Enterprise Development & Microfinance, 36:2s, 171-194

Performance Comparison of CAPM and Fama–French Factor Models Across Developed and Emerging Markets

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Abstract: *The asset pricing models are very important to financial economics in the modern day, and they can help in estimating expected returns, assessing investment performance, and making portfolio management and corporate financial decisions. The Capital Asset Pricing Model (CAPM), the Fama–French Three-Factor Model (FF3F), and the Fama–French Five-Factor Model (FF5F) are some of the significant models in the evolution of asset pricing theory among the above. This study provides an empirical and theoretical analysis of these models that contrasts them.This study synthesizes theoretical developments and empirical evidence from developed and emerging markets and compares these models. The study uses a semi-systematic (integrative) literature review method by searching for peer-reviewed articles from the leading academic databases (Scopus, Web of Science, ScienceDirect, SpringerLink, Emerald Insight, Taylor & Francis, Wiley Online Library, and Google Scholar) that appeared throughout the year between 1993 and 2026. The analysis explores the models in terms of their theoretical assumption, factor structure, explanatory power, empirical performance, application to practice, strengths and limitations. The results suggest that although CAPM is a simple and widely used benchmark it does have a limitation because it uses only market beta to explain the returns. The FF3F model consists of the FF model with the addition of size and value factors while the FF5F model is the FF model with the addition of profitability and investment factors, both of which substantially improve the asset pricing properties of the model, and the FF5F model improves explanatory power further. The performance of these all-factors models, however, is somewhat different on developed and emerging markets because of the differences in market efficiency, institutional quality, investor behavior and macroeconomic conditions. Moreover, long-term anomalies like momentum, liquidity and sustainability-related risks are not well understood in current models. The study aims to highlight the theoretical, methodological and geographical research gaps and to suggest future research directions combining behavioral finance, environmental, social and governance (ESG) factors, alternative data and machine learning techniques. The results offer an overview for researchers, practitioners, and policy makers interested in learning about the development, use, and prospects of asset pricing models.*

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Introduction

The theory of asset prices has been one of the most significant and widely-studied fields in financial economics due to its importance in understanding the link between risk and expected average return of portfolios. Being able to precisely calculate the anticipated returns of financial assets is essential for portfolio management, security valuations, corporate investment decisions, capital budgeting, performance assessment, and risk management. Asset pricing models are used by investors and financial managers to analyze and make the decision to buy or sell securities at a suitable value based on the risk level. These models have been continuously evolving over the last 60 years and have greatly affected academic research and application to investment strategies (Sharpe, 1964; Fama and French, no date).

The CAPM established by **William F. Sharpe**, **John Lintner**, and **Jan Mossin** has been used to establish a A linear correlation exists between the anticipated average return of portfolios and systematic risk (β). The CAPM theory suggests that investors only receive a return for systematic risk; the idea is that unsystematic risk can be eliminated by diversification. The ease of use, ease of interpretation, and ease of application has made CAPM the framework that was most widely used for estimating the cost of shareholders' equity and measuring portfolio performance. The model has widely been used in corporate finance, investment management, and regulatory decision-making and academic research. One of the major objections to CAPM came with the realization that there were some stock return anomalies which were not fully accounted for by market beta. They reported that the observed size, b/m Ratio, momentum, Op, and investment characteristics are persistent and suggest that there are other risk factors that affect expected average return of portfolioss. Such empirical anomalies led to the development of multifactor asset pricing models and provided impetus to the development of the single factor theory of CAPM. Of these, the FFTFM is one of the most important developments in empirical asset pricing.

Fama & French (1993) added two more risk factors to the CAPM, besides the market risk factor, namely Size (SMB) and Value (HML). They showed that small market value of companies and high B/M firms have higher average returns than CAPM predicts. The three factors model adds significantly to the explanatory power of asset pricing, by adding firm-specific factors that reflect systematic differences in expected average return of portfolios. The FFTFM has since been one of the most commonly applied models in empirical finance, and it has been applied to developed, emerging, and frontier markets.

Though it offered a level of improvement, later studies found further anomalies that could not be accounted for with the three-factor model. Specifically, the study revealed that companies with higher operating Op have tended to report better stock performance, and firms with conservative investment practices have reported better performance than firms with aggressive investment practices. To overcome these drawbacks, Fama & French(2015) introduced Five-Factor Model by adding Op (RMW) and investment (Conservative Minus Aggressive, CMA) factors to the existing three-factor model. The five factor model was a significant improvement in the power to explain cross-sectional differences in average stock returns and a much more complete model of what firm characteristics influence expected average return of portfolioss.

However, the role of the Op and investment factors, their potential overlap, and the model's effectiveness in various countries and market conditions have remained a topic of debate(Fama and French, 2013) .

In the last decade, there have been a growing number of empirical studies that have examined the CAPM performance, the FFTFM Model and the Five-Factor Model in different geographical regions, industries, and economic environments. There are many studies that show that multifactor models beat the CAPM, but this is not always the case. For example, the Five-Factor Model has shown to be most successful at explaining personality in developed markets, while the Op and investment factors have shown inconsistent results in emerging markets, where they are less able to explain personality (Foye, 2018). Likewise, existing European research has revealed that factor premiums are not equally successful on markets in different countries, meaning that the characteristics of markets in different regions affect the performance of asset pricing models (Fama & French, 2012). The results indicate that the performance of the factor models is not only dependent on theoretical aspects but also on the institutional environment, market efficiency, investor behavior and the macroeconomic environment.

This divergence has led to much discussion about the broad applicability and stability of current asset price models. There have been conflicting results in the literature, stemming from differences across samples in terms of sample periods, portfolio construction methods, estimation techniques, markets, and economic regimes. In addition, the evolution of the field of sustainable finance, the inclusion of environmental, social and governance (ESG) considerations in investing, machine learning, the recognition of climate-related financial risks and alternative investment assets have broadened the asset pricing arena and thus require new and comprehensive reviews that bring together the classical theories and emerging perspectives.

While a number of review studies and articles have been written about asset pricing models, they tend to be narrow in scope: they may be single models, particular markets or limited time horizons. Well-developed reviews that provide a critical synthesis of the theoretical development of CAPM, the FFT & FFF Factor Model are still rather limited, especially with respect to evidence from developed and emerging markets. Moreover, there are very few reviews that systematically compare methodological difference, conflicting results and outstanding research gaps that will remain to affect the development of the asset pricing literature. Raising these questions is crucial in order to gain a better insight into the weaknesses and potentials of the currently available models and to help guide future research.

Review Methodology

The current study uses the semi-systematic (integrative) literature review method to critically analyze the development of the asset pricing model from CAPM to the FFTFM and FF5F models. For research domains that have established theories and a multitude of empirical studies, a semi-systematic review might be the right approach for researchers to consolidate knowledge from a variety of streams of literature to identify conceptual debates, methodological differences, and future research opportunities(Snyder, 2019).

While a narrative review can be subjectively selected from articles by its author, the present review has been conducted in a transparent, and repeatable, way to identify, screen, and synthesize relevant articles. To further enhance the credibility, transparency, and reproducibility of management and finance research review paper, the researchers recommend the use of systematic search procedures along with critical thematic analysis in recent methodological literature(Sauer and Seuring, 2023).

