ESG disclosures and capital structure: An analysis of debt and equity dynamics in India

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A B S T R A C T

The current study aims to explore how environmental, social and governance (ESG) disclosures impact the capital structure decisions of the non-financial Indian firms listed on the NSE500 index for the period of 2015–2022. The pooled OLS and system GMM estimations indicate that higher ESG disclosure scores are linked to lower debt-to-equity (DTE) ratio, suggesting that improved ESG disclosures allow a firm to have better access to equity financing via stock markets. Environmental and social disclosures play a key role in reducing leverage. Further, the impact of ESG on DTE is more pronounced for firms in environmentally sensitive industries and those with lower initial ESG scores. Moreover, the relationship strengthens during periods of economic and market downturns particularly during the COVID-19 crisis. The mediation analysis shows that cost of debt and cost of equity are important channels through which ESG affects choices related to debt financing viz-a-vis equity financing respectively. The present study adds to the sustainable finance literature on emerging markets by shedding light on the role of ESG in shaping corporate capital structure. The results of the study offer practical implications for corporate managers, investors, and policymakers, emphasizing the importance of ESG transparency in financial decision-making.

1. Introduction

The transformational dynamics of corporate responsibility and sustainability have invited academia, industries, policy makers and practitioners to study the integration of sustainability in corporate decision–making (Malik & Kashiramka, 2025a; Zhao & Zhang, 2024). The transition is fundamentally impacted by the involvement of Environmental, Social, and Governance (ESG) factors into the strategies and decision-making of firms (Lian et al., 2023; Malik & Kashiramka, 2025b). ESG helps to assess the non-financial performance of a firm on three grounds. The three main areas are related with the environment (climate change, resource usage, emissions, innovation), social (workplace relationship, labour practices, diversity, human rights and community) and governance aspects. They cover the triple bottom line perspective by including environmental and social aspects in addition to the financial outcome (Alshehhi et al., 2018). According to Behl et al. (2022), these shifts are as a result of changing legal norms, cultural expectations, ethical obligations, and corporate transparency and responsibility. A report by Morgan Stanley Capital International (2021) (MSCI) states that 79 % of Asia-Pacific businesses has increased ESG investments after the COVID-19 pandemic. This indicates the increasing influence of ESG on corporations. Today, businesses should consider alignment of goals with a broader set of stakeholders

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like society, employees, and the environment and not merely the shareholders or shareholder wealth (Broadstock et al., 2020; Malik & Kashiramka, 2024). This change is driven by the pressures of law and commerce, forcing firms to implement strong ESG practices and increase transparent reporting on sustainability. International organisations have also attempted to address sustainability issues. The global climate change scenario has changed after the 2030 Agenda for Sustainable Development and the Paris Agreement. (Malik & Kashiramka, 2025a). Thus, firms have started considering ESG factors while making investing and financing decisions. Moreover, regulatory authorities around the globe have enhanced the standards of ESG reporting by making it compulsory for firms to report their sustainability performance (Malik & Kashiramka, 2025b; Eliwa et al., 2021; Limkriangkrai et al., 2017). This means, India with the direction of the SEBI substituted Business Responsibility Report (BRR) with Business Responsibility and Sustainability Report (BRSR). This was made mandatory for the first 1000 listed companies starting 2022–2023 and is a significant milestone in the corporate sustainability journey in India.

In view of the increasing global attention on sustainability reporting, several researchers have attempted to examine the determinants of sustainable performance such as firm value (Aboud & Diab, 2018; Malik & Kashiramka, 2024), dividend payout (Malik & Kashiramka, 2025b; Salah & Amar, 2022), risk (Bouslah et al., 2013; He et al., 2022) as well as earnings quality (Mohmed et al., 2020; Tohang et al., 2024). The influence of ESG on financial performance is broadly acceptable, but its impact on capital structure and how it operates is poorly understood (Goss & Roberts, 2011). The capital structure of a firm is the combination of debt and equity financing. It serves as a cornerstone of the firm's financial health, risk profile and strategic adaptability. The capital structure theories have so far been biased towards financial factors such as equity mispricing (Baker & Wurgler, 2002; Bonaimé et al., 2014), tax shield (Malenya, Olweny, Mutua, & Mukanzi, 2017; DeAngelo & Masulis, 1980), agency conflicts (Leland, 1998; Mauer & Sarkar, 2005) managerial behaviour (Adeneye & Chu, 2020; Wong, 2015). While sustainability has become increasingly significant, corporate finance literature has yet to offer a theoretical lens in elucidating ESG's influence over leverage decisions.

According to the prior literature (Behl et al., 2022), firms in developed economies like the US and UK have been rewarded for taking up ESG practices. Also, the companies from the emerging economies like India have been facing the pressure from their regulators as well as investors to disclose about their ESG activities. Thus, the current study aims to fill this gap and tries to empirically examine the effect of ESG disclosures on financing decisions using 2015 to 2022 data for Indian companies. Despite being a recent development in Asia, not much has been studied about the emerging markets (Alsayegh et al., 2020). India is the fifth largest economy in the world and an eminent player in international markets. Certainly, this offers considerable policy relevant background to study the relationship between ESG practices and corporate strategies for several reasons. India is among the early emerging economies where the SEBI enforced mandatory ESG disclosures to the top 1000 listed firms under the BRSR requiring reporting of ESG practices. Moreover, Indian companies function within a financial framework controlled by banks, restricting their access to external funding, which lead to substantially elevated capital costs. In this regard, ESG can be critical in reducing the cost of financing and in shaping choices of leverage. Moreover, concentrated ownership and family-run governance mechanisms require transparent ESG reporting to gain credibility with creditors and investors. Ultimately, the effect of ESG disclosures on capital structure of firms is important for policy makers and corporate decision-makers in India, given the country's commitment to net-zero emissions by 2070. India's unique socio-economic conditions, regulatory environment and business landscape make firms in the country an ideal setting to examine the impact of ESG on decision-making.

The research demonstrates that ESG disclosures have a significant negative impact on DTE. Moreover, all ESG dimensions, ENV, SOC and GOV, are negatively correlated with DTE. Environmental and social disclosures have a greater impact on reducing reliance on debt financing than governance disclosure. These findings conform to agency theory as superior ESG performance improves a firm's creditworthiness, leading to easier access to equity financing and lesser reliance on debt. To achieve robustness, the study employs different econometrics technique, notably two-step system generalized method of moments (GMM) estimation with instruments tested for validity. As a result, the estimates are more reliable with respect to endogeneity and omitted variable bias. The study further finds that ESG disclosure scores negatively impact debt financing, while positively impacting equity financing. Besides, it is found that cost of debt and cost of equity are the mediating factors in the ESG-capital structure nexus. In addition, several subsample analyses have been carried out further to gain more insight on ESG-DTE nexus. To begin with, the negative association between ESG and DTE is stronger for firms operating in environmentally sensitive industries, as such firms are likely to face more regulatory scrutiny and investor expectations regarding sustainable commitments. Likewise, firms with initially lower ESG scores experience a more pronounced reduction in leverage when they enhance their ESG disclosures. This suggests that transparency has more impact when firms lag behind in ESG performance. Further, the study explores the impact of economic uncertainty by splitting the sample between pre-COVID (2015–2019) and COVID/post-COVID (2020–2022). The findings show that, during crises, the negative impact of ESG on leverage is enhanced, indicating a role for ESG disclosure in strengthening the resilience and financial flexibility of firms.

Yang and Xiang (2025) report that higher interest-bearing liabilities and more short-term borrowing led to lower ESG performance as investment in innovation and social responsibility suffers in Chinese manufacturing firms. The results suggest that too much exposure to debt limit the abilities of the firms to undertake projects. Taking this perspective forward, the present study investigates the reverse channel i.e. how ESG disclosures influence firms' financing choices and cost of capital, thereby providing a complementary view of the ESG–capital structure nexus in the context of Indian firms.

This study makes several important contributions to the literature on ESG and corporate financing decisions. It builds on a growing body of research examining the relationship between a firm's ESG practices and its capital structure choices. In the realm of sustainability, ESG refers to the environmental, social and governance factors considered when assessing an organization's behaviour. It argues that ESG disclosures vary debt, equity and overall financing decisions in an integrated empirical framework. The main contribution of the study is its examination of the mechanisms through which ESG disclosure affects capital structure decisions. Earlier studies have mostly examined the direct-impact of the ESG on capital structure in developed and emerging markets. Not many studies,

however, have focused on how ESG disclosure gets channelised into financing decisions. This research adds to the literature by using the cost of debt and the cost of equity as mediators to provide evidence on the impact of ESG disclosures on financing costs and the effects on capital structure outcomes. This will give fresh insight into the ways in which the ESG component influence financing beyond the capital structure. Moreover, while the cross-country analysis of the ESG-financing nexus offers insight but ignores country-specific institutional dynamics. By focusing on India, this paper provides contextual evidence for an emerging economy that has a bank-based financial system, changing regulations and developed investors, augmenting previous cross-country studies. Further, the research reveals the influence of the ESG-financing connection across industries and how they impact financing in environment sensitive industries through ESG disclosures. Furthermore, this study contribute to the growing literature in corporate finance during crises in relation to COVID-19 on the ESG-capital structure relationship. In contrast to most previous studies that have evaluated sustainability primarily through the lens of CSR, this study takes a more comprehensive approach using ESG. By using ESG scores which incorporates environmental, social, and governance aspects, it gives a nuanced understanding of how these impact corporate financing strategies. The findings are relevant to policy makers, investors and business leaders They stress the need for regulatory framework that promote ESG integration; the insight investors need to embed ESG into risk management and investment strategies; and the alignment of corporate finance strategy with sustainability objectives. Overall, this study fills a several literature gaps, notably with respect to emerging markets and the discourse on sustainable finance and responsible business activities.

A closely related study by Bagh, Hunjra, Guo, and Bouri (2025) explores the impact of ESG performance on both market and book-based leverage of firms from BRICS economies. Their findings suggest that superior ESG performance reduces market leverage while exerting a positive effect on book leverage. Our study differs from and extends this evidence in several important dimensions. First, rather than ESG performance, this study focuses on ESG disclosure, capturing the informational and transparency channel through which sustainability reporting affects financing decisions of firms. This aspect is particularly relevant in emerging markets characterized by higher information asymmetry. Second, we concentrate on a single-country setting (India), allowing us to control for institutional heterogeneity and to examine within-country dynamics that may be obscured in cross-country analyses. Third, beyond reporting leverage results, this study explicitly examines the mechanisms underlying the ESG–capital structure relationship by identifying the cost of debt and cost of equity as mediating channels, industry-specific exposure and crisis-period heterogeneity.

The rest of the paper is structured as follows. Section 2 provides a review of the relevant literature and presents the hypotheses. Section 3 outlines the research methodology, including details on data, sample selection, and variable definitions. Section 4 presents the empirical findings and additional analyses. Finally, Section 5 concludes with implications and suggestions for future research.

2. Theoretical background and hypotheses development

This section presents the theoretical framework and a comprehensive review of literature on how ESG disclosures affect financing decisions of a company.

2.1. Theoretical background

The capital structure argument began with the Modigliani and Miller (1958) paper which argued that under perfect market conditions, a firm's value is unaffected by its financing. Nonetheless, the real world is different because of information asymmetry, agency costs and taxes. This has prompted substantial disagreement among researchers, as well as the emergence of various new theoretical frameworks. Currently in the area of corporate sustainability, a singul theory cannot explain the complex relationship between ESG disclosures and financing decision making. Combining insights from different theories will give us a better understanding of the issue. Hence, this research is based on two streams of thoughts. The first stream encompasses Jensen and Meckling's (1976) agency theory, Spence's (1973) signalling theory, and Suchman's (1995) and Lindblom's (1994) legitimacy theory. These theories focus on the impact of ESG disclosure to reduce information asymmetry as well as manage perceptions of different stakeholders. Interestingly, the second stream of thought, which comprises stakeholder's theory (Freeman, 1984) and the triple bottom line, seems to broaden the objective of the firm beyond shareholder wealth to long-term value creation and risk management. In the end, the study analyses how the trade-off theory and capital asset pricing model (CAPM) assess the financial effects of these ESG activities (Zhao & Zhang, 2024).

Agency theory (Jensen & Meckling, 1976) explains that information asymmetry causes misaligned managerial and shareholder interests and conflicts in business financing decisions. Managers with inside information may prioritize personal objectives rather than maximizing shareholders' wealth (Adeneye & Kammoun, 2022). In this regard, ESG disclosures help monitor agency costs by serving as a monitoring mechanism and reducing information asymmetry (Asimakopoulos et al., 2023; Hamrouni et al., 2019; Malik & Kashiramka, 2025a). This is also consistent with the signalling theory which suggests that ESG disclosures act as a certification signal that indicates that firms have adopted sustainable practices and are committed towards mitigating business risk (Chan et al., 2017; Li et al., 2024). Further, a long-term strategic signal that communicates stability and sustainability can help in limiting information asymmetry and problems of adverse selection (Hamrouni et al., 2019). It ultimately helps to affirm trust among internal and external stakeholders and firms with higher ESG disclosure scores may be rewarded with better financing opportunities (Malik & Kashiramka, 2024). Further, legitimacy theory (Suchman, 1995) contends that firms engage in ESG activities to align with societal norms and expectations to enhance their reputation and ensure long-term sustainability (Hamrouni et al., 2019). By improving performance and disclosure over the sustainability parameters, firms gain credibility and acceptance by diverse stakeholders. This leads firms to enhance their reputation and lessen regulatory intervention, ultimately influencing financing decisions.

One more stream surpasses the objective of shareholders' wealth and reminds that long-term value is created by better risk

management and not necessarily through immediate wealth maximization. In another word, the goal of the firm is long-term value creation based on superior risk management capabilities through long-term stakeholder engagement (Zhao & Zhang, 2024). Among the theories considered in this stream are the stakeholder's theory (Freeman, 1984) and the triple bottom line. The stakeholder theory (Freeman, 1984) is a socio-economic and normatively prescriptive theory which suggests that the corporation must take into account the interests of all stakeholders (shareholders, creditors, investors, employees, customers, and communities) in their decision-making. Since stakeholders' demand transparency concerning a firm's economic, social and environmental aspects, and financial statements alone are not adequate (Chouaibi et al., 2024), firms must disclose their non-financial performance (García-Sánchez et al., 2016; Gray et al., 1988). ESG disclosures provide additional information relevant to stakeholders, increasing the trust of lenders and investors and enhancing the reputation of firms (Hamrouni et al., 2019; Malik & Kashiramka, 2025a). Furthermore, ESG initiatives create a business model that is more robust, resilient and sustainable, thereby reduces risk (Fandella et al., 2023). This principle is highly relevant for firms in emerging markets like India where sustainability regulations are getting stricter and stakeholders have a major influence. Similarly, triple bottom line (TBL) theory highlights that firms should seek environmental and social gains in addition to the economic benefits (Elkington & Rowlands, 1999). It encourages organisations and investors to consider the social and environmental impacts of business decisions beyond financial measures, connecting corporate strategy with sustainable development goals (Malik & Kashiramka, 2024). The TBL framework suggests that sustainable practices can enhance long-term profitability, market position, and stakeholder trust by reducing risks from environmental degradation, social instability, and governance failures (Malik & Kashiramka, 2024; Zhao & Zhang, 2024).

Lastly, we look into existing frameworks that evaluate the financial costs of ESG initiatives. According to the trade-off theory (Fama & French, 2002), firms need to strike a balance between ESG costs and financial profitability. ESG disclosures offer firms long-term benefits such as improved reputation and risk management. However, they also incur short-term costs, which may negatively affect their profitability in the short term (Fandella et al., 2023). In this regard, investors may experience a dilemma or trade-off that exists between endorsing ESG and maximizing short-term returns (Fandella et al., 2023). Thus, a firm's ESG strategy, and the perceived trade-off between costs and benefits of ESG disclosures, influence financing decisions. The trade-off theory emphasizes upon the cost of ESG disclosures, the financial benefit of ESG disclosures, which can be quantified through risk reduction using capital asset pricing model (CAPM). An application of CAPM model to the prediction of returns of stocks shows that return of any security depends on its risk as well as return of risk-free security and return of market portfolio (Zhao & Zhang, 2024). The CAPM model is expanded by taking ESG consideration into account as firms with better ESG disclosures may have lower systematic risk or beta owing to lower exposure to environmental liabilities, social conflicts and governance failure (Cai et al., 2016). As a result, investors may demand a lower risk premium, reducing the cost of equity. These theories give a comprehensive, multi-faceted framework for the study. They suggest that ESG disclosure may affect capital structure not by one but all mechanisms at the same time. This involves reducing information asymmetry and agency costs, building relational wealth with diverse stakeholders to manage non-financial risks, gaining the social license to operate, and changing the firm's fundamental risk profile of the form as perceived by capital markets.

