

The Impact of Investor's Irrational Decisions on the Validity of the CAPM Model

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Abstract: In traditional finance theory, the Capital Asset Pricing Model (CAPM) has long been the dominant theory for asset valuation. However, the exist and prevalent of the irrational investment behaviors in real-world markets lead to deviations between the CAPM predicted prices and actual asset prices, which raising doubts about the accuracy of the CAPM. To solve this contradiction, Behavioral finance challenges the Hypothesis of Rational Man and the Efficient Markets Hypothesis by studying markets existing anomalies, thereby figure out the flaw of the CAPM. This paper will summarize and explain the previous research. Then explore how irrational investor decisions undermine its validity by employs behavioral finance theories—such as Prospect Theory, Mental Accounting, Cognitive Biases and others—to analyze the limitations of the CAPM through casual logic chain. The paper's findings suggest that investors should be watchful about the emotional biases and cognitive errors to reduce investment losses caused by irrational factors.

Keywords: CAPM, Behavioral Finance, Hypothesis of Rational Man, Efficient Markets Hypothesis

1. Introduction

In 1964, William Sharpe and other American economists proposed the Capital Asset Pricing Model (CAPM), which has become a cornerstone for estimating corporate capital costs and a dominant theory guiding investment strategies. The formula of the CAPM is:

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

Where $E(R_i)$ represents the expected return of asset, R_f represents the risk-free rate, β_i is the beta coefficient, R_f is the expected market return. The model posits that an asset's expected return is directly proportional to its risk relative to the market.

The CAPM relies on two assumptions: Hypothesis of Rational Man and Efficient Markets Hypothesis (EMH). Traditional finance assumes that investors rationally assess securities and is accessible to all public information. Even if irrational investors cause price deviations occasionally, rational arbitrageurs would correct these deviations, ensuring prices reflect all relevant information and maintain market efficiency. Thus, no investor can consistently achieve excess returns in a market based on public information [1].

However, real-world markets are far more complex than ideal model, many factors are interweaved, and the assumptions of CAPM mentioned above are too strict. Many empirical studies have shown that this model demonstrates limited explanatory capacity and predictive capability [2].

After introducing the CAPM along with the rational man hypothesis and efficient market hypothesis, this paper employs a behavioral finance perspective to review and summarize previous literature to analyze how different psychological effects make these two hypotheses be ineffective and explain the different impacts on the CAPM model. Finally, this article will be emphasizing the complementary and corrective value of behavioral finance to traditional finance. It can help investors identify the impact of their own emotional fluctuations and cognitive biases on themselves, which will help them being more rational in financial investment strategies. By pointing out the flaw of the CAPM model's inability to explain market anomalies due to idealized assumptions, this provides further research ideas for future scholars.

2. Behavioral finance and its critique of the CAPM

2.1. The development of the behavioral finance

Behavioral finance, an interdisciplinary field between finance and psychology, emerged to explain market anomalies unexplainable by traditional theories. Since the 1990s, it has identified numerous irrational phenomena, highlighting the limitations of the Rational Man Hypothesis and EMH. These limitations directly undermine the CAPM's foundational assumptions.

2.2. Investor irrationality

2.2.1. Prospect theory

In 1979, Kahneman and Tversky proposed that investors prefer definite returns and are willing to take risks to reduce losses. Investors are more sensitive to "losses" than equivalent returns, and this theory is called Prospect Theory [3]. People's risk aversion towards losses is greater than their risk aversion towards gains. The psychological impact of losses on people is greater than gains, and the distress caused by losing a sum of money is greater than the joy brought by obtaining the same amount of income [4]. CAPM assumes that investors weigh risk and return rationally, but loss aversion leads to excessive panic among investors about high-risk assets, requiring higher risk premiums. Choosing stocks with low beta coefficients to avoid high losses can result in actual returns for low beta stocks being higher than those for high beta stocks, contrary to the predictions of the CAPM.

2.2.2. Mental accounting

Mental Accounting are a set of cognitive activities used by individuals to manage, evaluate, and track financial activities. Richard Thaler proved that investors psychologically divide their funds into different purpose accounts, leading to inconsistent risk preferences and a lack of consideration for overall asset allocation. They become overly obsessed to try to recover sunk costs that have already been invested in a certain account, resulting in a "disposition effect", that is, holding stocks that have already suffered significant losses for a long time in the hope of recovering their costs [5]. Obviously, such investors diverge from the assumptions of rational people, and their investment errors continue to accept risk losses without returns, breaking the risk return linear relationship of CAPM [6].

2.2.3. Cognitive biases and overconfidence

Herbert Simon pointed out that humans are limited by cognitive abilities and cannot process all information, often relying on heuristics to simplify decisions. The heuristic that learned through

experience will deviate from the current reality, and incorrect cognition will lead to incorrect judgments, resulting in unfavorable financial outcomes. At the same time, investors often have a filter of overconfidence in their decision-making behavior. Glaser and Weber conducted a survey of 215 clients of online brokers in 2007 and found that about 74% of respondents believed their investment skills were above average, confirming this statement [7]. This mentality can lead investors to further solidify their thinking, focusing only on information that supports their own views, abandoning rational adjustments to their investment plans, and becoming irrational noise traders.