The review process was conducted using the Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4-SLR) approach proposed by (Maldonado-Canca *et al.*, 2024) which has become increasingly being adopted within business and management research. To guarantee that the literature selection process is systematic, transparent, and theoretically meaningful, the SPAR-4-SLR protocol is divided into three steps: (1) Assembling: (2) Arranging: (3) Assessing: SPAR-4-SLR allows for knowledge synthesis in comparison with traditional review methods and offers flexibility in methodology, which is especially appropriate for theory driven reviews in finance.

Studies were obtained from several international academic search databases, such as *Scopus, Web of Science, Science Direct, Springer Link, Emerald Insight, Taylor & Francis Online, Wiley Online Library and Google Scholar,* to ensure the thorough coverage of the literature. These databases were chosen because they cover high quality peer-reviewed journals across the areas of finance, economics, and business management, and therefore have reduced publication bias and increased the reliability of the findings of the review.

A thorough keyword search strategy was used to locate relevant publications. The major search terms used were CAPM, FFTFM, FFFFM, Asset Pricing, Factor Models, Equity Returns, Stock Returns, Cross sectional Asset Pricing, Emerging Markets, Developed Markets and India. Its main focus was on peer-reviewed journal articles from 1993 to 2026, including the creation of the FFTFM to the latest advances in multifactor asset pricing. Several seminal theoretical works, however, published prior to 1993, such as the ground-breaking work on portfolio theory and asset pricing were included because they were essential to the historical development of the discipline. This way, a balanced synthesis of the classical theories and the contemporary empirical evidence is available.

Explicit inclusion and exclusion criteria were drawn up before the screening process to ensure consistency and quality. Studies were selected if they (i) were published in peer-reviewed journals, (ii) dealt with CAPM, FF3F, FF5F or related multifactor asset pricing models, (iii) contained some results that were both theoretical and empirical that were relevant for equity markets, and (iv) were written in English. Conversely, studies that did not relate to equity asset pricing, dissertations, editorials, book chapters, and conference proceedings were not included. Only working papers which would have had a significant impact on the subsequent academic literature were taken into account.

After identifying pertinent publications, duplicate publications were eliminated and remaining studies were screened by their titles and abstracts. The articles were then evaluated using full text, which was used to determine the relevance of the articles to the objectives of this review. At this point, research that were not sufficiently methodological, empirical or directly relevant to asset pricing models were deleted. This organized screening method increases the transparency and reproducibility of the screening process, and minimizes the risk of selection bias. In recent methodological studies, systematic screening procedures are highlighted to enhance the validity and reliability of evidence synthesis in management and finance research. Besides thematic synthesis, a comparative analysis was also conducted in order to analyze the differences regarding the research design, sample characteristics, estimation techniques, geographical coverage, and empirical results among studies. Special focus was given to those differences that stemmed from a maturing market, economic climate, portfolio construction methods, factor definitions and statistical estimation procedures. The comparisons help find methodological inconsistencies which can account for the divergent results on the performance of the different asset pricing models.

In order to strengthen the robustness of the review, a greater number of articles published in Scopus- and Web of Science-indexed journals were emphasized, particularly those in high impact finance journals. Theoretical papers were selected even if they were not published in the last ten years, if they had a lasting impact on the evolution of asset pricing theory. Recent empirical research (published in the past 10 years) was also given priority to reflect recent developments such as evidence from developing countries, international comparisons, and more recent methodological innovations.

Finally, the literature was analysed with critical approach in order to see the gaps in the theoretical, methodological, geographical and empirical research. The review is not a summary of the previous research, but it also provides a comparison of different views, areas of agreement and disagreement, and opportunities for further studies. This important synthesis method aligns with the recent call for high-quality review papers, emphasizing that review papers should be more than a descriptive summary, and should generate conceptual understanding, unresolved debates and a coherent research agenda for future research (Paul and Menzies, 2023).

CAPM

CAPM is one of the most influential models in the field of financial economics today and has evolved into future models of asset pricing. CAPM has been widely used in the fields of corporate finance, portfolio management and investment analysis and capital budgeting since its inception in the 1960s to estimate the expected average return of portfolios on a risky asset. The model gives investors a systematic framework to understand the relationship between risk and expected average return of portfolios: Only the systematic risk should be rewarded and unsystematic risk can be eliminated by diversifying their portfolios. Despite the development of multifactor asset pricing models, CAPM remains influential to academic research and practical financial decision making because of its simplicity, intuitive appeal, and ease of implementation (Perold, 2004; Damodaran, 2012).

The evolution of CAPM was a significant leap forward in financial theory and it gave financial analysis a new way of solving a fundamental issue: what would be the price of assets in an efficient capital market when they are risky? Before CAPM, investors were primarily concerned with diversifying investments, with no theory to suggest how much they should expect to gain if they purchased securities that were risky. To resolve this issue, CAPM developed an equilibrium function between the expected average return of portfolios of an asset and the asset's role in the market portfolio's overall risk. The model assumes that investors' behavior is rational, that they desire to maximize their expected utility, and that they are able to build efficient portfolios in a setting of perfect capital markets. Based on these assumptions, the expected average return of portfolios of an individual asset is only a function of the systematic risk of that asset, as measured by the beta (β), and not the total risk measured by the standard deviation (σ) of the asset's returns (Brealey, Myers, & Allen, 2020).

The premise behind the theory of CAPM is the diversification of firm-specific risk away.The theory behind CAPM is that only market-wide is rewarded as it can be diversified away. Beta is a measure of the return sensitivity of a given security to the movements in the market portfolio and therefore is a measure of the exposure of the security to systematic risk. Securities that have a beta greater than one are likely to yield higher returns since they are more sensitive to market movements than securities with a $\beta<1$, which are relatively less risky and hence are likely to give lower returns. The Security Market Line (SML) is one of the most popular concepts in finance, and it represents this linear relationship between expected average return of portfolios and beta (Berk & DeMarzo, 2023).

The acceptance of the CAPM is due to its usefulness in various fields of finance. The model has been widely used to calculate the cost of shareholders' equity capital, the portfolio performance, the investment project analysis and evaluation, the discount rate for capital budgeting project, and the required return for mergers, acquisitions, and estimation of business valuation. The CAPM remains widely used by financial practitioners, regulatory bodies, and analysts for several reasons, such as offering a comparatively simple and clear model for determining expected average return of portfolioss based on market data that is easily accessible. Moreover, CAPM is used as a standard to test other advanced multi-factor asset pricing models (Damodaran, 2012).

The CAPM is very elegant from a theoretical perspective, but some of its assumptions have been criticised. The model is based on capital markets with zero taxes, zero transaction costs, and zero information asymmetry. It also assumes that the investors have similar expectations of future risks and return, can borrow and lend any amount of capital at the risk-free rate(Rf), and that they use only a single investment time horizon. Such assumptions allow for the study of the theory, but are not seen in the real financial markets, in which investors are heterogeneous and market imperfections are prevalent (Levy, 2010).

Another major disadvantage of the CAPM is that it assumes that the expected average return of portfolios is determined by beta only. Many empirical papers have shown that these cross-sectional fluctuations in stock returns cannot be fully captured by a beta only model. There are a number of stable anomalies that suggest that firm-specific factors like market value of companies, b/m ratio, Op, investment behaviour and momentum have a significant effect on the expected average return of portfolioss that go beyond simply the market risk. These anomalies indicate that the multi-factor framework of CAPM might have a simpler explanation for securities' pricing in financial markets than the one-factor model (Cakici, Fabozzi, & Tan, 2013).

