatility	MSCI Hong Kong
Average	5.91	7.05

Switzerland (Annual Returns %)		Souce
	MSCI Switzerland Minimum Volatility	MSCI Switzerland
Average	9.03	8.08

As can be observed above, these high ratio countries are also consistent with the common notion of economically developed countries. In two out of the three cases above the average value of the returns of the minimum volatility index are greater than that of the MSCI country index. Only the average data for Hong Kong applies as per the CAPM theorisation, where a lower volatility index gives lower returns than the index consistent with a market beta of 1. In all the other two cases the average value for Saudi Arabia as well as Switzerland shows the returns for the country minimum volatility is more than the usual MSCI country index's average return.

The values for the countries with a *low value of the Market capitalisation to GDP ratio* are:

China (Annual Returns %)		Source
	MSCI China Minimum Volatility	MSCI China
Average	7.55	9.48

Brazil (Annual Returns %)		Source
	MSCI Brazil Minimum Volatility	MSCI Brazil
Average	0.16	-2.23

India (Annual Returns %)		Source
	MSCI India Minimum Volatility	MSCI India
Average	9.74	8.92

As can be observed above, these low ratio countries are also consistent with the common notion of economically developing countries. In two out of the three cases above the average value of the returns of the minimum volatility index are greater than that of the MSCI country index. Only the average data for China applies as per the CAPM theorisation, where a lower volatility index gives lower returns than the index consistent with a market beta of 1. In all the other two cases the average value for Brazil as well as India shows the returns for the country minimum volatility is more than the usual MSCI country index's average return.

The above analysis comes to prove that the CAPM may stand invalid in spite of the economic state of the economy, i.e., irrespective of whether a country is developing or developed. Though just analysing the MSCI indices for low volatility as well as the country indices may not be enough to prove the instability of the theory of CAPM it provides evidence to probe the same further. However the same is out of the scope of this paper. To understand whether the concern only lies in developing and/or developed countries or grows further. The countries eventually picked for low volatility coincide with the countries which are intersecting with the developing economies. However, we cannot by this study, limit the same to only developing countries and can draw a line to call for the kind of economies where this phenomenon can be observed as inconclusive.

CONCLUSION

With the studies conducted, it is safe to conclude that beta is not an accurate lonesome asset pricing factor in a developing economy like India, as suggested by the Capital Asset Pricing Model. Subsequently higher beta does not always lead to higher returns or vice versa. There are many more risks and factors, for example a largely volatile PESTLE factor involved in emerging markets that are not accounted for in the capital asset pricing model. Developing countries require models that are more extensive and include more factors other than risk and market premium. As was also observed from the study of the Buffett Indicator, the lapse of usage of the CAPM has transcended boundaries. Developed economies with largely over-valued capital markets have shown evidence as to low volatility not always meaning low returns. In fact low volatility has beat the wider market return in the various combinations of portfolios created and datasets assessed. It is important to take into consideration the size, style and momentum of the market. Based on our study, we suggest using the Fama-French model in order to generate alpha returns. It takes into consideration factors other than the market risk and resonates with the Indian market, hence leading to more consistent returns. This paper creates scope for analysing CAPM on the basis of time duration as well to understand better the waning away of the effect of the risk-return hypothesis as per the CAPM.

BIBLIOGRAPHY

- Simmet, A., & Pohlmeier, W. (2020). The CAPM with Measurement Error: 'There's life in the old dog yet!'. *Journal of Economics and Statistics 2020*.
- Bajpai, S., & Sharma, A. K. (2015). An Empirical Testing of Capital Asset Pricing Model in India . *XVIII Annual International Conference of the Society of Operations Managemen*.
- Da, Z., Guo, R.-J., & Jagannathan, R. (2009). CAPM FOR ESTIMATING THE COST OF EQUITY CAPITAL: INTERPRETING THE EMPIRICAL EVIDENCE. *NATIONAL BUREAU OF ECONOMIC RESEARCH*.
- Sharpe, W. F. (1964). Capital Asset Prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*.
- Das, S. (2008). Testing the Stability of Beta Over Market Phases: An Empirical Studyin the Indian Context. *International Management Institute*.
- Bahl, B. (2006). Testing the Fama and French Three-Factor Model and its Variants for the Indian Stock Returns.
- Maji, K. (2010). Validity of Capital Asset Pricing Model & Stability of Systematic Risk (Beta): An Empirical Study on Indian Stock Market.
- Islam, K. U., & Hussain, S. (2017). Is the Capital Asset Pricing Model valid in the Indian context ? *Pacific Business Review International*.
- Ansari, V. A. (2000). Capital Asset Pricing Model: Should We Stop Using It? *SAGE Journals*.
- David W. Mullins, J. (1982, January). *Harvard Business Review*. Retrieved from https://hbr.org/1982/01/does-the-capital-asset-pricing-model-work
- Khudoykulov, K. (2020). Asset-pricing models: A case of Indian capital market. *Taylor & Francis*.
- Paul, M. (2013). Validity of the Capital Assets Pricing Model: Evidence from the Indian companies – the NSE India. *SSRN Electronic Journal*.

