

Received 07/01/2025
Review began 07/13/2025
Review ended 08/06/2025
Published 08/28/2025
Corrected 01/21/2026

© Copyright 2025

Lopez et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI:

<https://doi.org/10.7759/s44404-025-07854-4>

Corrected: Exploring the Relationship of Environmental, Social, and Governance (ESG) Scores on Firm Performance: An Empirical Analysis

Ann Lopez ^{1, 2}, Padavinangady Nakul Bhat ^{3, 2}, Dai Lin Huang ^{4, 2}, Shabd Sahni ^{5, 2}, Ashita Allamraju ^{6, 2}

1. Centre for Budget Studies, Cochin University of Science and Technology, Kochi, IND 2. Economics, International Centre for Applied Systems Science for Sustainable Development (ICASSSD), Cambridge, CAN 3. Department of Computer Science and Engineering, Manipal Institute of Technology, Manipal Academy of Higher Education, Udipi, IND 4. Department of Political Science and Bieler School of Environment, McGill University, Montreal, CAN 5. Department of Electrical Engineering, Dayalbagh Educational Institute, Agra, IND 6. Institute for Management and Innovation, University of Toronto, Toronto, CAN

Corresponding author: Ann Lopez, ann28lopez@gmail.com

This article has been corrected.

Correction date: January 21, 2026. Cite this correction as Lopez A, Bhat P, Huang D, et al. (January 21, 2026) Correction: Exploring the Relationship of Environmental, Social, and Governance (ESG) Scores on Firm Performance: An Empirical Analysis. Cureus J Bus Econ 3 : es44404-026-00017-z.
doi:<https://dx.doi.org/10.7759/s44404-026-00017-z>.

The abstract has been revised for improved readability; the updated version is provided below.

Abstract

Understanding whether sustainability initiatives enhance financial performance is a central concern in management and finance research. Using Environmental, Social, and Governance (ESG) scores as a proxy for sustainability, this paper examines their temporal effects on firm profitability in the Indian automotive sector. The analysis applies structural equation modeling, specifically cross-lagged panel path analysis, to a panel of 26 firms.

The results reveal a significant positive relationship between ESG scores in 2020 and return on assets (ROA) in 2021, but an insignificant negative association between ESG scores in 2021 and ROA in 2022. Subcomponent analysis shows distinct patterns: the Environmental score in 2020 significantly predicts higher ROA in 2021, but its effect in 2021 on 2022 ROA is weaker and insignificant; the Social score has an insignificant positive effect in the first period but a significant negative effect in the second; and Governance scores display positive and negative associations across the two periods, though neither is statistically significant. Across models, fit indices are mixed: χ^2/df , the Comparative Fit Index (CFI), and the Tucker–Lewis Index (TLI) generally indicate good fit, while the Root Mean Square Error of Approximation (RMSEA) points to poor fit.

These findings underscore the nuanced and time-sensitive nature of ESG–financial performance linkages in emerging economies. The study offers insights for investors, fund managers, and corporate leaders seeking to evaluate sustainability initiatives in the Indian automotive industry.

Abstract

Understanding whether sustainability initiatives enhance financial performance is a central concern in management and finance research. Using Environmental, Social, and Governance (ESG) scores as a proxy for sustainability, this paper examines their temporal effects on firm profitability in the Indian automotive sector. The analysis applies structural equation modeling, specifically cross-lagged panel path analysis, to a panel of 26 firms.

The results reveal a significant positive relationship between ESG scores in 2020 and return on assets (ROA) in 2021, but an insignificant negative association between ESG scores in 2021 and ROA in 2022. Subcomponent analysis shows distinct patterns: the Environmental score in 2020 significantly predicts higher ROA in 2021, but its effect in 2021 on 2022 ROA is weaker and insignificant; the Social score has an insignificant positive effect in the first period but a significant negative effect in the second; and Governance scores display positive and negative associations across the two periods, though neither is statistically significant. Across models, fit indices are mixed: χ^2/df , the Comparative Fit Index (CFI), and the Tucker–Lewis Index (TLI) generally indicate good fit, while the Root Mean Square Error of

How to cite this article

Lopez A, Bhat P, Huang D, et al. (August 28, 2025) Exploring the Relationship of Environmental, Social, and Governance (ESG) Scores on Firm Performance: An Empirical Analysis. Cureus J Bus Econ 2 : es44404-025-07854-4. DOI <https://doi.org/10.7759/s44404-025-07854-4>

Approximation (RMSEA) points to poor fit.

These findings underscore the nuanced and time-sensitive nature of ESG-financial performance linkages in emerging economies. The study offers insights for investors, fund managers, and corporate leaders seeking to evaluate sustainability initiatives in the Indian automotive industry.

Categories: Corporate Governance & Business Ethics, Strategic finance, Sustainable Economic Development

Keywords: environmental, social and governance scores, corporate sustainability, firm performance, cross-lagged panel path analysis, indian automotive sector

Introduction

Today's business landscape presents a critical challenge: to foster a new approach to business that seamlessly integrates profitability, ethical responsibility, and societal impact ([Freeman and Velamuri, 2023](#)). Stakeholders-including individual citizens, communities, public interest groups, and governments-are increasingly advocating for more sustainable products and processes ([Porter and Derry, 2012](#)). While traditionally, stakeholders in a company were viewed from an anthropocentric perspective, encompassing shareholders, employees, and consumers, Mitchell et al. ([Mitchell et al., 1997](#)) expanded this view to include the environment as a potential stakeholder. This broader perspective highlights the growing influence of social and environmental groups, which pressure companies to redesign their products to be more environmentally friendly ([Sharma and Henriques, 2005](#)). Companies responding to these pressures from consumers and environmental advocates tend to produce higher-quality reports, as noted by Rudyanto and Siregar ([Rudyanto and Siregar, 2018](#)).

The United Nations Principles for Responsible Investment advocates for investors to integrate Environmental, Social, and Governance (ESG) factors when evaluating companies for potential investments. The idea is that businesses with strong ESG performance tend to be more sustainable and better equipped to manage risks, which could lead to improved long-term financial performance. However, the pace at which ESG considerations are translating into measurable financial and economic sustainability for companies has been hindered by several factors. These include investor skepticism about relying on ESG rankings for investment decisions and disruptions caused by the COVID-19 pandemic, among others ([Dincă et al., 2022](#)). Nevertheless, drivers such as social unrest triggered by rising inflation and the growing urgency of addressing climate change are likely to accelerate progress in this area ([Dincă et al., 2022](#)).

In the 1970s, American investors began focusing on socially responsible investing, making it a significant factor in investment decisions. Companies that failed to align with the social and ethical values of investors were often disregarded entirely ([Nascimento et al., 2024](#)). The 1997 Kyoto Protocol further advanced this trend with the introduction of ESG scores as financial predictors, offering a quantitative and comparative framework for evaluating a company's sustainability efforts. However, it was not until the early 2000s that the United Nations formally coined the term ESG ([Nascimento et al., 2024](#)). Initially used as a risk assessment tool, ESG gained prominence as a financial indicator in the wake of the 2010 Deepwater Horizon Oil Spill-the most devastating oil spill in history. This disaster heightened public demand for corporate accountability and transparency, emphasizing the need for robust indicators to prevent similar catastrophes in the future ([Nascimento et al., 2024](#)). Figure 1 outlines the historical timeline of ESG development.