2.2. Hypotheses development

This section of the study formulates the hypotheses based on the integrated theoretical framework suitable to empirically test the relationship between ESG disclosures and corporate capital structure in India. Research on the impact of ESG disclosures on profitability is ever-growing (Malik & Kashiramka, 2024). Nevertheless, one of the main objectives of a business is more than only profit maximization, but the shareholder's wealth in the long run. Additionally, increasing importance of sustainability requires firms to evaluate the effect of their decisions and strategies on all the stakeholders involved (Freeman, 1984). Eldar (2017) compares shareholder and stakeholder theories and explains how ESG can help enhance firm value by cutting down negative externalities. The shareholder theory states that firms should focus on maximizing shareholder wealth with positive net present value (NPV) projects (Shleifer & Vishny, 1997). Unlike, the stakeholder theory posits that sustainability can enhance the long-term value of a company since it looks after their social responsibility, meets their environmental obligations and improves the reputation of a corporation (Ng & Rezaee, 2015). To achieve the goal of stakeholder's wealth maximization, firms need to make strategic financing decisions that optimize their capital structure. Financing decisions, primarily debt financing and equity financing are essential for businesses to secure funds for investments and operational needs (Gupta & Das, 2024). Nonetheless, financing decisions can become distorted due to agency problems and information asymmetries (Malik & Kashiramka, 2025a). To combat these, firms use ESG disclosures as a signalling mechanism to project positive attributes and influence the perception of shareholders (Malik & Kashiramka, 2025b). However, sustainability initiatives and their signalling usually require large resources, referred to as the cost incurred in carrying out the signalling activity (Gupta & Das, 2024). Consistent ESG signals positively affect stakeholders' behaviour, associated with a high signalling benefit-to-cost ratio (Aggarwal & Kyaw, 2009). In contrast, firms with low and inconsistent ESG disclosures create distrust amongst stakeholders, rise in agency costs, and greater information asymmetry. Thus, having the right balance of ESG investment is pertinent as excessive expenditure without substantial returns can distort the financial performance.

The relationship between sustainability and capital structure of firms have started to get mainstream attention, with early studies highlighting both benefits and drawbacks. Recent studies analyze the influence of ESG performance on firms' financing choices with competing findings. According to Sharfman and Fernando (2008); Yang et al. (2018) and Yang and Yulianto (2022), ESG transparency allows firms to maintain a higher level of leverage in USA and Korea respectively while Lemma et al. (2022) reported that more ESG efforts lead to lower leverage. According to the study of 6295 Chinese A-listed firms by Zahid et al. (2023), firms with higher aggregate ESG performance are less reliant on debt financing, while also gaining better access to equity financing. Zhao and Zhang (2024) likewise suggest that debt financing is negatively related to environmental and governance scores but equity financing is positively

linked to environmental and governance scores for Chinese firms from 2010 to 2022. Sharfman and Fernando (2008) used risk mitigation theory to argue that a firm's cost of equity is reduced by the better management of environmental risk, while its cost of debt may increase. The debt market is perceived to believe that the nature of eco-friendly activities is resource-intensive and costly. Building further from the risk mitigation view, El Ghoul et al. (2011) note that there is a negative relationship between corporate sustainability performance (CSP) and the cost of equity. According to them, firms with high environmental and social responsibility are less risky, which reduces uncertainty for investors and the required return on equity (Lynch &; O'Hagan-Luff, 2024Lynch & O'Hagan-Luff, 2024). Also, sustainability signifies stability which expands investor reach and improves access to capital. The conceptual connection between ESG and cost of capital extends beyond risk reduction. It is argued that ESG-based sustainability measures bring long-term financial advantage for firms, lower litigation and environmental compliance costs (Sharfman & Fernando, 2008), and creation of better corporate reputation (Malik & Kashiramka, 2024). According to the stakeholder theory, the firms engaging in sustainability initiatives can limit the risks of lawsuits, environmental infractions, and reputational damage. Due to this, their cost of financing becomes low (Godfrey, 2005; Malik & Kashiramka, 2024). Firms exhibiting stronger stakeholder orientation have lower leverage and therefore experience less exposure to financial risk (Bae et al., 2011). Likewise, Ayton et al. (2022) found a negative correlation between ESG and idiosyncratic financial risk. According to Eccles et al. (2012) and Gregory et al. (2014), firms with high ESG scores are less vulnerable to market shocks. Clarkson et al. (2011) further reported that firms with good social and environmental practices benefit from reduced regulatory risks resulting in lower discount rates and financing costs.

Building on this perspective, the current study argues that robust ESG disclosures can significantly influence a firm's capital structure, primarily by altering its risk profile and its attractiveness to different types of capital providers. This argument is grounded in several theoretical frameworks discussed. From the perspective of stakeholder's theory, firms with strong ESG performance build moral capital with a wide range of stakeholders, reducing the likelihood of costly conflicts and enhancing operational stability (Godfrey, 2005). Simultaneously, consistent with signalling theory, ESG disclosures act as a credible signal to the market about the firm's superior management quality and long-term viability, thereby reducing information asymmetry and perceived investment risk (Aggarwal & Kyaw, 2009; Spence, 1973). Finally, legitimacy theory suggests that firms aligning with societal norms through ESG face lower regulatory and reputational risks. This aggregate reduction in firm-specific and systematic risk makes the firm a more attractive investment for equity holders who are sensitive to downside risk. As a firm becomes more appealing to the equity market, it may gain better access to equity financing and rely proportionally less on debt. This leads us to our first hypothesis:

H1. ESG disclosures negatively impact debt-to-equity ratio for Indian firms.

While H1 depicts a direct relationship of ESG with capital structure, it does not specify the underlying mechanisms influencing the ESG-capital structure nexus. The theoretical frameworks suggest that the cost of capital might be a channel of transmission. To the best of our knowledge, while ESG has been explored as having a direct relationship with the costs of debt and equity, their role as a mediator in determining the end capital structure in an emerging market like India is a gap in literature. This research seeks to fill this void by assessing cost of debt and cost of equity as separate mediating pathways.

According to Heinkel et al. (2001), sustainable enterprises are able to benefit from lower financing costs in capital markets. Hence, capital costs motivate firms to engage in socially responsible business activities. A firm relies on its cost of capital that is both equity and debt, for deciding on its investment, profitability and financial structure (Easley & O'hara, 2004).

The mediating role of the cost of debt has a strong theoretical backing based on agency theory and signalling theory. The conceptualizations imply that a strong ESG disclosure enhances information clarity and lessens agency issues; thus, leading to reduced risk perception by lenders and improved financial access of the firm (Cheng et al., 2014; Eliwa et al., 2021). Prior studies extensively examined the relationship between ESG and cost of debt but reported mixed results. Research suggests that strong ESG practices improve information transparency, mitigate agency problems and improve firms' access to finance because of reduced capital constraints (Cheng et al., 2014; Eliwa et al., 2021). The borrowers with strong ESG credentials frequently have an advantage in terms of cost of borrowing, as banks and credit rating agencies view such borrowers to be less risky as well as having long term sustainability (Lavin & Montecinos-Pearce, 2022; Xu et al., 2021; Attig et al., 2013). According to evidence from the US, Europe, China, India and Chile, superior ESG performance is associated with lower cost of debt, better credit ratings, and increased debt capacity (Goss & Roberts, 2011; Malik & Kashiramka, 2024; Salvi et al., 2021; Sharfman & Fernando, 2008). However, several studies suggest that ESG investments may not necessarily provide favorable financing. ESG activities may be viewed by banks and credit institutions as a waste of resources, resulting in an increase of the cost of borrowing or a reduction in access to lending, especially for weaker firms (Goss & Roberts, 2011; Magnanelli & Izzo, 2017; Suto & Takehara, 2017). Some research also shows that firms which prioritize ESG disclosures often adopt conservative financial policies, including lower leverage and higher liquidity to maintain stakeholders' confidence (Ezzi et al., 2020; Harjoto, 2017; Sheikh, 2019). According to Gracia and Siregar (2021), sustainability efforts have a negative impact on debt financing but a negligible impact on the cost of debt in ASEAN countries. Thus, it is expected that while ESG disclosures generally lead to a lower cost of debt, the exact extent of the impact depends on the quality of the borrowing firm, perception of the lender and borrowers and various other external macroeconomic factors. Based on the theoretical channel and empirical evidence that ESG affects the cost of debt, we argue that the cost of debt is an important intermediary in a firm's future debt financing choices. Consequently, the hypothesis that follows is formulated:

H2. Cost of debt mediates the ESG-debt relationship.

Similarly, the mediating role of the cost of equity can be understood using stakeholders' theory and the CAPM framework. These frameworks suggest that better ESG disclosures can lower a firm's systematic risk and enhance stakeholder confidence. This, in turn, reduces the rate of return required by equity investors. The ESG–COE relationship has been studies extensively in recent years with

different implications in different markets and regulatory environments. Xu et al. (2015) focused on CSR and COE of Chinese firms and found the importance of CSR engagement in reducing cost of equity financing; especially during economic downturns. Li and Liu (2018) and Chen et al. (2023) found the similar result for Chinese A-Share firms from 2008 to 2014 and 2010 to 2022 respectively. Further evidence from US markets supports these findings. El Ghoul et al., 2011 analyzed the effect of CSR on the COE of U.S. firms between 1992 and 2007. They argue that firms with high CSR scores have a low COE. They also pointed out that the cost of capital can be lowered by investing in environmental policies, product strategies and employee relations. Additionally, companies doing business in the tobacco and nuclear industries face higher COE due to negative perception of common public and investors. In another study, Dhaliwal et al. (2011) said that firms with higher COE were more likely to initiate CSR activities in the current year to reduce financing costs in future years. Firms that engage in superior environmental risk management practices, particularly firms that are in the S&P 500 index, have lower COE (Sharfman & Fernando, 2008). In the period from 1993 to 2009, Harjoto and Jo (2015) ran an analysis on the CSR initiatives in American firms by distinguishing between mandatory and voluntary CSR initiatives. It was realized that mandatory ones which are generally regulatory-driven help lower the COE. European markets are showing similar trends.

According to a study by Chouaibi et al. (2021), ESG reduces implicit COE for French firms. The study concludes that ESG efforts lower cost of equity financing and affect corporate investment decision making. According to Reverte (2012), the relationship between CSR disclosure quality and COE is negative, because higher disclosure reduces information asymmetry among Spanish firms. Similarly, Connors and Silva-Gao (2008) found that companies in the electric and chemical industry emit higher chemicals and thus face higher COE. Extending the scope of study, Feng et al. (2015) conducted a cross-country study of 25 nations covering the period from 2002 to 2010 and established that COE reductions due to CSR are more pronounced in Europe and North America but are less evident in Asian markets. In these markets, CSR expenditures are considered more as advertising costs, hence the negative reaction of the market. Moreover, Wang et al. (2013) observed that companies based in North America, Europe and Africa having a strong CSR performance experience lower COE. However, this is not true for Asian firms, i.e., the higher the CSR performance, costlier the equity financing. Supporting this, Dahiya and Singh (2021) established a positive relationship between the ESG proxies and COE for Indian manufacturing firms, suggesting that investors do not always perceive CSR as a value-enhancing one. A study by Hutagaol-Marto-widjojo et al. (2023) on basic materials firms in eleven Asian countries found a positive association between ESG scores and COE. Further, Ng and Rezaee (2015) found that ESG performance is negatively related to COE. According to Richardson and Welker (2001), there is a significant positive relationship between social performance and COE of Canadian firms. This has been attributed to the impact of social performance on the risk of firms due to social projects. However, better financial performance could mitigate such risk. This extensive yet inconclusive literature underscores the need to test the influence of ESG on equity particularly for Asian and Indian markets. Further, in light of the rising concern over the ESG-related issues in international financial decision making, it is important to evaluate the impact of ESG performance on the cost of equity and subsequent equity financing. Therefore, the following hypothesis is formulated:

H3. Cost of equity mediates the ESG-equity relationship.

According to a few studies, ESG activities positively relate to equity financing; however, that is not a conclusive consensus. The debate becomes even more complicated in environmentally sensitive industries with doubts whether ESG align with the business model. The association regarding the ESG and capital structure might not be uniform across all industries and might aggravate in case of environmentally-sensitive industries (ESIs) as they always under scrutiny. As a result, institutions send signals through their ESG disclosures not only to enhance value but also to mitigate risks that they face. According to seminal studies, investors demand greater expected return for holding shares in polluting or sin industries (Heinkel et al., 2001). A number of studies look at CSR and the cost of equity for environmentally sensitive industries. Evidence shows that a company that discloses CSR or environment information suffers significantly reduced cost of equity (Barron & Qu, 2014). Furthermore, the effect is more pronounced in environmentally sensitive industries (Reverte, 2009; Clarkson et al., 2013). A study by Hmaittane et al. (2019) which analyses 2006 U.S. firm-year observations from 1991 to 2012 across controversial industries reveals that CSR engagement significantly reduces the implied cost of equity capital across all controversial sectors with the effect being most pronounced in the alcohol and tobacco industries. In a similar study, Yang and Yulianto (2022) analyzed international environment-sensitive sectors during the period of 2008–2019 and concluded that CSR performance, particularly social and environmental initiatives by the chemical firms leads to the lower cost of equity financing. Chemical companies are considered riskier than pharma companies due to their level of leverage and book-to-market ratios, but CSR reduces these risks. Thus, CSR activities contribute to risk reduction by minimizing investment risks and reducing the cost of equity for the firms, particularly those in highly environment-sensitive industries (Hmaittane et al., 2019). These companies disclose more information on sustainability, leading to better investor valuation that matches a lower cost of equity (Pham et al., 2020). Thus, detailed disclosures from environmentally sensitive companies can lower investor's uncertainty as they provide crucial information (Adams et al., 1998).

Nevertheless, a few studies argue that CSR does not always lower the cost of equity. According to El Ghoul et al. (2011) and Hong and Kacperczyk (2009), companies operating in sin industries, tobacco, and gambling, face greater levels of uncertainty as compared to other companies because of regulations and lawsuits. Cost related to those may outweigh the benefits of CSR. The U.S. institutions that have stronger constraints in social norms hold lesser sin stocks. This further reduces analyst coverage and lowers investor demand for these funds (Hong & Kacperczyk, 2009). In addition, El Ghoul et al. (2011) state that firms scoring high in sustainability will have a lower cost of equity. However, firms in the nuclear power and tobacco industry have a much higher cost of equity. According to Chava (2014), investors require such stocks to have higher returns because of environmental factors. Consequently, this leads to lower institutional investment in firms with poor environmental performance. The investors may see sustainability as the "insurance" against bad events, reducing idiosyncratic risk. According to Boubaker et al. (2020), firms involved in CSR have a lower risk of financial

distress, while the study by Jo and Na (2012) revealed that this effect is more pronounced in controversial sectors. Hmaittane et al. (2019) further demonstrated that the strong negative impact of disclosures on COE in these sectors has led to managerial commitment to ESG practices. Consequently, companies operating in industries sensitive to environmental issues can leverage ESG disclosures to enhance investor confidence and secure better equity funding. The theories of legitimacy and signalling aid in the theoretically justifying this intensified effect. For companies in sensitive sectors, the license to operate is continually scrutinised as a major strategic issue (Suchman, 1995). As a result, the signals conveyed through ESG disclosures are not merely value-enhancing, but are critical for preventing significant regulatory, litigation, and reputational risks. Accordingly, we should expect both the risk-reducing effect of ESG and the corresponding capital market response to be greater for these companies. As a result, the following hypothesis is formulated:

H4. The impact of ESG on debt-to-equity ratio is stronger for firms in environmentally-sensitive industries.