Empirical studies of CAPM have generated conflicting results between countries and market settings. There are a number of studies which suggest that CAPM is reasonably successful in forecasting returns on well diversified portfolios of large stocks in developed markets but falls short significantly when applied to single stocks or emerging markets. The empirical performance of the model is rather different depending on the geographical region, as is the extent of market efficiency, market liquidity, institutional development, and investor behaviour. In emerging economies, extra sources of systematic risk can affect stock returns, limiting the usefulness of beta in predicting returns (Rossi, 2016).

The Indian equity market also gives mixed results as to the validity of CAPM. Some research also finds a positive correlation between beta and stock returns, but other research shows that only a portion of the variability in returns is accounted for by market beta. The size of the firm, the value nature of the firm, liquidity, and macroeconomic factors often have a higher explanatory power than beta alone. Such findings suggest that some of the CAPM's assumptions may not fit well the specifications of newly developed financial markets in which circumstances are characterized by evolving institutional settings and investment behavior (Sehgal & Balakrishnan, 2013).

Despite its success in explaining many of the documented return anomalies, CAPM failed to satisfy a number of researchers, which led to the development of multifactor asset pricing models. These effects—size, value, momentum, Op, and investment—combined have been a threat to the idea that expected average return of portfolioss are determined only by systematic market risk. As new empirical facts emerged, researchers began to recognize that the characteristics of the firm have a systematic effect on the price of the asset, and thus should be included in asset pricing models. The FFTFM, which builds on CAPM by including extra risk factors that attempt to explain the cross-sectional fluctuations in expected average return of portfolioss (Barillas & Shanken, 2018).

3.1 Development and Theoretical Foundation of the CAPM

The CAPM is considered one of the most important models in financial economics and the first model to provide a full framework to explain the relationship between risk and expected average return of portfolios. The model was introduced by William Sharpe (1964), John Lintner (1965) and Jan Mossin (1966), and improved the concepts of portfolio diversification with an equilibrium framework in which the expected average return of portfolios of a security is solely a function of its systematic risk. This difficulty directed to the improvement of CAPM, which provided a theoretical framework for asset valuation, portfolio management and business finance decision making. Unlike previous portfolio theories which concentrated on portfolio construction, CAPM explains the way in which assets should be priced in a competitive capital market, and has been one of the cornerstones in modern investment theory (Perold, 2004; Levy, 2010; Birkman, 2014).

CAPM makes a number of assumptions, including that investors are rational, capital markets are frictionless, and the model assumes that investors share the same expectations about the future state of the market. Investors can borrow and lend unlimited amounts at the risk-free rate. These assumptions entail that investors are assumed to have diversified portfolios, which means that firm-specific or unsystematic risk can be eliminated by diversification. Only systematic risk is rewarded in equilibrium. Systematic risk is the measure of the asset's sensitivity to broad market movements, and is measured by the beta (β) coefficient. The model thus suggests the linear relationship between expected average return of portfolios and systematic risk in the form of the Security Market Line (SML) and that securities with higher beta values are likely to earn higher returns. Berk & DeMarzo (2023); Brealey, Myers, & Allen (2020) noted that this elegant framework established beta as the main indicator of investment risk and it became the standard for calculating the cost of shareholders' equity and measuring investment performance.

Although many multifactor asset pricing models have been developed over the past few decades, CAPM remains the theoretical model that is used to evaluate other models. The conceptual simplicity, intuitive interpretation, and practical applicability have fostered its broad acceptance by academics, investment professionals, and financial institutions around the world. But further empirical studies have cast doubt on the ability of market beta to account for the cross-section of stock return fluctuations, and several return anomalies related to the size, value, Op, and investment characteristics of individual firms have been discovered. Over time, these empirical inconsistencies came to doubt the explanatory power of the single-factor model, and prompted the emergence of multifactor models, including the FFTFM, which recognized the importance of adding other systematic risk factors to improve the power of asset pricing models (Barillas & Shanken, 2018; Harvey, Liu, & Zhu, 2016).

3.2 Assumptions and Mathematical Framework of the CAPM

The CAPM is based on a number of simplifying assumptions which make it possible to derive an symmetrical relationship between expected average return of portfolios and risk. The model is based on the premise that investors are rational, averse to financial risk, and want to maximize the expected future wealth, choosing mean-variance efficient portfolios. It makes additional assumptions of perfect capital markets, which includes zero taxes, zero transaction costs, and zero restrictions on short selling, and that investors have identical expectations for asset returns, variances, and co-variances. Further, CAPM assumes investors are able to borrow and lend as much or as little as they want at the same risk-free interest rate, and that they make investments on a single investment period. While these assumptions increase the analytical tractability of the model, they do not necessarily reflect reality in financial markets, in which information asymmetries, differences in beliefs, market friction, and behavioral biases often affect investment choices (Copeland et al., 2014; Fabozzi et al., 2002).

The mathematical model of CAPM shows that it is only systematic market risk, as measured by the beta (β) co-efficient, which affects the expected average return of portfolios on an asset. The expected average return of portfolios is given by:

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

This is because CAPM is easy to understand. Numerous applications of the model exist, such as computing the cost of shareholders' equity capital, analysing portfolio performance, setting hurdle rates for capital budgeting analysis and evaluating investment opportunities in various industries. The intuitive interpretation of CAPM and its relatively easy implementation continue to make it the model of choice for regulatory agencies, investment banks, and financial analysts. However, the application of the model requires the accurate estimation of beta, choosing of an appropriate market portfolio and selection of a representative risk-free rate of return, which are all methodological issues in empirical research. The use of a single-factor framework has prompted researchers to consider whether the market beta is the sole factor of market risk that needs to be addressed, and to develop multi-factor asset pricing models that can incorporate other dimension of market risk in addition to market beta (Estrada, 2007; Focardi & Fabozzi, 2004).

3.3 Empirical Evidence on the CAPM

CAPM has been extensively tested in the developed and emerging financial markets since it was introduced. Early empirical research most often found positive evidence that systematic risk (beta) was correlated with expected stock returns, which is consistent with CAPM's theory for some market conditions. But subsequent studies showed that the explanatory power of beta was much less than was initially thought. Research revealed that assets with comparable beta can return very differently, implying that other factors besides market risk affect the price of assets. The results cast doubt on the usefulness of the one-factor version and also on the usefulness of CAPM to explain the cross-sectional fluctuations in stock returns. Despite its usefulness in developing an understanding of the risk–return relationship, CAPM has been found not to be consistently successful across different periods, markets, and portfolio specifications (Fama & French 2004; Jagannathan & Wang 2007; Ang 2014).

The results from the international markets also show that the performance of CAPM differs significantly among the developed and the emerging economies. Beta is used to account for a portion of the expected average return of portfolios in developed markets like the U.S. and Western Europe, but in these markets it is not able to capture key documented anomalies in firm size, b/m ratio, momentum, Op, and investment. In emerging markets, however, market imperfections, illiquidity, information asymmetry and institutional differences have been reported to limit the validity of this beta explanation. Comparative studies suggest that the asset pricing ability of CAPM is generally superior in large-cap and highly liquid markets than in smaller and less efficient markets, showing the role that market structure plays in asset pricing. So, researchers have started proposing multifactor asset pricing models (Cochrane, 2011; Bali, Engle, & Murray, 2016; Hou, Xue, & Zhang, 2020) which show that systematic risk is multidimensional and not fully captured by a single market factor.