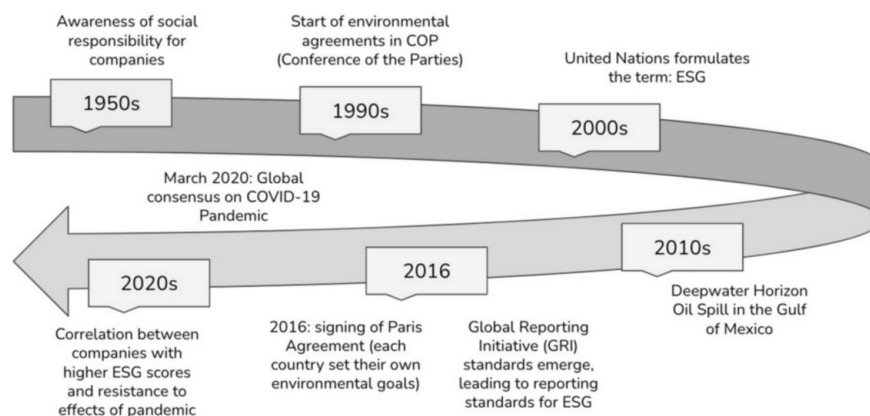


FIGURE 1: Timeline of ESG from 1950

Source: Author. ESG, Environmental, Social, and Governance

Empirically assessing the companies' organizational efforts toward becoming legitimate can bolster explaining and analyzing many organizational behaviors taken with respect to the environment (Dowling and Pfeffer, 1975). The Stanford Research Institute (now SRI International) argued that businesses must take into account the interests and concerns of all the stakeholders in order to achieve sustained long-term success (Freeman and McVea, 2001). In a world where "change" is just about the only thing that never changes, it is necessary that the interests of stakeholders be integrated into the very purpose of the firm so as to break the cycle of constant reactive changes in strategic planning and in Freeman's words (for) "the achievement of an organisation's objectives" (Freeman and McVea, 2001). Zumente and Lăce (Zumente and Lăce, 2021) analyzed the ESG rating availability and its variability for the companies listed on the stock exchanges of Europe and found that significant divergence exists between ESG ratings, even for European companies, despite similar underlying sustainability disclosure regulations. Agosto et al. (Agosto et al., 2023) have provided a single ESG score that combines the information from different providers. They used Bayes' theorem to assign each ESG score a weight based on the likelihood of the observed counts of credit rating classes under the partitions (or groupings) generated by the ESG scores. Cesarone et al. (Cesarone et al., 2024) use a method called the k-sum operator, to aggregate the ESG criteria, which helps formulate a concise and effective ESG evaluation measure. Even if a combined ESG score is not used, as long as the agencies are open about their approaches and information evaluation mechanisms, and investors and companies are acquainted with the potential differences, it shall be possible to decide which ratings reflect their views and priorities the best. Zumente and Lăce (Zumente and Lăce, 2021) ESG scores have been a relatively new concept compared to corporate social responsibility (CSR). One of the reasons for the lack of ESG disclosure scores and reporting could be that ESG is still a dynamic concept that can be manipulated to increase stakeholder and investor trust and support. For this reason, we are interested in exploring automotive companies in India to provide insight into how ESG gains further importance if it correlates to financial performance. Additionally, though ESG has great importance for people within companies, consumers are also interested in the sustainability of the automobiles that they are purchasing. With the looming threat of climate change, global warming, and increasing extreme natural disasters, the automotive companies which historically ran purely on fossil fuels must make changes to satisfy the environmental and social interests of their consumers. For these reasons, ESG is important to both the stakeholders, as well as the consumers who have produced a general trend toward desiring more sustainable and green vehicles.

This paper tries to understand how ESG scores affect a company's financial performance. Return on assets is used as a proxy to measure financial performance, and the relationship is analyzed using structural equation modelling (SEM). Dincă et al. (Dincă et al., 2022) as well as Behl et al. (Behl et al., 2022) have used this method to assess the relationship between the ESG scores and firm value. The paper explores the combined ESG score as well as individual E, S, and G scores. Since the three pillars of ESG might have different effects on a company's valuation, each should be examined separately (Dincă et al., 2022).

Literature review

Theoretical Background

Stakeholder theory highlights a positive relationship between ESG ratings and firm value. ESG ratings serve as a key indicator of a firm's alignment with stakeholder interests, demonstrating its commitment to sustainability, CSR, and transparent performance disclosure (Clément et al., 2025). Strong ESG scores reflect better practices in environmental protection, fair labor policies, community impact, and

governance, which enhance stakeholder trust and satisfaction.

Traditional business objectives, however, tend to prioritize profit maximization over sustainability and stakeholder well-being. Profit-driven strategies may include production and transportation methods that contribute to pollution or exploit labor, resulting in short-term gains but proving unsustainable in the long-term. Such approaches overlook the broader needs and aspirations of stakeholders, focusing narrowly on shareholder returns. Additionally, businesses may resist adopting environmentally friendly initiatives if these disrupt existing operations, even when the initiatives could yield long-term profitability. Instead, they prefer less disruptive policies, despite potential trade-offs with sustainability and profitability (Dowell and Muthulingam, 2017).

However, a number of studies employing a myriad of methodologies seem to arrive at a common conclusion: firms employing practices that support the various stakeholders’ interests appear to attain the same corporate and financial goals that the traditional strategies work toward (Donaldson and Preston, 1995). It is, therefore, in the firms’ best interest that they adopt sustainable practices.

One of the ways companies ensure this is through CSR initiatives. "CSR, defined as 'the continuing commitment by business to behave ethically and contribute to economic development, while improving the quality of life of the workforce and their families as well as of the local community and society at large' (Moir, 2001) is an effective means for firms to demonstrate their commitment to stakeholder interests." The main goal of CSR is to create value for key stakeholders and fulfil businesses’ responsibilities to them (Freeman and Velamuri, 2023) reflecting the intrinsic worth of stakeholder interests emphasized by stakeholder theory (Donaldson and Preston, 1995). CSR initiatives are a strategic approach for firms to actively support stakeholder interests, thereby improving their ESG ratings. These initiatives also include environmental protection programs, community engagement efforts, and fair labor practices, which help foster goodwill and trust among stakeholders and boost the ESG ratings. For socially responsible investors, ESG ratings provide an essential benchmark for evaluating a company’s environmental and social impact as well as the quality of its governance.

Author(s) and Year	Variables	Methodology	Key Findings
(Yin et al., 2023)	Dependent Variable: Stock returns Independent Variable: ESG Control Variables: Company age, Tobin's Q, Financial leverage, TOP10 (Ownership concentration - top 10 shareholders), OWN (Property rights - state vs. non-state-owned, dummy variable), RGN (Region - eastern vs. non-eastern, dummy variable) Mediating Variables: ROA, PNT (Number of patents - corporate innovation capability)	Fixed effects unbalanced panel data analysis	The study confirms a significant positive relationship between ESG performance and stock returns, with notable variations based on ownership type and regional location. While non-state-owned companies and firms in the eastern region benefit most from ESG efforts, state-owned companies face challenges aligning ESG initiatives with shareholder value. Financial performance and innovation capability act as mediators, emphasizing the strategic importance of ESG integration for long-term profitability and returns.
(Kalia and Aggarwal, 2023)	Dependent Variables: ROA, ROE Independent Variable: ESG score Control Variables: Firm size, Financial leverage, Market value, Price to book ratio, Market capitalization	Pooled Ordinary Least Squares	Business performance is positively impacted by ESG activities, and the relationship between ESG activities and business performance is influenced by institutional norms and different economic development levels.
(Dincă et al., 2022)	Dependent Variables: ROA, Enterprise value, Tobin's Q Independent Variables: ESG score, E score, S score, G score	Cross-lagged panel model	The analysis reveals mixed correlations between ESG components and firm value (Tobin's Q) in the global automotive sector. No significant correlation was found between the Environment (E) score and firm value, while the Social (S) score showed unclear and statistically insignificant results. Governance (G) score exhibited both positive and negative correlations across different time intervals, and the overall ESG score displayed positive correlations in select years. Although a positive trend between ESG scores and firm performance is observed, it is inconsistent. These findings do not support the hypothesis that ESG scores significantly affect company performance or influence investor decisions, highlighting the complex and context-dependent nature of ESG impacts.
(Ademi and Klungseth, 2022)	Dependent Variables: ROCE, Tobin's Q Independent Variables: ESG score Control Variables: Debt-to-equity ratio (DOT), Firm size	Panel data regression analysis	The analysis finds ESG ratings to have a positive correlation with the financial performance of market valuation in the sampled companies and suggests that companies with higher ESG ratings show resistance towards global economic disturbances.
			The impact of ESG performance (ESGP) on financial performance (FP)

