The Application of CAPM Model in Stocks Investment and Alternatives Models of CAPM

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Abstract: The relationship between systematic risk-i.e., the broad risks involved in investing, and the expected return on assets, especially stocks, is explained by the Capital Asset Pricing Model (CAPM). Investors can use the CAPM approach to determine an expected return(E(Ri)) and compare it to the required return (Ri). It is recommended to invest in stocks where the required return exceeds the expected return. The CAPM is popular among investors due to its simplicity and accuracy. However, it is often criticized for its limitations as a single-factor model, as it only accounts for systematic risk, which is measured by Beta. This paper will discuss its limitations, including the limited assumptions it makes, its inability to be generalized to certain areas, and the fact that it only includes systemic risks. Some theories were then put forth to modify these shortcomings. This paper will also examine alternative models including the Arbitrage Pricing Theory (APT) and the Fama-French Three-Factor Model, which have been suggested as replacements for CAPM.

Keywords: CAPM, stock investment, invest decisions, Arbitrage Pricing Theory, Fama-French Three-Factor Model.

1.   Introduction

The Capital Asset Pricing Model (CAPM) works as a foundation in contemporary financial theory, exercising a significant role in the evaluation of assets, the oversight of portfolios, and the domain of corporate finance. CAPM changed how investors think about risk and return by relating the expected yield of assets to its market risk. Investors need to deeply consider the risk of investments and select the most suitable approaches that align with their objectives and risk appetite to achieve financial goals. CAPM is preferred by investors in market as its simplicity and accuracy [1]. However, because the CAPM only accounts for systemic risk, which is determined by beta, it is thought to be less accurate [2]. To modify it, some theories were subsequently proposed. The Arbitrage Pricing Theory (APT), for example, believes that the yield of assets has multiple sources of risk. Additionally, the Fama-French Three-Factor Model expands CAPM by introducing the SMB (Small Minus Big) and HML (High Minus Low) factors. This paper will review the application of CAPM in stock investment and decision-making, providing guidance for investors while also discussing its limitations and alternatives, such as APT and the Fama-French model, through the literature review.

2. Background of CAPM

An important component of contemporary financial theory, the Capital Asset Pricing Model (CAPM) is applied in many different fields of finance. It was independently proposed by William Sharpe, John Lintner, and Jan Mossin in the 1960s, building upon the achievement of Harry Markowitz on Modern Portfolio Theory.

The foundation of CAPM is that investors are risk averse and need to be compensated for assuming more risk. Based on the concept, there are two types of risk associated with investments: systematic risk, which is related to the market, and unsystematic risk, which is related to individual assets. According to CAPM, only systematic risk is relevant because unsystematic risk can be diversified in a well-made portfolio. A key concept introduced by CAPM is "beta" (β), which measures how much a stock's price fluctuates in comparison to the overall market. If an asset's beta is higher than 1, it means that its price changes are greater than those of the market as a whole. A beta of less than 1, on the other hand, indicates that the stock is less unstable than the market.

Knowing the beta of different stocks helps investors construct portfolios that match their risk tolerance.

3. Application in Stock investment

The CAPM model has long been a popular tool among investors in the stock market due to its ease of use and its ability to aid in making reasonable investment decisions. This section introduces the data that needs to be calculated when using CAPM and how to use the results to make stock investment decisions.

3.1. Data Analysis Tools

CAPM's formula is:

$$E(Ri) = Rf + Bi[E(Rm) - Rf] \tag{1}$$

where:

- E(Ri) is the expected rate of return on equity i.
- Rf is the risk-free rate, typically represented by government bonds.
- β is the beta of the assets, indicating its relative volatility.
- E(Rm) is the expected return of the market portfolio.
- E (Rm) – Rf is the premium of market risk, representing the extra return expected from the market over the risk-free rate.

Determination of whether Stocks can be invested:
Ri> E (Ri), the shares are efficient and are more worthy of investment.
Ri <E (Ri), the stock is an inefficient stock and these are best avoided.