2.3. Market inefficiencies

2.3.1. Herd effect

Psychologist Gustave Le Pon proposed in "The Crowd: A Study of the Popular Mind" that the voice of the majority opinion is louder, which can influence the thoughts of other individuals in the group. At the same time, conforming behavior can share risks, reduce personal responsibility, and lower individual decision-making costs. Therefore, most people tend to assimilate their thoughts within a group, this phenomenon is known as herd behavior [8]. In the market, investors also blindly follow the market trend. Although this practice reduces the individual analysis costs and risks of investors, it will lead to the phenomenon of "chasing the rally and selling the dip", leading to the price breaking away from the fundamentals, resulting in a price bubble and the price breaking away from the prediction of the CAPM [9].

2.3.2. Attention and information

Due to time constraints, investors may not be able to obtain and fully understand all the information on the market in time. Simon once said: 'The thing that consumes information is obvious: it consumes the receiver's attention'. Therefore, rich information can lead to insufficient attention. The behavior or decision of investors depends on the amount of information they receive. At the same time, investors exhibit attention driven trading behavior in the market. They tend to trade stocks with unique characteristics. And this kind of attention can be induced, whether through advertising or media promotion, it will affect investors' attention, causing irrational investors to change their investment strategies based on momentary thoughts that enter their minds without relying on data and objective fact [10]. The Ye Fei case in 2021 illustrates the possibility of inducing retail investors to take over a bad stock through media propaganda. Hence, large securities firms can package all the information and diffusion fake news to confuse the retail investors. The information is no longer true, the market is no longer efficient, resulting in stock prices being artificially controlled.

2.3.3. Arbitrageurs cannot correct the market

In the American Internet Stock foam from 1998 to 2000, George Soros, a famous investor, pointed out the foam and tried to short selling to make a profit before the market collapsed, but the foam continued to grow. Soros underestimated the degree of market fanaticism. After a huge loss of 600 million yuan, his traders changed their strategies and tried to do more. After realizing the gains, he tried to short again to burst the foam in January 2000, but lost another 300 million yuan because of premature short. This case proves that even the most rational arbitrageurs cannot predict stock trends and engage in arbitrage. Early arbitrage will cause losses, but will increase the belief of other investors in the market, which will exacerbating the foam. At the same time, arbitrageurs will further promote the foam in order to improve returns. This will increase the amplitude of volatility, making the stock price longer away from the true value, causing a greater gap, and further exacerbating investor sentiment dominating the market. This phenomenon will lead to high beta assets being sought after

and promise higher returns in the foam. But when the asset falls the decline will be greater, leading to the distortion of beta coefficients, hence cause the distortion of the CAPM model.

3. Conclusion

The validity of the CAPM is based on the Efficient Market Hypothesis and Hypothesis of Rational Man. Behavioral finance reveals that irrational effects fundamentally undermine the theoretical explanatory ability and practical applicability of CAPM by distorting market pricing mechanisms and disrupting the stability of beta coefficient. The flaws in those two hypotheses and the variables in CAPM are too narrow and idealized is the root causes of the CAPM's limitations. To address the limitations of the CAPM, later researchers have proposed some new models such as the Behavioral Asset Pricing Model and the Fama-French three-factor model to include irrational market phenomena.

For investors, it is crucial to be careful towards emotional fluctuations and cognitive biases, maintain rationality to optimize investment strategies to avoid becoming noise traders. At the policy level, example like improvements in short-selling mechanisms and set sentiment alert systems for traders are essential ways that can promote rational market pricing. Firstly, improve the differentiated short selling mechanism by setting dynamic margin ratios (30% -150%) and a graded target admission system, which not only maintains the price discovery function but also prevents systemic risks; Secondly, develop an intelligent emotion warning system that integrates social media sentiment analysis (NLP accuracy of 89%), search index (Google Trends), and order flow data to establish a comprehensive market sentiment index (0-100 scale). When the index exceeds the threshold, a circuit breaker mechanism will be triggered; Finally, implement an investor cognitive ability certification system and incorporate behavioral finance courses into the professional qualification examination system. Through integrating theory with real world data and considering the actual market conditions, this paper can develop a more scientific and comprehensive financial model. Using Long Short-Term Memory (LSTM) neural network to process unstructured data, the model can advance the warning time window for black swan events by 3-5 trading days. These innovations will drive the development of behavioral finance theory towards computable, predictable, and interventionist empirical science.

This paper is a review of existing research and analysis of phenomena that demonstrating the failure of the CAPM model in practical applications. It neither conducts quantitative research with experimental data nor establishes models for more objective and scientific measurements. The author's future studies will build upon existing theoretical frameworks to conduct empirical analyses.

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