(Bruna et al., 2022)	Dependent Variables: Financial Performance Score Independent Variables: ESG Control Variables: Firm size, Sector (Dummy variable distinguishing between sensitive and non-sensitive industries)	Time-lagged panel regression model	varies non-linearly across ESGP levels and firm sizes. For all firms except the smallest (cluster 1), FP decreases up to a mid-level of ESG commitment (ESG CS), after which a moderate recovery is observed. Smaller firms experience a consistently strong negative relationship, indicating challenges such as lack of ESG awareness, strategy, and operational capacity, with ESG investments failing to yield financial benefits below a certain size threshold. Medium-sized firms (cluster 3) show a more favorable relationship, reaching the turning point (from negative to positive) earlier than others. The transition to mandatory non-financial disclosures (NFD) under the EU directive in 2018 improved the ESGP-FP relationship, reversing a previously declining trend and supporting the effectiveness of regulatory enforcement in enhancing ESG impact on financial performance.
(Sinha Ray and Goel, 2022)	Dependent Variables: ROA, ROE, Firm size, Market capitalization, Profit before depreciation, interest, and tax, Tobin's Q, Share price Independent Variables: ESG	Arellano and Bond's dynamic generalized moment method	The study confirms statistically significant positive relationships between ESG_SCORE and financial metrics like ROA, PBDIT, and SHARE_PRICE, with positive autocorrelation observed in these associations. However, ESG_SCORE negatively affects ROE, FIRM SIZE, and MKT CAP, with impacts materializing after a two-year lag, making FIRM SIZE and MKT CAP unsuitable as control variables. ESG_SCORE shows no impact on TOBIN'S Q, while its influence on SHARE_PRICE is realized with a one-year lag. These findings align with similar studies, highlighting a positive correlation between ESG and both accounting and market-based performance metrics.
(Behl et al., 2022)	Dependent Variables: Tobin's Q Independent Variables: ESG score, E score, S score, G score Control Variables: Firm size	Cross-lagged panel path analysis	Cross-lagged analyses reveal that ESG components (Environment, Social, Governance scores) significantly impact firm value (Tobin's Q) in the Indian energy sector. Robust model fit statistics confirm the reliability of the findings. Environmental, social, and governance scores all predict firm value a year later, with notable temporal stability. However, in the short-term (2016–2018), higher ESG scores are associated with declines in firm value, transitioning to positive effects by 2019. These results suggest that while ESG investments may challenge short-term profitability, they significantly enhance firm value in the long run.
(Ahmad et al., 2021)	Dependent Variables: Market value (log), Earnings per share (log) Independent Variables: ESG scores (log), Economic scores (log), E score (log), S score (log), G score (log) Control Variables: Total assets (log), Debt-to-assets ratio (log), Revenues (log), Capital expenditures as a percentage of sales, Effective tax rate, High ESG-performing firms (dummy), Low ESG-performing firms (dummy)	Static and dynamic panel data analysis	The study finds that ESG significantly impacts market value and earnings per share but has no notable effect on economic performance. Firm size moderates the ESG- financial performance relationship, with low ESG firms showing a significant negative impact and high ESG firms an insignificant effect. Environmental performance negatively affects financial performance but lacks statistical significance. Uniquely, the study uses dynamic analysis to reveal that total ESG has a significant poitive influence on market value and earnings per share, despite the limited role of environmental performance.
(Engelhardt et al., 2021)	Dependent Variables: Firm's cumulative raw stock returns, Firm's cumulative abnormal stock returns Independent Variables: ESG scores, High ESG (dummy variable for when a firm's ESG score is higher than its country's median)	Multivariate regression models	Greater corporate social responsibility (CSR) led to greater resilience against high market uncertainty during the COVID-19 crisis.
(Shanaev and Ghimire, 2022)	Dependent Variables: Stock returns Independent Variables: ESG ratings (upgrades, downgrades, control for unchanged ratings) Control Variables: Market capitalisation (size), Book-to-market ratio (value/growth factors), Market excess return (EMRt), Size factor (SMBt), Value factor (HMLt), Momentum factor (MOMt), Profitability factor (RMWt), Investment factor (CMAt) Additional Analysis Variables: ESG leaders (AAA/AA), ESG laggards (CCC/B), COVID-19 period, Overlapping event windows, Large stocks, Small stocks, Value stocks, Growth stocks	Calendar-time portfolio methodology	ESG-downgraded stocks experience significant negative abnormal risk-adjusted returns, while ESG upgrades yield positive but insignificant returns, mirroring the asymmetric impact observed in credit ratings. This negative effect persists even after accounting for anticipation effects and is more pronounced for high-rated firms than low- rated ones. Post-2017 data shows stronger results due to increased rating revisions and improved market information. During the COVID-19 pandemic, ESG upgrades boosted stock performance by over 2% per month, highlighting the importance of ESG in managing market turbulence. ESG rating changes notably impact large and growth stocks, influencing asset allocation within traditional factor portfolios, underscoring the nuanced effects of ESG ratings on stock performance.

(Alareeni and Hamdan, 2020)	Dependent Variables: ROA, ROE, Tobin's Q Independent Variables: ESG index, EVN index, CSR index, CG index Control Variables: Firm size, Financial leverage, Assets turnover, Asset growth	Panel data analysis	Environmental disclosure has a positive relation to Tobin's Q. There is a negative relation between Tobin's Q and CSR disclosure. CG disclosure was found to positively affect ROA and Tobin's Q, whereas it negatively affected ROE. ROA, ROE, and Tobin's Q were found to be positively correlated with firm size and asset turnover. The firm's financial performance, as measured by ROE, is positively and significantly correlated with financial leverage.
(Dalal and Thaker, 2019)	Dependent Variables: ROA, Tobin's Q Independent Variables: ESG Control Variables: Financial leverage, Firm size	Random effect panel data regression analysis	The analysis reveals a significant positive relationship at the 0.05 level between ESG scores and the dependent variables, ROA and Tobin's Q. In contrast, control variables like leverage and size show no material impact on these financial metrics. Companies with higher ESG scores demonstrate superior financial performance.
(Amritha and Balasubramanian, 2019)	Dependent Variables: Tobin's Q Independent Variables: ESG score, E score, S score, G score Control Variables: R&D expenses, Return on asset, Sales growth, Firm size	Ordinary Linear Square (OLS)	The study reveals that an increase in total ESG score leads to a decline in Tobin's Q value, indicating that ESG factors impact Tobin's Q. Individually, environmental, social, and governance scores, as well as firm size, all negatively affect Tobin's Q. These findings highlight a consistent negative relationship between ESG factors and firm value.
(Almeyda and Darmansyah, 2019)	Dependent Variables: ROA, ROC, Stock Price, Price to earnings ratio Independent Variables: ESG score, E score, S score, G score	OLS regression, fixed effect and random effect	The analysis of data from seven markets reveals a significant influence of overall ESG disclosure on the financial performance of real estate companies, particularly in accounting metrics like ROA and ROC. However, market-based measures such as Stock Price and P/E show no correlation with ESG disclosure. Firms with higher ESG commitments demonstrate better operational and financial performance. Notably, environmental disclosure has a statistically significant positive relationship with ROC and Stock Price, while social and governance factors show no significant influence on firm financial performance.
(Atan et al., 2018)	Dependent Variables: ROE, WACC, Tobin's Q Independent Variables: ESG score, E score, S score, G score Control Variables: Firm size, Financial leverage	Pooled OLS, fixed effect, and random effect	The regression results indicate no significant relationship between individual or combined ESG factors and firm profitability (ROE) or firm value (Tobin's Q). Individually, none of the ESG factors significantly impact the cost of capital (WACC). However, the combined ESG score positively and significantly influences WACC, suggesting that overall ESG performance plays a role in determining a company's cost of capital.
(Velte, 2017)	Dependent Variables: ROA, Tobin's Q Independent Variables: ESG score (ESGP), E score (ENS), S score (SOS), G score (GS) Control Variables: R&D, Beta, Debt, Size, IND Dummy variable for (1) manufacturing and (2) services (branch of industry)	Correlation and regression analysis	Total ESG score (ESGP) shows a positive correlation with Tobin's Q and ROA, especially in the short term, where social and governance aspects have a larger positive impact than environmental factors. A positive correlation between ESG components (E, S, G) and financial performance (ROA and Tobin's Q) is found, but the impact is stronger in non-longitudinal studies.
(Albertini, 2013)	Environmental Management Variables (EMVs): Environmental Management Variables (EMVs): Environmental strategy, Strategic planning integration, Environmental practices, Process/product-driven systems, ISO 14001 certification, EMS adoption, Voluntary programs, Pollution prevention, Eco-efficiency, Green processes, Environmental innovation. Environmental Performance Variables (EPVs): CO emissions, Physical waste, Water consumption, Toxic releases, Emission reduction, Oil/chemical spills, Emission recycling Environmental Disclosure Variables (EDVs): Toxic emission disclosures, Environmental awards, Accidents/crises, Investment announcements Corporate Financial Performance (CFP) Indicators: P/E ratio, Price/share, Share appreciation, EPS, ROE, ROA, ROS, ROI, Tobin's Q, Pollution control cost savings, Green product	Meta-analysis	The analysis finds a positive relationship between corporate environmental management (CEM) and corporate financial performance (CFP). There are several moderators that significantly influence the relation between CEM and CFP. The moderators include regional differences showing that the relation is significantly stronger in the rest of the world than US-Canada and even less in Europe. There is also evidence of other moderators affecting the relationship in Europe. The activity sector is not a significant moderator. Further research is needed before drawing conclusions about the role of the observation period. Duration of the study is also a significant moderator with the relationship being significantly stronger for non-longitudinal studies compared to longitudinal studies.

