

CAPM: A Time-Tested Investment Model for Modern Portfolios

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Abstract. This paper provides an in-depth exploration of the Capital Asset Pricing Model (CAPM), which is a pricing model that is an important part of financial theory. It will discuss the origins, assumptions and implications of the CAPM model in investment decisions and compares the pros and cons with other asset pricing models such as the single index model and the arbitrage pricing theory. The CAPM model has undergone significant evolution and adaptation over time through the recognition of its limitations and complexity of real-world markets as society developed at an increasing rate. Since CAPM was one of the first asset pricing model, it had room to be improved and have been critiqued, it laid the foundation for further developments such as the Fama-French Three-Factor Model which enhances the understanding of risk and returns. This paper aims to highlight the CAPM model's theoretical foundations, its practical applications in the real world, and its role in evolving financial analysis and financial predictions.

Keywords: Fama, CAPM, Investment, Risk.

1. Introduction

The CAPM model can be traced back to the early 1960s through the development by Jack Trynor (1961), William F. Sharpe (1964), John Lintner (1965) and Jan Mossin (1966). These works have been build on top of earlier work of Harry Markowitz's portfolio theory, which aims to maximize efficient returns on set risks. One of CAPM's notable event is the formalization of Sharpe's paper "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk" [1] which had revolutionized investment analysis by linking an asset's expected return to its market risk, marked by beta (β). Since CAPM was one of the first asset pricing model, it had room to be improved and have been critiqued, it laid the foundation for further developments such as the Fama-French Three-Factor Model which enhances the understanding of risk and returns. CAPM however still remains as an integral part to finance, with various influence in development and financial analysis [17,18].

The fundamental presumptions of CAPM are essential to its applicability and reliability. Among the scenarios covered by these assumptions is one in which all investors are price takers with the same investment horizons and goals, primarily concentrating on maximising expected returns while lowering risk (variance). Because the model does not account for taxes or transaction costs, investors are able to lend and borrow money at risk-free rates. The underlying presumptions provide an idealised framework in which all publicly traded assets comprise the market, and the market portfolio is a value-weighted index of these assets. These theoretical prerequisites are crucial to the operation of the CAPM because they offer a streamlined setting that separates the link between risk and expected return, facilitating more understandable analysis and model-based forecasts. [1,6]

The CAPM model has undergone significant evolution and adaptation over time through the recognition of its limitations and complexity of real-world markets as society developed at an increasing rate. Theorists have extended in several ways to combat this by building more models on top of CAPM such as multifactor models such as the Fama-French Three-Factor Model as mentioned before, and the Arbitrage Pricing Theory (APT)[3] which proposes a multifactor approach without relying on the market portfolio. Moreover, extensions like the Consumption CAPM (CCAPM) links back to consumption patterns, and the Liquidity-Adjusted CAPM accounts for liquidity risk. These revolutionized models present efforts in theorists to better adjust the CAPM model for our modern society as the financial market evolves, creating new factors to take into consideration such as liquidity, dividends, debts, and so much more [2]. It also demonstrates the adaptability and versatility of the CAPM model as a strong base for analysts to use and build upon. The CAPM model will

continue to evolve in the financial market and influence both academic application in finance such as theories and practical applications by investors [20].

2. Model Application

2.1. Basic model

The Capital Asset Pricing Model (CAPM) is expressed as:

$$R_i = R_f + \beta_i (R_m - R_f), \quad (1)$$

The expected return of investment (R) in the CAPM formula is the return an investor expects to get from an investment after accounting for related risks. The yield on government bonds, or the risk-free rate, or R_f , stands for the projected return on an investment that carries no risk at all. The investment's volatility or systematic risk is gauged by its beta, or β_i , in relation to general market fluctuations. More volatility than the market is indicated by a beta larger than 1, whilst lesser volatility is indicated by a beta less than 1. The market risk premium, or $(R_m - R_f)$, represents the extra expected return over the risk-free rate that the section headings are in boldface capital and lowercase letters. Second level headings are typed as part of the succeeding paragraph (like the subsection heading of this paragraph).

The CAPM model finds application in financial decisions across the globe with diverse investment strategies and estimating expected returns on assets. A notable instance highlighting CAPM's real-world applicability is in a study conducted by Fama and French [4], which acknowledged its importance of determining stock returns. This study shows CAPM's ongoing applicability in evaluating investment performance, especially in sectors influenced by significant economic shifts, such as the economic collapse of 2007 and the post-pandemic era [4].

