Applitability Analysis of CAPM in China A-Share Market

Mulin Zhu[1,a,*]

[1]*Institute of economy, Hebei GEO University, Shijiazhuang 050031, China*
a. 1910831139@mail.sit.edu.cn
*corresponding author

Abstract: In this paper, we first analyze and summarize the background to CAPM development. The CAPM model is introduced in detail, the development process of the model and its advantages and limitations are analyzed and expounded. And set out the current state of research on CAPM models at home and abroad. The previous literatures of other researchers were cited, and their views were sorted and analyzed one by one. Once we had a basic understanding of the CAPM model, on this basis, all of the monthly A share data in the CSMAR database from February 1994 to August 2021 were selected as samples to sort and preprocess the data. T-test analysis was performed on the Fama-Macbeth regression model. From the regression results, it can be seen that only the market factor is significant out of all the factors, thus, one can conclude that the CAPM model is effective in explaining the market for A stocks.

Keywords: CAPM model, market factor, Fama-Macbeth, regression, T-test

1. Introduction

CAPM, full name Capital Asset Pricing Model, was proposed in 1960 by Treynor, Sharpe, Lintner, Mossin, and others. This model is a mathematical model of the relationship between asset returns and risk. Under the premise of market equilibrium, the expected return of an asset should show a certain linear correlation with the risk it takes. In this case, investors can determine the future risk of an asset by making reasonable predictions about its future returns. Capital asset pricing model is an economic model based on a series of basic assumptions and theories. In reality, investors tend to choose portfolios based on their own projections of the company's future earnings. The CAPM model can be used to assess the expected return on an investment asset to achieve a balance of risk and return considerations. Investors usually judge an asset's contribution to future earnings by its expected return. If the expected return on the asset is higher than the reasonable return calculated by CAPM, it may be considered an underestimate and vice versa, which is a possible misunderstanding. If the expected return is lower than the overall performance of the market, it may be considered an overestimate of the value of the asset. Based on an asset's beta value, investors can compare its expected return with the overall performance of the market to assess the merits of their investment return. In the CAPM model, market combinations are widely used to represent risk and return across the market, providing an effective decision-making framework for investors. The results of the CAPM model are influenced by the choice of market mix, so in practice, the right market mix needs to be selected to achieve the best results. The market mix consists of a variety of securities with different income and loss distributions among them. Common market combinations include stock indices such as the S & P

500, a widely used index combination. The volatility of stocks is an important parameter. In the CAPM model, risk-free interest rate is a widely used interest rate choice, which can effectively reduce the risk and improve the reliability of the model. Risk free interest rate refers to the relationship between market risk and return, that is, there is a linear relationship between market risk and return. In practice, one of the most common risk-free assets is the yield on Treasurys. Risk-free interest rates can provide a reference price for stocks and bonds, allowing investors to expect returns. However, CAPM's estimated results may be impacted by risk-free interest rate options due to changing market conditions.

Let's give a brief overview of the model's strengths and limitations. Based on balanced market assumptions, CAPM has constructed a clear theoretical framework for asset pricing that evaluates asset returns more intuitively by quantifying the relationship between risk and return. The CAPM model is easy to use and computationally convenient, allowing for accurate calculation of expected returns by considering key parameters such as market mix, risk-free interest rate, and asset end beta. In addition, the model can provide reasonable valuation results under lower assumptions. In addition, the capital asset model clearly articulates the positive relationship between risk and expected return, which helps investors understand the trade-offs that need to be considered when making investment decisions. In addition, CAPM's market portfolio serves as a reference point for investors to assess the performance of their portfolio and adjust it as necessary. In addition, the model is applicable not only to the assessment of expected return on assets, but also to various areas such as risk management, portfolio management and asset pricing. However, as a single factor model, the validity of CAPM model is limited by several theoretical assumptions, including but not limited to investor rationality and frictionless market. However, these assumptions are not always reliable in the real market. CAPM's single-factor model makes it difficult to account for the outperformance of certain assets, such as value stocks and small-cap stocks, because it considers market risk to the exclusion of other factors. It also ignores non-systemic risk to the exclusion of systemic risk to assets. Market mix selection is critical in the CAPM model, as different market mix selection can lead to different forecast outcomes. In addition, empirical research has revealed the limitations of CAPM in explaining market return differentials, raising questions about the validity of the model, as well as the shortcomings of CAPM in taking into account irrational investor behavior, market bubbles, and other factors that can have a significant impact in real markets.

Considering the advantages and disadvantages of CAPM model as the base model of asset pricing theory, investors need to consider the assumptions and limitations of CAPM model in combination with other models and reality.