	differentiation, Environmental reputation Moderating Variables: Activity sector, Study duration, Regional differences, Environmental strategy, Regulation type, Policy flexibility		
(Fischer and Sawczyn, 2013)	Dependent Variable: CFP Independent Variables: CSP, R&D Control Variables: Firm size, Beta, Industry (Dummy variable for (1) manufacturing and (2) services)	Multivariate regression analysis	The OLS regression models explore the relationships between Corporate Social Performance (CSP), Corporate Financial Performance (CFP), and innovation, with firm size, risk, and industry as control variables, using a one-year lag. In Model 1, CSP is the dependent variable, and CFP and innovation are independent variables, revealing a strong positive relationship between CFP (2006) and CSP (2007) across all variations. In Model 2, CFP is the dependent variable, with CSP and innovation as independent variables. These models highlight the dynamic interplay between financial and social performance, emphasizing the influence of CFP on subsequent CSP.
(Balatbat et al., 2012)	Dependent Variables: ROA, ROE, Return on invested capital, EBITDA margin, Net operating profit less adjusted taxes, EPS, DPS, Dividend yield, P/E Ratio, Enterprise value, Market capitalization to trading revenue ratio, Price to book value Independent Variables: ESG score	One-to-One Correlation Analysis, Multi- Linear Regression Analysis, Portfolio Analysis, Cumulative Frequency Distributions and Correlation Strength Testing	The study employed a comprehensive methodology to analyze the relationship between ESG scores and financial performance across various sectors. Cumulative frequency plots revealed that oil and gas, as well as mining, are the worst-performing sectors, while banking and financial services outperformed others. Correlation analysis found no strong positive relation between ESG scores and profitability, except in the mining and food and beverage sectors, with a positive linear trend observed between equity valuation measures (EPS, DPS, EV) and ESG scores. Hypothesis testing rejected the positive impact of ESG scores on financial performance (H1) across most sectors, except for the food and beverage sector. Multi-linear regression analysis highlighted a positive relationship between size and growth with financial performance, while leverage had a negative impact. Although ESG beta coefficients were generally positive, EV was the only financial metric statistically significant against ESG scores. Sensitivity tests, including separate analysis of E, S, and G scores and varying weightings, produced consistent results. Lag analysis extended by two years showed no statistically significant findings. Portfolio analysis indicated that ESG leaders outperformed laggards based on the BHR indicator, with laggards exhibiting higher portfolio variance. Finally, the accuracy of analyst forecasts revealed a negative association between forecast errors (FERROR) and ESG scores, with statistically significant results for the food and beverage sector ($p < 0.05$) and the travel and leisure sector ($p < 0.1$) in the one-year horizon, and for the food and beverage sector ($p < 0.05$) in the two-year horizon. This robust methodology underscores the nuanced relationship between ESG scores and financial performance.

TABLE 1: Literature review

Source: Author. ESG, Environmental, Social, and Governance; ROA, Return on Assets; ROE, Return on Equity

The relationship between ESG practices and financial performance has been studied extensively (Table 1). Many studies have taken into consideration the combined ESG score only (Kalia and Aggarwal, 2023), (Dalal and Thaker, 2019), (Bruna et al., 2022), (Sinha Ray and Goel, 2022), (Balatbat et al., 2012) while others have taken into account the separate E score, S score, G score (Behl et al., 2022), (Velte, 2017), (Dincă et al., 2022), (Ahmad et al., 2021), (Amritha and Balasubramanian, 2019), (Almeyda and Darmansyah, 2019), and (Atan et al., 2018). Environmental performance and financial performance are positively correlated, according to a meta-analysis of 52 studies conducted over a 35-year period. Albertini (Albertini, 2013) and Yin et al. (Yin et al., 2023), in addition to the above variables, have considered several other variables such as solvency, ownership concentration, R&D as well as property rights and region.

The studies have been done across various countries and sectors and have given mixed results. Kalia and Aggarwal (Kalia and Aggarwal, 2023) have used Pooled Ordinary Linear Square (OLS) to do a cross-sectional analysis of 33 countries across 5 continents. On the other hand, Dincă et al. (Dincă et al., 2022) have used cross-lagged panel model (CLPM) to analyze a more elaborate dataset involving 131 countries

spanning 5 continents. Engelhardt et al. (Engelhardt et al., 2021) have used multivariate regression models on a dataset of 1452 European firms from 16 different countries, whereas Bruna et al. (Bruna et al., 2022) have analyzed a time-lagged panel regression model on 350 European listed companies. Almeyda and Darmansyah (Almeyda and Darmansyah, 2019) have conducted OLS regression on a dataset inclusive of the G7 countries.

Research indicates that healthcare companies in India engaging in enhanced ESG activities are more profitable compared to their peers (Kalia and Aggarwal, 2023). Similar findings have been observed for SP 500 companies (Ahmad et al., 2021) (Ademi and Klungseth, 2022). In China, companies with stronger ESG scores demonstrate higher earnings and better stock returns (Yin et al., 2023). However, conflicting results emerge when different measures of financial performance are used. For instance, while the financial performance of G7 real estate corporations is significantly influenced by ESG disclosure based on accounting metrics, no relationship exists between ESG components and market-based indicators (Almeyda and Darmansyah, 2019). A similar lack of alignment is observed in German firms (Velte, 2017). In the Indian context, ESG scores generally show a positive impact on financial metrics such as Return on Assets (ROA), Profit Before Depreciation, Interest, and Taxes (PBDIT), Tobin's Q, and Share Price (Dalal and Thaker, 2019). However, while ESG scores positively influence ROA and Tobin's Q, they exhibit a negative impact on Return on Equity (ROE), firm size, and market capitalization (Sinha Ray and Goel, 2022).

Corporate environmental management has been positively linked to corporate financial performance (CFP), though regional variations and study duration can affect the strength of this relationship (Albertini, 2013). Additionally, the market response to ESG improvements appears to have a one-year lag, with share price impacts becoming evident after this period (Sinha Ray and Goel, 2022). Similarly, CFP in one year positively influences corporate social performance (CSP) in the subsequent year. CSP is also enhanced by innovation, with factors such as firm size, risk, and industry held constant (Fischer and Sawczyn, 2013).

These findings underscore the complexity of the relationship between ESG performance and financial outcomes, influenced by sectoral, regional, and temporal variables. The stakeholder theory states that satisfying multiple stakeholders' interests can enhance a company's performance by improving its reputation, reducing risks, and fostering long-term value creation. This approach posits that addressing stakeholder needs can create synergies that benefit both the company and its shareholders, ultimately leading to better financial returns. However, portfolio analysis of financial returns of ESG leaders and laggards on the basis of stock returns, buy and hold return (BHR) and arithmetic return offer depressing results. Only in the case of BHR ESG leaders outperform laggards, although the extent of influence of the global financial crisis on this predicament is uncertain (Balatbat et al., 2012). Atan et al. (Atan et al., 2018) found no relationship between ESG score and firm performance. Ahmad et al. (Ahmad et al., 2021) found that the ESG score has an influence on the market value and EPS of a firm but does not impact the economic performance much. A sector-specific study by (Balatbat et al., 2012) using correlation analysis between ESG scores and firm performance, yielded a positive correlation only for the food and beverage sector.

Firm size does play a role in these relations. As the ESG composite score for European companies increases, financial performance first declines for the majority of enterprises (with the exception of the smallest), but it improves after a certain point, suggesting that early ESG efforts have a negative influence on FP and that subsequent commitments cause a partial recovery. The relationship between the financial and non-financial performance of medium-sized businesses is more favorable (Bruna et al., 2022). There are also studies that have found that there is a negative relationship between ESG scores and financial performance. Amritha and Balasubramanian (Amritha and Balasubramanian, 2019) have found a negative association between the ESG scores and financial performance of Indian companies.

When considering the E score, S score, and G score separately, various studies have demonstrated differing impacts on firm performance. Kalia and Aggarwal (Kalia and Aggarwal, 2023) found positive effects of the E score and S score on firm performance, while Ahmad et al. (Ahmad et al., 2021) reported mixed results. Specifically, Ahmad et al. (Ahmad et al., 2021) observed that the E score positively influences ROA and Tobin's Q, whereas it negatively impacts ROE. Velte (Velte, 2017) also identified positive effects of the E score on firm performance. Amritha and Balasubramanian (Amritha and Balasubramanian, 2019) found negative effects of both the S score and G score on firm performance. Additionally, Almeyda and Darmansyah (Almeyda and Darmansyah, 2019) indicated that the G score does not have a significant relationship with firm performance. Furthermore, the limited impact of environmental performance on firm performance has been noted by Ahmad et al. (Ahmad et al., 2021), suggesting that environmental scores alone may not be robust indicators of financial outcomes.

