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A Review of the Applicability of Pricing Models in the Stock Market

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Abstract: The capital asset pricing model (CAPM) model has always been the core theory of asset pricing and is widely used in the world as a finance tool in the securities market, but it is not fully effective for the economic market due to the current state of development in some countries. This paper compares and analyses the CAPM model and its improved and alternative models based on existing literature and statistical data. This paper first explains the CAPM model, analyses its formula, and then describes the disadvantages and shortcomings of the CAPM model. Then it gives examples of other replaceable models, first explains those models, then lists the advantages of these models compared with the CAPM model as well as some of their shortcomings, and finally concludes through the comparison of these models to the CAPM model that although the CAPM model may not be applicable to the market in many cases, it can be replaced by other models, and even then there is no one-size-fits-all model that can replace all the market models, and conclusions need to be made on a case-by-case basis.

Keywords: CAPM, CCAPM, ICAPM, APT

1. Introduction

The capital asset pricing model is based on modern asset allocation theory (MPT). This theory expresses the relationship between the return on assets and the risk coefficient, as well as the systemic risk [1]. The assumption of CAPM is somewhat farfetched. Specifically, its conclusions often contradict experimental evidence. But its significance cannot be ignored, as it has always been an important theory in financial economics and the foundation of more advanced models. The CAPM model has a wide range of uses, including examining the connection between expected returns on assets and risky assets in equity markets to measure the return on securities, estimating the cost of capital, assessing portfolio management performance, analyzing risk, and using it as a measure of normal return in event studies and calculations to comprehend stock fundamentals and choose investments [2]. There are also some assumptions in this model. For example, markets are effective, investors are rational, the same investment cycle exists, investors can borrow at a risk-free rate, and the risk-free rate is the same [3]. This paper explains the CAPM model and extends some of the other models, using a literature review to illustrate the shortcomings of the CAPM model and the substitutability of other models.

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2. Methodology

The first step is to collect data using related databases. In the process of the research, the main keywords of the article are identified into several possible sub-keywords such as CAPM, APT, ICAPM, and CCAPM. This paper reviews the literature related to the CAPM model. The articles found in the search were very extensive. However, not all of them were relevant to the topic. To find literature that is most relevant to the topic of this article, the author chose to use the Currency, Relevance, Authority, Accuracy, and Purpose model (CRAAP model) to select the study. The author identified the availability of the CAPM model through the papers found. In the first round, the author removed articles that were not relevant to the topic through titles and keywords, and in the second round, the author removed articles that were not nearly as relevant through the abstract and introduction. The final paper will be completed with the selected articles.

3. CAPM Model

CAPM is the foundation of asset pricing and portfolio theory. The reason why this model is worth studying and paying attention to is because it proposes how to evaluate risk and its relationship with expected returns [3]. First, this article starts with some explanation of the CAPM formula for a given risky asset S.

R_S is the return variable for portfolio S;
R_M is the return variable of the market portfolio;
R_f is the market risk-free rate;
β_S is the risk sensitivity of portfolio S to the market.

$$ER_s = ER_f + (ER_m - ER_f)\beta \quad (1)$$

Where R_f is the time value of the asset, which is the return generated at the risk-free interest rate. $(ER_m\text{-}ER_f)\beta$ is the risk return on the asset, which compensates the investor for the risk he assumes. $(ER_m\text{-}Er_f)$ the risky return on the market portfolio.

The CAPM model is quite helpful, yet it still has a lot of flaws and issues. Using New York Stock Exchange (NYSE) stocks from the years 1931 to 1965, in order to regress the average excess returns on the betas, Black et al. developed 10 portfolios with varied historical beta estimations [4]. Overall, they find evidence in favor of a linear relationship between average asset returns implied by the coreCAPM and their betas. However, this relationship is flatter than predicted, leading to some misspecification of low and high beta portfolios. Not only that, Fama and French found that different market values compared to book value for a portfolio of companies constituted other returns that differed from the expected returns given by a beta wash. Thus, the influencing factors are not always fully accounted for in the equation [3].

Researchers have tried to conduct indirect tests using “proxies” that simulate market portfolios. Commonly, U.S. common stock indexes are employed, although studies have also taken a wider range of assets into account, including bonds, real estate, or labor income [5]. It’s possible that the precise composition of the portfolio is unimportant given the high level of correlation between various proxies and between proxies and real market portfolios. So, whether a proxy variable is mean-variance efficient does not affect whether a market portfolio is mean-variance efficient. The results of Debondt et al. and Jegadeesh et al. using a classification of rises and falls over time also found different results from the CAPM model [6].

Banz put the CAPM to the test by determining if the firm’s size can account for the remaining variation in the average return on assets that cannot be explained by the CAPM’s beta. In fact, Banz proved that scale is indeed better than beta in explaining the cross-sectional changes in the average

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return rate of a given set of assets. This research result poses a challenge to CAPM. He found that the average stock return of small companies (those with lower market capitalization) is significantly higher than that of large companies. This is the result obtained by using CAPM to explain the risk. This result is based on data from 1936 to 1975 [7]. The validity of the Fama and French study has been contested. The study's assertions that size matters a lot, the book-to-market equity ratio matters a lot, and that beta plays no role in explaining cross-sectional volatility in returns have drawn the most criticism. Studies that address Fama and French's doubts typically examine the study's data [3]. Fama and French's findings depend significantly on how their statistical tests are interpreted. Fama and French have a significant standard error in estimating beta coefficients [3][8].