Since business cycles affect the capital allocation strategies of firms significantly, financing decisions can vary in stable and crisis periods. Recent evidence from Chinese listed firms indicates that the relationship between financial flexibility and a firm's risk-taking is non-linear and less sensitive in the post-COVID era (Hunjra et al., 2024). This supports the idea that firm behaviour regarding financing and risk adapts dynamically over time to changing economic conditions. As a result, investors may think differently about sustainability investments depending on external economic conditions independent to a firm. According to Godfrey et al. (2009) and Koh et al. (2014), strong stakeholder relationship generates goodwill which serves as an "insurance-like" buffer against market downturns. According to Albuquerque et al. (2019), firms with better environmental and social ratings were more resilient to the COVID-19 market crash in early 2020 due to higher loyalty of customers and investors. This insurance-like effect is linked directly to the stakeholders' theory (Freeman, 1984). The theory suggests that companies develop goodwill with all their stakeholders (employees, customer, supplier and community) which will eventually come back during difficult times. This moral capital cushions the impact of the systemic crisis, creating the impression of a firm that is more robust and less risky to providers of capital. Hence, we assume that market will value ESG differently during the crisis. Consequently, we formulate the hypothesis as follows:

H5. The impact of ESG on debt-to-equity ratio differs during period of crisis.

3. Research design

This section outlines the sources of data and the sample selection process, defines the measurement of variables, and introduces the empirical model employed to test the research hypotheses.

3.1. Data and sample selection

This study uses 2015–2022 Indian corporate financial metrics and ESG disclosure scores. This timeline was chosen for numerous reasons to ensure empirical analysis robustness, reliability, and relevance. The 2013 Companies Act mandated CSR disclosure for Indian enterprises in the 2014-15 fiscal year, starting the research period (Malik & Kashiramka, 2024). This regulation reform represented a turning point in corporate sustainability reporting, making it a good place to start studying ESG disclosures and capital structure. ESG transparency and financial decision-making trends in reaction to global and domestic sustainability policies, awareness, and regulatory advancements can also be examined over time. International events like the Paris Agreement on Climate Change and the UN Sustainable Development Goals (SDGs) have shaped business ESG commitments worldwide in 2015. While this study was underway, Indian regulatory agencies like SEBI implemented and reinforced ESG-related disclosure requirements, significantly changing enterprises' sustainability reporting practices. Finally, ESG data for Indian enterprises is abundant from 2015 onwards, giving it a suitable study starting point.

It makes sense to choose Indian companies as the sample population because India's economy and rules are different from those of other countries. India, as one of the fastest-growing emerging economies and the fifth-largest economy in the world, provides a distinctive, rich, and diverse context for examining the interplay between ESG disclosures and corporate financial policies. In developed countries, ESG disclosure procedures are more standardised. However, in India, ESG reporting varies greatly between industries and company sizes. This variety makes for a great real-world context to study how ESG disclosures affect decisions about capital structure. India has had a steady but steady rise in ESG integration compared to other emerging nations. This is due to both government rules and investors' desire for companies to be more environmentally friendly. With the growing focus on sustainable finance and responsible investing in India, comprehending the effects of ESG disclosures on corporate financing choices is of both academic and practical importance.

To analyze the impact of ESG disclosure scores on the capital structure of firms based in India, an initial sample of 500 companies listed on the National Stock Exchange (NSE 500 firms) was taken for the period 2015–2022. The initial sample then excludes companies in the financial sector due to their distinct reporting, capital structure and regulation systems relative to non-financial companies (Hamrouni et al., 2020; La Rosa et al., 2018; Malik & Kashiramka, 2025b; Pucheta-Martínez et al., 2023). A significant portion of utility firms is highly leveraged and regulated. However, these firms are retained in the sample because of two reasons. Utility firms are not very different from other firms in non-financial sectors in terms of investment, disclosure, and adoption of ESG. While financial firms rely on leverage, utilities tend to use debt to finance tangible, non-current assets, which is the case with any non-financial firm. In addition, utilities are central to India's energy transition and carbon reduction agenda, which makes ESG disclosures much more relevant to this sector. Excluding them will omit an important industry where ESG performance interacts with financing decisions and capital structure choices. By keeping utilities, the study captures heterogeneity across non-financial industries, such as the ones most

exposed to sustainability pressures and is broadly consistent with the existing literature, that usually includes utilities in ESG–capital structure studies (Malik & Kashiramka, 2024). Thereafter, firms with missing data are removed (Adeneye et al., 2023). In the end, all continuous variables are winsorized at the 1 % level to reduce the influence of outliers.

The Bloomberg® database is the source of the key financial variables for this study and ESG disclosure scores. Bloomberg ESG scores are considered objective and reliable indicators of sustainability disclosures as evidenced by extensive empirical support in the literature (Hamrouni et al., 2020; Malik & Kashiramka, 2025a; Zahid et al., 2023). Detailed definition of all variables together with sources is provided in appendix A.

Table 1 illustrates the final sample of unbalanced panel-data consisting of 1375 firm-year observations across the 10 industry sectors according to the Global Industry Classification Standard (GICS) along with the average ESG disclosure scores. The sample's largest sector share (26.69 %) is from the 'Materials' sector, followed by 'Industrials' (18.91 %) and 'Consumer Discretionary' (16.51 %). The table further shows that Indian non-financial firms have moderate average ESG scores. The score obtained with regard to the environmental and social aspect is relatively low, suggesting ample scope for improvement in the future as the global as well as local regulatory environment pressures sustainability increasingly. The energy sector has earned leading overall ESG, environmental and social scores might be due to the heavy regulatory and stakeholder expectations and the urgent need to address climate risks.

3.2. Variables measurement

The capital structure of a firm is represented by the debt-to-equity ratio or DTE which serves as the key dependent variable in the study. In accordance with Zhao and Zhang (2024) and Pucheta-Martínez et al. (2023), DTE is calculated as the ratio of total debt to total equity, which indicates a firm's usage of debt financing relative to equity. ESG disclosure scores are the primary independent variable of the study. The Bloomberg® database is the source of the aggregate environmental, social, and governance (ESG) disclosure scores and its individual dimensions. The Bloomberg® ESG scores range from 0 to 100 where 0 represents no transparency and 100 shows complete transparency. While ESG disclosure does not necessarily equate to realized ESG performance, it reflects transparency, intensity of reporting and signalling behaviour of firms towards capital markets. Given the focus on this study on capital structure and financing decisions, ESG disclosure is a suitable proxy for the information environment in which the investor and creditor operate. Finally, cost of debt (COD) and cost of equity (COE) are the mediating variables in the proposed framework that the study uses to examine the mediating effects. Along with this, in line with the literature on capital structure determinants (La Rosa et al., 2018; Malik & Kashiramka, 2025a; Yang et al., 2018; Yang & Yulianto, 2022; Zhao & Zhang, 2024), a broad range of controls specific to firm is included to mitigate omitted variable bias and enhance robustness of models. SIZE, ROA, FATA, CF, NDTS, ICR, SG, Z-score, TQ and BETA are control variables used in multiple regressions. SIZE refers to a natural logarithm of total assets. ROA refers return on asset and is used to proxy for profitability. FATA represents fixed assets per total assets. CF, NDTS, ICR, SG, Z-score, TQ and BETA represents cash flow, non-debt tax shields, interest coverage ratio, Altman (1968) Z-score, Tobin's Q and Beta respectively. Appendix A contains detailed definitions, measurements, and sources of data for all variables used.

3.3. Model specification

To empirically examine the relationship between ESG disclosure scores and corporate financing decisions, the study employs the following baseline regression model.

$$DTE_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 X_{i,t} + YearFE + IndustryFE + e_{i,t} \tag{1}$$

where $DTE_{i,t}$ is the debt-to-equity ratio for firm i in year t, $ESG_{i,t}$ represents the ESG disclosure scores, $X_{i,t}$ denotes a vector of firm-level control variables, and $e_{i,t}$ is the error term. YearFE and IndustryFE are the year and industry fixed effects used to account for unobservable heterogeneity over time and across industries.

Table 1
Sample distribution by industry.

GICS-Industry	N	Percent	ESG	ENV	SOC	GOV
Communication services	46	3.35	35.122	8.092	22.810	77.119
Consumer discretionary	227	16.51	35.356	16.144	17.914	74.900
Consumer staples	114	8.29	35.973	14.191	18.374	77.176
Energy	42	3.05	44.788	29.018	28.701	76.526
Health care	123	8.95	37.061	13.370	19.599	75.318
Industrials	260	18.91	36.438	14.074	19.459	72.980
Information technology	81	5.89	37.422	16.438	21.433	76.448
Materials	367	26.69	39.728	18.311	22.813	76.752
Real estate	57	4.15	30.796	12.682	22.491	69.315
Utilities	58	4.22	42.782	22.435	26.610	79.165
Total	1375	100.00				

Note(s): The table shows the breakdown of sample observations and mean aggregate and individual ESG scores across industries as per GICS classification. N is the number of observations. The data spans from 2015 to 2022. Variables are defined in the Appendix Table 1.
Source: Authors' compilation

The analysis employs pooled Ordinary Least Squares (OLS) regression (Malik & Kashiramka, 2025a; Zahid et al., 2023; Adeneye, 2023). To correct for heteroscedasticity and autocorrelation, robust standard errors are clustered at the firm-level. Acknowledging the limitations of pooled OLS in addressing endogeneity and omitted variable bias, the study further adopts the system Generalized Method of Moments (GMM) estimator by Arellano and Bover (1995), which performs better than difference GMM and two-stage least squares (2SLS) in addressing endogeneity and omitted variable bias (Adeneye et al., 2023; Bagh, Hunjra, Ntim, & Naseer, 2025; Hunjra et al., 2024). This increases the robustness of empirical findings by addressing endogeneity, unobservable heterogeneity, estimation bias, and dynamic panel modelling (Pucheta-Martínez et al., 2023).

The research employs the debt-to-assets (DTA) and equity-to-assets (ETA) measures for further analysis. According to theoretical expectations, when DTA or DTE is the dependent variable, the ESG coefficient is expected to be negative, whereas when ETA is the dependent variable, it is expected to be positive. The further mediation analysis used by the study is Baron and Kenny's (1986) mediation analysis to investigate how COD and COE mediate the ESG-DTA and ESG-ETA relationship. As a first step, the estimate of the dependent variable (DTA/ETA) on the independent variable (ESG) is computed to learn the total effect of ESG disclosure on DTA/ETA. In the second stage, COD/COE, the mediator, is regressed on ESG, the independent variable, to check whether ESG disclosure affects COD/COE. The dependent variable (DTA/ETA) is then regressed simultaneously on the independent variable (ESG) and the mediator (COD/COE) to evaluate the mediating effect of the COD/COE at the final stage.

Accordingly, to test the second hypothesis, the conceptual framework is specified through the following three regression models:

Total Effect Model: The impact of ESG disclosure on the debt-to-assets ratio:

$$DTA_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 X_{i,t} + YearFE + IndustryFE + e_{i,t} \tag{2}$$

Mediator Model: The influence of ESG disclosure on the cost of capital (COC):

$$COD_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 X_{i,t} + YearFE + IndustryFE + e_{i,t} \tag{3}$$

Mediated Effect Model: The joint effect of ESG and COC on the debt-to-assets ratio:

$$DTA_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 COD_{i,t} + \beta_3 X_{i,t} + YearFE + IndustryFE + e_{i,t} \tag{4}$$

where $DTA_{i,t}$ is debt-to-assets ratio, $COD_{i,t}$ is the cost of debt, $ESG_{i,t}$ is the ESG disclosure scores, $X_{i,t}$ is a vector of firm-level control variables, and $e_{i,t}$ is the error term. YearFE and IndustryFE represent year and industry fixed effects to control for unobservable heterogeneity over time and across industries. Fig. 1 presents the impact of ESG disclosure scores on DTA through a mediating role of cost of debt. The relationship (c) represents the total effect of ESG disclosure scores on DTA. The role of the mediating variables generates a decomposition of the total effect (c) of the independent variable (ESG disclosure scores) on the dependent variable (DTA) into a direct effect (ć) and an indirect effect (ab).

For examining the mediating effect of the cost of equity (COE) on the relationship between ESG disclosure and equity-to-assets ratio, the study employs a similar approach:

Total Effect Model:

$$ETA_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 X_{i,t} + YearFE + IndustryFE + e_{i,t} \tag{5}$$

Mediator Model:

$$COE_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 X_{i,t} + YearFE + IndustryFE + e_{i,t} \tag{6}$$

Mediated Effect Model:

$$ETA_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 COE_{i,t} + \beta_3 X_{i,t} + YearFE + IndustryFE + e_{i,t} \tag{7}$$
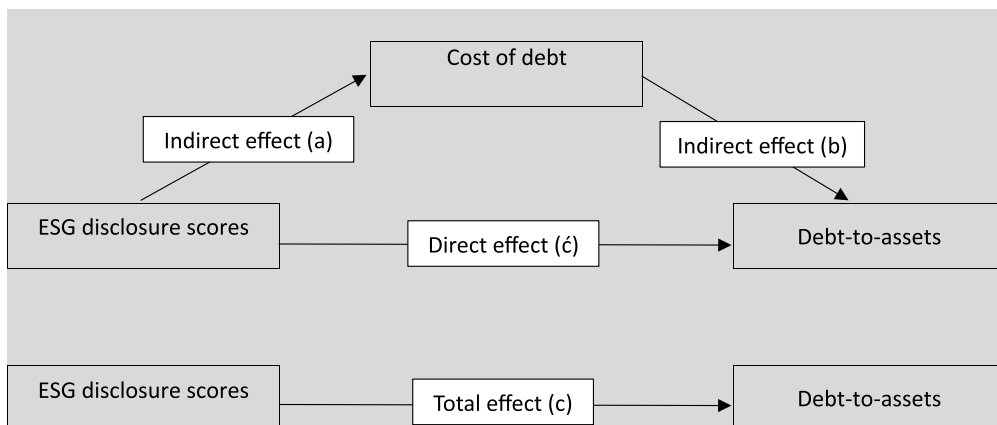

Fig. 1. Mediating role of COD on the relationship between ESG disclosure scores and debt-to-assets ratio.

where $ETA_{i,t}$ is equity-to-assets ratio, $COE_{i,t}$ is the cost of equity, $ESG_{i,t}$ is the ESG disclosure scores, $X_{i,t}$ is a vector of firm-level control variables, and $e_{i,t}$ is the error term. YearFE and IndustryFE represent year and industry fixed effects to control for unobservable heterogeneity over time and across industries. Fig. 2 presents the pictorial representation for the impact of ESG disclosure scores on ETA through a mediating role of cost of equity. The relationship (c) is the total effect of ESG disclosure scores on ETA. The role of the mediating variables generates a decomposition of the total effect (c) of the independent variable (ESG disclosure scores) on the dependent variable (ETA) into a direct effect (ć) and an indirect effect (ab).

Further, this study hypothesizes that the negative relationship between ESG disclosure scores and the debt-to-equity ratio (DTE) is more pronounced in firms from environmentally sensitive industries (with higher CO_2 emissions). In line with Gracia and Siregar (2021) and Yoon et al. (2018), this study classifies firms belonging to energy, materials, industrials, real estate and utilities sector as environmentally sensitive. This proposition is tested empirically by dividing the main sample into two subsamples, categorizing firms into high-emission and low-emission groups. This approach enables a comparative analysis to determine whether the impact of ESG disclosures on capital structure decisions varies with a firm's environmental footprint.

Finally, this study explores how the relationship between ESG and DTE changed after the breakout of COVID-19 pandemic. In line with Malik and Kashiramka (2025a), Malik and Kashiramka (2024), Gupta and Das (2024) and Vo et al. (2022), the baseline model has been re-estimated for two subperiods: Pre-COVID (2015–2019), and COVID/Post-COVID (2020–2022).

4. Empirical results

4.1. Descriptive statistics and correlation

Table 2 reports the descriptive statistics of the key variables used in the study. The DTE has an average of 56.011 with the standard deviation of 78.612 indicating substantial variance in the capital structure of Indian firms. The average ESG disclosure scores (ESG) are 36.863 with a minimum and maximum of 9.091 and 68.464 respectively showing a moderate degree of sustainability disclosure by Indian firms. The mean scores for the environmental (ENV), social (SOC), and governance (GOV) dimensions are 15.481, 20.746, and 75.970 respectively. This indicates stronger governance practices than environmental and social disclosures which could be attributed to the mounting regulatory and compliance pressures since the Securities and Exchange Board of India (SEBI) closely monitors the corporate governance standards of India. In contrast to governance, the environmental and social scores are low and still have a long way to go before achieving sustainability. The relatively low environmental scores indicate the challenges in implementing environmental initiatives such as expensive technology or the need for heavy investment planning. The low social scores show that more attention is required to be paid on the stakeholder, employee and community fronts. Overall, governance reform has become more popular, but stronger policy measures and incentives are required to improve the environmental and social performance of Indian firms.