Behl et al. (Behl et al., 2022) conducted a cross-lagged path analysis and discovered that while firm value did not predict environment score or social score at any of the four time points, environment score and social score did predict firm value with a one-year lag. A higher environment/social score predicted a lower firm value in the first two waves, as seen by the negative correlations found between environmental, social, and governance scores in 2016 and 2017 and the firm value in 2017 and 2018, respectively. In the

third wave, an increase in firm value in 2019 was indicated by higher environment, social, and governance scores in 2018. Dincă et al. (Dincă et al., 2022) used a similar method of analysis and found inconclusive results.

Engelhardt et al. (Engelhardt et al., 2021) use a firm's cumulative raw stock returns as well as a firm's cumulative abnormal stock returns as their dependent variables and ESG scores and high ESG, which is a dummy variable to denote instances when a firm's ESG score is higher than its country's median. They found that greater CSR led to greater resilience against high market uncertainty during the COVID-19 crisis. Shanaev and Ghimire (Shanaev and Ghimire, 2022) found a negative but statistically insignificant result that companies who found a dip in their ESG ratings during COVID-19 faced a negative impact on their stock performance. Conversely, companies with a rise in their ESG ratings found their stock prices improving. Ademi and Klungseth (Ademi and Klungseth, 2022) found that the 2019-2020 data supports the value-creation theory, which indicates that businesses with better ESG ratings are more resilient to shocks to the world economy.

Research Method

Research questions and hypotheses statement

The research question posed by this study, "What is the impact of individual Environmental, Social, and Governance (E, S, G) scores, as well as the overall ESG score, on the financial performance of the company?" addresses a critical gap in the existing literature. While prior studies have explored the aggregate impact of ESG performance, limited attention has been given to the distinct contributions of the ESG dimensions to firm profitability. In light of the Stakeholder Theory discussed above, which emphasizes the alignment of corporate strategies with stakeholder interests, we propose four hypotheses:

H1: Environmental (E) score has a significant, positive effect on ROA in time $T + 1$.

H2: Social (S) score has a significant, positive effect on ROA in time $T + 1$.

H3: Governance (G) score has a significant, positive effect on ROA in time $T + 1$.

H4: ESG score has a significant, positive effect on ROA in time $T + 1$.

These hypotheses are grounded in the premise that ESG practices not only address stakeholder concerns but also drive long-term financial performance. A better ESG score indicates sustainable choices, enhances reputation, and reduces risk, which translates to stakeholder trust and employee satisfaction and contributes to competitive advantages like higher customer loyalty and reduced employee turnover. Additionally, it leads to more effective capital management, improved management quality, including dependability and execution efficiency, and more qualitative nature-operating capabilities (Zumente and Bistrova, 2021).

Thus, this study seeks to empirically test the impact of ESG dimensions on firm financial performance, as predicted by stakeholder theory, and explore the relationship between ESG scores and financial performance further, particularly in the Indian automotive industry.

Data and methodology

The dataset contains 26 Indian automotive companies from 2020 to 2022. The relationship between financial performance as measured by ROA and ESG combined score and individual E, S and G scores. Data for ESG scores were obtained from the Bloomberg Terminal, which provides standardized ESG metrics for publicly listed companies (Bloomberg Terminal, 2024). The initial dataset contained 99 companies with operations in India which was filtered based on the availability of data. ESG scores were available only for a subset of the firms in the original sample, reflecting the limited extent of ESG disclosure across companies in the sector. The list of companies considered is given in Table 2.

Bloomberg gathers ESG data directly from company reports, ensuring that information is sourced from the companies themselves. These data are then standardized to maintain consistency across different countries, accounting for variations that may arise due to regional reporting standards. Bloomberg does not alter the underlying data beyond this standardization process, maintaining the integrity of the original information. If a company lacks ESG data on Bloomberg, it simply indicates that the company has not publicly reported this information. This standardized approach provides a reliable and comparable index for evaluating companies' ESG performance, with scores typically ranging from 1 to 10, where 10 represents the highest level of compliance or performance.

CLPM includes autoregressive paths, thereby improving construct stability. This makes them more appropriate for studying causal influences, as this helps us to examine changes beyond what would have been expected from the variable's own persistence. They also have a low data requirement; they are "just

identified" with only two waves of data, which makes it an appealing modeling approach from a practical point of view (Hamaker et al., 2015). To test the proposed hypotheses, a SEM approach is utilized, employing a CLPM over a three-year period (T1 to T3) from 2020 to 2023. Figure 2 shows a general CLPM spanning three time periods.

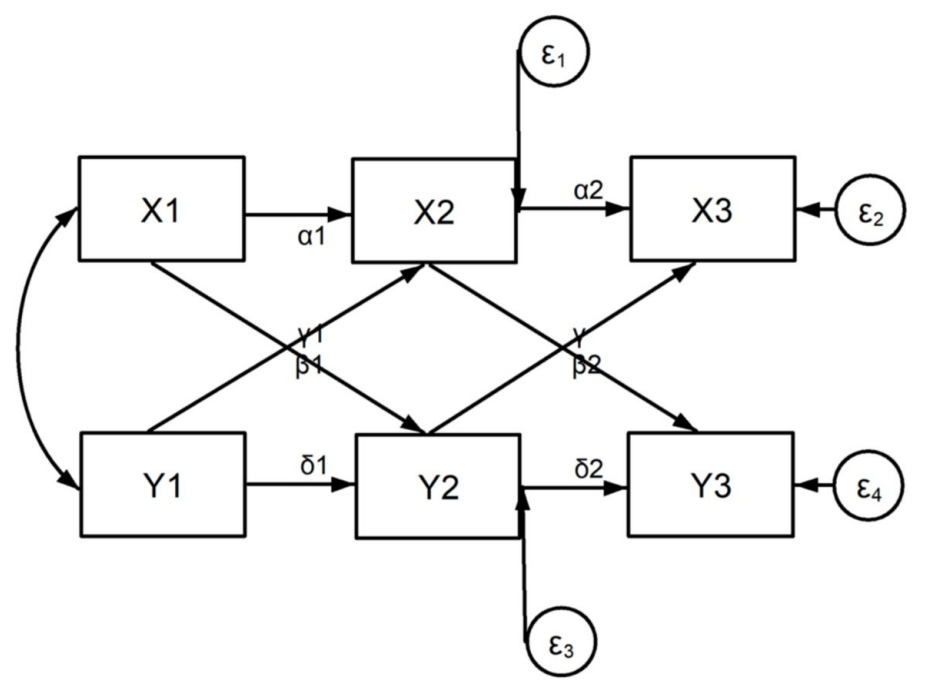


FIGURE 2: Cross-lagged panel model (CLPM) over a three-year period

Source: Author

Name of the Company
Maruti Suzuki India
Tata motors
BMW
KIA Corp
Ford Motor Co
Volkswagen AG
General Motors C
Isuzu Motors
Jaguar Land Rover Automotive PLC
Mercedes-Benz GR
Volvo AB-B
Polaris INC equity
Mitsubishi Motor
Guangzhou Auto-H
Olectra Greentech Ltd
Ola Electric Mobility Ltd
Fisker Inc
BAIC Motor Corp Ltd
Tranztar Commercial Vehicle Applications Ltd
Piaggio & C SpA
Navistar International Corp
Force Motors Ltd
Dongfeng Motor Group Co Ltd
CNH Industrial NV
Yamaha Motor Co Ltd
Eicher Motors Ltd

TABLE 2: List of companies considered

Source: Author

Results And Discussion

Descriptive statistics

Table 3 reports the descriptive statistics for each variable, grouped by year. The skewness of ROA (Return on Assets) for all years in the analyzed period is relatively high and negative, with values of -1.84729 in 2020, -2.36117 in 2021, and -2.07626 in 2022. This strong negative skewness suggests a predominance of firms with lower ROA values, possibly indicating that a few high-performing companies drive the average while most firms report relatively lower ROA figures.