- Lewis, K. K. (2011). Global Asset Pricing. *University of Pennsylvania Scholarly Commons*.
- Pham, C. D., & Phuoc, L. (2020). An augmented capital asset pricing model using new macroeconomic determinants. *Heliyon*.
- E.S, D. S., Antony, J., & Nitha , K. (2020). Is CAPM Still Alive for Sensex Stocks in Indian Stock Market? -An Empirical Analysis. *IAEME Publication*.
- Chaudhary, P. (2016). Test of CAPM: A Study of India and US. *GIS Business*.
- Khamidov, K. K. (2015). Testing Capital Asset Pricing Model (CAPM) on the Emerging Markets of the Europe. *Spanish Journal of Rural Development*.
- Semenyuk, V. (2016). Pragmatics Of Using A Modified Capm Model For Estimating Cost Of Equity On Emerging Markets. *Baltic Journal of Economic Studies*.
- Chaudhary, P. (2016). Test of CAPM: A Study of India and US. *International Journalof Financial Management*.
- Chawla, D., & Basu, D. (2010). An Empirical Test of CAPM—The Case of Indian Stock Market. *International Management Institute, New Delhi*.
- Škalamera-Alilović, D., Dimitrić, M., & Bilić, M. M. (2016). CAPM on Post-Crisis Capital Markets of European Transition Coutries. *THE EU ECONOMIC ENVIRONMENT POST-CRISIS: POLICIES, INSTITUTIONS AND MECHANISMS*.
- Gelderblom, O., Jonker, J., & Jong, A. D. (2013). The Formative Years of the Modern Corporation: The Dutch East India Company VOC, 1602–1623. *Cambridge University Press*.
- Unknown. (n.d.). *MBA Knowledge Base*. Retrieved from An Overview of Indian Capital Market – History of Indian Capital Market: https://www.mbaknol.com/financial-management/an-overview-of-indian-capital-market/
- *The Securities and Exchange Board of India*. (n.d.). Retrieved from The Securities and Exchange Board of India: https://www.sebi.gov.in/about-sebi.html

- SEBI. (n.d.). *SEBI*. Retrieved from SEBI: https://www.sebi.gov.in/stock-exchanges.html
- Ramarathinam, A. (2021, January 4). *Hindustan Times* . Retrieved from Hindustan Times : https://www.hindustantimes.com/business-news/india-s-market-cap-swells-to-2-5-trillion/story-yd5fkIt4PvMsmzQL8NgbDM.html
- Imarticus. (2020, February). *What is the structure of the Indian Capital Markets?* Retrieved from imarticus: https://blog.imarticus.org/what-is-the-structure-of-the-indian-capital-market/
- Juman, B. M., & Irshad, M. (2015). An Overview of India Capital Markets. *Bonfring International Journal of Industrial Engineering and Management Science, Vol. 5, No.2, June 2015*.
- Nasdaq. (2012, May 11). *Nasdaq*. Retrieved from Nasdaq: https://www.nasdaq.com/articles/what-difference-between-developed-emerging-and-frontier-market-2012-05-11
- CFI. (n.d.). *CFI*. Retrieved from CFI: https://corporatefinanceinstitute.com/resources/knowledge/valuation/market-cap-to-gdp-buffett-indicator/
- World Bank. (2020). *World Bank*. Retrieved from World Bank: https://data.worldbank.org/indicator/CM.MKT.LCAP.GD.ZS
- Kant, K. (2021, January). *rediff.com*. Retrieved from rediff.com: https://www.rediff.com/money/report/indias-m-cap-to-gdp-ratio-crosses-100-in-over-10-yrs/20210122.htm
- Sullivan, E. J. (2006). A Brief History of the Capital Asset Pricing Model. *Nabet*.
- Uni. (2020). Retrieved from https://www.uniassignment.com/essay-samples/finance/history-of-the-development-of-capm-finance-essay.php
- Perold, A.́. (2004). The Capital Asset Pricing Model. *Journal of Economic Perspectives*.