Table 3 presents the Pearson correlation matrix and the corresponding VIF and tolerance values (1/VIF) for DTE, ESG disclosure scores and the control variables employed in the baseline model. ESG disclosure exhibits a significant negative relationship with DTE, supporting the hypothesis. According to the rule of thumb, multicollinearity may be a concern if the absolute correlation value exceeds 0.80. However, as shown in Table 3, all correlation values are below this threshold, indicating no multicollinearity issues. To further validate this, the variance inflation factor (VIF) analysis is performed. VIF for all the variables remain well below the conventional threshold of 10 (Gujarati & Porter, 2009), with the highest VIF being 3.391 for Tobin's Q, indicating no severe multicollinearity concerns in the regression models.
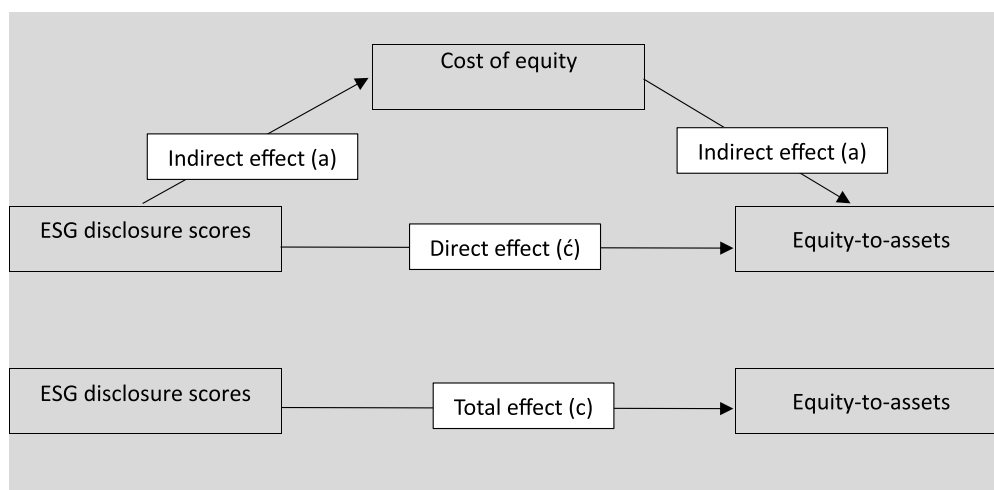
Fig. 2. Mediating role of COE on the relationship between ESG disclosure scores and equity-to-assets ratio.

Table 2
Descriptive statistics.

Variable	N	Mean	Std. Dev.	Min	Max
DTE	1356	56.011	78.612	0	987.951
DTA	1369	19.284	16.711	0	80.524
ETA	1362	51.641	19.022	0.464	93.356
ESG	1369	36.863	11.920	9.091	68.464
ENV	1301	15.481	17.810	0	67.835
SOC	1298	20.746	11.305	0	55.865
GOV	1358	75.970	10.372	39.286	92.354
SIZE	1369	11.210	1.364	8.322	14.979
ROA	1369	10.901	7.301	−11.020	49.957
FATA	1369	33.041	20.562	0.513	79.130
CF	1369	9.654	7.603	−12.928	35.303
NDTS	1369	2.623	1.641	0.022	13.949
ICR	1247	0.128	0.260	0	2.666
SG	1369	11.322	20.422	−47.824	136.725
Z-score	1369	7.466	7.370	0.352	53.309
TQ	1348	3.064	2.421	0.666	16.924
BETA	1369	0.891	1.372	−8.112	4.122

Note(s): The table reports the descriptive statistics for the variables included in the model. The data spans from 2015 to 2022. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

4.2. Baseline regression results

The baseline linear analysis for ESG disclosure scores and finance patterns, as evaluated by debt-to-equity ratio, is shown in Tables 4 and 5 using pooled ordinary least squares (OLS) and system generalized method of moments (GMM). Separate models have been generated for each ESG disclosure score dimension to determine which dimension affects capital structure. Column (1) reports results for the aggregate ESG disclosure score, while columns (2) to (4) break down the aggregate ESG score into environmental, social, and governance disclosure scores, respectively. As reported in Table 4, the estimated coefficient of ESG in column (1) is negative and statistically significant ($\beta = -0.0115$, $p < 0.01$), suggesting that higher ESG disclosure is associated with lower debt-to-equity ratio. This suggests that a one unit increase in ESG disclosure score leads to a 0.0115 unit decrease in the DTE ratio for Indian non-financial firms, keeping other factors constant. It is not only statistically but also economically significant. In terms of economic significance, one standard deviation increase in ESG disclosure score is associated with a 13.708 % reduction in the debt financing. Thus, given the average DTE ratio in the sample is about 56.011, a 13.708 % increase in ESG disclosure scores account for a 24.4737 % change in the dependent variable for an average firm in the sample. Such findings are according to our expectation since firms with better ESG disclosures enjoy a better reputation and market position that attracts equity investors looking for long-term sustainable returns. These companies are inclined to use lower debt and may use equity financing to fund their operations and investments (Chen et al., 2023). The evidence presented is consistent with the evidence from Zhao and Zhang (2024), Pucheta-Martínez et al. (2023), Zahid et al. (2023) and Harjoto (2017). The disaggregated ESG scores as shown in columns (2) to (4) indicate that both environmental and social disclosure scores have a significantly negative relationship with DTE ($\beta = -0.0058$, $p < 0.01$; $\beta = -0.0101$, $p < 0.01$). On the other hand, governance disclosure is only marginally significant ($\beta = -0.0069$, $p < 0.10$), meaning that environmental and social disclosures are more influential than governance disclosures in a firm's leverage decision. In essence, the findings reveal that more ESG disclosures by Indian firms serve to facilitate these firms in raising funds from stock markets more easily.

Among the control variables, firm size is positively associated with DTE, while profitability, cash flow from operations, financial health indicator (Z-score), and financial constraint indicator (ICR) exhibit negative associations with debt-to-equity ratio. This indicates that companies with higher financial flexibility tend to choose equity financing over debt financing (which tends to be more costly). This indicates that larger firms, with a high proportion of fixed assets, high growth potentials and lower profitability tend to maintain higher leverage (Yang & Yulianto, 2022; Zahid et al., 2023).

The GMM estimates as reported in Table 5 reinforce the negative association between ESG disclosures and debt-to-equity ratios, further strengthening the robustness of the results. In addition to the main results, several diagnostic tests were conducted to validate the robustness of the GMM estimates (Malik & Kashiramka, 2025a). First, the Hansen test of over-identifying constraints assessed the validity of the instrumental variables. The instruments are legitimate since the p-values exceed the 5 % significance level and are not correlated with the error term. This indicates no over-identification, confirming that the instruments are suitable for the model. The Arellano-Bond autocorrelation test was used to determine if the residuals had first- and second-order serial correlation. In differenced residuals, first-order autocorrelation (AR(1)) is predicted, but the test for second-order autocorrelation (AR(2)) should not be significant for GMM estimates to be accurate. Significant AR(1) and negligible AR(2) ($p > 0.05$) confirmed that the moment requirements are appropriately defined and that the dynamic panel model is suitable for this investigation. The lagged dependent variable of the model is important, highlighting the relevance of dynamic changes in capital structure decisions of firms. The diagnostic tests indicate that endogeneity, instrument weakness, and dynamic model mis-specification do not affect GMM estimates.

The study also investigates two other dependent variables viz. debt-to-assets (DTA) and equity-to-assets (ETA) to gain deeper insights into financing methods. The purpose of DTA model is to test if ESG disclosures have any effect on debt financing through cost

Table 3
Pairwise correlation matrix and multicollinearity test.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	VIF	1/VIF
(1) DTE	1.000													
(2) ESG	0.023*	1.000											1.532	0.653
(3) SIZE	0.261*	0.517*	1.000										1.763	0.567
(4) ROA	−0.328*	0.004	−0.295*	1.000									2.391	0.418
(5) FATA	0.227*	0.015	0.074*	−0.072*	1.000								1.644	0.608
(6) CF	−0.322*	0.067*	−0.181*	0.648*	0.016	1.000							1.940	0.515
(7) NDTS	−0.021	0.003	−0.049*	0.034	0.061*	−0.029	1.000						1.679	0.596
(8) ICR	−0.138*	0.030	−0.037	0.114*	−0.090*	0.108*	−0.017	1.000					1.029	0.971
(9) SG	−0.021	−0.010	−0.097*	0.130*	−0.018	−0.015	−0.018	−0.002	1.000				1.099	0.910
(10) Z-score	−0.367*	−0.022	−0.378*	0.619*	−0.184*	0.472*	0.021	0.122*	0.085*	1.000			3.336	0.300
(11) TQ	−0.293*	−0.015	−0.342*	0.587*	−0.149*	0.411*	0.026	0.051*	0.133*	0.770*	1.000		3.391	0.295
(12) BETA	−0.139*	0.027	−0.103*	0.047*	−0.047*	0.086*	0.024	−0.009	0.106*	0.086*	0.056*	1.000		

Note(s): The table presents the Pearson correlation coefficients along variation inflation factor (VIF) and tolerance values (1/VIF). * indicates significance at the 1 % level. The data spans from 2015 to 2022. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.

Source: *Bloomberg®, Author's compilation and estimation.*

Table 4
ESG disclosure and DTE: Baseline regression results using pooled OLS.

VARIABLES	(1)	(2)	(3)	(4)
	DTE	DTE	DTE	DTE
ESG	−0.0115***			
	(0.0031)			
ENV		−0.0058***		
		(0.0013)		
SOC			−0.0101***	
			(0.0022)	
GOV				−0.0069*
				(0.0040)
SIZE	0.1474***	0.1360***	0.1332***	0.0972***
	(0.0173)	(0.0170)	(0.0159)	(0.0137)
ROA	−0.0138***	−0.0113**	−0.0116**	−0.0140***
	(0.0052)	(0.0048)	(0.0048)	(0.0052)
FATA	0.0068***	0.0064***	0.0060***	0.0076***
	(0.0016)	(0.0014)	(0.0014)	(0.0017)
CF	−0.0186***	−0.0205***	−0.0208***	−0.0198***
	(0.0043)	(0.0041)	(0.0042)	(0.0043)
NDTS	0.0167	0.0277	0.0285	0.0124
	(0.0246)	(0.0220)	(0.0218)	(0.0249)
ICR	−0.2992***	−0.2937***	−0.3231***	−0.3265***
	(0.0404)	(0.0378)	(0.0472)	(0.0377)
SG	0.0014	0.0018*	0.0015	0.0015
	(0.0010)	(0.0011)	(0.0011)	(0.0011)
Z-score	−0.0292***	−0.0289***	−0.0298***	−0.0298***
	(0.0046)	(0.0046)	(0.0047)	(0.0048)
TQ	0.0476***	0.0457***	0.0513***	0.0434***
	(0.0110)	(0.0109)	(0.0111)	(0.0110)
BETA	−0.0777***	−0.0694***	−0.0702***	−0.0778***
	(0.0242)	(0.0221)	(0.0224)	(0.0238)
Constant	−0.3976**	−0.5866***	−0.3863*	0.3512
	(0.1926)	(0.2188)	(0.2089)	(0.3766)
Observations	1223	1169	1164	1231
R-squared	0.3153	0.3295	0.3287	0.3013
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the baseline regression results for the impact of ESG disclosures on DTE ratio using pooled OLS regression. DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

of debt while ETA model is to assess if ESG transparency affect the increase of cost of equity which in turn affect equity financing.

4.3. Mediation analysis

The results, so far, have demonstrated that ESG disclosure scores significantly reduce the debt-to-equity ratio for non-financial firms in India. Nonetheless, the underlying mechanisms behind this relationship remains unclear. As a result, it is important to explore the pathways through which ESG disclosure influences DTE and assess the relative strength of these channels for both theoretical and practical significance. Due to the fact that cost of debt (COD) and cost of equity (COE) are the determining factors of debt financing and equity financing, respectively, analyzing the effect of ESG disclosure on COD and COE can provides great insight on its effect on DTE ratio. Therefore, this section examines whether or not COD and COE mediate the link between ESG disclosure scores and the DTE ratio.

Fig. 3 illustrates the mediation procedure in detail. To support mediation, Baron and Kenny (1986) suggest the requirement of three conditions, which must be met to support the mediating effect. These conditions are as follows: (i) In the first regression (Step 1), the independent variable ESG must significantly predict the dependent variable (DTA/ETA), (ii) In the second regression (Step 2), the independent variable ESG must significantly predict the mediator (COD/COE) and (iii) In the third regression (Step 3), the mediator (COD/COE) must significantly predict the dependent variable (DTA/ETA). Partial mediation occurs when the fourth regression indicates that the effect of the independent variable on the dependent variable is less than that in the first step (Step 4). Full mediation is determined when there is no effect of the independent variable on the dependent variable when the mediator is added (Step 4).

The empirical results on the mediating role of cost of debt (COD) in the relationship between ESG disclosure and the debt-to-assets (DTA) ratio are presented in Table 6. The coefficient of ESG in column (1) represents the total effect of ESG on DTA; column (2) shows

Table 5
ESG disclosure and DTE: Baseline regression results using system GMM estimation.

VARIABLES	(1) DTE	(2) DTE	(3) DTE	(4) DTE
Lag of DTE	0.6398***	0.6455***	0.6263***	0.7222***
	(0.1025)	(0.1032)	(0.1093)	(0.1045)
ESG	−0.0021*			
	(0.0013)			
ENV		−0.0015*		
		(0.0009)		
SOC			−0.0034*	
			(0.0019)	
GOV				−0.0087**
				(0.0044)
SIZE	0.0503***	0.0487***	0.0539**	0.0508***
	(0.0172)	(0.0180)	(0.0209)	(0.0172)
ROA	−0.0046*	−0.0041	−0.0059*	−0.0020
	(0.0027)	(0.0027)	(0.0034)	(0.0023)
FATA	0.0024**	0.0025**	0.0028**	0.0017
	(0.0011)	(0.0011)	(0.0012)	(0.0011)
CF	−0.0114***	−0.0118***	−0.0123***	−0.0134***
	(0.0029)	(0.0030)	(0.0032)	(0.0026)
NDTS	0.0053	0.0048	0.0022	0.0073
	(0.0132)	(0.0132)	(0.0127)	(0.0145)
ICR	−0.0003	−0.0003	0.0002	−0.0000
	(0.0009)	(0.0009)	(0.0009)	(0.0008)
SG	0.0010	0.0010	0.0008	0.0001
	(0.0007)	(0.0007)	(0.0007)	(0.0006)
Z-score	−0.0077**	−0.0074**	−0.0145**	−0.0038
	(0.0034)	(0.0034)	(0.0066)	(0.0033)
TQ	0.0228***	0.0229***	0.0520**	0.0203***
	(0.0072)	(0.0074)	(0.0206)	(0.0069)
BETA	−0.0239***	−0.0253***	−0.0238***	−0.0229***
	(0.0066)	(0.0070)	(0.0071)	(0.0066)
Constant	−0.2537**	−0.2954**	−0.2679*	0.2598
	(0.1187)	(0.1468)	(0.1412)	(0.2232)
Observations	1330	1269	1265	1340
Number of ID	269	259	258	269
AR(1)	−2.42(0.0157)	−2.36(0.0183)	−2.35(0.0187)	−2.74(0.00620)
AR(2)	−0.40(0.691)	−0.47(0.636)	−0.43(0.665)	−0.25(0.799)
Hansen	2.72(0.257)	2.77(0.251)	2.83(0.243)	6.22(0.399)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the results of baseline regression regarding the impact of ESG disclosures on DTE ratio using system GMM estimation. DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: *Bloomberg®, Author's compilation and estimation.*

the impact of ESG on COD; and column (3) presents the joint effect of ESG and COD on DTA. Column (1) shows that ESG disclosure is negatively associated with DTA (β = −0.0006, p < 0.10), suggesting that higher ESG disclosures reduces debt financing. The result of the coefficient of ESG on COD is negative and significant (β = −0•0152, p < 0.01) as seen in column (2), indicating that ESG disclosure reduces the weighted average cost of debt (COD) for Indian firms. This phenomenon is consistent with La Rosa et al. (2018) and Malik and Kashiramka (2024) who report that firms with better ESG disclosures are perceived to be less risky by the lenders which leads to a lower cost of borrowing. In column (3), COD as a mediator maintains a negative correlation with DTA (β = −0.0240, p < 0.01), whereas the ESG disclosure coefficient is insignificant. The results of this study indicate that an increase in a firm's ESG disclosures does not encourage it to borrow more as evidenced by the reduced level of debt held by the firm. Rather, a firm with greater ESG disclosures is found to possess a lower cost of debt and a decreased debt-to-assets ratio (DTA) as compared to other firms. Instead, companies with higher ESG ratings may gain better access to alternate funding channels such as equity funding; and internal funds which lessen their borrowing. Also, firms with better ESG scores may generate higher retain earnings which will help them to use it to internally finance investments instead of through debt. Moreover, many ESG-oriented firms may intentionally avoid high leverage as it signals financial instability and contradict their sustainability goals. In summary, these results meet the requirements of a perfect mediation as outlined by Baron and Kenny (1986). Therefore, the second hypothesis (H2) which posits that cost of debt mediates the relationship between ESG and DTA is strongly supported.