In contrast, the ESG scores (Environmental, Social, and Governance) for 2020, 2021, and 2022 display skewness values close to zero (0.082389, 0.070672, and 0.118198, respectively), indicating that these scores are almost symmetrically distributed. This suggests that ESG data is relatively balanced across the firms in the dataset, likely available for companies facing uniform ESG disclosure pressures, possibly due to industry standards or regulatory expectations. The parallel trends in ESG scores and ROA support the

hypothesis that overall ESG performance positively affects financial outcomes.

Additionally, the individual Environmental (E), Social (S), and Governance (G) scores show a slight positive skew, with values like 0.175328 for E in 2020 and 0.257751 for S in 2020. This positive skewness for the E and S scores indicates a slight bias toward higher ESG component scores among firms in the dataset. This may reflect that companies with higher ESG scores are more prominent or responsive to ESG standards, particularly in industries where such disclosures are critical for reputation or compliance.

Variable	N	Mean	SD	Median	Min	Max	Range	Skewness	Kurtosis
roa2020	25	-0.08792	6.9654	1.6978	-24.39	12.31	36.70	-1.847	7.649
roa2021	25	1.2687	10.941	4.1753	-35.48	11.81	47.29	-2.361	7.968
roa2022	26	0.3019	14.085	4.5221	-39.74	16.97	56.71	-2.076	6.060
esg2020	18	4.0494	1.3618	4.025	2.21	6.44	4.23	0.0824	1.779
esg2021	21	3.7619	1.5838	3.71	1.19	6.05	4.86	0.0707	1.663
esg2022	21	3.9476	1.5821	4.06	1.44	6.51	5.07	0.1182	1.732
e2020	13	2.5808	1.5307	2.44	0.45	4.87	4.42	0.1753	1.643
e2021	15	2.8360	1.8451	2.61	0.00	5.65	5.65	0.1377	1.663
e2022	13	3.3262	2.0225	3.88	0.00	6.44	6.44	-0.0744	1.777
s2020	13	3.7585	1.8881	2.90	1.34	6.53	5.19	0.2578	1.472
s2021	15	3.1393	1.8463	2.55	0.81	6.04	5.23	0.3562	1.585
s2022	13	3.4092	1.9299	2.71	1.34	6.66	5.32	0.6041	1.829
g2020	13	5.6254	1.0295	5.17	4.48	8.43	3.95	1.5871	5.238
g2021	14	5.6000	0.9860	5.26	4.65	8.36	3.71	1.6664	5.370
g2022	13	5.6538	0.9573	5.27	4.87	8.31	3.44	1.6837	5.533

TABLE 3: Descriptive statistics

Source: Author

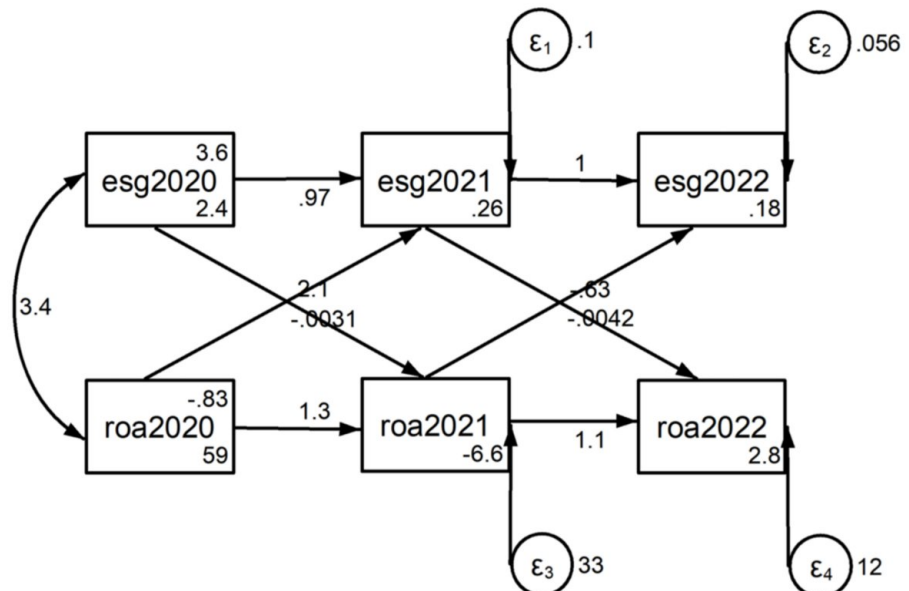
Correlation matrix

Table 4 shows the correlation matrix. It shows strong positive correlations among the ESG scores across different years, such as esg2020 and esg2021, indicating stability in ESG measures over time. The Environmental (E), Social (S), and Governance (G) scores also exhibit high correlations within each category, suggesting consistency across years. In contrast, the ROA variables generally have weaker or near-zero correlations with ESG scores. The higher correlation coefficients (>0.6) are given in bold.

		roa2020	roa2021	roa2022	esg2020	esg2021	esg2022	e2020	e2021	e2022	s2020	s2021	s2022	g2020	g2021	g2022
ROA	roa2020	1	0.69	0.05	-0.1	-0.15	-0.16	-0.31	-0.37	-0.32	0.13	0.12	0.14	0.12	-0.17	-0.11
	roa2021	0.69	1	0.13	0.38	0.3	0.22	0.31	0.39	0.32	0.58	0.54	0.57	0.54	0.06	0.12
	roa2022	0.05	0.13	1	0.25	0.3	0.27	0.3	0.41	0.41	0.54	0.57	0.59	0.57	-0.18	-0.08
ESG	esg2020	-0.1	0.38	0.25	1	0.97	0.95	0.86	0.81	0.93	0.98	0.93	0.86	0.85	0.74	0.84
	esg2021	-0.15	0.3	0.3	0.97	1	0.95	0.86	0.89	0.85	0.86	0.95	0.74	0.65	0.57	0.75
	esg2022	-0.16	0.22	0.27	0.95	0.95	1	0.7	0.86	0.58	0.64	0.84	0.85	0.58	0.97	0.8
E	e2020	-0.31	0.31	0.3	0.86	0.86	0.7	1	0.69	0.51	0.75	0.66	0.64	0.57	0.75	0.59
	e2021	-0.37	0.39	0.41	0.81	0.89	0.86	0.69	1	0.77	0.77	0.81	0.77	0.67	0.63	0.8
	e2022	-0.32	0.32	0.41	0.93	0.85	0.58	0.51	0.77	1	0.77	0.63	0.57	0.65	0.58	0.54
S	s2020	0.13	0.58	0.54	0.98	0.86	0.64	0.75	0.77	0.77	1	0.7	0.76	0.88	0.98	0.99
	s2021	0.12	0.54	0.57	0.93	0.95	0.84	0.66	0.81	0.63	0.7	1	0.85	0.95	0.88	0.75
	s2022	0.14	0.57	0.59	0.86	0.74	0.85	0.64	0.77	0.57	0.76	0.85	1	0.79	0.86	0.69
G	g2020	0.12	0.54	0.57	0.85	0.65	0.58	0.57	0.67	0.65	0.88	0.95	0.79	1	0.95	0.8
	g2021	-0.17	0.06	-0.18	0.74	0.57	0.97	0.75	0.63	0.58	0.98	0.88	0.86	0.95	1	0.53
	g2022	-0.11	0.12	-0.08	0.84	0.75	0.8	0.59	0.8	0.54	0.99	0.75	0.69	0.8	0.53	1

TABLE 4: Correlation matrix

Source: Author. ROA, Return on Assets; ESG, Environmental, Social, and Governance

CLPM results*Relationship between ESG Score and Firm Value***FIGURE 3: Cross-lagged panel model between ESG and ROA**

Source: Author. ESG, Environmental, Social, and Governance; ROA, Return on Assets

Figure 3 shows the CLPM between ESG score and firm value measured using ROA. The ESG scores of 2020 and 2021 have a moderate positive relationship with the ESG score of the successive years. ROA of 2020 and 2021 have a strong positive relationship with ROA of 2021 and 2022. The ESG score of 2020 has a strong positive relationship with ROA of 2021, and ESG score of 2021 has a moderate negative relationship with ROA of 2022. ROA of 2020 has a weak positive relationship with ESG of 2021, and ROA of 2021 has a very weak negative relationship with ESG of 2022. All the relationships except that of ESG 2021, ROA 2020 and ROA 2021 on ROA 2022, ESG 2020 and ESG 2021, respectively, are significant. Model fit indices, summarized in Table 5, indicate that the model shows a good fit according to χ^2/df , Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI), but the Root Mean Square Error of Approximation (RMSEA) indicates a poor fit.