There are also some different empirical results for the CAPM model, and these results are contradictory to the model in which the expected returns can be explained by β. Not only that, the CAPM model has many limitations, for instance: Complete market assumption.

4. APT Model

There are other models that avoid some of the drawbacks of the CAPM model such as the APT model and the ICAPM model. APT model was the first to make an attempt to fix the defects that the CAPM model had, despite the fact that the model as a whole was unable to do so. Factor models describe securities returns. Specifically, there are enough securities in the market to diversify risks, and an effective securities market restricts the formation of arbitrage opportunities. These three essential premises form the basis of the theory. Arbitrage pricing theory is a potential alternative for investors since it tries to explain the relationship between risk and expected return in terms of many variables rather than just one market [9][10].

In a number of aspects, the APT model is superior to the CAPM model. Its calculations are more accurate than the CAPM model calculations at forecasting stock returns. They can be used to predict stock returns, even if the Gross Domestic Product (GDP) and interest rate variables in APT only account for 51.1% of the variation in stock returns. It is possible to predict stock returns using both theories. However, it is advised to adopt the APT model rather than the CAPM model in terms of accuracy and validity. Compared to the CAPM model, the APT model is more precise [11].

Even so, there are aspects of the CAPM model that are better than APT. There is a significant difference in prediction accuracy between these two models. Specifically, it is reflected in the accuracy of predicting the return on manufacturing stocks from 1991 to 2001. The CAPM model and the APT model are significantly less accurate at forecasting stock returns in the manufacturing sector during the economic crisis. Compared to the APT model, the CAPM model is more accurate. [11]. The CAPM model is more valuable. This result comes from research using standard deviation from 2001 to 2006. When predicting stock returns, the CAPM model is more accurate than the APT model due to the use of standard deviation research results. The CAPM model is more accurate than the APT model in predicting stock returns [12]. So the APT model is clearly not a panacea either.

5. ICAPM Model

A excellent alternative to the APT model is the ICAPM model. It aids investors in estimating prospective investment returns based on levels of risk. ICAPM extends this theory by allowing for more practical investor behavior, particularly in response to the fact that most investors want to protect their assets from market fluctuations, and creates dynamic investment portfolios as risk hedging tools. By considering how investors interact with the market, the ICAPM offers a better level of accuracy than other models [13].

The ICAPM model is the CAPM model with a hedging term added to the back of the CAPM model, and it takes the parameters of many future periods into account.

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$$ER_s = ER_f + (ER_m - ER_f)\beta - \sum_{i=1}^{n} \beta_i^h (\alpha_i^h - R_f) \quad (2)$$

When tested with the SBM25 portfolios, the Fama and French (1993) three-factor model consistently meets the ICAPM limitations the best when investment opportunities are driven by the first two moments of aggregate returns [13]. The other models, with the exception of this model and the Carhart model, cannot be supported by the ICAPM theory. In reality, the ICAPM is not a "fishing license." [14]

6. CCAPM Model

The initial CAPM model had more flaws. Specifically, it is a static single loop model. The meaning is that although this is an equilibrium with investor participation, the impact of investor behavior on the asset market cannot be reflected in specific investment activities. The stochastic discount factor form of CCAPM, which was later developed, has been employed particularly in empirical evidence and is very suitable for theoretical research, thus even though CCAPM is more recent, it is more ideal.

The Capital Asset Pricing Model (CCAPM) is one of the capital asset pricing models proposed by Breeden [15]. The CCAPM model predicts a direct correlation between stock return volatility and consumption volatility based on predicted stock return and consumption beta. The model clarifies the relationship between changes in stock market returns and consumption trends [16]. The center of CCAPM is to determine the correlation between the overall price dynamics of stocks and macroeconomic indicators present in the economic system. In addition, the correlation between macroeconomic indicators is also at the center of this model's consideration [17].

However, CAPM surpassed CCAPM. Specifically, it refers to goodness of fit, stock pricing accuracy, etc. In addition, regardless of other factors such as dividends and import growth rates, market systemic factors are statistically significant at the 1% level in all seven market financial sectors. It is obvious that market beta is still a useful indicator of risk and return. In theory, CCAPM and Consumer Beta Index should be able to better measure system risk. However, after verification, it was found that compared to CAPM, CCAPM's empirical performance in seven industry segments of the Taiwan stock market is not satisfactory [18].

7. Conclusion

This paper first explains the CAPM model and then goes on to give some examples of improved models used to enhance the applicability of the CAPM, as well as some models that can be used in place of the CAPM model. Through this article, we can understand that although the CAPM is a classic formula, it is not applicable to many real market environments, and even though it can be replaced by other models such as APT, CCAPM, and ICAPM, different models may only be applicable to certain regions and times. In short, there is no one-size-fits-all formula, so any use of public notices needs to be tailored to the local context. This paper does not use a lot of real data for calculations and explanations, so this will be optimized in future research.

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