Table 7 extends the mediation analysis by exploring the impact of ESG disclosure on the equity-to-assets (ETA) ratio of firms
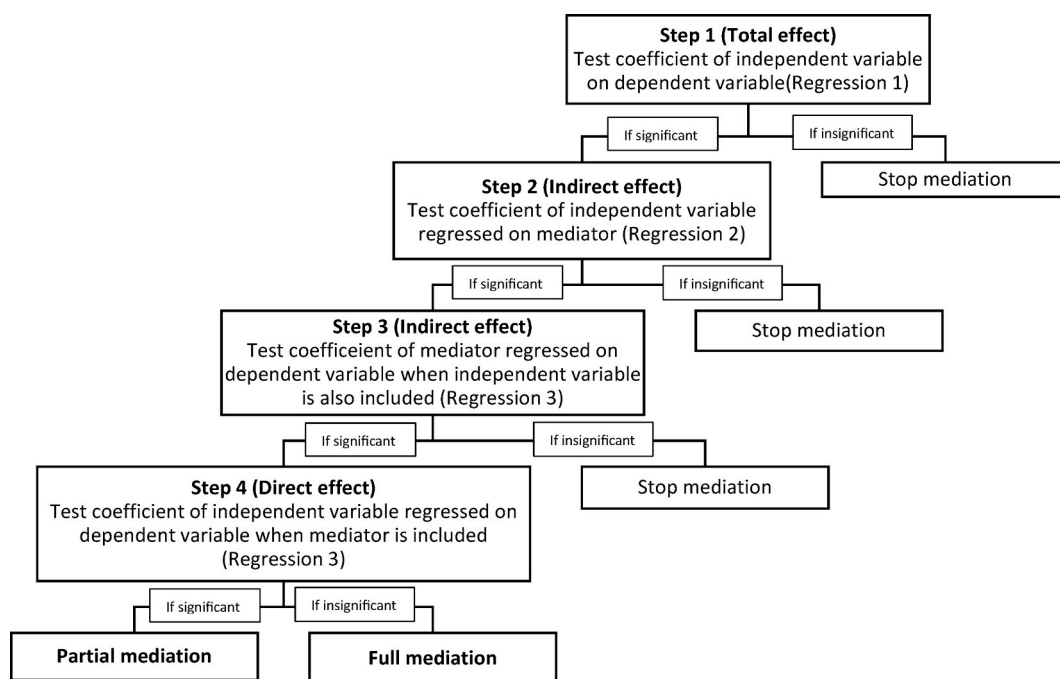
Fig. 3. Mediation analysis framework.

through the mediating role of cost of equity (COE). The findings noted in column (1) indicate that ESG disclosure positively affects ETA ($\beta = 0.1904$, p < 0.01). This suggests that more disclosures on ESG would result in higher equity financing, consistent with the findings of Zhao and Zhang (2024). As revealed by the estimates in column (2), ESG disclosure decreases COE significantly with $\beta = -0.0069$, p < 0.05. This suggests that the firms with stronger ESG practices face lower costs of equity financing. The reduction in COE due to higher ESG disclosure scores has also been documented by Chen et al. (2023) and Fandella et al. (2023). The introduction of COE as a mediator in column (3) shows that the coefficient of ESG disclosure remains positive but smaller in magnitude while COE negatively affects ETA ($\beta = -0.9282$ and p < 0.01). The implication of the result, according to Baron and Kenny (1986) approach, indicates the partial mediation effect that is ESG disclosures increase firm equity levels via lower cost of equity financing. This evidence is consistent with financing costs playing a role in strengthening firm capital structures. A breakdown of the effects reveals that the direct effect of ESG on ETA is 0.1733, while the indirect (mediating) effect via COE is 0.0064 (-0.0069×-0.9282). As such, the total influence of ESG on ETA is 0.1797 [0.1733 + 0.0064]], which is almost in line with Column (1)'s 0.1904 coefficient (within the error range). This suggests that ESG has a direct effect on ETA of 96.39 % and COE mediating effect on ETA of 3.61 %. Taken together, the findings lend support to Hypothesis 3 (H3) suggesting that COE mediates the relationship between ESG disclosure and ETA ratio. The analysis confirms that ESG has a positive effect on ETA, which operates through the pathway of COE reduction for increased equity financing. Therefore, although ESG disclosure lowers both cost of debt and cost of equity, firms prefer to re-optimize their capital structure by shifting toward equity.

4.4. High vs low carbon emitting industries

An important factor that could potentially influence the relationship between ESG disclosures and capital structure is a firm's affiliation with an environmentally sensitive industry or polluting industry According to Gamerschlag et al. (2011), companies in high-pollution sectors often exhibit higher levels of ESG disclosure and performance than those in low-pollution industries. The ongoing trend is primarily driven by the perception that ESG investments in environmentally sensitive sectors add firm value by reducing risks and improving corporate reputation. Moreover, firms in polluting sectors utilize higher ESG disclosures as a strategic response to regulators and other stakeholders. Thus, the ESG disclosures may have varied advantages across industries, especially among highly polluting industries. Nevertheless, an analysis of the present literature shows that influence has rarely been studied (Li et al., 2024). It is important to address this gap to understand whether firms with different environmental impacts employ different ESG financing strategies. Consequently, this section of the study investigates whether the influence of ESG disclosures on DTE differs at the industry level. To investigate this possible industry-specific variation, a subsample analysis has been conducted by splitting up the main sample into two distinct groups, namely more environmentally sensitive industries (or high-carbon emitting industries) and less environmentally sensitive industries (or low-carbon emitting industries). As shown in Tables 8 and 9, there is a significant negative relationship between the ESG disclosures and the DTE ratio across both subsamples. However, these results further reveal that there is a stronger and more significant negative relationship between the ESG disclosures and the debt-to-equity ratio for firms belonging to

Table 6
ESG disclosure and DTA: Mediating impact of COD.

VARIABLES	(1)	(2)	(3)
	DTA	COD	DTA
ESG	−0.0006*	−0.0152***	−0.0002
	(0.0003)	(0.0039)	(0.0003)
COD			−0.0240***
			(0.0026)
SIZE	0.0243***	−0.1789***	0.0198***
	(0.0031)	(0.0361)	(0.0030)
ROA	−0.0020**	−0.0017	−0.0020**
	(0.0008)	(0.0080)	(0.0008)
FATA	0.0025***	−0.0025	0.0024***
	(0.0003)	(0.0027)	(0.0002)
CF	−0.0052***	0.0183***	−0.0047***
	(0.0007)	(0.0070)	(0.0007)
NDTS	0.0078**	−0.0493	0.0068**
	(0.0031)	(0.0308)	(0.0030)
ICR	−0.1168***	0.2314	−0.1111***
	(0.0108)	(0.1737)	(0.0100)
SG	0.0006***	0.0010	0.0006***
	(0.0002)	(0.0017)	(0.0002)
Z-score	−0.0097***	0.0230**	−0.0092***
	(0.0011)	(0.0093)	(0.0011)
TQ	0.0121***	−0.0342	0.0112***
	(0.0027)	(0.0267)	(0.0026)
BETA	−0.0112***	0.0955***	−0.0087***
	(0.0029)	(0.0329)	(0.0029)
Constant	−0.0060	12.3651***	0.2926***
	(0.0358)	(0.4283)	(0.0474)
Observations	1235	1228	1227
R-squared	0.5759	0.4594	0.6078
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Note(s): The table reports the results for the mediating impact of COD on the relationship ESG disclosures and DTA. Column 1 presents the results for the impact of ESG on DTA; column 2 presents the results for the impact of ESG on the mediator variable (COD) and column 3 reports the results for the impact of ESG on DTA when mediator variable is included in the model. DTA is the debt-to-assets ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. COD is the cost of debt. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: *Bloomberg®, Author's compilation and estimation.*

more environmentally sensitive industries. The research showed that high carbon intensity firms with higher ESG disclosure rely less on debt financing. More specifically, ESG disclosure score for high carbon industry firms exhibits a statistically significant negative coefficient (−0.0151, p < 0.01). When looking at individual ESG dimensions, environmental (−0.0072, p < 0.01) and social (−0.0108, p < 0.01) disclosures have a significant negative association with leverage, but governance disclosure has no statistically significant effect. The evidence suggests that increased environmental and social transparency help firms to rely less on debt, likely due to investors and creditors becoming more critical of their sustainability practices. According to the findings, the DTE ratio and ESG disclosures have a negative link in case of firms that belong to a low-carbon emitting industry, though the link is relatively weaker (−0.0146, p < 0.10). Among the components of ESG, both environmental (−0.0031, p < 0.10) and social (−0.0093, p < 0.05) disclosures have a significantly negative effect on leverage while governance disclosure is insignificant. The results suggest that while ESG transparency affects capital structure decisions in all the industries, its impact is significantly higher for firms in environment-sensitive industries. This indicates that the investors value the green initiatives and disclosures of environment-sensitive industries in India. In both subsamples, there is a statistically significant positive association between firm size and the debt-to-equity (DTE) ratio implying that larger firms have more access to financing through debt. Moreover, lower leverage is consistently associated with higher profitability, higher cash flows from operations, and better financial health (Z-score) of the firm, implying that financially stable firms reduce their reliance on debt. The value for Tobin's Q is positive and statistically significant in most models. This suggests that firms with good growth opportunities are more willing to incur debt. In conclusion, the subsample analysis emphasizes the importance of industry context in determining the impact of ESG disclosure on capital structure choices.

Table 7
ESG disclosure and ETA: Mediating impact of COE.

VARIABLES	(1)	(2)	(3)
	ETA	COE	ETA
ESG	0.1904***	−0.0069**	0.1773***
	(0.0383)	(0.0033)	(0.0389)
COE			−0.9282***
			(0.3184)
SIZE	−3.5092***	0.2073***	−3.2821***
	(0.3403)	(0.0317)	(0.3452)
ROA	0.3651***	−0.0082	0.3477***
	(0.0970)	(0.0071)	(0.0971)
FATA	−0.0229	0.0075***	−0.0162
	(0.0263)	(0.0025)	(0.0267)
CF	0.2876***	−0.0158***	0.2831***
	(0.0740)	(0.0059)	(0.0751)
NDTS	0.2493	−0.0654**	0.1869
	(0.3258)	(0.0268)	(0.3307)
ICR	0.0012	−0.0001	0.0011
	(0.0010)	(0.0001)	(0.0009)
SG	−0.0604***	−0.0018	−0.0584**
	(0.0229)	(0.0017)	(0.0231)
Z-score	1.4969***	−0.0182***	1.4870***
	(0.1138)	(0.0064)	(0.1128)
TQ	−1.3274***	0.0002	−1.3407***
	(0.1137)	(0.0012)	(0.1132)
BETA	−0.0097	0.0805***	0.0117
	(0.3251)	(0.0278)	(0.3277)
Constant	79.7125***	10.0737***	88.9549***
	(4.4556)	(0.3629)	(5.5473)
Observations	1356	1346	1340
R-squared	0.5769	0.6377	0.5801
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Note(s): The table reports the results for the mediating impact of COE on the relationship ESG disclosures and ETA. Column 1 presents the results for the impact of ESG on ETA; column 2 presents the results for the impact of ESG on the mediator variable (COE) and column 3 reports the results for the impact of ESG on ETA when mediator variable is included in the model. ETA is the equity-to-assets ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. COE is the cost of equity. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
***Source:** Bloomberg®, Author's compilation and estimation.*

4.5. High vs low ESG scores

In the analysis so far, the study has established negative relationship between that ESG disclosure scores and DTE ratio for Indian firms. However, the analysis did not consider whether the strength of this relationship varies depending on the level of ESG scores (Asimakopoulos et al., 2023) To address this gap, this section delves deeper by categorizing firms into two groups based on their ESG disclosure scores relative to the median of the sample for each year. Firms with ESG scores above the median are classified as "High ESG" firms, while those with scores below the median are categorized as "Low ESG" firms. Tables 10 and 11 present the regression results examining the relationship between ESG disclosures and firms' debt-to-equity (DTE) ratios for high ESG firms and low ESG firms respectively. In both the subsamples, the coefficient on ESG is negative and statistically significant, indicating that greater ESG transparency is associated with a lower debt-to-equity ratio. However, the magnitude of the impact is greater in the low ESG sample (−0.0179***) compared to the high ESG sample (−0.0057**), indicating that firms with initially poor ESG disclosure experience a more pronounced decrease in their debt financing when they improve ESG disclosure. Companies with a low level of ESG may have a greater potential for improvement. Even marginal improvements in ESG disclosures may lead to a significant shift in investor and creditor perceptions which would also lead to an increase in access to equity finance and reduced reliance on debt. To provide more insight regarding the impact of individual ESG dimensions, the composite ESG disclosure score is replaced by its environmental, social and governance components. The results show significant differences between the two subsamples. The coefficient on ENV is negative and significant in both subsamples. The impact, however, was much more pronounced for low ESG firms (−0.0791***) than for high ESG firms (−0.0055***), suggesting that these firms find environmental transparency a stronger determinant of their leverage choices. The low ESG is negative and statistically significant for SOC in the low ESG sample (−0.0235***), while the high ESG is insignificant in the high ESG sample (0.0030). This is indications that social disclosure affects capital structure choice of mainly firm with weak ESG. The coefficient on GOV is insignificant in both subsamples, implying that governance transparency alone is not a significant

Table 8
ESG disclosure and DTE: More environmentally sensitive industries.

VARIABLES	(1)	(2)	(3)	(4)
	DTE	DTE	DTE	DTE
ESG	−0.0151***			
	(0.0030)			
ENV		−0.0072***		
		(0.0018)		
SOC			−0.0108***	
			(0.0028)	
GOV				−0.0037
				(0.0037)
SIZE	0.1544***	0.1557***	0.1500***	0.1028***
	(0.0209)	(0.0235)	(0.0232)	(0.0201)
ROA	−0.0112*	−0.0113*	−0.0112*	−0.0100*
	(0.0058)	(0.0060)	(0.0060)	(0.0057)
FATA	0.0042**	0.0043**	0.0039**	0.0053***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
CF	−0.0182***	−0.0186***	−0.0190***	−0.0200***
	(0.0059)	(0.0061)	(0.0062)	(0.0060)
NDTS	0.0346	0.0304	0.0315	0.0302
	(0.0280)	(0.0289)	(0.0289)	(0.0286)
ICR	−0.3127***	−0.3119***	−0.3829***	−0.3479***
	(0.0524)	(0.0458)	(0.0715)	(0.0416)
SG	0.0017	0.0021	0.0018	0.0018
	(0.0013)	(0.0014)	(0.0013)	(0.0013)
Z-score	−0.0309***	−0.0316***	−0.0306***	−0.0325***
	(0.0074)	(0.0078)	(0.0077)	(0.0076)
TQ	0.0370*	0.0394**	0.0395**	0.0327*
	(0.0190)	(0.0200)	(0.0196)	(0.0189)
BETA	−0.0955***	−0.0977***	−0.0991***	−0.0930***
	(0.0363)	(0.0365)	(0.0374)	(0.0356)
Constant	−0.4843	−0.7124*	−0.5563	0.0199
	(0.3776)	(0.3790)	(0.3929)	(0.5262)
Observations	709	674	671	717
R-squared	0.3349	0.3300	0.3246	0.3155
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the regression results for the impact of ESG disclosures on DTE ratio in more environmentally sensitive industries (on the basis of CO_2 emissions). DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: *Bloomberg®, Author's compilation and estimation.*

determinant of capital structure. Most of the control variables are in line with theory, strengthening the results. The analysis suggests that the effect of ESG disclosures on capital structure varies across firms. Furthermore, firms with lower ESG scores are likely to reduce their leverage as compared to other firms. However, the effect is substantially stronger in low ESG firms (−0.0791***) than in high ESG firms (−0.0055***), suggesting that environmental transparency plays a more critical role in shaping leverage decisions for firms with initially low ESG scores. The coefficient on SOC is negative and statistically significant only in the low ESG sample (−0.0235***), whereas it is insignificant in the high ESG sample (−0.0030). This suggests that social disclosure influences capital structure decisions primarily in firms with weak ESG profiles. The coefficient on GOV is insignificant in both subsamples, indicating that governance transparency alone does not significantly influence capital structure decisions. The control variables largely align with theoretical expectations, reinforcing the robustness of the findings. Overall, this analysis underscores the heterogeneity in the impact of ESG disclosures on capital structure and highlights the greater potential for leverage reduction among firms with initially low ESG scores.

