

ESG Rating Divergence and Corporate Green Innovation: Review and Prospects

Zongqin Yang*

School of Business Administration, Guizhou University of Finance and Economics, Guiyang 550025, Guizhou, China

**Corresponding author:* Zongqin Yang, 2818459182@qq.com

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Abstract: Against the backdrop of the accelerating global green and low-carbon transition, ESG ratings have emerged as a pivotal tool for assessing corporate sustainability performance. However, the considerable divergence in ESG evaluations across rating agencies introduces uncertainty into ESG investment markets, disrupts stakeholder judgment and decision-making, and subsequently influences corporate resource allocation and strategic choices, ultimately shaping corporate green innovation. Adopting a literature review perspective, this paper systematically synthesizes the concept and economic consequences of ESG rating divergence, summarizes the connotation and determinants of corporate green innovation, and summarizes the heterogeneous findings regarding their relationship. On this basis, this paper identifies the limitations of existing research and outlines future directions, with the aim of providing useful references for subsequent studies.

Keywords: ESG rating; Rating divergence; Green innovation

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1. Introduction

As global environmental challenges continue to intensify, with climate change, environmental pollution, and tightening resource constraints becoming increasingly severe, sustainable economic development and corporate green innovation have become widely discussed topics in society. Green innovation, through the research, development, and application of environmentally friendly technologies, products, and services, reduces the negative environmental impact of corporate operations while enhancing corporate social reputation and long-term competitiveness. ESG ratings serve both as a measure of a firm's capacity for sustainable development and its fulfillment of social responsibilities, and as a primary channel through which external stakeholders access information about corporate ESG performance ^[1]. Existing research has confirmed that ESG ratings are of significant importance in promoting corporate green innovation and facilitating green and low-carbon development. However, the widespread ESG rating divergence among different rating agencies weakens the predictive power of ESG performance for future market information, exacerbates uncertainty in ESG investment markets, and consequently complicates the decision-making of firms, investors, and other stakeholders, thereby exerting a profound impact on corporate green innovation ^[2]. Accordingly, this paper systematically reviews

extant literature and integrates research conclusions on ESG rating divergence, corporate green innovation, and their relationship to provide valuable theoretical implications for future studies.

2. Research on ESG rating divergence

2.1. The concept of ESG rating divergence

ESG ratings are comprehensive evaluations conducted by third-party professional institutions on corporate performance across the environmental, social, and governance dimensions. Their core purpose is to quantify, standardize, and enable comparability of corporate non-financial information, thereby providing incremental information regarding corporate sustainable development and future value, and serving as an effective complement to financial information^[3]. ESG rating divergence refers to the discrepancies in ESG performance assessments of the same firm across different rating agencies.

Currently, there are more than 600 ESG rating agencies worldwide, including Bloomberg, FTSE Russell, MSCI, Refinitiv, S&P Global, Sustainalytics, Wind and Huazheng, among others. ESG rating divergence is widely recognized as a pervasive phenomenon^[4]. Such divergence arises from multiple sources, including differences in rating agencies' conceptual understanding of ESG, inconsistencies in measurement methodologies, and variations in the completeness and quality of corporate information disclosure^[2].

2.2. Effects of ESG rating divergence

Existing literature has explored the economic effects of corporate ESG rating divergence from diverse perspectives, yet inconsistent conclusions have been reached. Most studies argue that ESG rating divergence exerts adverse effects on firms, leading to lower stock returns, higher stock price volatility, lower quality of analysts' earnings forecasts, tighter corporate financing constraints, and impaired firm value. For instance, Tan and Pan^[5] found that greater ESG rating divergence was associated with lower stock returns and higher volatility. Zhou *et al.*^[3] pointed out that ESG rating divergence suppresses analyst earnings forecast accuracy by increasing analysts' information processing costs, thereby exacerbating corporate financing constraints. Zhao *et al.*^[6], based on information asymmetry theory, demonstrated the negative impact of ESG rating divergence on firm value, with information uncertainty and agency costs identified as two key mechanisms.

