

Investor Behavior and Limitations of Asset Pricing Model under Green Finance

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Abstract: With the advancement of global sustainable development strategies, green finance has become a core driver of economic transformation and upgrading, and the development of environmental, social and governance (ESG) investment concepts has challenged traditional asset pricing models. Increasing investor attention to ESG factors has led to a shift in investment decision logic from single financial returns to multi-dimensional sustainability assessments. By combining the existing literature, this article discusses the transformation of investor behavior and the limitations of the CAPM and Fama French five-factor model in the context of green finance. The study shows that companies with good ESG performance receive higher market recognition and lower financing costs, while the CAPM model fails to fully explain asset returns because it does not incorporate ESG factors and investor sentiment. And although the Fama-French five-factor model has some explanatory power, it does not cover ESG dimensions, and some of the factors perform redundantly in the A-share market. However, after adding ESG factor, the performance of the model is improved, especially in the grouping of small capitalization and value stocks. Therefore, in the context of green finance, investor behavior presents ESG integration and sentiment-driven features, which challenge the validity of traditional pricing models.

Keywords: Green Finance, Investor Behavior, Asset Pricing Model, ESG

1. Introduction

With the promotion of the global sustainable development strategy, green finance has become the core driving force of economic transformation and upgrading. The rise of the Environmental, Social, Governance (ESG) investment philosophy has prompted investors to move from single financial returns to multi-dimensional sustainability assessments. Companies with good ESG performance tend to receive higher market recognition and lower financing costs, and their stocks show significant market value effect and value effect in the A-share market [1,2]. However, the limitations of the CAPM and the Fama-French five-factor model are evident in the context of green finance, which triggers a reflection on whether existing models need to be adapted to the new market environment.

In recent years, studies have shown that investor sentiment and trading behavior have a significant impact on asset prices, and this impact shows different characteristics under different market conditions [3]. In addition, as green finance develops rapidly, investors' preferences for risks and returns are changing, and the limitations of traditional models are also emerging [4].

The aim of this paper is to explore the shift in investor behavior and the limitations of traditional asset pricing models in the context of green finance. First of all, this paper analyzes the rise of green

finance and its impact on investor behavior patterns, and then deeply discusses the limitations of traditional CAPM model and Fama French five factor model in the context of green finance. This study reveals new features of investor behavior in the context of green finance and its challenges to traditional asset pricing models, providing new perspectives for academia and industry. The findings of this research contribute to a deeper comprehension of how green finance interacts with investor behavior. They also lay a theoretical groundwork for refining the asset pricing model and offer valuable insights to guide investors' decision-making processes within the realm of green finance.

2. Green Finance and Investor Behavior

2.1. The Rise of Green Finance

Through innovative financial instruments (e.g., green bonds, ESG funds) and strategies, green finance has effectively guided capital flows to environmental protection, low-carbon and sustainable development areas, providing the necessary financial support for these areas, thus promoting the green transformation and sustainable development of the economy [1].

According to the GSIA 2022 report, global ESG assets under management grow from \$22.8 trillion in 2016 to \$41.5 trillion in 2022, reflecting investors' increasing focus on sustainability and ESG factors. ESG investing focuses not only on the financial performance of companies, but also on their performance in terms of environmental protection, social responsibility and corporate governance. To facilitate the continued advancement of ESG investment, regulatory authorities are continuously enhancing the requirements for ESG information disclosure. For example, the China Securities Regulatory Commission (CSRC) has gradually promoted the standardisation and normalisation of ESG disclosure by listed companies, requiring them to disclose in detail their environmental, social and corporate governance performance and improvement measures in their annual reports and other important documents. This measure serves to bolster the transparency and reliability of publicly traded firms, offering investors a more robust and detailed foundation for making informed investment choices [5].

2.2. Shifting Patterns of Investor Behavior

In the context of green finance, investor behavior has shown some shifts, mainly in terms of ESG performance and sentiment drivers.