The strong positive influence of the ESG score in 2020 on ROA in 2021 highlights the potential for a well-executed ESG strategy to contribute positively to financial performance in the short-term (Kalia and Aggarwal, 2023), (Ahmad et al., 2021), (Ademi and Klungseth, 2022), (Yin et al., 2023), and (Dalal and Thaker, 2019). However, the moderate negative relationship between the ESG score of 2021 and ROA of 2022 suggests that increased ESG efforts might involve costs or trade-offs that negatively impact financial outcomes in the medium-term. This is in line with the findings of Amritha and Balasubramanian (Amritha and Balasubramanian, 2019). This underscores the importance of aligning ESG initiatives with financial goals to achieve sustainable growth.

Relationship Between E Score and Firm Value

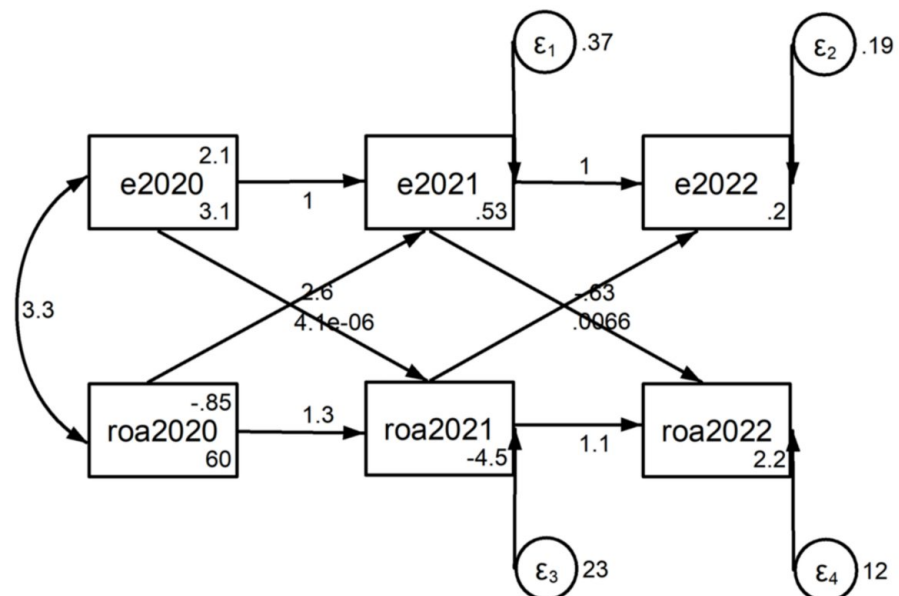


FIGURE 4: Cross-lagged panel model between E and ROA

Source: Author. ROA, Return on Assets

Figure 4 shows the CLPM between E score and ROA. The E scores of 2020 and 2021 have a strong positive relationship with the E score of the successive years. ROA of 2020 and 2021 have a strong positive relationship with ROA of 2021 and 2022.

The E score of 2020 has a strong positive relationship with ROA of 2021, while the E score of 2021 has a moderate negative relationship with ROA of 2022. ROA of 2020 and 2021 both have a very weak positive relation on the E scores of the next years. All the relationships except that of E 2021, ROA 2020 and ROA 2021 on ROA 2022, E 2020 and E 2021, respectively, are significant. Model fit indices, summarized in Table 5, indicate that the model shows a good fit according to χ^2/df , CFI, and TLI, but the RMSEA indicates a poor fit.

The strong positive relationship between the E score of 2020 and ROA of 2021 suggests that early investments in environmental performance can lead to improved financial outcomes in the short-term. This aligns with the findings of Kalia and Aggarwal, Ahmad et al., and Velte (Kalia and Aggarwal, 2023), (Ahmad et al., 2021), and (Velte, 2017). However, the moderate negative relationship between the E score of 2021 and ROA of 2022 indicates potential short-term trade-offs or challenges in balancing

environmental initiatives with profitability. Firms may face increased costs or operational adjustments associated with environmental practices that could temporarily reduce financial performance, contradicting the findings of the earlier researchers.

Relationship Between S Score and Firm Value

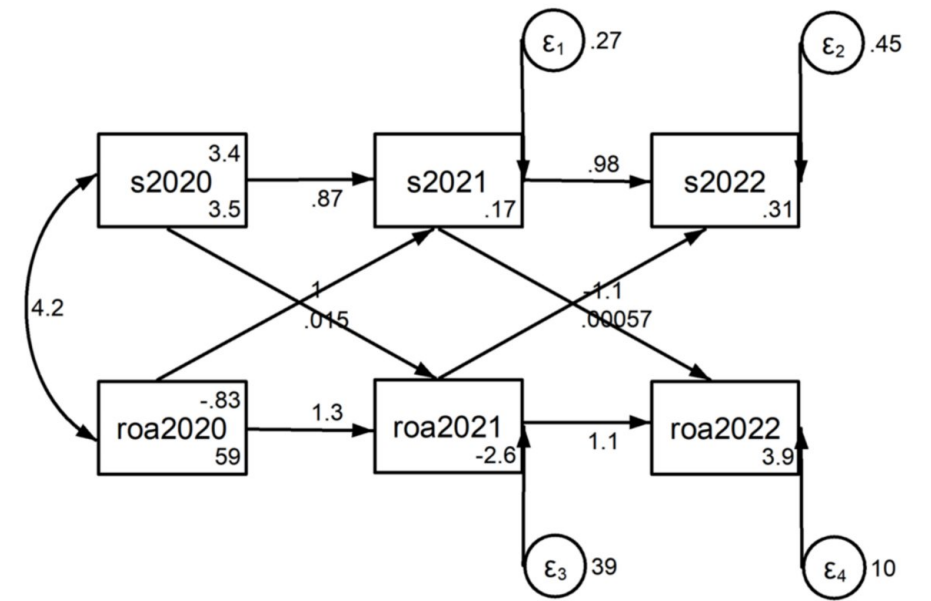


FIGURE 5: Cross-lagged panel model between S and ROA

Source: Author. ROA, Return on Assets

Figure 5 shows the CLPM between the S score and firm value measured using ROA. The S scores of 2020 and 2021 have a moderate positive relationship with the S score of the successive years. ROA of 2020 and 2021 have a strong positive relationship with ROA of 2021 and 2022. The S score of 2020 has a moderate positive relationship on ROA of 2021, while the S score of 2021 has a strong negative relationship on ROA of 2022. ROA of 2020 and 2021 have a very weak positive relationship on the S score of the successive years. All the relationships except that of S 2020, ROA 2020 and ROA 2021 on ROA 2021, S 2020 and S 2021, respectively, are significant. Model fit indices, summarized in Table 5, indicate that the model shows a good fit according to CFI, and TLI, but the χ^2/df and RMSEA indicate a poor fit.

The moderate positive relationship between the S score of one year and firm value (ROA) in the subsequent year implies that firms' sustainability practices can have a meaningful impact on their financial performance. This highlights the importance of sustaining long-term investments in social responsibility, aligning with the findings of Kalia and Aggarwal (Kalia and Aggarwal, 2023). The strong negative relationship between the S score of 2021 and ROA of 2022 suggests that increased sustainability efforts might lead to short-term financial trade-offs.