Furthermore, CAPM's utility extends beyond theoretical bounds, as it is utilized in practical problem-solving in various financial scenarios. This is evident in portfolio management and corporate finance, which uses CAPM's systematic approach to risk assessment and is indispensable due to its practicality. It presents a structured method to weigh the potential risks against expected returns, allowing for more informed and strategic investment decisions. Black, Jensen, and Scholes demonstrated this utility through their empirical tests of the CAPM, showcasing its robustness in financial decision-making processes [5]. Black, Jensen, and Scholes conducted a thorough empirical analysis of the CAPM in their landmark 1972 research, "The Capital Asset Pricing Model: Some Empirical Tests," which was a crucial step in determining the model's applicability. Their study, which was influential in the finance literature, aimed to balance actual market data with the theoretical predictions of the CAPM. The analysis found that although the CAPM is a useful tool for predicting the risk-return connection, real market behavior differed noticeably from the model's suggested linear relationship in several areas, most notably the link between beta and predicted returns. Despite these differences, their research emphasized the central idea of CAPM: Expected returns are positively connected with risk. In real-world settings, the CAPM is widely used in portfolio management to balance risk and estimate expected returns. It is also used in corporate finance as a basic tool to estimate cost of equity and guide capital budgeting, in the creation of investment strategies for both individual and institutional investors, and in comparing the performance of stocks and mutual funds to industry benchmarks. Although exposing some of CAPM's shortcomings, Black, Jensen, and Scholes' examination confirmed the model's fundamental place in financial analysis and reinforced its continued applicability in a variety of financial settings despite theoretical simplifications [19].

In another analysis called "A Practitioner's Guide to CAPM: An Empirical Study" by Jordan French, the modern practical applications of CAPM is explored through calculating the needed return on stocks and assessing investment decisions. According to French's study, beta is the most common risk assessment factor that investments use and a considerable proportion of CFOs regularly use the CAPM model for return estimates, indicating that the methodology's popularity has grown over time. A sizable data set is used in the study, with securities from the US and ASEAN serving as

representative examples of established and developing markets, respectively. The difference in the ideal duration of the estimating window required to apply CAPM successfully in established vs emerging markets is one important discovery. According to the study, longer estimate windows produce better outcomes in established markets, whereas shorter windows work better in emerging markets, which is seen through the results drawn from the US portfolio compared to the ASEAN portfolio. This distinction draws attention to the model's adaptability to changing market conditions and displays the global usage across all economies [6].

The use of CAPM is empirically validated by the fact that financial analysts and portfolio managers use it extensively around the world. Research like that done by Fama and French [4] as well as more recent analysis like Jordan French's empirical research [6] show how useful and relevant CAPM is even today. These studies frequently show how the Capital Asset Pricing Model (CAPM) may be used to explain the differences in returns across various portfolios, particularly in a variety of economic scenarios like post-recessionary times or flourishing markets.

For example, CAPM has proved useful in evaluating investment success, particularly in areas affected by major economic upheavals like the financial crisis of 2007 and the post-pandemic period. The model's capacity to offer a methodical and quantitative way to modify predicted returns by taking risk preferences and market volatility into account has been especially valuable.

2.2. Comparisons

Many scholarly studies have been done on CAPM, comparing to other pricing models like the Arbitrage Pricing Theory (APT) and the Fama-French Three-Factor Model. The usefulness of these models in developing markets, namely in Borsa Istanbul, was investigated by Gökgöz and Seyhan [7], who also showed how the predicted accuracy of each model fluctuates depending on the specific market conditions. Their research highlights the relative simplicity of the CAPM model, which, in spite of its broad adoption, is occasionally superior to the more intricate APT and Fama-French models in settings with greater levels of market inefficiencies [3, 7].

The methodical approach to risk and intuitive nature of CAPM are among its main benefits. Hanenberg [8] highlights how the CAPM provides a simple and easy-to-understand methodology for estimating an asset's expected return because of its exclusive focus on market risk (beta). Due to its simplicity, it may be used to a wide range of financial industries such as corporate capital planning and individual investment strategy. According to research like that of Lunde and Hebnes [9], the empirical validation of CAPM validates its usefulness in risk-adjusted performance evaluation over extended periods of time, supporting its applicability in real-world investment settings.

Nevertheless, CAPM is not without its detractors, the two main ones are its underlying presumptions of market efficiency and a single-factor model that only considers market risk as Wu [10] and Zhang [11] describe. These presumptions may cause the risk landscape to be oversimplified, which might impair the model's ability to accurately forecast real-world returns, particularly in markets that are changing quickly or don't strictly follow the rules of market efficiency. Moreover, research works such as Salarkia [12] and Wijaya [13] illustrate substitute models that include supplementary elements, implying that a more sophisticated method of asset pricing would be required in specific situations.

3. Conclusions

The Capital Asset Pricing Model's (CAPM) future directions suggest that it will need to be modified to take on new tasks in situations and financial markets that are changing. The incorporation of intricate factors is becoming more and more crucial as technology advancements, globalization, and market fluctuations drive changes in the financial sector. For example, the tendency towards more holistic methods in asset pricing is shown by the incorporation of environmental, social, and governance (ESG) elements into classic financial models, as investigated in works such as Scholtens'

[14]. These modifications demonstrate how the CAPM must change in order to be applicable in the current market environment.

Furthermore, CAPM's ability to evolve is highlighted by its use in tackling modern challenges like climate hazards. This is demonstrated by Assab's work in 2024, which shows how the model is used to include climate risks into the price of infrastructure loans [14,15]. This modification not only brings CAPM into compliance with contemporary environmental issues, but it also demonstrates how it may support prudent and progressive investment methods. These advances point to a move in the finance sector towards models that incorporate wider risk factors, preserving the applicability and efficacy of CAPM in a financial environment that is constantly evolving.

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