2.2.1. ESG Performance

Numerous empirical studies have revealed a non-negative relationship between ESG performance and firm financial performance. Among them, the impact of governance dimension is particularly prominent, indicating that it is significant to manage the company well to improve the company's financial performance [4]. More importantly, institutional investors, especially independent and long-term stable institutional investors, prefer companies with high ESG ratings in investment decisions. This shows that with the concept of socially responsible investment deeply rooted in the hearts of the people, ESG performance has become an important consideration for institutional investors to evaluate investment targets [6].

2.2.2. Emotionally Driven

The emotional state of investors has a direct impact on their trading behavior, which further ripples through the volatility of asset prices. Especially in short-term market volatility, the role of sentiment effects is more significant. Zhou's empirical results show that for every unit of increase in the sentiment index, the excess return of a shares increases by 0.0276%, and the sensitivity of small cap

stocks is higher, but its impact on large cap stocks is not significant. This divergence stems from the dominance of retail investors in small-cap stock trading, whose sentiment is susceptible to market noise and suggests that the trading activities of investors have a more pronounced effect on the excess returns in the market [3]. In addition, the information asymmetry of green financial products intensifies emotional transmission, such as the speculation of the concept of carbon neutrality, which may trigger valuation bubbles [7]. And under the guidance of market optimism or pessimism, investors may make irrational decisions, resulting in asset prices deviating from fundamentals.

3. Analysis of the Limitations of Traditional Pricing Models

3.1. Limitations of the CAPM Model

In the realm of green finance, the limitations of the Capital Asset Pricing Model (CAPM) are becoming more apparent. The CAPM centres on systematic risk (β) and believes that the expected return of assets is proportional to the market risk premium, but it assumes that investors are perfectly rational and the market is efficient, ignoring the impact of non-financial factors and investor behavioural biases on asset returns [8].

3.1.1. Failure to Include ESG Factors

Research shows that companies with excellent ESG performance tend to have lower risk premiums. For example, Yuan's research shows that when a firm's ESG score rises, its stock return is significantly higher, and portfolios with high ESG ratings have higher excess returns while taking on less risk [9]. However, the CAPM model does not include ESG variables, which makes it impossible to explain the ESG premium phenomenon. This suggests that relying on systematic risk (beta) alone to explain asset returns is incomplete and that ESG factors have a significant impact on asset returns.

Table 1 demonstrates the CAPM model regression results for different ESG rating portfolios (decreasing from 1 to 4) among CSI 300 constituents. The empirical analysis reveals that portfolios with high ESG ratings exhibit a positive α . This suggests that, even after accounting for market risk, these portfolios are still able to generate excess returns. However, the beta coefficients in the CAPM model do not vary much across ESG-rated portfolios and are not effective in distinguishing the differences in returns across ESG-rated portfolios. In addition, the adjusted R squared value varies greatly between different ESG rating portfolios, indicating that the CAPM model has limitations in explaining the excess returns of ESG portfolios.

Table 1: Portfolio CAPM model regression results [9].

Coefficient	1	2	3	4
α	0.0351	0.0345	0.0267	0.0193
t value	(4.305)	(4.371)	(5.679)	(4.164)
β_m	0.6275	0.629256	0.635319	0.637666
t value	(5.379)	(5.392)	(8.636)	(8.711)
Adjusted R2	0.198	0.199	0.394	0.399

3.1.2. Failure to Consider Investor Sentiment and Behavioral Biases

Zhao's research found that investor sentiment indicators (such as turnover rate, financing balance, etc.) were significantly correlated with stock returns. For example, a high turnover rate usually means high market sentiment and active investor trading, which can lead to stock prices deviating from their fundamental value [7]. However, CAPM model assumes that investors have no emotional fluctuations,

which cannot explain this sentiment driven market anomaly. Moreover, the impact of investor sentiment on stock returns is more significant in small and medium-sized market capitalization stocks, which further illustrates the limitations of CAPM model in explaining asset returns.

