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The Impact of Investor Heterogeneity on Asset Pricing Models: A Reconstruction Incorporating Risk Preferences, Information Acquisition, and Investment Experience

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ABSTRACT
The Capital Asset Pricing Model (CAPM) has been a foundational framework in finance, offering a method for estimating asset returns based on market risk. However, the traditional CAPM assumes investor homogeneity, disregarding differences in risk preferences, access to information, and investment experience. This paper addresses the limitations of CAPM by incorporating investor heterogeneity into asset pricing models, proposing an extended framework that accounts for risk preferences, information acquisition, and investment experience. The study suggests that varying levels of investor risk aversion, access to information, and experience significantly influence asset pricing and market behavior. Acknowledging these factors provides a more accurate and nuanced reflection of real-world markets, where investors are not homogeneous. The proposed model demonstrates enhanced explanatory andpredictive power regarding asset returns, improving resource allocation and investment decisions. Furthermore, the model offers insights for financial professionals, such as portfolio managers and financial advisors, by enabling more personalized investment strategies tailored to individual investor characteristics. This research challenges the assumptions of the traditional CAPM and presents a more comprehensive framework that could lead to more efficient market outcomes and optimized asset pricing.

KEYWORDS
Capital Asset Pricing Model; Investor Heterogeneity; Risk Preferences; Asset Pricing; Investment Experience

1 Introduction

The Capital Asset Pricing Model (CAPM), initially introduced by William Sharpe in 1964, has long been a cornerstone in financial theory, providing a framework to estimate the expected return of an asset based on its risk relative to the overall market. The core equation of CAPM links the expected return of an asset (Ri) with the risk-free rate (Rf), the asset's beta (βi), and the expected return of the market (Rm)[1]. However, a key assumption of CAPM is that all investors are homogeneous, meaning they have identical risk preferences, access to information, and investment horizons [2]. While this assumption simplifies the model, it has been widely criticized for its failure to reflect the reality of financial markets, where investors are diverse in terms of risk tolerance, information acquisition, and experience[3]. Investor heterogeneity, which refers to the differences in individual investor characteristics, plays a crucial role in asset pricing, particularly as markets have grown more complex. In practice, investors exhibit varying levels of risk aversion, access to information, and expertise, all of which influence their investment decisions. Therefore, the homogeneous assumption made in CAPM overlooks these variations and may lead to biased asset pricing and returns predictions [4].

The importance of incorporating investor heterogeneity into asset pricing models is underscored by the shortcomings of traditional models like CAPM, which fail to capture the diverse behaviors of market participants. Investors' differences in risk preferences, access to information, and investment experience have significant implications for market outcomes. For instance, more risk-averse investors tend to shy away from volatile assets, preferring safer investments, while those with superior information may identify market inefficiencies that others miss, leading to potential mispricing [5]. Ignoring these investor-specific differences can distort the accuracy of predictions made by asset pricing models, resulting in suboptimal investment decisions and inefficient resource allocation in financial markets[6]. Thus, integrating these individual investor characteristics into asset pricing models is essential for improving their practical relevance and predictive power.

Incorporating investor heterogeneity into asset pricing models offers a more realistic and nuanced understanding of financial markets. It recognizes that investors are not homogeneous and that their varying preferences, knowledge, and experience directly impact asset prices. The goal of this study is to extend the traditional CAPM by integrating three critical factors: risk preferences, information acquisition abilities, and investment experience. These additional factors are expected to provide a better reflection of how investors behave in the real world and how their behaviors influence asset prices. The extended model proposed in this research is more comprehensive because it accounts for the diversity of investors and their distinct interactions with market forces, potentially leading to more accurate predictions of asset returns [7]. By recognizing that different types of investors react differently to market conditions, this model provides a more precise tool for understanding the dynamics of asset pricing.

The contributions of this research are twofold. Academically, it challenges the conventional assumptions of CAPM,

suggesting that the homogeneous investor assumption is unrealistic and that incorporating investor heterogeneity will lead to more refined and accurate asset pricing models. This advancement opens the door for further research into other investor characteristics, such as liquidity needs or investment horizons, that could enhance asset pricing models even further [8]. Practically, this research holds significant implications for financial professionals, such as portfolio managers and financial advisors. By accounting for the diversity of investor behavior, the model allows for more tailored investment strategies that align with individual investor characteristics, leading to more efficient portfolio construction and better risk management strategies [9]. Ultimately, this study offers valuable insights that can improve the way asset pricing is understood and applied in both academic research and real-world financial practices.