The empirical results of the Indian equity market generally support the results reported in other emerging markets. There have been several studies that have found an empirical relationship between beta and stock returns that is statistically significant but not large enough to account for the observed return patterns. Other characteristics of the company, such as market value of companies, value, Op and liquidity have been shown to have more explanatory power than beta alone, especially in different market cycles and different industrial sectors. Further, the growing globalisation of the Indian capital market has established new influences that were not considered in the classical CAPM model. Most of the recent empirical studies, therefore, suggest that CAPM is still useful as a benchmark model; however, it is found to have limited applicability when used without any other models because the multifactor models like the FFT & FFF Factor Model are more useful in explaining the stock return behaviour in the contemporary financial markets (Sehgal, Subramaniam, & Deisting, 2020; Connor, Goldberg, & Korajczyk, 2010; Gupta & Kelly, 2019.

3.4 Strengths of the CAPM

Despite all the criticism and the development of more than one CAPM, the CAPM is still one of the most important and widely used models in finance. It is one of the most important features of its concept, because it relates clearly and intuitively the concepts of systematic risk to the concept of expected average return of portfolios in a single risk factor, the beta. The CAPM is straightforward to understand, estimate and implement, and is based on a small number of market data, whereas more sophisticated asset pricing models are based on estimation of multiple risk factors. That simplicity has been a key factor in its ongoing application in academic studies, financial education, and in professional investment practice, and has led to its use as a standard by which other asset pricing theories are judged (Elton, Gruber, Brown, & Goetzmann, 2014; Ross, Westerfield, & Jordan, 2022).

Another key advantage of CAPM is that it is widely used in corporate finance and investment management. The model is extensively used to calculate the cost of shareholders' equity capital, to calculate the discount rate for the capital budgeting decisions, to analyze portfolio performance, to analyze mergers and acquisitions and to support business valuation. The CAPM is widely used by financial institutions, investment banks, consulting firms and regulatory agencies because it offers a common way to calculate the minimum expected rate of return on an investment with risk. Moreover, its embedding in commonly used valuation methods, such as the Discounted Cash Flow (DCF) model and Weighted Average Cost of Capital (WACC) has strengthened its relevance to the financial decision-making process for both developed and developing markets (Koller, Goedhart, & Wessels, 2020; Pinto et al., 2022). Theoretically, CAPM laid the groundwork for the modern study of asset pricing because it taught investors to only require compensation for non-diversifiable risk. The idea radically changed financial economics and spurred many decades of empirical research testing, extending and improving asset pricing theory. Later models have been built, such as the FFTFM and Five Factor Model, not as substitutes for CAPM, but as supplements to CAPM, in order to address the empirical problems of CAPM while maintaining the underlying assumption of equilibrium within the model. As such, CAPM remains a fundamental reference for assessing the performance of other asset pricing models, and has had a significant impact on the development of contemporary financial theory, not only in terms of its actual uses but also as a landmark in the evolution of financial theory in general (Bodie, Kane, & Marcus, 2021; Campbell, 2018).

3.5 Limitations and Criticisms of the CAPM

The CAPM has been a major influence in the development of modern financial economics, but has been much criticized for its restrictive assumptions and narrow empirical validity. The model makes the following assumptions: Ideal capital markets, uniform investor anticipations, boundless borrowing and lending at a risk-free rate, and the presence of an authentic market portfolio. In practice, financial markets have transaction costs, taxes, liquidity constraints, information asymmetry and are characterized by different investor behavior profiles that are not captured in the CAPM. Moreover, the notion of investors' making decisions for a one-shot investment could only reflect the static aspect of financial markets, while macroeconomic conditions, investor sentiment and evolving risk preferences continuously affect asset prices in markets. The unrealistic assumptions severely constrain the usefulness of CAPM and its usefulness in understanding the complexity of security returns in the modern financial markets (Black, 1993; Roll, 1977; Reinganum, 1981).

The most important criticism of CAPM is that it fails to account for some of the regular return anomalies found in empirical studies. A large number of studies have demonstrated that market beta is not enough to explain the cross-sectional differences in stock returns. For example, small-cap stocks have been returning higher than expected on average, when compared with CAPM, and stocks with high b/m ratios have outperformed those with high growth ratios over long periods of time. Likewise, momentum, Op, investment behavior and liquidity have been found to be systematic factors that are not accounted for in the single factor model. These changes in the returns of stocks over time and across markets indicate that stock returns are driven by more than just market beta, casting doubt on the empirical validity of CAPM (Banz, 1981; Basu, 1977; Jegadeesh & Titman, 1993; Amihud, 2002).

Growing empirical evidence of the lack of a single factor in the CAPM prompted researchers to look for models of asset pricing that are more comprehensive, including additional systematic risk factors. This change in the research resulted in the emergence of multiple factor asset pricing models, with the FFTFM being the most influential extension to the market factor, adding size (SMB) and value (HML) factors. Subsequent studies showed that these extra factors significantly enhanced the ability of asset pricing models to explain both developed and emerging markets asset prices. Thus, the simplicity and elegance of CAPM make it continue to be a valuable reference, but its weaknesses in terms of empirical performance have made it clear that more sophisticated models that account for the complexity of today's financial markets are necessary (Ferson & Harvey, 1999; Barillas & Shanken, 2017; Hou, Mo, Xue, & Zhang, 2021).

3.6 Transition from CAPM to the FFTFM

By the late 1980s, the CAPM had become the subject of a paradigm shift in asset pricing research due to its empirical shortcomings. While CAPM laid the groundwork for a theory of relating expected average return of portfolioss to systematic market risk, a large number of empirical studies began to provide evidence that beta alone could not fully account for the cross-sectional differences in stock returns. A number of anomalies repeatedly tested the model's most important assumption that systematic market risk is the only factor that determines the expected average return of portfolios. Persistent anomalies such as the size effect, the value effect and the momentum effect repeatedly tested the model's central proposition that expected average return of portfolios are determined only by systematic market risk. These results indicated that other company-specific factors had a systematic impact on the performance of stocks, and thus should be included in asset pricing models (Keim, 1983; Lakonishok, Shleifer, & Vishny, 1994).

The size effect and the value effect were the most widely supported anomalies, both in developed and emerging markets. In a consistent fashion, a wide range of studies have found that small-cap firms experienced greater average returns compared to large firms, and that high b/m Ratio equity ratio stocks had outperformed growth stocks during long time horizons. These return patterns were also important after the addition of market beta, suggesting that CAPM did not explain the important aspects of the systematic risk. Eventually, researchers identified that a model that explained security returns based on just one single factor was not adequate and that there were additional risk factors to be captured in an asset pricing model. This general consensus in the data gave birth to the FFTFM (Chan, Hamao, & Lakonishok, 1991; Davis, Fama, & French, 2000).

To address these empirical problems, Fama & French(1993) extended the CAPM to incorporate two additional factors: SMBand HML. Their model claimed that both expected stock returns and firm size and b/m Ratio features are determined by market risk, and that this has a significant improvement on the explanation of asset pricing. A major development in the empirical asset pricing literature was the introduction of the FFTFM, which moved the emphasis from single-factor equilibrium models to multifactor models that more closely reflected the empirical behaviour of the market. As a result, the Three-Factor Model became the standard in empirical finance, and paved the way for the later introduction of the FFFFM, which added Op and investment factors (Daniel & Titman, 1997; Griffin, 2002).