Conversely, some studies have identified positive economic consequences of ESG rating divergence, suggesting that it may contribute to higher stock returns and mitigate stock price crash risk. Rajna *et al.*^[7] found that firms with greater ESG rating divergence tend to have higher stock returns, and this effect is primarily driven by divergence in the environmental dimension. According to Shao *et al.*^[4], investors' correct interpretation of the multi-dimensional information embedded in ESG rating divergence reduces information asymmetry, thereby decreasing the likelihood of stock price crashes.

Moreover, ESG rating divergence may indirectly impede corporate operations by weakening the beneficial effects of ESG performance. Yu^[8] found that ESG performance contributes to enhanced environmental performance; however, ESG rating divergence distorts signal transmission, leading to diminished capital allocation efficiency and elevated financing costs, which constrain effective green technology investment and thereby weaken the positive effect.

3. Research on corporate green innovation

3.1. The concept of green innovation

Corporate green innovation is intended to mitigate negative environmental impacts, enhance resource

utilization efficiency, and reduce energy consumption and emissions, thereby achieving a win-win outcome for both economic growth and environmental protection. Based on behavioral motives, green innovation can be categorized into substantive green innovation and strategic green innovation. Substantive green innovation takes improving environmental quality and strengthening green competitiveness as its core objectives, whereas strategic green innovation seeks to rapidly expand innovation scale as a means to serve short-term pursuits of securing external investment opportunities and policy preferences ^[1].

3.2. Determinants of green innovation

Compared with traditional innovation, green innovation is characterized by high costs, long cycles, and high risks, which constitute practical obstacles to firms' independent innovation efforts and result in generally insufficient corporate motivation ^[9]. Against this backdrop, the cultivation and enhancement of green innovation capabilities have attracted extensive and in-depth academic discussion.

Corporate green innovation is influenced by a multitude of factors. At the macro-environmental level, the literature primarily examines the impact of policy and institutional factors as well as market factors on corporate green innovation. Ma and Zhuo ^[10] demonstrated the promoting effect of environmental regulation on green technological innovation. Liu *et al.* ^[11] argued that the soft market supervision induced by ESG ratings leads Chinese firms to engage in formalistic behavior that prioritizes quantity over quality, thereby exacerbating green innovation bubbles. At the micro-level, factors such as internal corporate governance and digital transformation also exert significant influences on green innovation. Huang ^[12] showed that executive team stability can significantly enhance the level of corporate green innovation, with equity incentives playing a positive moderating role in this relationship and corporate digitalization serving as an important transmission channel. According to Hu and Dai ^[13], digital transformation alleviates internal and external information asymmetry, optimizes the allocation of innovation resources, and boosts corporate green innovation, while an enhancement in firms' competitive position weakens this facilitating effect.

4. The impact of ESG rating divergence on corporate green innovation

4.1. Positive effects of ESG rating divergence on green innovation

Some scholars argue that ESG rating divergence can promote corporate green innovation. ESG rating divergence may lead to reputational damage, increased financing costs, or greater compliance pressure and external scrutiny, prompting firms to employ green innovation as a signaling tool to rebuild market trust. At the same time, the negative consequences associated with ESG rating divergence intensify managerial performance pressure and financing constraints, forcing firms to undertake strategic adjustments and increase green innovation investment in order to mitigate the risks arising from such divergence. According to Zeng *et al.* ^[2], ESG rating divergence exerts a positive effect on the level of corporate green innovation, primarily through heightened media attention, public environmental concern, and analyst attention, as well as by encouraging firms to develop more R&D personnel and increase internal R&D expenditure. Yao and Chen ^[1], drawing on reputation theory and information asymmetry theory, demonstrated that ESG rating divergence promotes substantive green innovation by enhancing media coverage and analyst following. Yang *et al.* ^[14] further discovered that this positive effect of ESG rating divergence on corporate green innovation is more pronounced when the divergence pertains to environmental and social performance ratings.