2.   Literature Review

Historically, many scholars have explored the CAPM model. After William Sharp proposed the CAPM model to illustrate the relationship between expected return and risk on assets [1], John Lintner explored in a subsequent study how investors consider the relationship between asset valuation and expected return when selecting risky assets and constructing equity portfolios [2]. In 1966, James Tauber proposed and discussed how, under balanced market conditions, investors could construct asset portfolios to balance risk and return [3]. Fama et al. propose a three-factor model to overcome some of the limitations of CAPM and highlight the role of market risk, size and value factors in stock returns [4]. In addition to previous studies by foreign scholars, many Chinese scholars have also delved into the application of CAPM in various fields [5]. Zhang double studied the applicability of the CAPM model and Fama-French tri-factor model to extreme stress tests by selecting data from the Shanghai 50 Index between 2019 and 2021. Through the analysis of WACC model and CAPM model, Sheng-won Lin introduced the theory of centralized capital structure in detail, and further explained the relationship between corporate capital structure and corporate value

[6]. Yang and Zheng used the A-share market in 2021 to study and test the applicability of CAPM. The pair only selected the monthly data of 50 shares in the Shanghai A-share market for regression analysis [7]. In addition to the stock market research, Yan et al. and others also examined the cryptocurrency market CAPM model. They estimated the cryptocurrency beta coefficient, beta coefficient time series regression, and cross-sectional regression using definiteness and regression equations, respectively [8, 9]. Based on CAPM theory, the target of risk portfolio decision based on expected rate of return and volatility, the target portfolio model is consumer stocks, and the optimal portfolio is obtained by using programming software. In the end, Zhu described and summarized the research situation of CAPM models in China [10].

3.   Research Process

In order to explore the applicability of CAPM model in China's A-share market, a large number of data should be selected for analysis and pre-processing, and the relevant knowledge of descriptive statistics should be used to analyze the data, and finally the research results can be obtained. Market factor is not a traditional factor, so it is not necessary to construct a combination of other long-short hedging factors to test it. In this paper, the monthly data of A-shares in the CSMAR database from February 1994 to August 2021 are selected as samples. After data preprocessing and extreme values are removed. First, all stocks were divided into two groups of small market value and large market value according to the median market value of the 2×3 factor construction method, and then divided into three groups of high, medium and low according to the book-market value ratio. The two indexes of market value and book market value intersected. The operating profit rate and investment style replaced the book-market ratio of six stock portfolios, and the above steps were repeated to construct market factors. Finally, Fama-Macbeth regression analysis was carried out on the model with programming software, and the results were analyzed and sorted out with the obtained data

4.   Research Results

Table 1: T-testing of individual factors.

T test results	mkt-rf	SMB	HML
mean	0.010123	0.008432	0.004434
t	1.694102	3.150816	1.618619
p-value	0.041189	0.001777	0.106485

Table 2: The regression result of CAPM model.

Fm regression	mkt-rf	SMB	HML	const
mean	0.014193	0.000433	0.001571	0.000916
t	2.927334	0.186381	0.661891	0.421887
t nw	2.570624	0.238569	0.661742	0.209056
p-value	0.003665	0.852264	0.508519	0.673392

Table 1 is an examination of individual factors and table 2 is an examination of the overall model. As can be seen from table 1, both market factors and SMB factors have some explanatory power, but overall, the multi-factor model is not applicable in this sample. Based on the statistical table 2 presented by the Fama-Macbeth regression, we conclude that the p-value of the market factor in the

T test is significantly less than 0.01, indicating that the presence of the market factor is extremely significant. In addition, market factors have a significant impact on earnings indicators, and this effect decreases gradually with the increase in the size of stocks. Moreover, based on empirical analysis, we found no significant correlation between market factors and other factors. This also reflects the complexity of the application of market factors in practice. However, while factors such as size and value were not significant, the p-value corresponding to other factors was significantly higher than 0.05. We also found that liquidity factors had the greatest impact on earnings levels, followed by volatility factors and book to market ratios of all factors. This suggests that these factors may be at risk of being overestimated or underestimated, and that they are closely related to market factors, albeit to a slightly different extent. The CAPM model showed remarkable efficacy in the interpretation of the A share market, as only market factors showed superior performance, while the influence of other factors in the sample was less evident. Although the proposition is well established, our results may be influenced by a variety of factors in different scenarios, including data sample selection, differences in pretreatment methods, and regression selection. In addition, there are limitations to the scope of Fama-Macbeth's return, and there may be another way to infer the significant presence of other factors.

5.   Conclusion

Finally, the paper puts forward some policy suggestions to improve the efficiency and quality of China's stock market. From the above results, we can learn that only market factors are significant and other factors are not, but due to the choice of data and the way it is processed, the results are only a reference. Overall, while the CAPM model has some explanatory power in the A share market, it does not fully capture stock returns. In fact, there are many factors that influence stock returns, so we need to explore more precise research methods for further study.

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