FFTFM

4.1 Development and Theoretical Foundation of the FFTFM

The Fama – French Three Factor Model (FF3F) has been designed to overcome several empirical deficiencies of the CAPM, specifically, the failure of the CAPM to account for various anomalies in the stock returns field. The CAPM theory has been tested and supported by a wealth of empirical evidence, which shows that market beta is not the only reason for the difference in returns among firms with comparable betas. To address these inconsistencies, Fama & French (1993) introduced a multifactor asset pricing model that added two more factors to the CAPM, which are associated with the firm size and b/m Ratio equity. Their goal was not to totally supplant CAPM, but to augment its explanatory power by adding factors that consistently appeared in empirical studies. Given its introduction, the FF3F model has been one of the most widely used models in empirical asset pricing literature, and is the standard model for understanding the cross-sectional fluctuations in stock returns (Fama & French, 1996; Cochrane, 2001).

The theory behind the FF3F model rests on the idea that the systematic risks underlying a firm are not captured by just market beta and can be proxied by the firm's characteristics (size and value). The model also includes SMB and HML, which are factors for excess returns of small-cap companies and excess returns of high b/m Ratio companies, respectively, compared to their large-cap counterparts. These factors were created based on the pattern observed that small firms tended to outperform large firms and value firms tended to outperform growth firms overtime. The FF3F model explained expected stock returns better than the single-factor CAPM (Davis, Fama, & French, 2000; Fama & French, 2006) since it added these other factors of risk. The launch of the FF3F model represented a substantial change in financial economics theory, from one factor to multifactor asset pricing. However, the model showed that expected average return of portfolioss depend on a number of systematic risk factors and not just on market risk, which led researchers to seek other forms of priced risk in the financial market. Because of its good empirical performance in developed markets, it has been used extensively in the fields of portfolio management, performance analysis of mutual funds, risk management, and corporate finance. However, the results of this research also uncovered some anomalies which would inspire the creation of the FFFFM, such as Op and investment. Therefore the FF3F model is an important milestone in the development of modern asset pricing theory, that is between the simplicity of the CAPM and the higher explanatory power of subsequent multifactor models (Liew & Vassalou, 2000; Petkova, 2006).

4.2 Model Components and Theoretical Framework of the FFTFM

The FFTFM is presented in this section, detailing its components and theoretical foundation.In this section, the components and theory of the FFTFM are described.

The FFTFMModel (FF3F) introduces the concept that stock returns should be explained by three systematic risk factors instead of only one risk factor, which is market risk as it has been used in the CAPM. The model includes the market risk premium (Rm – Rf), the size factor (Small Minus Big) and the value factor (High Minus Low). The mathematical model of the model is written as:

$$\mathbf{Ri - Rf = \alpha i + \beta i(Rm - Rf) + si(SMB) + hi(HML) + \varepsilon i}$$

Where:

Ri = Return on asset *i*

Rf = Risk-free rate of return

αi = Model intercept (abnormal return or alpha)

βi = Sensitivity to the market risk premium

Rm−Rf = Market risk premium

SMB (*Small Minus Big*) = Size factor

HML (*High Minus Low*) = Value factor,

εi = Random error term (idiosyncratic risk)

Return on asset i, \betai is the sensitivity to market risk, si is the exposure to the size factor, and hi is the sensitivity to the value factor. The FF3F model suggests that systematic risk from firm size and b/m Ratio characteristics is another dimension of systematic risk that investors should be compensated for holding, in contrast to CAPM, which assumes only beta is a source of systematic risk.The FF3F model asserts that expected average return of portfolioss include the systematic risk from firm size and b/m Ratio characteristics, and they represent another dimension of systematic risk that investors should be compensated for holding, as opposed to CAPM, which focuses on beta only.

The SMB (Small Minus Big) factor is the difference in return between the small and large cap stocks in a portfolio. Based on empirical evidence, it has been found that smaller firms tend to have higher mean returns, since they face larger financial constraints, liquidity problems, informativeness, and uncertainty in business. Likewise, the HML factor is computed as the difference in returns of the high b/m Ratio (HBM) firms and the low b/m Ratio (LBM) firms. Value firms (those with high book to market ratios) tend to be more distressed or less likely to grow than growth firms, and thus earn higher expected average return of portfolioss. These factors are interpreted as proxies for underlying systematic risks which are not captured by market beta and are thus found to improve the ability of the model to explain differences in stock returns across cross-sections (Lakonishok, Shleifer, and Vishny, 1994, Griffin and Lemmon, 2002, Berk, Green, and Naik, 1999).

The FF3F model's theoretical value is that it accounts for several sources of financial market systematic risk in addition to one market factor. Many empirical studies have shown that SMB and HML significantly boost the explanatory power of asset pricing models in various countries, industries and time periods. As a result, the FF3F model is now a common model used by portfolio managers for performance evaluation, risk management, and mutual fund analysis, as well as for academic research. However, some of the anomalies observed with the corporate Op and investment behavior were also not fully captured by the model, resulting in additional extensions of the Fama–French framework. The Three-Factor Model was a significant improvement upon the CAPM model, but it also paved the way for the creation of more robust multifactor models in current asset pricing research (Petkova, 2006; Ferson and Harvey, 1999; Hou, Karolyi and Kho, 2011).

4.3 Empirical Evidence on the FFTFM

The FFTFM (FF3F) has been validated in developed and emerging financial markets and it is generally considered one of the most successful multifactor asset pricing model. Many empirical papers have documented that with the addition of the size (SMB) and value (HML) factors, the asset pricing model is able to explain asset pricing better than the traditional CAPM. Fama & French(1998) found that value stocks (by the Graham and Billerman methodology) yield superior returns consistently over growth stocks in all major international markets, and the size effect is still a significant contributor to stock returns for many developed economies. Later research found that the FF3F model is more useful in explaining the cross-sectional fluctuations in stock returns, and also outperform the single factor CAPM model in terms of pricing performance of the portfolio, especially for diversified equity portfolios (Connor & Sehgal, 2001; Chiah, Chai, Zhong, & Li, 2016). The model thus established acquired the status of the standard model in empirical asset pricing research and mutual fund performance evaluation literature in academic and professional circles.

The FF3F model works well in developed markets, but it has been found to have more mixed results in emerging markets. Some studies indicate that the size and value premiums persist in emerging markets, while others note significant differences in the size and value premiums across countries, sectors and economies. These inconsistencies are attributed to various factors, including differences in market efficiency, liquidity, institutional quality, and investor behavior, indicating that the effect of SMB and HML is not always present. Furthermore, country-specific effects have been identified in comparative international studies which suggest that regional economic characteristics are important for the success of the FF3F model and that country-specific forces affect asset returns. However, and importantly, the FF3F model has consistently outperformed the CAPM model in explanatory ability for a wide variety of markets around the world, making it an effective multifactor model (Foye, 2018; Cakici, Fabozzi, & Tan, 2013; Fama & French, 2012).

Results of the Indian stock market suggest the FF3F model is superior to CAPM, with some studies and evidence showing the size effect and value effect are greater. The research conducted in the Indian stock markets reveals that the SMB and HML factors provide better explanation of stock returns in particular for small-cap and value-based stocks and thus minimize the pricing errors of the one-factor CAPM. However, some studies claim that during market volatility, the power of the model decreases and that other variables like Op, investment, momentum and liquidity increase the power of the model. The results indicate that the FF3F model is a significant enhancement of CAPM, but not a complete explanation for all of the return anomalies. The literature has eventually led to the development of the FFFFM, which accounts for Op and investment factors, to present a more complete picture of stock return behaviours (Sehgal & Balakrishnan, 2013; Kumar & Shaikh, 2022; Fama & French, 2015).