4.6. Before and during pandemic

The behaviour of creditors and investors is often shaped by prevailing macroeconomic conditions. As highlighted by Benlemlih and Bitar (2018), firms with higher ESG scores benefit from their social and environmental transparency, particularly during period of crisis. ESG disclosures help mitigate the negative impacts of crises and provide a buffer against firm-specific shocks. The observed sample (2015–2022) includes the COVID-19 pandemic and its aftermath. To explore whether economic instability influences the relationship between ESG disclosure scores and the debt-to-equity (DTE) ratio, this section conducts a subsample analysis by dividing the study period (2015–2022) into two distinct phases: the pre-COVID or stability period (2015–2019) and the COVID/post-COVID or crisis period (2020–2022). Table 12 displays the results for the pre-COVID subsample. The results for the COVID/Post-COVID period

Table 9
ESG disclosure and DTE: Less environmentally sensitive industries.

VARIABLES	(1)	(2)	(3)	(4)
	DTE	DTE	DTE	DTE
ESG	−0.0146*			
	(0.0077)			
ENV		−0.0031*		
		(0.0017)		
SOC			−0.0093**	
			(0.0038)	
GOV				−0.0129
				(0.0090)
SIZE	0.1479***	0.0870***	0.1011***	0.0991***
	(0.0499)	(0.0289)	(0.0295)	(0.0309)
ROA	−0.0154**	−0.0133*	−0.0127*	−0.0177**
	(0.0071)	(0.0068)	(0.0067)	(0.0078)
FATA	0.0123***	0.0096***	0.0095***	0.0119***
	(0.0038)	(0.0023)	(0.0023)	(0.0036)
CF	−0.0176***	−0.0216***	−0.0215***	−0.0182***
	(0.0062)	(0.0049)	(0.0048)	(0.0061)
NDTS	−0.0182	0.0214	0.0210	−0.0217
	(0.0485)	(0.0343)	(0.0341)	(0.0492)
ICR	−0.2941***	−0.2768***	−0.2794***	−0.3069***
	(0.0660)	(0.0599)	(0.0590)	(0.0632)
SG	0.0002	0.0004	0.0002	0.0002
	(0.0021)	(0.0022)	(0.0023)	(0.0022)
Z-score	−0.0265***	−0.0255***	−0.0272***	−0.0267***
	(0.0060)	(0.0058)	(0.0059)	(0.0063)
TQ	0.0588***	0.0544***	0.0618***	0.0541***
	(0.0155)	(0.0147)	(0.0157)	(0.0154)
BETA	−0.0539*	−0.0388*	−0.0374*	−0.0538**
	(0.0275)	(0.0200)	(0.0199)	(0.0267)
Constant	−0.3918	−0.1474	−0.1691	0.7247
	(0.3023)	(0.2999)	(0.2680)	(0.5492)
Observations	514	495	493	514
R-squared	0.2921	0.3310	0.3366	0.2898
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the regression results for the impact of ESG disclosures on DTE ratio in less environmentally sensitive industries (on the basis of CO_2 emissions). DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: *Bloomberg®, Author's compilation and estimation.*

are reported in Table 13. For the 2015–2019 period, ESG disclosure is negatively and significantly associated with the debt-to-equity ratio (DTE) ($\beta = -0.0077$, $p < 0.01$). Among the individual components, both environmental disclosure ($\beta = -0.0055$, $p < 0.01$) and social disclosure ($\beta = -0.0124$, $p < 0.01$) exhibit a significant negative relationship with DTE. However, governance disclosure is statistically insignificant. These findings suggest that environmental and social disclosure played a more substantial role in shaping firms' capital structures before the COVID-19 pandemic. In contrast, for the 2020–2022 period, the negative association between ESG disclosure and DTE becomes stronger ($\beta = -0.0158$, $p < 0.05$), suggesting that ESG-conscious firms further reduced their reliance on debt during and after the pandemic. Unlike in the pre-COVID period, governance disclosure in the COVID period shows a negative and marginally significant effect on DTE ($\beta = -0.0191$, $p < 0.10$), indicating its increased importance in financial decision-making during periods of economic uncertainty. The impact of environmental disclosure remains significant ($\beta = -0.0056$, $p < 0.01$), while the negative effect of social disclosure weakens slightly ($\beta = -0.0070$, $p < 0.05$). The findings suggest that the benefits of ESG disclosures in reducing leverage are more significantly observed in periods of economic downturns, which attests to the resilience of these initiatives. COVID 19 has caused investors and creditors to become more risk-averse. As a result, during times of crisis, investors view firms that engage in and disclose ESG measures as less risky, which raises equity financing. Furthermore, the newly found significance for the governance component during the crisis period highlights the key role that transparent corporate governance plays in achieving financial stability in times of uncertainty. Furthermore, the findings corroborate with Buchanan et al. (2018), which mentions that a crisis worsens the agency problem and consequently reduces debt financing.

The two subsamples show differences in several control variables. Both periods show a consistent positive and significant effect of firm size, although the post-COVID effect size diminishes slightly. The return on assets was not significant prior to COVID but turns negative and significant post-2020 that is, more profitable firms reduce leverage after the pandemic. The cash flow from operations has a negative and significant effect on DTE in both periods. However, this effect slightly decreased in the post-COVID period. Financial

Table 10
ESG disclosure and DTE: High ESG scores.

VARIABLES	(1) DTE	(2) DTE	(3) DTE	(4) DTE
ESG	−0.0057**			
	(0.0025)			
ENV		−0.0055***		
		(0.0014)		
SOC			−0.0030	
			(0.0027)	
GOV				−0.0068
				(0.0097)
SIZE	0.1055***	0.1006***	0.0997***	0.1216***
	(0.0187)	(0.0169)	(0.0202)	(0.0241)
ROA	−0.0132***	−0.0094**	−0.0097**	−0.0138*
	(0.0044)	(0.0045)	(0.0044)	(0.0081)
FATA	0.0069***	0.0079***	0.0062***	0.0077***
	(0.0014)	(0.0014)	(0.0015)	(0.0022)
CF	−0.0201***	−0.0243***	−0.0179***	−0.0294***
	(0.0037)	(0.0037)	(0.0038)	(0.0066)
NDTS	−0.0005	−0.0026	0.0213	0.0328
	(0.0167)	(0.0161)	(0.0165)	(0.0253)
ICR	−0.3191***	−0.2573***	−0.3645***	−0.3734***
	(0.0685)	(0.0599)	(0.0791)	(0.0913)
SG	0.0026**	0.0042***	0.0023**	0.0027*
	(0.0011)	(0.0010)	(0.0011)	(0.0016)
Z-score	−0.0242***	−0.0246***	−0.0250***	−0.0173**
	(0.0050)	(0.0053)	(0.0050)	(0.0077)
TQ	0.0425***	0.0342**	0.0344**	0.0311
	(0.0149)	(0.0147)	(0.0156)	(0.0253)
BETA	−0.0432**	−0.0601***	−0.0631***	−0.0349
	(0.0175)	(0.0180)	(0.0194)	(0.0236)
Constant	−0.1549	−0.2418	−0.0863	0.0095
	(0.2580)	(0.2922)	(0.2662)	(0.7954)
Observations	705	594	677	365
R-squared	0.4444	0.5214	0.4053	0.4647
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the regression results for the impact of ESG disclosures on DTE ratio for firms having ESG scores higher than the median ESG score in a particular year. DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: *Bloomberg®, Author's compilation and estimation.*

constraint measures, internal cash flow ratios (ICR) and Z-score, have a greater adverse impact on DTE after COVID-19, indicating firms' greater sensitivity to financial risk. Tobin's Q ratio continues to be positively related to DTE for both periods which means that high growth firms continued to use debt.

4.7. PSM and entropy balancing method

The study has initially used system GMM to mitigate concerns related to endogeneity, heteroskedasticity and autocorrelation. However, to improve the validity of the results, the study further includes two robustness tests including the propensity score matching (PSM) and entropy balancing methods to address and mitigate any potential endogeneity issues caused by the omitted variable and self-selection bias (Garcia et al., 2021; Kuzey et al., 2023). If the disclosure practices vary significantly across firms, some ambiguity may persist. Therefore, PSM was used to ensure ESG score comparability across sample firms and reduce measurement errors and selection biases. This quasi-experiential strategy employs observational data to generate a statistically equivalent control group for causal effects when random assignment is not possible. The literature uses this technique in many finance subfields (Bryan & Mason, 2020; Drago & Gallo, 2020; Si et al., 2021). We used a probit model to calculate PSM scores using companies' DTE ratios as outcome variables and control variables as covariates for firms with high (treatment group) and low (control group) ESG disclosure scores. Using psmatch2 in Stata, Nearest-Neighbour, Kernel, and Radius matching were used for propensity score matching. Nearest-Neighbour matching was done without replacement, Kernel matching used bandwidth of 0.06 and Radius matching used the same threshold and serving as caliper. Due to a strong common support, the caliper restriction did not lead to the exclusion of additional units, which resulted in all the matching strategies converging to the same matched sample (898 treated; 517 control). We estimated both the ATT and ATE, and the bootstrapped was performed for the latter to derive standard errors and do statistical.

Table 11
ESG disclosure and DTE: Low ESG scores.

VARIABLES	(1) DTE	(2) DTE	(3) DTE	(4) DTE
ESG	−0.0179***			
	(0.0064)			
ENV		−0.0791***		
		(0.0292)		
SOC			−0.0235***	
			(0.0084)	
GOV				−0.0081
				(0.0052)
SIZE	0.2141***	0.2137***	0.1580***	0.0834*
	(0.0457)	(0.0389)	(0.0354)	(0.0461)
ROA	−0.0102	−0.0166**	−0.0114	−0.0029
	(0.0095)	(0.0077)	(0.0096)	(0.0121)
FATA	0.0078***	0.0046*	0.0068**	0.0101***
	(0.0030)	(0.0026)	(0.0028)	(0.0038)
CF	−0.0192***	−0.0163***	−0.0269***	−0.0233**
	(0.0074)	(0.0063)	(0.0071)	(0.0091)
NDTS	0.0345	0.0628**	0.0320	−0.0643
	(0.0319)	(0.0278)	(0.0318)	(0.0462)
ICR	−0.1496	−0.2414	−0.1653	−0.2229
	(0.1934)	(0.1792)	(0.1729)	(0.1779)
SG	−0.0004	−0.0001	−0.0006	0.0005
	(0.0021)	(0.0019)	(0.0021)	(0.0027)
Z-score	−0.0429***	−0.0336***	−0.0438***	−0.0447***
	(0.0120)	(0.0090)	(0.0121)	(0.0160)
TQ	0.0755**	0.0738**	0.1021***	0.0180
	(0.0345)	(0.0290)	(0.0323)	(0.0463)
BETA	−0.1143***	−0.0721**	−0.0757**	−0.1265***
	(0.0345)	(0.0280)	(0.0295)	(0.0459)
Constant	−0.9728*	−1.4054***	−1.0520**	0.9595
	(0.5616)	(0.4960)	(0.4970)	(0.6503)
Observations	517	574	486	398
R-squared	0.2708	0.2708	0.3041	0.2585
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the regression results for the impact of ESG disclosures on DTE ratio for firms having ESG scores lower than the median ESG score in a particular year. DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

The results presented in Table 14 shows the direct treatment effect and ATT for nearest neighbour, kernel, and radius matching algorithms. The direct treatment effect between the treated and control group (−0.113, p-value = 0.043) is significant and suggest that firms with high ESG disclosure scores will have lower DTE ratio as compared to firms with low scores. The ATT scores across three matching methods nearest neighbour (ATT = −0.218, t-stat = −2.09), kernel (ATT = −0.189, t-stat = −2.09) and radius (ATT = −0.189, t-stat = −5.24). The results are consistent across matching approaches and statistically significant under sensitivity analysis (Rosenbaum bounds up to Γ = 1.4). These findings are consistent across multiple matching specifications, confirming the robustness and stability of the estimated effects and rejects the model-specific assumptions as the cause of the observed biases. This shows that firms with high ESG disclosure prefer conservative financing models to meet stakeholder expectations of stability, transparency, and long-term risk minimisation.

The ATE results presented in Table 15 corroborate our findings in ATT. Companies that disclose high ESG information are proven to have significantly lower DTE ratios with the sign, size, and statistical significance remaining stable across Nearest-Neighbour, Kernel and Radius matching estimators.

The study further employs entropy balancing method to reduce self-selection bias (Kuzey et al., 2023). Entropy balancing reweights the control group (low-ESG firms) to achieve covariate balance (mean, variance and skewness) with the treated group (high-ESG firms). As seen in the appendix Table 2, notable differences existed between the treated and control groups across several key firm covariates before reweighting. After applying the entropy weights, the means of all covariates in the control group are perfectly balanced to match those of the treated group, ensuring that any subsequent observed differences in capital structure are not attributable to the firm characteristics, thereby strengthening the validity of our causal estimates. Finally, the entropy weights generated are applied in the baseline regression results and the results are reported in Table 16. Our primary variables of interest, the aggregate ESG disclosure score and its individual dimensions are negative and significant, providing strong evidence that higher levels of ESG

Table 12
ESG disclosure and DTE: Pre-COVID or stability period.

VARIABLES	(1)	(2)	(3)	(4)
	DTE	DTE	DTE	DTE
ESG	−0.0077***			
	(0.0027)			
ENV		−0.0055***		
		(0.0017)		
SOC			−0.0124***	
			(0.0029)	
GOV				0.0002
				(0.0023)
SIZE	0.1434***	0.1422***	0.1600***	0.0973***
	(0.0215)	(0.0217)	(0.0208)	(0.0167)
ROA	−0.0069	−0.0068	−0.0073	−0.0068
	(0.0066)	(0.0068)	(0.0067)	(0.0066)
FATA	0.0065***	0.0071***	0.0062***	0.0073***
	(0.0016)	(0.0016)	(0.0016)	(0.0016)
CF	−0.0219***	−0.0222***	−0.0224***	−0.0227***
	(0.0045)	(0.0045)	(0.0044)	(0.0045)
NDTS	0.0248	0.0253	0.0310	0.0167
	(0.0283)	(0.0296)	(0.0292)	(0.0286)
ICR	−0.2930***	−0.2883***	−0.3113***	−0.2948***
	(0.0528)	(0.0486)	(0.0578)	(0.0489)
SG	0.0002	0.0010	0.0006	0.0007
	(0.0015)	(0.0016)	(0.0016)	(0.0015)
Z-score	−0.0400***	−0.0406***	−0.0418***	−0.0421***
	(0.0071)	(0.0075)	(0.0072)	(0.0073)
TQ	0.0486***	0.0492***	0.0588***	0.0465***
	(0.0166)	(0.0170)	(0.0168)	(0.0169)
BETA	−0.0588**	−0.0632**	−0.0647**	−0.0597**
	(0.0251)	(0.0259)	(0.0261)	(0.0254)
Constant	−0.4779**	−0.6148**	−0.6173**	−0.1789
	(0.2191)	(0.2699)	(0.2514)	(0.2901)
Observations	764	729	726	769
R-squared	0.3687	0.3673	0.3792	0.3557
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the regression results for the impact of ESG disclosures on DTE ratio for the period 2015–2019 (Pre-COVID or stability period). DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

disclosure and its dimensions are associated with a lower debt-to-equity ratio, supporting the preliminary findings.