3.2. Investment Decisions Based on CAPM Results

Investors can utilize the CAPM, for instance, to determine if a certain stock is risk-worthy. By comparing the required return (Ri) of a stock with its expected return (E(Ri)), which is calculated using the CAPM, they can assess whether the stock is inexpensive or overvalued. If the predicted return exceeds the required return given by the CAPM, the stock may be cheap and therefore a suitable investment. Conversely, if the expected return is lower, the stock may be overvalued, suggesting that it could be a poor investment choice.

This application is reflected in a study conducted in Indonesia by Alamsyah, Inayati, and Rahman, where the researchers selected 26 stocks from the LQ45 index, which comprises the best-performing stocks on the Indonesian capital market. They calculated Ri, E(Rm), Rf and β then used the CAPM to calculate the expected returns of 26 stocks. Because the stocks were in the same market environment, the values of E(Rm) and Rf are the same. However, the volatility of each stock was different, meaning that β was different for each stock and the calculated Ri were also different. Finally, they compared Ri to E(Ri).[3]

The Ri of ADRO was calculated to be 0.011813, while its E(Ri) was 0.008701, indicating that ADRO outperformed investor expectations. On the contrary, the Ri of TLKM was 0.002894 while its E(Ri) was 0.018950, suggesting that it is an inefficient stock. [3] When choosing stocks to invest in, the general rule is to choose efficient stocks, or equities whose returns individually exceed the anticipated rate of return [(Ri) > E(Ri)]. Therefore, the 16 stocks that were deemed effective in Alamsyah, Inayati and Rahman's study are worth investing in, while the remaining 10 ineffective stocks can be considered not investing in or sold.

4. The Alternatives of CAPM

4.1. The Limitation of CAPM

Despite its utility in aiding investment decisions, empirical studies have identified several limitations of the CAPM.

4.1.1. Limitations Due to Assumptions

First of all, the use of CAPM is based on certain overly idealized assumptions, such as the fact that there is a low risk tolerance among all investors and that they have frictionless access to market information, which means they can fully and fairly evaluate the market. However, these assumptions can affect the validity of expected returns. According to Brusov, Filatova and Kulik, the market is assumed to be dominated by perfectly rational actors who only consider investment returns when making decisions; otherwise, the CAPM formula will not function. However, in reality, information access varies among market participants, leading some to base decisions on facts unavailable to others [4]. It is clear that CAPM ignores many factors such as the non-transparency of financial markets, transaction costs, and market external factors that cause stock price fluctuations.

4.1.2. Limitations in Specific Markets

Additionally, CAPM cannot be well-used in some developing and economic downside countries. As Chen mentioned, the results of tests conducted by researchers in the Chinese market show consistent results, even though the statistics are not statistically significant or consistently accurate and the beta does not clearly show a positive association with the projected return because of the inefficient stock market in China [5]. It is demonstrated by their calculations and research that CAPM is not appropriate for all businesses and places lacking a very strong market.

4.1.3. Systematic Risk Only

What's more, beta, as the only risk indicator, focuses on the systematic risk of an asset but it ignores unsystematic risk which can still impact returns, especially in less diversified portfolios. In the research of PETROVIĆ et al, they mentioned that because southeast European countries face more hazards than highly developed countries, a country risk premium has been added to modify the CAPM model when calculating the risk of investment in SEE countries [6]. Through the result, after expanding with country risk premium, investors could make more efficient decisions.

These limitation factors have prompted that multi-factor models are being developed to provide an expanded explanation of assets pricing.

4.2. Solution

4.2.1. Arbitrage Pricing Theory (APT)

Arbitrage Pricing Theory (APT), proposed by economist Stephen Ross in 1976, is an alternative to the CAPM that solves some of its limitations. Unlike CAPM, which depends on only market risk element, APT is a multi-factor model that incorporates various sources of risk to explain asset returns. The fundamental idea of APT is that an asset's pricing ought to represent how exposed it is to various risk variables. APT assumes that macroeconomic factors, including changes in energy costs, GDP growth, inflation rates, and interest rates, influence asset returns.

Because it does not rely on market equilibrium and permits a more thorough examination of the variables influencing asset returns, APT is a more flexible approach than CAPM. The model can be expressed as:

$$\text{Expected Return} = Rf + \beta 1 \times \text{Factor1} + \beta 2 \times \text{Factor2} + \cdots + \beta n \times \text{Factor n} + \varepsilon \qquad (2)$$

Where:

- Rf is the risk-free rate,
- $\beta 1$ to βn represents the sensitivity degree of the asset to each factor,
- ε is the random error term especially in assets.