4.4 Strengths of the FFTFM

FFTFM (FF3F) is considered one of the most important developments in empirical asset pricing theory as it significantly enhances the explanatory power of the CAPM . The model successfully explains the systematic fluctuations in returns on stocks that is not accounted for by the single factor model, by also including the size (SMB) and value (HML) factors. Many empirical studies have shown that FF3F offers a superior fit for cross-sectional stock returns within markets, portfolio constructions and investment time horizon. This ability to explain has made the model the standard to test asset pricing theories and assess the performance of the portfolio in developed and emerging financial markets (Fama & French, 2017; Barillas & Shanken, 2018).

The other great advantage of the FF3F model is its wide applications in academic research and investment practice. The model has been widely used in the mutual fund performance evaluation, constructing portfolios, risk management, estimation of cost of shareholders' equity, and corporate finance. Investment managers often use the model to separate out the skill of the manager from returns attributed to systematic risk factors, and researchers have used it as a benchmark to study market anomalies and to create new factor models. Its usefulness in various countries and industries further enhanced its credibility, and it is one of the most powerful multifactor models in financial economics. Furthermore the simplicity of the model allows researchers to efficiently estimate sensitivities of these factors while retaining model power of explanation compared to CAPM (Cremers, Petajisto, & Zitzewitz, 2013; Ang, 2014). Theoretically, the FF3F model was a major breakthrough, showing that the expected average return of portfolios of an asset depends on several factors of the systematic risk. This paradigm shift led to a vast amount of research on new pricing factors and played an important role in the development of current multifactor asset pricing theory. The model also had a large empirical basis for later extensions of the work, such as the FFFFM, which added Op and investment factors to explain the remaining unexplained return fluctuationss. The FF3F model is thus an important step forward from CAPM and a stepping stone to modern factor-based investment research (Hou, Xue, & Zhang, 2015; Harvey, Liu, & Zhu, 2016).

4.5 Limitations and Criticisms of the FFTFM

The FFTFM (FF3F) is an improvement over the CAPM but has its shortcomings. One of the major criticisms is that the model does not account for all the cross-sectional fluctuations in stock returns. The addition of the size (SMB) and value (HML) factors greatly improves the explanatory power, but there are some empirical studies that show that there are interesting anomalies that are not explained. Specifically, abnormal returns are found for momentum, Op, investment behavior, liquidity, and earnings quality in both the cross-section and the time-series of stock returns, beyond the 3-factor model. These results indicate that the model explains only part of the systematic risk in the financial market and that other risk factors are needed to fully explain the returns at which investors can expect to earn their money back (Carhart, 1997; Novy-Marx, 2013; Asness, Frazzini & Pedersen, 2019).

Another important constraint relates to the robustness and broad applicability of the SMB and HML factors in different markets and economic conditions. While the model works in many developed economies, there have been mixed findings in the empirical evidence from emerging economies concerning the importance of size and value premiums. Some studies indicate that the explanatory power of the factors differs in different countries, industries and market conditions due to differences in institutional development, investor behavior, accounting standards, and market efficiency. Furthermore, value premium has eroded over the past few decades in several developed markets, raising doubts on the extent to which the HML factor is associated with systematic risk or simply a consequence of shifting market conditions. There are inconsistencies in such a case, which suggests that the FF3F model may not apply to all financial markets and investment periods (Hou, Xue, & Zhang, 2020; Cakici, 2015; Foye, 2018).

This empirical evidence made it increasingly clear that these limitations exist, prompting researchers to continue improving on the multifactor asset pricing models. In this regard, studies showed that Op and investment attributes have significant explanatory power even after accounting for the market, size, and value. The findings in turn inspired the researchers to augment their original model with additional factors: the Op (RMW) factor and the investment (CMA) factor, and create the FFFFM. The FF3F model has, however, failed to explain the full extent of the systematic risk, making it clear that there is a need for more comprehensive asset pricing models that can accommodate a more extensive set of return anomalies (Fama & French, 2015; Hou, Mo, Xue, & Zhang, 2021; Barillas & Shanken, 2018).

4.6 Transition from the FFTFM to the Five-Factor Model

The FFTFM (FF3F) was an important improvement over the CAPM because it added the size (SMB) and value (HML) factors to the CAPM's market risk. However, further empirical studies found the model did not account for some longstanding puzzles concerning investment behavior and Op of corporations. Studies reported that the firms consistently with the highest operating Op earned better risk adjusted returns, while the firms with a conservative investment policy outperformed the firms with an aggressive investment policy. However, these return patterns held true even after controlling for the market, size, and value factors and the FF3F model did not explain all systematic risk sources that impacted the returns of stocks (Novy-Marx, 2013; Titman, Wei, & Xie, 2004).

With new evidence of Op and investment anomalies, researchers began to take a second look at the factor structure of the FF3F model. Theoretical work has indicated that relationship between the Op of the firm and future cash flows and discount rates are close enough to the expected stock returns, and the same goes for the expected average return of portfolioss of investment in the firm. The higher the operating Op, firms are likely to have higher expected cash flows and lower financial distress, while conservative firms are likely to provide higher future returns than aggressive firms. These results underscored the necessity to develop a more comprehensive asset pricing model that would allow for the measurement of these other dimensions of systematic risk. As a result, the three-factor framework was gradually recognized as an incomplete depiction of the combination of expected average return of portfolioss on stocks (Chen & Zhang, 2010; Hou, Xue, & Zhang, 2015).

Given these changes, Fama & French(2015) expanded the original model to include two more factors: Conservative Minus Aggressive (CMA) and Robust Minus Weak (RMW), the latter being the Op premium and the former the investment premium. The resulting Five Factor Model was an attempt to enhance the explanatory power of the FF3F model by adding these dimensions of risk, without changing the original dimensions of market, size and value. This was a key development in the history of multifactor asset pricing and has since been the subject of extensive empirical studies, on which it has been tested, to study its performance in developed and emerging markets. The next section thus presents theoretical underpinnings, empirical findings, advantages, and drawbacks of the FFFFM to assess the extent to which the latter model offers a useful refinement of its predecessor (Fama & French, 2015; Fama & French, 2017).

5.1 Development and Theoretical Foundation of the FFFFM

The concept of the Five-Factor Model has a strong theoretical relationship with the prospective cash flows and investment policies of the firms. In the valuation theory, firms with a more positive operating Op will have more positive expected stock returns because they are expected to have more positive cash flows in the future. For firms with conservative investment policies, the characteristics of financial discipline and predictable long-term growth would lead to better market performance than firms with aggressive investment policies. The FF5F model allows for a more complete depiction of systematic risk by combining Op, size, and value components with the market component, and better ties the asset pricing theory to the corporate financial fundamentals. Thus, the third factor model is expanded to account for the explanatory power of the model, while maintaining its basic equilibrium framework (Novy-Marx, 2013; Chen & Zhang, 2010).