4.8. Alternate variables approach

The reliance of this study on the book-based leverage ratios reflects historical accounting values rather than market perceptions which may potentially limit the ability to capture how ESG disclosure influences market-based financing decisions of firms. To address this concern, we conduct additional robustness analyses using two market-based leverage measures. First, we construct a market leverage ratio based on Tobin's Q, where market value of assets is estimated as the book value of total assets multiplied by Tobin's Q. Market leverage is calculated as total debt divided by market value of assets. Second, we employ an equity-market-based leverage measure, where the market value of equity is approximated using the firm's market capitalization-to-book value ratio. Market leverage is then defined as total debt divided by the sum of total debt and market value of equity. The results, reported in Tables 17 and 18, indicate that the coefficient on ESG disclosure remains negative and statistically significant across both market-based specifications. Our findings are broadly consistent with Bagh, Hunjra, Guo, and Bouri (2025) which reports that firms with stronger ESG performance tend to exhibit lower leverage, particularly when market-based measures are employed. This confirms that the baseline findings remain robust when capital structure is measured from a market perspective.

4.9. Financial constraints

Further, in order to test whether the relationship between ESG and DTE differs in response to financial constraints faced by firms, this study conducts a heterogeneity analysis by classifying firms into high and low financially constrained groups using the Kaplan-

Table 13
ESG disclosure and DTE: COVID/Post-COVID or crisis period.

VARIABLES	(1)	(2)	(3)	(4)
	DTE	DTE	DTE	DTE
ESG	−0.0158**			
	(0.0064)			
ENV		−0.0056***		
		(0.0020)		
SOC			−0.0070**	
			(0.0035)	
GOV				−0.0191*
				(0.0101)
SIZE	0.1413***	0.1104***	0.0824***	0.0997***
	(0.0313)	(0.0296)	(0.0276)	(0.0266)
ROA	−0.0173**	−0.0115*	−0.0110*	−0.0176**
	(0.0075)	(0.0061)	(0.0063)	(0.0074)
FATA	0.0069**	0.0047*	0.0047*	0.0078**
	(0.0035)	(0.0025)	(0.0026)	(0.0034)
CF	−0.0141*	−0.0188**	−0.0195**	−0.0165**
	(0.0081)	(0.0075)	(0.0077)	(0.0080)
NDTS	0.0033	0.0316	0.0295	0.0073
	(0.0476)	(0.0338)	(0.0345)	(0.0453)
ICR	−0.2382***	−0.2430***	−0.2669***	−0.3154***
	(0.0582)	(0.0455)	(0.0827)	(0.0653)
SG	0.0024*	0.0023	0.0020	0.0022
	(0.0014)	(0.0015)	(0.0015)	(0.0014)
Z-score	−0.0242***	−0.0234***	−0.0240***	−0.0227***
	(0.0054)	(0.0052)	(0.0054)	(0.0053)
TQ	0.0497***	0.0463***	0.0468***	0.0416***
	(0.0146)	(0.0143)	(0.0141)	(0.0144)
BETA	−0.1090**	−0.0885**	−0.0883**	−0.0981**
	(0.0441)	(0.0398)	(0.0405)	(0.0395)
Constant	−0.1137	−0.3873	0.0867	1.3166
	(0.3654)	(0.3817)	(0.3931)	(0.8640)
Observations	459	440	438	462
R-squared	0.2771	0.3011	0.2851	0.2816
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the regression results for the impact of ESG disclosures on DTE ratio for the period 2020–2022 (COVID/Post-COVID or crisis period). DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

Table 14
ESG disclosure and DTE: High ESG disclosure vs low ESG disclosure using PSM.

Outcome variable	Matching method	Direct treatment effect	p-value	T_N	C_N	ATT	t-stat	p-value
DTE Ratio	Nearest Neighbour	−0.113	0.043	898	517	−0.218	−2.09	<0.05
DTE Ratio	Kernel	−0.113	0.043	898	517	−0.189	−2.09	<0.05
DTE Ratio	Radius	−0.113	0.043	898	517	−0.113	−5.24	<0.05

Note(s): The table reports the PSM results for the impact of ESG disclosures on DTE ratio using PSM method. DTE (outcome variable) is the debt-to-equity ratio. T_N is the number of firms in treatment group, C_N is the number of firms in control group, ATT is the average treatment effect. Year and industry fixed effects are included in all models. Co-variates of the model are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

Zingales (KZ) index. Firms with KZ index values above the sample median are categorized as financially constrained (high), while those below the median are classified as unconstrained (low). The results presented in Tables 19 and 20 report that ESG disclosure is negatively associated with DTE in both groups. However, highly constrained firms exhibit greater reduction in leverage with improvements in ESG disclosure. Rather than exploiting lower cost of borrowing associated with higher ESG disclosure, financially constrained firms prioritize balance-sheet deleveraging, reflecting precautionary financing. Importantly, these results help validate the coexistence of lower cost of debt and declining leverage as highlighted in the mediation analysis. The evidence supports the view that ESG disclosures serve as a strategic tool for constrained firms to manage leverage and enhance financial resilience.

Table 15
ESG disclosure and ATE: High ESG disclosure vs low ESG disclosure using PSM.

Outcome variable	Matching method	ATE	Std. Error	Z	p-value	95 %Conf. Interval	
DTE Ratio	Nearest Neighbour	−0.229	0.071	−3.240	0.001	−0.367	−0.090
DTE Ratio	Kernel	−0.229	0.071	−3.240	0.001	−0.367	−0.090
DTE Ratio	Radius	−0.143	0.043	−3.330	0.001	−0.227	−0.059

Note(s): The table reports the PSM results for the impact of ESG disclosures on ATE ratio using PSM method. DTE (outcome variable) is the debt-to-equity ratio. ATE is the average treatment effect. Year and industry fixed effects are included in all models.
Source: Bloomberg®, Author's compilation and estimation.

Table 16
ESG disclosure and DTE: Post entropy balancing regression estimation.

VARIABLES	(1)	(2)	(3)	(4)
	DTE	DTE	DTE	DTE
ESG	−0.0136***			
	(0.0027)			
ENV		−0.0060***		
		(0.0014)		
SOC			−0.0103***	
			(0.0022)	
GOV				−0.0062*
				(0.0037)
SIZE	0.1915***	0.1407***	0.1268***	0.0799***
	(0.0270)	(0.0233)	(0.0172)	(0.0186)
ROA	−0.0122	−0.0107*	−0.0099*	−0.0152***
	(0.0074)	(0.0061)	(0.0051)	(0.0052)
FATA	0.0083***	0.0062***	0.0052***	0.0058***
	(0.0024)	(0.0020)	(0.0015)	(0.0020)
CF	−0.0172**	−0.0178***	−0.0225***	−0.0168***
	(0.0074)	(0.0056)	(0.0040)	(0.0043)
NDTS	0.0412	0.0240	0.0585**	0.0017
	(0.0401)	(0.0266)	(0.0228)	(0.0335)
ICR	−0.3516***	−0.3373***	−0.3213***	−0.3252***
	(0.0582)	(0.0519)	(0.0594)	(0.0467)
SG	0.0009	0.0016	0.0012	0.0021*
	(0.0015)	(0.0013)	(0.0011)	(0.0011)
Z-score	−0.0250***	−0.0337***	−0.0282***	−0.0286***
	(0.0061)	(0.0056)	(0.0048)	(0.0068)
TQ	0.0381**	0.0482***	0.0464***	0.0407***
	(0.0180)	(0.0141)	(0.0120)	(0.0135)
BETA	−0.0635**	−0.0663***	−0.0641***	−0.0976***
	(0.0246)	(0.0235)	(0.0239)	(0.0321)
Constant	−0.5027	−0.5168*	−0.3817*	0.6883
	(0.3604)	(0.2828)	(0.2242)	(0.4768)
Observations	1223	1169	1164	1231
R-squared	0.3986	0.3519	0.3632	0.2814

Note(s): The table reports the regression results for the impact of ESG disclosures on DTE ratio using the entropy balancing estimation method. DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

5. Discussion and conclusion

5.1. Discussion and conclusion

Traditional financial theory suggests that the primary objective of a firm is to maximize the wealth of its shareholders. In the contemporary world, the increasing requirement for ESG reporting has compelled firms to include sustainability and social responsibility into their strategic goals, serving both as a compliance measure and a tool to augment their competitive edge. Furthermore, governments globally are diligently revising regulatory frameworks to promote corporate accountability while safeguarding the profitability of enterprises. These reforms have progressively expanded the objective of corporations from maximizing shareholder wealth to adopting a more inclusive and comprehensive approach of maximizing stakeholders' wealth. Despite this transition, the

Table 17
ESG disclosure and DTE: Market leverage using Tobin's Q.

VARIABLES	(1)	(2)	(3)	(4)
	MLEV	MLEV	MLEV	MLEV
ESG	−0.0016***			
	(0.0003)			
ENV		−0.0011***		
		(0.0002)		
SOC			−0.0020***	
			(0.0003)	
GOV				−0.0004
				(0.0003)
SIZE	0.0359***	0.0366***	0.0369***	0.0274***
	(0.0026)	(0.0027)	(0.0026)	(0.0023)
ROA	−0.0021***	−0.0022***	−0.0023***	−0.0022***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
FATA	0.0018***	0.0018***	0.0017***	0.0019***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
CF	−0.0042***	−0.0042***	−0.0042***	−0.0044***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
NDTS	0.0000	−0.0004	−0.0002	−0.0016
	(0.0021)	(0.0021)	(0.0021)	(0.0022)
ICR	−0.0634***	−0.0672***	−0.0696***	−0.0681***
	(0.0095)	(0.0095)	(0.0115)	(0.0094)
SG	−0.0000	0.0000	−0.0000	0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Z-score	−0.0025***	−0.0024***	−0.0026***	−0.0026***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
TQ	−0.0072***	−0.0078***	−0.0065***	−0.0078***
	(0.0021)	(0.0021)	(0.0021)	(0.0021)
BETA	−0.0101***	−0.0113***	−0.0111***	−0.0104***
	(0.0025)	(0.0026)	(0.0026)	(0.0026)
Constant	−0.1517***	−0.1955***	−0.1661***	−0.0731**
	(0.0294)	(0.0346)	(0.0310)	(0.0324)
Observations	1235	1180	1175	1242
R-squared	0.6251	0.6231	0.6266	0.6024
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the baseline regression results for the impact of ESG disclosures on MLEV ratio using pooled OLS regression. MLEV is the market leverage ratio based on Tobin's Q. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

implications of ESG disclosures on the financial decisions of firms, particularly their capital structure choices, remain unexplored. While implementing sustainable initiatives can impose financial burdens, the extent to which ESG investments yield financial benefits continues to be a topic of debate in corporate finance. While most prior studies have examined the impact of ESG disclosures on the end goals of a firm i.e profitability and market valuation (Buchanan et al., 2018; Malik & Kashiramka, 2024; Yoon et al., 2018), this study extends the literature by investigating the means to these end goals. Specifically, this paper explores the impact of ESG disclosures on the capital structure of firms and the underlying mechanisms driving this relationship. Using a panel dataset of non-financial Indian firms listed on the NSE500 index between 2015 and 2022, the study finds a negative relationship between ESG disclosure scores and the debt-to-equity (DTE) ratio, implying that firms with stronger ESG disclosures rely less on debt and more on equity financing. Economically, this relationship reflects the role of ESG disclosures in reducing information asymmetry and perceived default risk. This is particularly valued by equity investors, who are pricing the firm's future cash flows and terminal value. A lower perceived risk translates directly into a lower cost of equity, making it a cheaper and more attractive source of financing for high-ESG firms. Firms with credible ESG disclosures signal responsible management and long-term orientation, which enhances investor confidence and widens access to equity markets at favorable terms. In contrast, debt providers perceive such firms as less risky, leading to lower borrowing costs and more conservative leverage targets. Thus, ESG acts as both a trust signal and a risk-reduction mechanism in the capital market, enabling firms to optimize their capital structure through lower cost of capital and improved financial flexibility. A disaggregated examination of ESG components indicates that social and environmental disclosures play a dominant role in reducing the reliance of firms on debt financing, indicating that tangible sustainability actions (e.g., energy efficiency, employee welfare, community programs) are more economically valued by the market than governance disclosures alone. This is particularly relevant in the context of India as it suggests that in a market where baseline governance standards are increasingly mandated by regulators like SEBI, good governance is becoming a given. Investors now look to E and S disclosures as the key differentiators that signal a firm's

Table 18
ESG disclosure and DTE: Market leverage using equity valuation.

VARIABLES	(1)	(2)	(3)	(4)
	MLEV	MLEV	MLEV	MLEV
ESG	−0.0032***			
	(0.0004)			
ENV		−0.0020***		
		(0.0003)		
SOC			−0.0033***	
			(0.0005)	
GOV				−0.0015***
				(0.0004)
SIZE	0.0575***	0.0571***	0.0562***	0.0426***
	(0.0040)	(0.0041)	(0.0040)	(0.0035)
ROA	−0.0048***	−0.0049***	−0.0051***	−0.0048***
	(0.0010)	(0.0010)	(0.0010)	(0.0010)
FATA	0.0019***	0.0020***	0.0019***	0.0021***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
CF	−0.0041***	−0.0040***	−0.0041***	−0.0045***
	(0.0009)	(0.0010)	(0.0010)	(0.0010)
NDTS	−0.0023	−0.0028	−0.0028	−0.0040
	(0.0033)	(0.0035)	(0.0034)	(0.0035)
ICR	−0.0784***	−0.0815***	−0.0868***	−0.0889***
	(0.0130)	(0.0126)	(0.0158)	(0.0129)
SG	−0.0001	0.0000	−0.0000	−0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Z-score	−0.0022**	−0.0020**	−0.0023***	−0.0024***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
TQ	−0.0089***	−0.0101***	−0.0081***	−0.0102***
	(0.0028)	(0.0029)	(0.0029)	(0.0029)
BETA	−0.0067*	−0.0082**	−0.0080**	−0.0077**
	(0.0035)	(0.0036)	(0.0036)	(0.0036)
Constant	−0.2997***	−0.3794***	−0.3144***	−0.1116**
	(0.0437)	(0.0513)	(0.0472)	(0.0499)
Observations	1222	1168	1162	1231
R-squared	0.5783	0.5727	0.5737	0.5490
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the baseline regression results for the impact of ESG disclosures on MLEV ratio using pooled OLS regression. MLEV is the market leverage ratio based on equity valuation. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: *Bloomberg®, Author's compilation and estimation.*

resilience and forward-thinking strategy. This aligns with the findings of Yang and Yulianto (2022) and underscores the significance of sustainability reporting in financial decision-making, particularly within the Indian market.

The study disaggregates the DTE ratio into its two main constituents viz debt-to-assets ratio (DTA) and equity-to-assets ratio (ETA) and further examines the mediating roles of the cost of debt (COD) and the cost of equity (COE), respectively. The findings show that those companies disclosing ESG experience a reduction in the COD as well as the COE, suggesting that more disclosure of ESG makes firms less risky in the eyes of creditors and investors. However, higher ESG disclosures lead to a decrease in DTA, despite the decrease in COD, suggesting that businesses with strong ESG opt for less debt financing. Due to the fact that debt commitments impose fixed financial burden and pose a bankruptcy threat for the firms, those with strong ESG practices would prefer not take on excessive leverage to maintain operational resilience in uncertain economic conditions. An increase in ESG disclosure lowers COE, whereas COE mediates the relation between ESG and ETA. As per findings, firms that conform to ESG practices are more likely to raise money through equity financing than debt financing. The observed trend toward equity financing appears to be influenced by socially responsible investors who prefer firms that are involved in environmental and social issues. Thus, ESG ratings are transparent and credible indicators of a firm's non-financial performance, providing useful information to the capital markets. Our results reinforce and further develop the recent study carried out by Bagh, Hunjra, Guo, and Bouri (2025) which provided evidence that ESG performance has conflicting effects on market- and book-based leverage in BRICS economies.

Further analyses are conducted to understand the ESG-financing decision nexus in greater depth. The heterogeneity test results indicate that the impact of a firm's ESG score in reducing debt financing is higher in high carbon emitting or environmentally sensitive industries than less carbon emitting industries. Companies operating in the environmentally sensitive sectors face a higher regulatory scrutiny and market pressure. Environmental risk is a fundamental business risk for these firms. As a result, investors in these sectors are more vigilant as a single negative environmental event could lead to major fines and operational shutdowns and reputational ruin.