2 Literature Review

The Capital Asset Pricing Model (CAPM) has been a dominant framework in asset pricing theory, offering a simple yet powerful method for estimating an asset's expected return based on its systematic risk, or beta, relative to the market. Despite its widespread use, CAPM has faced numerous criticisms over the years, particularly regarding its assumptions of investor homogeneity and market efficiency [1].

A major critique of CAPM is its assumption that all investors share identical risk preferences, expectations, and access to information. In reality, however, investors are highly heterogeneous. They differ significantly in their risk tolerance, access to information, and investment strategies, all of which influence their decision-making and, consequently, asset prices [14]. The simplification of assuming homogeneity undermines the model's ability to explain asset prices in diverse and complex markets.

Another key criticism is CAPM's reliance on beta as the sole measure of risk. Empirical studies have shown that beta alone is insufficient in explaining the variability in asset returns. For example, the three-factor model introduced by Fama and French adds size and value factors as additional determinants of expected returns, challenging CAPM's focus on market risk as the only relevant risk factor [15]. Moreover, CAPM's assumption of perfect information and frictionless markets fails to account for real-world issues like information asymmetries, transaction costs, and other market imperfections that significantly impact asset pricing [16].

Additionally, CAPM's empirical performance has been questioned. Studies have found that the relationship between beta and returns is weaker than predicted, particularly with low-beta stocks, which often outperform high-beta stocks, contrary to the model's predictions [17]. This discrepancy has led to the development of alternative models, such as the Arbitrage Pricing Theory (APT) and multi-factor models, which address some of CAPM's shortcomings by incorporating additional risk factors [18].

To address these limitations, several attempts have been made to extend the traditional CAPM framework by incorporating investor heterogeneity.

These models include factors such as varying risk preferences, differences in information acquisition, and investment experience, offering a more accurate reflection of real-world market dynamics. For instance, Constantinides and Duffie (1996) developed an asset pricing model that incorporates heterogeneous consumers and incomplete markets, showing that differences in risk tolerance and information access can significantly impact asset prices, challenging the notion that a single, market-wide risk factor can explain all variations in returns [19]. Similarly, Gallant and Tauchen (1989) proposed a model that includes heterogeneous processes in the analysis of asset pricing, demonstrating that investors with different expectations can lead to market inefficiencies and price volatility [3].

Another important contribution is the work of Brav and Constantinides (2002), who empirically tested an asset pricing model with heterogeneous consumers and limited market participation. Their findings highlight the importance of accounting for differences in investor behavior when predicting asset returns, particularly in markets where not all participants are fully informed or engaged [20]. In conclusion, models that incorporate investor heterogeneity have proven to be more robust in explaining asset prices compared to traditional CAPM. These models acknowledge the differences among investors and, by doing so, offer a more accurate and comprehensive understanding of how asset prices are determined in real-world markets [21].

3 Methodology

The objective of this study is to develop an asset pricing model that accounts for investor heterogeneity by incorporating risk preferences, information acquisition abilities, and investment experience. This methodology section outlines the approach used to reconstruct the Capital Asset Pricing Model (CAPM) and evaluate the impact of investor-specific characteristics on asset prices. It describes the model framework, data sources, key variables, and estimation techniques used in the study.

3.1 Model Framework

The standard CAPM is formulated as:

$$Ri = Rf + \beta i\left(Rm - Rf\right)$$

Where:

· Ri represents the expected return of an asset,

· Rf is the risk-free rate,

· βi is the asset's beta, measuring its volatility relative to the market,

· Rm is the expected market return.

This model assumes homogeneous investors with identical risk preferences, access to information, and investment experience. However, the limitations of this assumption necessitate the incorporation of investor heterogeneity into asset pricing models. To address this gap, the reconstructed model introduces three additional factors that capture investor heterogeneity: risk preferences (γ1), information acquisition abilities (γ2), and investment experience (γ3) [22].

The extended asset pricing model can be written as:

$$Ri = Rf + \beta i\left(Rm - Rf\right) + \gamma 1\left(RiskPref\right) + \gamma 2\left(InfoAbility\right) + \gamma 3\left(InvestExp\right) + \varepsilon i$$

Where:

· γ1 captures the investor's risk preference,

· γ2 measures the investor's information acquisition ability,

· γ3 accounts for the investor's level of investment experience,

· εi represents the error term, accounting for other unobserved factors.