4.2. Negative effects of ESG rating divergence on green innovation

Some scholars contend that ESG rating divergence inhibits corporate green innovation. ESG rating divergence

transmits chaotic signals to the capital market, leading to reputational damage, elevated debt capital costs, weakened talent attractiveness, and intensified information asymmetry. These consequences impede firms' acquisition and allocation of financial, human, and technological resources, and ultimately constrain the enhancement of green innovation capabilities. Researchers like Zhen and Sun ^[9] contended that ESG rating divergence significantly suppresses both the quantity and quality of green innovation through channels such as exacerbating financing constraints, weakening human capital accumulation, and compressing R&D expenditure. Li and Li ^[15] demonstrated that the expansion of ESG rating divergence significantly inhibits the improvement of corporate green innovation efficiency, with debt capital cost serving as a key mediating factor.

In addition, some studies have suggested that ESG rating divergence increases the quantity of corporate green innovation while inhibiting its quality, thereby exacerbating green innovation bubbles. On the one hand, ESG rating divergence attracts extensive external attention and generates significant market pressure, compelling management to swiftly respond to external expectations and uphold reputation and legitimacy by increasing the number of easily observable green patent applications. On the other hand, ESG rating divergence exacerbates information asymmetry and risk premiums between firms and external capital providers, thereby hindering external financing and making it difficult for firms to bear the long-term and substantial R&D investments required for high-quality green innovation. According to Li and Chen ^[16], ESG rating divergence increased the quantity of corporate green innovation through the channel of market pressure, while inhibiting its quality through the channel of financing constraints, which in turn leads to the emergence of green innovation bubbles. This is also confirmed by Zhu *et al.* ^[17], who argued that owing to the short-board effect, ESG rating divergence increased the quantity but reduced the quality of corporate green innovation. This effect operated through both external pressure and internal strategic adjustment channels.

5. Conclusion and future directions

The existing literature has formed a relatively systematic research framework regarding ESG rating divergence and corporate green innovation. ESG rating divergence is widely recognized as a pervasive phenomenon, and its economic consequences are predominantly negative, although some studies have also identified positive effects. Corporate green innovation is influenced by numerous factors, primarily including macro-level factors such as environmental regulation and soft market supervision, as well as micro-level factors such as internal corporate governance and digital transformation. Regarding the relationship between the two, scholars have conducted relatively extensive research, yet no consensus has been reached, and further investigation is warranted.

First, future research should strengthen the depth and breadth of studies on the impact of ESG rating divergence on green innovation. Most existing studies treat rating divergence as a monolithic construct, but research on the differentiated effects of divergence across the environmental, social, and governance dimensions on green innovation remains scarce. Future studies could construct dimension-specific divergence indicators separately, examine their differential effects, explore their underlying mechanisms, and investigate whether the "short board dimension" dominates the directional adjustment of corporate green innovation behavior.

Second, methodological innovation in studying ESG rating divergence and corporate green innovation is needed. The conflicting findings in the existing literature suggest that researchers should pay attention to the effects of variations in research design, including sample selection and choice of green innovation metrics. Future research could employ meta-analysis to systematically synthesize existing empirical results and identify the underlying causes of divergent conclusions. Quasi-natural experimental designs could also be adopted to achieve causal identification. Furthermore, current studies predominantly rely on secondary panel data for empirical analysis. Future research could introduce qualitative research methods to explore the

genuine perceptions, attributions, and strategic intentions of various stakeholders when confronting ESG rating divergence, thereby uncovering the micro-mechanisms through which ESG rating divergence affects corporate green innovation.

Third, future research could further examine whether ESG rating divergence exerts non-linear effects on corporate green innovation. The relationship between the two may differ across varying ranges of ESG rating divergence. For instance, within a moderate range of divergence, firms may undertake substantive innovation driven by the motivation to address deficiencies. However, when divergence exceeds a certain threshold, excessive signal confusion may intensify resource constraints, compelling firms to shift toward strategic innovation and thereby triggering green innovation bubbles.

Finally, the boundary conditions and contextual factors under which ESG rating divergence affects green innovation should be further explored. At the firm level, future research could investigate how factors such as firm life cycle and organizational resilience moderate the impact of rating divergence on green innovation, and whether the sensitivity to divergence differs between firms in growth and maturity stages. At the institutional environment level, scholars could analyze whether institutional factors such as local environmental law enforcement intensity, carbon trading market development, and the establishment of pilot zones for green finance reform influence the negative effects of ESG rating divergence on green innovation.

Disclosure statement

The author declares no conflict of interest.

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