Table 19
ESG disclosure and DTE: Low financially constrained group.

VARIABLES	(1)	(2)	(3)	(4)
	DTE	DTE	DTE	DTE
ESG	−0.0017*			
	(0.0009)			
ENV		−0.0012***		
		(0.0003)		
SOC			−0.0005	
			(0.0005)	
GOV				−0.0010
				(0.0012)
SIZE	0.0173**	0.0173***	0.0073	0.0091
	(0.0075)	(0.0055)	(0.0047)	(0.0058)
ROA	−0.0025*	−0.0015*	−0.0015	−0.0024*
	(0.0013)	(0.0009)	(0.0009)	(0.0014)
FATA	0.0009	0.0004	0.0005	0.0009
	(0.0006)	(0.0004)	(0.0004)	(0.0006)
CF	−0.0010	−0.0012	−0.0014	−0.0011
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
NDTS	−0.0071	−0.0012	−0.0025	−0.0074
	(0.0060)	(0.0032)	(0.0034)	(0.0060)
ICR	−0.0907***	−0.0780***	−0.0898***	−0.0917***
	(0.0104)	(0.0085)	(0.0099)	(0.0113)
SG	0.0000	0.0001	0.0001	0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Z-score	−0.0057***	−0.0055***	−0.0057***	−0.0056***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
TQ	0.0074***	0.0070***	0.0066***	0.0063**
	(0.0027)	(0.0022)	(0.0023)	(0.0026)
BETA	0.0017	0.0024	0.0031	0.0016
	(0.0032)	(0.0030)	(0.0030)	(0.0033)
Constant	0.0551	−0.0151	0.1134**	0.1751**
	(0.0600)	(0.0673)	(0.0547)	(0.0718)
Observations	538	507	504	551
R-squared	0.2201	0.2668	0.2423	0.2085
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the baseline regression results for the impact of ESG disclosures on DTE ratio for firms belonging to low financially constrained group. DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: Bloomberg®, Author's compilation and estimation.

Having strong ESG disclosures is thus a key indicator of operational excellence and risk management that leads to a significantly lower cost of capital for firms in more environmentally sensitive industries than firms in less sensitive industries.

Furthermore, the effect of ESG on DTE ratio is stronger for firms with ESG scores below the median. This outcome indicates the diminishing marginal returns economic principle. A firm with a poor ESG score navigating its way towards transparency and better practices provides the market with new and positive information. Consequently, this will substantially reduce the uncertainty and perceived risk. This results in a significant price adjustment by investors. As a consequence, firms that possess ESG scores below the median are seen to experience a stronger reduction in leverage with the increase in their ESG disclosure. This shows that companies with weaker ESG practices are initially subjected to greater skepticism by investors. When these firms improve their ESG transparency, they signal a commitment to responsible business practices, alleviate investor concerns, and gain access to alternate sources of funding.

Moreover, the relationship between ESG disclosures and capital structure strengthened during the COVID-19 period as investors became more sensitive towards sustainability and resilience during the crisis. The pandemic highlighted the key role of non-financial risks, including supply chain issues, employee welfare and social responsibility. The firms that were demonstrating strong ESG commitments were more favoured by investors because they were more likely to navigate the economic shocks posed by the pandemic and maintain stakeholder trust. In this context, firms with high ESG disclosures benefit from greater access to equity capital, indicating the strategic value of ESG investment during uncertain macroeconomic conditions. Whenever uncertainty is high, market participants prefer to choose firms that are well-managed, transparent, and capable of withstanding non-financial shocks. The high ESG scores are a credible signal of this resilience that increases the demand for better ESG rated stocks in times of crisis thereby enhancing equity financing. The ESG disclosures thus have a countercyclical role as firms with strong ESG credentials find it easier to access capital besides having greater investor trust during times of uncertainty, supporting the argument that ESG disclosures act like a financial insurance policy during economic downturns. Our findings support the recent studies by Hunjra et al. (2024) and Bagh et al. (2024)

Table 20
ESG disclosure and DTE: High financially constrained group.

VARIABLES	(1) DTE	(2) DTE	(3) DTE	(4) DTE
ESG	−0.0153***			
	(0.0056)			
ENV		−0.0059***		
		(0.0019)		
SOC			−0.0097***	
			(0.0028)	
GOV				−0.0118
				(0.0076)
SIZE	0.1196***	0.1013***	0.1001***	0.0681***
	(0.0232)	(0.0233)	(0.0220)	(0.0201)
ROA	−0.0145	−0.0128	−0.0128	−0.0141
	(0.0096)	(0.0094)	(0.0094)	(0.0098)
FATA	0.0035	0.0027	0.0024	0.0032
	(0.0022)	(0.0019)	(0.0019)	(0.0022)
CF	−0.0150**	−0.0183***	−0.0178***	−0.0161**
	(0.0072)	(0.0066)	(0.0066)	(0.0073)
NDTS	0.0118	0.0344	0.0338	0.0148
	(0.0359)	(0.0290)	(0.0292)	(0.0353)
ICR	2.6553***	2.8170***	2.6707**	2.7661***
	(1.0271)	(1.0557)	(1.0401)	(1.0406)
SG	0.0006	0.0010	0.0009	0.0005
	(0.0016)	(0.0017)	(0.0017)	(0.0017)
Z-score	−0.1295***	−0.1203***	−0.1200***	−0.1322***
	(0.0195)	(0.0186)	(0.0189)	(0.0196)
TQ	0.1873***	0.1749***	0.1783***	0.1814***
	(0.0332)	(0.0316)	(0.0326)	(0.0318)
BETA	−0.1119**	−0.0934**	−0.0976**	−0.1080**
	(0.0440)	(0.0419)	(0.0421)	(0.0429)
Constant	0.1746	−0.0123	0.1251	1.1268
	(0.3402)	(0.3578)	(0.3814)	(0.7254)
Observations	685	662	660	680
R-squared	0.2418	0.2496	0.2493	0.2303
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note(s): The table reports the baseline regression results for the impact of ESG disclosures on DTE ratio for firms belonging to high financially constrained group. DTE is the debt-to-equity ratio. ESG, ENV, SOC and GOV refer to aggregate ESG, environmental, social, and governance disclosure scores, respectively. ***, ** and * represent statistical significance at the 1 %, 5 % and 10 % levels, respectively. Robust standard errors are displayed in parentheses. The data spans from 2015 to 2022. Year and industry fixed effects are included in all models. Variables are winsorized at the 1st and 99th percentile and defined in the Appendix Table 1.
Source: *Bloomberg®, Author's compilation and estimation.*

regarding the role of financial flexibility and firm behaviour in times of crises. Hunjra et al. (2024) convey that while higher flexibility generally promotes risk-taking, this relation stopped to exist after the pandemic suggesting general behaviour change towards conservatism. Similarly, Bagh et al. (2024) find that climate change sentiments have a negative impact on firm value and the impact heightens in the face of crises. However, adopting strong ESG practices helps to reduce the negative impact. In doing so, corporate resilience increases considerably. While the study by Hunjra et al. (2024) indicates a generous risk appetite, our outcomes make a significant contribution to this knowledge by showing that even in this conservative framework, firms with strong ESG credentials benefit distinctly.

5.2. Contributions of the study

This research contributes to the growing literature on sustainable finance in several ways. By establishing an empirical relationship between ESG disclosures and capital structure decisions in the Indian corporate sector, it not only validates the economic mechanisms but also adds to the growing literature on the value creation of ESG initiatives. The study shows that firms with better ESG performance secure higher equity financing in capital markets, supporting stakeholder and signalling theories. In keeping with these views, ESG (environmental, social and governance) investments serve as a signalling device for the corporation which reduces agency problems and mitigates conflicts between managers, controlling shareholders and other stakeholders. This provides more access to equity financing, which counters the claim that ESG investments are principally value-destroying (Barnea & Rubin, 2010; Goss & Roberts, 2011; Magnanelli & Izzo, 2017).

The results provide important theoretical and practical implications for various stakeholders including managers, policy makers, and investors. For managers, this study highlights the significance of ESG disclosures in optimising capital structure decisions. The

overall positive effect of ESG on the reduction of leverage appears to be more pronounced in high carbon emitting industries. Thus, the firms belonging to these sectors may use ESG disclosure as a means to lower its debt utilization and enhance equity financing. Corporate executives must stop thinking of ESG as simply a compliance cost or marketing tool. It is a way to reduce the cost of equity and improve financial flexibility; thus, it must be integrated into financial planning. In addition, because environmental and social performance has a substantial impact on the debt-equity ratio than governance performance, firms should focus on environmental and social while strengthening their governance performance. Furthermore, companies should set sustainability targets, form sustainability committees and link managerial incentives to ESG objectives to enhance long-term financial sustainability.

From a regulatory perspective, policymakers can use these findings to develop regulations that enhance sustainable development. Governments may implement tax incentives, grants, or subsidies for firms that undertake and disclose them. These measures could change how the view of corporates from ESG being a compliance burden to an opportunity. Also, regulators can help to educate smaller and mid-sized companies with evidence that making ESG investments can bring real tangible financial returns, and is not just a cost burden or reserved for large-scale companies. The result emphasizes that ESG criteria should be included in the investment decisions of investors especially institutional ones like pension funds, asset managers, and sovereign wealth funds. Governance may be important but investors should treat environmental and social disclosures as critical indicators of long-term value and risk in the Indian context. Investing in firms with good ESG disclosure will offer investors the benefit of responsible investing. At the same time, it also helps in driving social and environmental good. Moreover, the results indicate that firms with high ESG are more defensive during market downturns. This provides a valuable insight to investors for constructing portfolios and managing risks in emerging markets.

The present research adds to the corporate finance and ESG sustainability literature. From an ESG perspective, the outcomes imply that ESG disclosures can mitigate information asymmetry, reduce investor skepticism at the same time signalling the commitment to ESG, and in turn, enhance reputation. From corporate finance perspective, the research establishes ESG disclosure and its respective pillars as the determinants of capital structure decisions, aligning with the broader discussion of financing choices.

5.3. Limitations and scope for future research

This study provided useful insights, yet its limits offer future research opportunities. To begin with, the research covers only the Indian enterprises, which can limit the generalizability of the study to other geographical locations and industries. Furthermore, the sample is from a particular point of time, may not adequately capture the firm-size area diversity of all Indian enterprises and as such, may not be generalizable. Consequently, the findings may not be applicable to all organisations, especially those in niche sectors or which possess distinctive characteristics. Future research could use this study in other countries with different institutional settings to compare developed and developing countries. A broadened sample size comprising more enterprises from diverse sectors and geographies might boost and generalise the findings. Future studies could examine whether these ESG driven capital structure dynamics hold for micro small and medium enterprises which are resource constrained and can't access capital markets. Secondly, while this paper examines the influence of ESG on debt and equity financing decisions, additional research could examine how other sustainability metrics will affect alternative financing sources. Investigating bootstrapping, crowdsourcing and green bonds would establish how ESG factors shape business financing strategies in evolving capital markets. A limitation of this study is that ESG disclosure scores may not fully capture underlying ESG performance of firms. Disclosure can sometimes reflect symbolic signaling rather than substantive sustainability outcomes. Future research may extend this framework using comprehensive ESG performance scores. To enhance comprehension of the financial implications of ESG transparency, future research may examine the effects of ESG disclosures on other financial decisions like cost of capital, dividend policy, business value, etc., to gain a wholistic knowledge on the financial tangible benefits of ESG disclosures.

Thus, this study provides empirical evidence that ESG disclosures have an impact on capital structure choices among the Indian corporates. This will provide useful insights for the managers, investors, and policymakers. The findings call for a supportive regulatory environment, responsible investment practices, and robust corporate governance frameworks to mainstream sustainable finance in India. In a more extensive manner, this paper can serve as guidance for monetizing ESG benefits to help accelerate the transition to a sustainable economy.

Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

We confirm that the manuscript has been read and approved by all named authors.

We confirm that the order of authors listed in the manuscript has been approved by all named authors.

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Appendix

Table 1
Description of variables

Notation	Variable	Calculation
Dependent variablese		
DTE	Debt-to-equity	Book value of debt to the book value of equity
DTA	Debt-to-assets	Book value of debt to the book value of assets
ETA	Equity-to-assets	Book value of equity to the book value of assets
Independent variablese		
ESG	ESG scores	ESG disclosure scores
ENV	Environmental score	The environmental dimension of the ESG score
SOC	Social score	The social dimension of ESG score
GOV	Governance score	The governance dimension of ESG score
Control variablese		
SIZE	Size of firm	Natural logarithm of total book value of assets
ROA	Return on assets	Net income before extraordinary items divided by total book value of assets
FATA	Tangibility	Ratio of book value of tangible assets to total assets
CF	Cash flow	Cash flow from operations scaled by total assets
NDTS	Non-debt tax shield	Depreciation scaled by total assets
ICR	Interest coverage ratio	Operating income scaled by interest expense
SG	Sales growth	Annual growth rate of net sales revenue
Z-score	Altman Z-score	1.2(Working capital/Total assets) + 1.4(Retained earnings/Total assets) + 3.3(Earnings before interest and tax/Total assets) + 0.6(Market value of equity/Total liabilities) + 1.0(Sales/Total assets)
TQ	Tobin's Q	Ratio of the market value of equity plus total liabilities to total assets
BETA	Beta	Measure of systematic risk
Mediating variablese		
COD	Cost of debt	Interest expense to total debt
COE	Cost of equity	Cost of equity measured as capital asset pricing model (CAPM)

Table 2
Entropy balancing estimation

PANEL A: ESG DISCLOSURE SCORES				
VARIABLES	Before weighting		After weighting	
	TREAT	CONTROL	TREAT	CONTROL
SIZE	11.43	10.75	11.43	11.43
ROA	10.97	10.27	10.97	10.97
FATA	32.49	36.52	32.49	32.49
CF	9.60	8.84	9.60	9.60
NDTS	2.69	2.76	2.69	2.69
ICR	0.13	0.12	0.13	0.13
SG	12.10	12.04	12.10	12.09
Z-score	7.25	6.45	7.25	7.25
TQ	3.07	2.68	3.07	3.07
BETA	0.95	0.99	0.95	0.95

PANEL B: ENVIRONMENTAL DISCLOSURE SCORES				
VARIABLES	Before weighting		After weighting	
	TREAT	CONTROL	TREAT	CONTROL
SIZE	11.37	10.83	11.37	11.37
ROA	10.87	10.39	10.87	10.87
FATA	33.21	35.56	33.21	33.21
CF	9.46	9.02	9.46	9.46
NDTS	2.71	2.74	2.71	2.71
ICR	0.13	0.11	0.13	0.13
SG	12.30	11.77	12.30	12.30
Z-score	7.01	6.79	7.01	7.01
TQ	3.00	2.78	3.00	3.00
BETA	1.00	0.92	1.00	1.00

Table 2 (*continued*)

PANEL C: SOCIAL DISCLOSURE SCORES				
VARIABLES	Before weighting		After weighting	
	TREAT	CONTROL	TREAT	CONTROL
SIZE	11.31	10.89	11.31	11.31
ROA	10.97	10.22	10.97	10.97
FATA	32.15	37.28	32.15	32.15
CF	9.48	8.97	9.48	9.48
NDTS	2.69	2.76	2.69	2.69
ICR	0.14	0.11	0.14	0.14
SG	12.12	11.99	12.12	12.12
Z-score	7.22	6.43	7.22	7.22
TQ	3.09	2.62	3.09	3.09
BETA	0.95	0.99	0.95	0.95
PANEL D: GOVERNANCE DISCLOSURE SCORES				
VARIABLES	Before weighting		After weighting	
	TREAT	CONTROL	TREAT	CONTROL
SIZE	11.18	11.03	11.18	11.18
ROA	10.90	10.07	10.90	10.89
FATA	34.12	34.48	34.12	34.12
CF	9.55	8.59	9.55	9.55
NDTS	2.76	2.62	2.76	2.76
ICR	0.12	0.14	0.12	0.12
SG	12.35	11.35	12.35	12.35
Z-score	7.24	6.03	7.24	7.24
TQ	3.01	2.64	3.01	3.01
BETA	1.07	0.71	1.07	1.07

Data availability

Data will be made available on request.

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