5.2 Model Components and Theoretical Framework of the FFFFM

The FFFFM (FF5F) include two other systematic risk factors besides the three factors of the FFTFM (FF3F): Op and Investment factors, while keeping the Market, Size and Value factors. The model suggests that expected stock returns depend on both the size factor (SMB) and the value factor (HML) along with the market risk premium ((Rm-Rf)), the Op factor (RMW) and the investment factor (Conservative Minus Aggressive, CMA). The mathematical representation of the model is given as:

$$\mathbf{Ri - Rf = \alpha i + \beta i(Rm - Rf) + si(SMB) + hi(HML) + ri(RMW) + ci(CMA) + \varepsilon i}$$

Where:

Ri = Return on asset *i*
Rf = Risk-free rate of return
αi = Intercept (abnormal return or alpha)
βi = Sensitivity to the market risk premium
Rm−Rf = Market risk premium
SMB (*Small Minus Big*) = Size factor
si = Sensitivity (loading) to the size factor
HML (*High Minus Low*) = Value factor
hi = Sensitivity (loading) to the value factor
RMW (*Robust Minus Weak*) = Profitability factor,
ri = Sensitivity (loading) to the profitability factor
CMA (*Conservative Minus Aggressive*) = Investment factor,
ci = Sensitivity (loading) to the investment factor
εi = Random error term (idiosyncratic risk)

The first three factors – market risk premium, SMB, and HML – have the same meaning as in the Three-Factor Model. The other factor is an RMW (Robust Minus Weak) factor that accounts for the return spread between the more and less profitable firms; there is evidence that higher Op firms earn higher average returns than less profitable firms. The CMA (Conservative Minus Aggressive) factor is the difference in return for firms following a conservative investment approach versus firms following an aggressive approach, and is based on the premise that companies with lower asset growth may outperform companies that are rapidly growing their assets. Both are based on valuation theory, in which the effect on future cash flows and discount rates explain the relationship between firms' Op and their investment policies and their expected average return of portfolioss. As a result, the FF5F model has a more robust theory linking physical characteristics of the firm to expected average return of portfolioss (Ball et al., 2020; Novy-Marx, 2013; Titman et al., 2004).

The novelty of the FF5F model is that it can represent a wider range of systematic risk, but with a comparatively small number of factors. A large number of empirical studies have demonstrated that the addition of RMW and CMA can enhance the model's performance by lowering the pricing errors and boosting the model's explanatory power for expected stock returns over diversified portfolios. But, researchers have also shown that Op and investment factors partially compensate for the explanatory effect of the value factor (HML), thus creating a discussion about the redundancy of factors in the five-factor framework. The findings have motivated a wide range of studies looking into the stability and importance of individual factors in various markets and economic conditions, resulting in the FF5F model being one of the most recently researched models in current asset pricing literature (Guo, Kubota, & Takehara, 2021; Chiah et al., 2016; Foye, 2018).

5.3 Global Empirical Evidence on the FFFFM

The FFFFM (FF5F) has since been widely analyzed in developed countries to see if adding Op (RMW) and investment (CMA) factors enhances the ability of the FFTFM to explain stock returns. In general, the FF5F model offers better explanatory power, as evidenced in the literature, especially in explaining pricing errors and the fit of diversified portfolios. There is, however, some debate on factor redundancy with several studies finding that the value factor (HML) is not as important once RMW and CMA are added as these two factors are included. Despite this criticism, the Five-Factor Model has been always superior to the CAPM and, in most situations, to the Three-Factor Model as well, making it one of the most popular asset pricing frameworks in modern empirical asset pricing (Fama & French, 2017; Chiah et al., 2016; Kubota & Takehara, 2018).

The picture is more complex in emerging markets. While the FF5F model has been validated in various studies to be superior to the Three-Factor Model, the impact of the Op and investment factors is different in different regions and market structures. For the emerging economies, Foye (2018) found that the Five-Factor Model significantly enhances asset pricing performance in Eastern Europe and Latin America, whereas it has only small effects in Asian markets since the Op premiums and investment premiums are relatively low. In a similar vein, further international research showed that Op is frequently the most important other factor in emerging markets, while the investment factor does not consistently explain the cross-section of countries due to the fluctuationss in the quality of institutions, market efficiency, corporate governance, and accounting practices. The results indicate that the FF5F model is quite market-specific, and some economic factors affect the importance of the different risk factors.

The Indian equity market shows similar results as far as the efficacy of Five-Factor Model is concerned. It has been shown, in recent empirical studies, that the FF5F generally performs better in predicting stock returns than CAPM and the Three-Factor Model does, because it adds Op and investment characteristics as factors. However, the explanatory power of the individual factors varies as a function of the portfolio construction method, time period and capitalization level. The investment factor, although it is important, yields relatively poor or insignificant results in several studies from India despite the fact that the value factor is claimed to be redundant in developed markets. The results suggest that the Five-Factor Model is a significant improvement in explaining the return of stocks in the Indian markets but is sensitive to the market conditions and specification of the model. Overall, the available empirical findings indicate that the model of the FF5F is the most extensive of the three models examined in this study but is not a solution to all the pricing anomalies, which leaves room to improve the model and develop new factors.

5.4 Strengths of the FFFFM

The value of the FFFFMmodel is its superior power to predict cross-sectional differences in stock returns, thanks to adding Op and investment factors to the Fama-French model. In general, it minimizes price errors and enhances the prediction of expected average return of portfolioss in diversified portfolios as compared to previous versions. This has propelled the model into a favorite tool for empirical finance to assess the performance of portfolios, allocate assets, evaluate performance, and determine the cost of shareholders' equity. It has also been shown to be robust across various industries and investment time horizons, especially when examining firms with varying Op and investment traits (Hou et al., 2021; Ball et al., 2020).

Another interesting feature is its theoretical connections between the fundamentals of corporate finance and asset pricing. The model adds firm Op and investment behaviour to the pricing model, providing a more economically sensible explanation of expected average return of portfolioss than conventional risk-based pricing models do. Therefore, the FF5F model is a crucial benchmark for the academic research and practical investment analysis, especially in comparison studies with other multifactor models (MF5) (Guo, Kubota, & Takehara, 2021; Jensen, Kelly, & Pedersen, 2023).

5.5 Limitations and Criticisms of the FFFFM

The Five-Factor Model is an improvement in explaining asset prices anomalies but not entirely. The model fails to provide a satisfactory explanation of momentum, low-volatility and liquidity-related return patterns, indicating that there are other systematic risk sources that are missing. Furthermore, the empirical evidence shows that the importance of the Op and investment factors is different in various countries and market regimes, which makes the model less universal in its application (Asness et al., 2019; Blitz et al., 2021).

Another criticism is with regard to model complexity and potential factor redundancy. Some of the factors have high correlation which makes their incremental explanation ability and complicates model interpretation, several studies argue this. Researchers remain interested in developing new multifactor models or machine-learning models of asset pricing that can better incorporate and model the nonlinear relationship and dynamic risk factors (Kelly, Pruitt, & Su, 2019; Gu, Kelly, & Xiu, 2020).

5.6 Transition to Comparative Analysis

The shift from the CAPM to the Three-Factor Model and later the Five-Factor Model shows the continuing development of asset pricing theory to provide more complete explanations for stock returns. The previous model has included important limitations of the prior model and each model has added more dimensions of systematic risk. Despite this, on a consistent basis, no particular model consistently outperforms the others in any market, over any period of time or in any portfolio, suggesting that model performance is context dependent.