Zubir noted that the APT model can be more preise at forecasting anticipated returns than CAPM since it takes into account a wider range of parameters than only the market mean and variance. These considerations include stock beta and numerous macroeconomic variables [7]. Yunita, Gustyana, and Kurniawan's study of the 44 stocks in the LQ45 index from August 2019 to November 2019 found that by using the CAPM model, 24 of the stocks had expected returns above the average expected return, while using the APT model for analysis, only 17 stocks can be feasibly invested [8]. This suggests that while CAPM is suitable for most investors, APT offers greater flexibility and a more nuanced analysis, leading to more specific and accurate investment results. APT's strength lies in its ability to incorporate multiple factors, making it a more precise tool for explaining asset returns compared to CAPM.

4.2.2. Fama-French Three-Factor Model

Fama-French Three-Factor Model, created in the early 1990s by Eugene Fama and Kenneth French, is a significant breakthrough in asset pricing theory, addressing some limitations of CAPM. In order to explain the observed anomalies in stock returns that CAPM was unable to explain, Fama and French introduced two further components.

The three factors in the Fama-French model are:

Market Risk (Rm - Rf): The market risk premium, which indicates the excess return of the market above the risk-free rate, is still a fundamental component of the model, similarly as the CAPM.

Size Factor (SMB - Small Minus Big): The size factor measures how the returns on small- and large-cap companies differ from one another. Empirical evidence shows that in the long term small-cap stocks typically perform better than large-cap companies. [9]. This size premium is reflected in the SMB factor.

Value Factor (HML - High Minus Low): The value factor accounts for the differences in returns comparing growth stocks with low book-to-market ratios and value stocks with high ones.

Historically, value stocks have yielded more returns than growth ones. HML represents the value premium.

The Fama-French Three-factor model is expressed as:

$$\text{Expected Return} = Rf + \beta1\ (Rm-Rf) + \beta2SMB + \beta3HML \qquad (3)$$

where:

- $\beta1$ represents the sensitivity to the market risk factor,
- $\beta2$ represents the sensitivity to the size factor,
- $\beta3$ represents the sensitivity to the value factor.

Jan, Iqbal, and Aamir analyzed 50 stocks listed on the Pakistan Stock Exchange to evaluate the impact of the size and value factors on earnings forecasts. Their results indicate that the Fama-French model, incorporating size and value factors, is more significant than a model with a single factor[10]. In another study, it was shown that portfolios exhibit diversification changes so investors can achieve better results by combining knowledge of the CAPM and data obtained using the Fama-French model [11]. Compared to CAPM, the Fama-French model is able to perform better when predicting returns across various equities since it incorporates the SMB and HML variables.

5. Conclusion

In stock investment, the CAPM model helps investors determine the expected return of a stock, considering its risk compared with the market. This is essential for making informed investment decisions. Efficient stocks are those with a required return higher than the expected return, and investors can use the CAPM model to calculate expected returns more easily and select better-performing stocks. There are also some limitations in CAPM. Because CAPM is founded on several extremely idealistic assumptions, it is not appropriate for application in all developing and economically vulnerable countries. When used as the only risk indicator, beta concentrates on an asset's systematic risk while ignoring unsystematic risk, which can still affect returns, particularly in portfolios with less diversification. The APT and the Fama-French Three-Factor Model modify CAPM to some extent. However, there are still some challenges with these two alternatives. The challenge with APT is determining which factors matter and how they affect returns. This needs for specialized knowledge of the specifics of the assets as well as the macroeconomic climate. For Fama-French Three-Factor Model, it does not take into consideration other variables like momentum, liquidity, or profitability that could affect returns.

In summary, despite its shortcomings, CAPM is still widely used due to its simplicity and ease of comparing investment options. While the APT and the Fama-French Three-Factor Model are significant improvement over CAPM, they are not the final step in asset pricing theory. The search for a more comprehensive pricing model that can capture more relevant risk factors is still need to be developed.

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