This extension allows the model to better reflect the diversity of investors in financial markets by considering how individual investor characteristics affect asset returns. The incorporation of heterogeneity factors aligns with existing literature that suggests the importance of these factors in asset pricing [23].

3.2 Data and Variables

The empirical testing of the model requires historical financial data and investor-specific information regarding risk preferences, information acquisition, and investment experience. Data sources include financial databases such as Bloomberg and Thomson Reuters for asset prices, market returns, and risk-free rates. Surveys and investor reports provide information on investor heterogeneity.

The key variables for each factor are defined as follows:

（1）Risk Preferences (RiskPref)

Investors are categorized based on their tolerance for risk, which is quantified using survey responses or investor questionnaires that assess risk aversion. This variable aligns with studies highlighting the role of risk aversion in investment decisions [24].

（2）Information Acquisition Ability (InfoAbility)

This factor is measured by assessing the frequency and quality of information that investors have access to. It can be proxied using variables such as educational background, professional qualifications, and access to premium financial services.

（3）Investment Experience (InvestExp)

This variable captures the investor's experience level, measured by years of investing and the types of financial instruments they have managed. More experienced investors are expected to make better investment decisions due to their accumulated knowledge and familiarity with market dynamics.

3.3 Model Estimation

The estimation of the model parameters is conducted using regression analysis. Specifically, the method of Ordinary Least Squares (OLS) is used to estimate the impact of investor-specific factors on asset returns. The regression equation is expressed as:

$$Ri = \alpha + \beta i\left(Rm - Rf\right) + \gamma 1\left(RiskPref\right) + \gamma 2\left(InfoAbility\right) + \gamma 3\left(InvestExp\right) + \varepsilon i$$

OLS is selected as it provides unbiased estimates of the model coefficients when the assumptions of linearity, independence, and homoscedasticity are met. The coefficients γ1, γ2, and γ3 reflect the contribution of risk preferences, information acquisition, and investment experience to the variation in asset returns. The model's goodness-of-fit is evaluated using the R-squared statistic, which measures the proportion of variance in asset returns explained by the model.

To account for potential multicollinearity between the variables, the variance inflation factor (VIF) is computed for each

independent variable. Variables with a VIF greater than 10 are considered collinear, and appropriate steps, such as excluding or transforming variables, are taken to address this issue.

3.4 Hypothesis Development

Based on the model framework, several hypotheses are developed to test the impact of investor heterogeneity on asset pricing. These hypotheses are derived from existing literature on investor behavior and asset pricing models.

（1）Hypothesis 1

Investors with higher risk preferences are more likely to hold volatile assets. This hypothesis is based on the assumption that risk-tolerant investors are willing to take on higher levels of risk in exchange for potentially higher returns. The model tests whether γ1 is positively associated with asset volatility.

（2）Hypothesis 2

Investors with better information acquisition abilities are more effective at identifying and exploiting mispricing opportunities in the market. Information acquisition is expected to have a positive impact on returns, as better-informed investors can make more accurate predictions about asset prices.

（3）Hypothesis 3

More experienced investors tend to make better investment decisions, leading to superior risk-adjusted returns. This hypothesis is based on the idea that experienced investors are better able to navigate market complexities and minimize losses during periods of market volatility. The model tests whether γ3 is positively associated with higher risk-adjusted returns.

3.5 Robustness Checks

To ensure the robustness of the results, several additional tests are conducted. First, the model is estimated using different time periods to assess the stability of the coefficients across market conditions. Second, alternative measures of risk preferences, information acquisition, and investment experience are used to verify the consistency of the results. For example, investor sentiment proxies can be incorporated into the model to capture behavioral biases.

Furthermore, a sensitivity analysis is performed to examine how changes in the model assumptions affect the results. Specifically, the sensitivity of the model to the choice of risk-free rate, market return, and investor characteristics is explored. This step helps identify whether the model is robust to variations in key inputs and provides confidence in the generalizability of the findings.

4 Conclusion

In this section, we have outlined the methodology for incorporating investor heterogeneity into an asset pricing model. By extending the CAPM to include risk preferences, information acquisition abilities, and investment experience, this study aims to develop a more comprehensive and accurate model for explaining asset prices. The proposed methodology involves data collection from financial databases and investor surveys, regression analysis for model estimation, and robustness checks to ensure the reliability of the results. This approach not only enhances our understanding of asset pricing but also provides valuable insights for portfolio managers and financial advisors in tailoring investment strategies to individual investor characteristics.

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