In this context, instead of finding a best of all models, recent research focuses on identifying the right model for the market context and the research goal. The next section, therefore, compares the CAPM, FFTFM and FFFFM in terms of their theoretical assumptions, explanatory power, empirical performance, strengths and weaknesses.

Comparative Analysis of CAPM, FFTFM, and FFFFM

Table 6.1 Comparative Evaluation of Asset Pricing Models

Criteria	CAPM	FF3F	FF5F
Developer	Sharpe (1964)	Fama & French (1993)	Fama & French (2015)
Number of Factors	1	3	5
Risk Factors	Market	Market, Size, Value	Market, Size, Value, Op, Investment
Main Objective	Estimate expected average return of portfolios using market risk	Capture size and value anomalies	Explain Op and investment anomalies
Complexity	Low	Moderate	High
Explanatory Power	Low	Moderate–High	High
Practical Application	Cost of shareholders' equity, capital budgeting	Portfolio analysis, fund evaluation	Advanced asset pricing and portfolio management
Major Limitation	Ignores multiple anomalies	Cannot explain Op and momentum	Momentum and liquidity remain unexplained

The evolution from CAPM to the FF5F model demonstrates a gradual improvement in explanatory power through the inclusion of additional systematic risk factors. However, increasing model complexity also raises challenges regarding factor interpretation and applicability across different markets.

Table 6.2 Strengths and Limitations of the Three Models

Model	**Major Strengths**	**Key Limitations**
CAPM	Simple, intuitive, widely used in finance	Weak empirical performance; unrealistic assumptions
FF3F	Explains size and value effects; better predictive ability than CAPM	Omits Op, investment, and momentum factors
FF5F	Higher explanatory power; incorporates firm fundamentals	Possible factor redundancy; inconsistent performance across markets

No single model consistently dominates across all market environments. While the FF5F model generally provides the most comprehensive framework, model selection should depend on the research objective, data availability, and characteristics of the market under investigation (Harvey, Liu, & Zhu, 2020; Avramov, Cheng, Lioui, & Tarelli, 2023).

Research Gaps and Future Research Directions

7.1 Research Gaps

While considerable progress in the field of asset pricing studies has been made, there are certain gaps that still exist. First, the majority of the empirical evidence focuses on developed markets with limited results and mixed evidence from emerging economies. The results of CAPM, FF3F, and FF5F are not universal across countries because of the differences in the efficiencies of the markets, the quality of institutional development, and the behaviour of investors. Moreover, the explanatory power of individual factors can vary over the market cycle and requires validation in a more contextual manner (Cenedese, Ranaldo, & Vasios, 2021; Zaremba, Umutlu, & Maydybura, 2021).

However, another crucial one is the fact that new sources of risk are not properly accounted for in traditional factor models. In recent years, several important factors such as digital transformation, ESG considerations, climate risks, geopolitical developments and alternative data have gained greater salience and are not sufficiently considered in traditional asset pricing models. This indicates that current models need to be further developed to stay relevant in a changing financial landscape (Pastor, Stambaugh, and Taylor, 2022; Giglio, Kelly, and Stroebel, 2021).

7.2 Future Research Directions

Longer data sets and cross-country comparisons are needed to test the robustness of the multifactor models in different market environments in future studies. More focus should also be paid to emerging and frontier markets where the institutional features significantly differ from developed markets. Comparing risks across sectors, firm size classes and times of financial uncertainty may offer more understanding of the stability of risks.

Further, future asset pricing studies will likely incorporate traditional financial factors with machine learning tools, other data sets, and sustainability-related variables. Combining financial, behavioural and ESG measures could offer a more holistic insight into expected average return of portfolioss than traditional linear factor models. These can be used to enhance theoretical knowledge and guide real-world investment choices (Bryzgalova et al., 2024; Gu et al., 2020).

Conclusion

In this review, the evolution of asset pricing models between the CAPM , the FFTFM (FF3F), and the FFFFM (FF5F) was discussed. The analysis illustrates that each new model is built on the weaknesses of the previous model and attempts to make the model a better explanation of cross-sectional stock returns. The FF3F model added the size and value factors, and was used to explain various anomalies in the market that were not explained by CAPM. The model was subsequently expanded to the FF5F model, allowing for the inclusion of Op and investment factors, which provided a more comprehensive explanation of the sources of returns.

The review also points out that there is also no one-size-fits-all model for all markets and economic circumstances. The FF5F model performs well on explaining the performance compared to CAPM and FF3F in general, but it has not performed well in all developed and emerging markets, and some of the anomalies, like momentum and liquidity, have not been fully understood. Therefore, the selection of asset pricing model should be based on the research purpose, market features, data accessibility, investment background, etc. instead of a benchmark model.

In sum, the results suggest that the asset pricing theory is still developing in the light of new empirical evidence and the evolving nature of financial markets. In the future, there will be a mixture of traditional risk factors, behaviour and sustainability factors, and sophisticated analysis like machine-learning and alternative data analytics. This can enhance the theories and practical applications within portfolio management, investment decision making and financial risk assessment. For this reason, this review summarizes the three dominant asset pricing models and serves as a stepping-stone for future research that can lead to the creation of more comprehensive and flexible models to account for expected stock returns.

Reference

Ang, A. (2014) *Asset Management: A Systematic Approach to Factor Investing*. Oxford: Oxford University Press.

Barillas, F. and Shanken, J. (2018) 'Comparing asset pricing models', *Journal of Finance*, 73(2), pp. 715–754. https://doi.org/10.1111/jofi.12607

Berk, J. and DeMarzo, P. (2023) *Corporate Finance*. 6th edn. Harlow: Pearson.

Bodie, Z., Kane, A. and Marcus, A.J. (2021) *Investments*. 12th edn. New York: McGraw-Hill Education.

Cochrane, J.H. (2011) *Presidential Address: Discount Rates*. *Journal of Finance*, 66(4), pp. 1047–1108.

Damodaran, A. (2012) *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*. 3rd edn. Hoboken, NJ: Wiley.

Fama, E.F. and French, K.R. (1993) 'Common risk factors in the returns on stocks and bonds', *Journal of Financial Economics*, 33(1), pp. 3–56. https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E.F. and French, K.R. (2015) 'A five-factor asset pricing model', *Journal of Financial Economics*, 116(1), pp. 1–22. https://doi.org/10.1016/j.jfineco.2014.10.010

Foye, J. (2018) ‘A comprehensive test of the Fama–French five-factor model in emerging markets’, *Emerging Markets Review*, 37, pp. 199–222.

Harvey, C.R., Liu, Y. and Zhu, H. (2016) ‘…and the Cross-Section of Expected Returns’, *Review of Financial Studies*, 29(1), pp. 5–68. https://doi.org/10.1093/rfs/hhv059

Maldonado-Canca, B., Paul, J. and Seuring, S. (2024) ‘SPAR-4-SLR: Scientific Procedures and Rationales for Systematic Literature Reviews’. *(Use the complete bibliographic details exactly as cited in your manuscript.)*

Paul, J. and Menzies, J. (2023) ‘Research review papers: Purpose, process and contribution’. *(Complete journal details should match your source list.)*

Snyder, H. (2019) ‘Literature review as a research methodology: An overview and guidelines’, *Journal of Business Research*, 104, pp. 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Sharpe, W.F. (1964) ‘Capital asset prices: A theory of market equilibrium under conditions of risk’, *The Journal of Finance*, 19(3), pp. 425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865