3.2. Limitations of Fama-French Five-factor Model

On the basis of the traditional CAPM model, Fama French five factor model introduces four factors: Scale (SMB), value (HML), profit (RMW) and investment (CMA), which significantly improves the ability to explain stock returns [10]. However, with the rise of green finance and sustainable investment concept, the limitations of the model in explaining stock returns have gradually been exposed.

3.2.1. Failure to Include ESG Factors

Mu's work reveals that ESG scores are significantly and positively correlated with stock returns [2]. This means that an enterprise's performance in environmental protection, social responsibility fulfilment and corporate governance not only enhances its long-term competitiveness, but may also have a direct impact on the market performance of its shares. However, the Fama-French five-factor model fails to take these factors into account, resulting in some omissions in explaining stock returns.

3.2.2. Factor Redundancy and Regional Differences

According to Eugene F. Fama's research, HML factor shows some redundancy in the five-factor model, and its explanatory power on stock returns is absorbed by other factors [10]. In addition, the performance of CMA factor in the A-share market is not satisfactory, and its explanatory power is relatively weak [7]. This implies that, although the five-factor model possesses a high theoretical capacity to explain market phenomena, the effectiveness of certain factors may be restricted in varying market contexts and could potentially become superfluous elements within the model.

3.2.3. An Attempt to Add ESG Factors

In order to make up for the lack of ESG dimensions in the Fama-French five-factor model, Mu tried to add ESG factors to the model, constructed the Fama-French five-factor + ESG factor model, and verified its validity in the A-share market [2]. The data in Table 2 show that although the Fama French five-factor model is still better than the model with ESG factors in some cases, the addition of ESG factor can significantly improve the explanatory power of the model in the context of green finance, especially in the grouping of small capitalization and value stocks. This highlights that with the expansion of green finance, the change of investor behavior, especially the attention to ESG factors, has an important impact on the effectiveness of traditional pricing models.

Table 2: Comparison of GRS statistics between the two models [2].

25 Size-Inv combination	GRS	A α_i
MKT SMB HML RMW CMA	1.485	0.003
Five Factors + ESG	1.762	0.003
25 Size-BM combination		
MKT SMB HML RMW CMA	1.321	0.003
Five Factors + ESG	1.377	0.003
25 Size-OP combination		
MKT SMB HML RMW CMA	2.280	0.004
Five Factors + ESG	1.530	0.002
25 Size-ESG combination		
MKT SMB HML RMW CMA	2.188	0.002
Five Factors + ESG	2.925	0.003

4. Conclusion

This paper provides an in-depth analysis of the shift in investor behavior in the context of green finance and its impact on the validity of traditional asset pricing models. The results show that with the rise of green finance, investor behavior shows significant ESG performance and sentiment driven characteristics. Companies with good ESG performance not only excel in financial performance, but also receive higher market recognition and lower financing costs. However, the traditional CAPM model has obvious limitations in explaining asset returns because it fails to include ESG factors and does not consider investor sentiment and behavioral bias. While the Fama - French five - factor model enhances the ability to explain stock returns to some degree, it still fails to account for ESG aspects, and certain factors exhibit redundancy across varying market conditions. After adding ESG factor, the explanatory ability of the model is improved, especially in the grouping of small market value and value stocks. This research uncovers the novel features of investor behavior within the realm of green finance and the subsequent challenges posed to the conventional asset pricing model, offering a fresh viewpoint for both academia and the industry. Future research could be broadened in several directions: on the one hand, a deeper investigation into the dynamic interplay between ESG factors and traditional financial metrics could be conducted to gain a clearer understanding of how they function in various economic cycles. On the other hand, this paper can study the behavioral differences of different types of investors (such as individual investors and institutional investors) in the context of green finance and their impact on the market. Finally, with the continuous development of green finance, the asset pricing model is further improved and optimized so that it can better adapt to the new market environment.

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