Relationship Between G Score and Firm Value

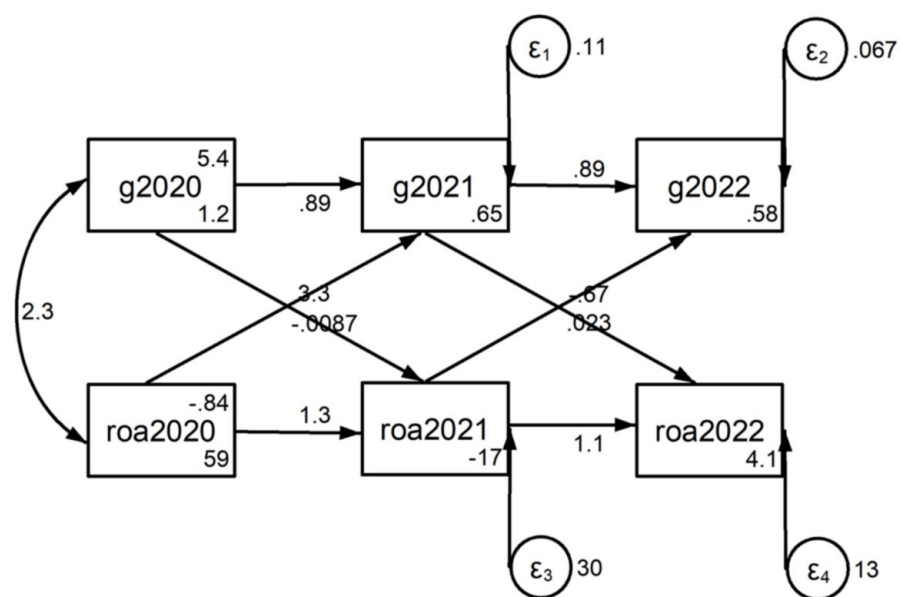


FIGURE 6: Cross-lagged panel model between G and ROA

Source: Author. ROA, Return on Assets

Figure 6 shows the CLPM between the S score and firm value measured using ROA. The G scores of 2020 and 2021 have a moderate positive relationship with the G score of the successive years. ROA of 2020 and 2021 have a strong positive relationship with ROA of 2021 and 2022. G 2020 has a strong positive relationship with ROA 2021, while G score of 2021 has a moderate negative relationship with ROA 2022. ROA of 2020 and 2021 have a very weak negative and positive relationship with G scores of 2021 and 2022, respectively. The relations between G scores and ROAs of 2020 and 2021 with G scores and ROAs of 2021 and 2022, respectively, are significant, while the relations between G scores and ROAs of 2020 and 2021 with ROAs and G scores of 2021 and 2022, respectively, are not significant. Model fit indices, summarized in Table 5, indicate a poor fit.

The strong positive relationship between the G score of 2020 and ROA of 2021 highlights the potential of effective governance practices to enhance financial performance in the short-term. However, the moderate negative relationship between the G score of 2021 and ROA of 2022 suggests that governance initiatives may involve short-term challenges or costs that could temporarily reduce financial returns, similar to the findings of Amritha and Balasubramanian (Amritha and Balasubramanian, 2019).

No.	Model	χ^2	Df	P-value	χ^2/df	RMSEA	SRMR	CFI	TLI
Model 1.1	ESG & ROA	7.78	6	0.2548	1.296666667	0.107		0.992	0.981
Model 1.2	E & ROA	7.97	6	0.24	1.328333333	0.113		0.987	0.969
Model 1.3	S & ROA	13.27	6	0.0389	2.211666667	0.216		0.951	0.886
Model 1.4	G & ROA	22.67	6	0.0009	3.778333333	0.327		0.894	0.752
Acceptance of good fit					<2 (Kline, 2005)	<0.08 (Browne and Cudeck, 1992)	<0.08 (Hu and Bentler, 1999)	>0.90 (Hu and Bentler, 1999)	>0.90 (Tucker and Lewis, 1973)

TABLE 5: Model fit statistics

Source: Author. ESG, Environmental, Social, and Governance; ROA, Return on Assets; SRMR, Standardized Root Mean Square Residual; CFI, Comparative Fit Index; TLI, Tucker–Lewis Index; RMSEA, Root Mean Square Error of Approximation

Discussion

This study hypothesizes that ESG scores have a significant and positive influence on firm value in the automotive industry. The investigation of the correlation between ESG scores and firm value in the automotive sector, however, contradicts the premise by failing to demonstrate a steady impact of ESG scores on firm value over time. Despite appearing to be in line with the findings of Dincă et al. (Dincă et al., 2022), other studies done in different sectors using ESG scores have offered contrasting results when taking into consideration financial metrics like ROA, although they have found negative relations when considering market-based metrics. The study also hypothesizes a significant positive relation of E, S, and G scores on firm performance. However, the present analysis offers mixed results. One factor influencing this could be the lack of continuous data, which is a limitation of this study.

ESG scores and sustainability disclosure are only recently gaining momentum, with many of the companies just starting out with compliance reporting and many having none at all. For instance, only since 2012 were the top 100 companies in India of market capitalization required to report ESG scores (Jha, 2023).

This could address the paucity of data with time, and the influence could be reevaluated over a longer period that could provide better insights. Although this study is limited to the automobile sector in India, the existence of different types of automobile firms ranging from private vehicle manufacturers, manufacturers of two wheelers and electric vehicles to commercial and diversified vehicle manufacturers with different visions and methods of production may have affected their compliance reporting provided that there are varied stakeholder expectations and regulatory practices. The availability of a multitude of ESG data providers, each with its own calculation metrics, could pose a challenge for investors in deciding which ones better align with their visions. The growing awareness among companies and stakeholders of the need for sustainable practices and compliance reporting itself offers a beacon of hope, indicating a shift in the right direction. As the industry matures and regulatory frameworks solidify, a clearer picture of ESG’s impact on firm value is likely to emerge. Although ESG disclosure practices could depress profits in the short run, its long-term benefits (which motivates firms to follow better production and distribution practices) could have a positive influence on the stakeholders makes it a worthy sacrifice.

Conclusions

In conclusion, this study reveals that ESG scores currently show an inconsistent influence on firm value within India’s automotive industry, with differing impacts based on financial and market-based metrics. These results emphasize the complex nature of the ESG-firm value relationship, especially in a sector as diverse as automotive manufacturing, where variations in company type and production methods may impact ESG reporting practices. One can also argue in favor of a time lag that exists between the incorporation of sustainable practices and its reflection on the financial performance of a company.

The Securities and Exchange Board of India mandate which requires the top 1000 companies to file a comprehensive report according to the Business Responsibility and Sustainability Reporting (BRSR) framework definitely has a positive impact. While the availability of ESG data has improved structurally,

our findings highlight uneven disclosure quality and coverage across firms. This suggests that mandates alone are not sufficient-the actual utility of ESG scoring for research and valuation hinges on how thoroughly firms comply and report. Akin to the impact of the different metrics for measurement of sustainability rating providers on the scores, individual companies such as Bloomberg are improving their rating practices as well, which have an impact on the quality as well as availability of the data. This could be useful to future researchers in improving the reliability of the work. Regulations around sustainability are also being strengthened with each passing day, further improving the quality and availability of the data.

While the study is limited by data gaps and the evolving state of ESG disclosure, it provides valuable insights into the challenges of assessing ESG impacts with the existing data. The lack of ESG disclosure itself constitutes an important research implication, as the uneven availability of ESG information across firms highlights transparency gaps that may hinder both academic research and investor decision-making. This underscores the need for improved ESG reporting practices and the development of more robust, standardized data. Future research leveraging such data could help clarify these relationships over time. As the automotive sector continues its shift toward sustainability, the role of ESG in firm valuation is likely to grow, emphasizing the ongoing need for comprehensive, longitudinal analysis in this area. Even though there are mixed empirical results on its short-term financial effects, ESG is still an important driver of change in industries, especially the resource-heavy car industry. It helps businesses become more sustainable, which leads to long-term resilience, innovation, and responsible value creation in an economy that is becoming more focused on sustainability.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Ann Lopez, Ashita Allamraju

Acquisition, analysis, or interpretation of data: Ann Lopez, Dai Lin Huang, Padavinangady Nakul Bhat, Shabd Sahni

Drafting of the manuscript: Ann Lopez, Dai Lin Huang

Critical review of the manuscript for important intellectual content: Ann Lopez, Ashita Allamraju, Padavinangady Nakul Bhat, Shabd Sahni

Supervision: Ashita Allamraju

Disclosures

Human subjects: All authors have confirmed that this study did not involve human participants or tissue.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

The authors gratefully acknowledge the support of the International Centre for Applied Systems Science for Sustainable Development (ICASSSD). This work was carried out during a Research School organized by ICASSSD, which provided the academic environment and resources that enabled the completion of this study. The Bloomberg terminal was used to procure data for this work. Data used in this study are available on reasonable request from the corresponding author.

References

1. Ademi B, Klungseth NJ: Does it pay to deliver superior ESG performance? Evidence from US S&P 500 companies. *Journal of Global Responsibility*. 2022, 13:421-49. [10.1108/jgr-01-2022-0006](https://doi.org/10.1108/jgr-01-2022-0006)
2. Agosto A, Giudici P, Tanda A: How to combine ESG scores? A proposal based on credit rating prediction. *Corporate Social Responsibility and Environmental Management*. 2023, 30:3222-230. [10.1002/csr.2548](https://doi.org/10.1002/csr.2548)
3. Ahmad N, Mobarek A, Roni NN, Tan AWK: Revisiting the impact of ESG on financial performance of FTSE350 UK firms: Static and dynamic panel data analysis. *Cogent Business & Management*. 2021, 8:[10.1080/23311975.2021.1900500](https://doi.org/10.1080/23311975.2021.1900500)

4. Albertini E: Does environmental management improve financial performance? A meta-analytical review. *Organization & Environment*. 2013, 26:431-57. [10.1177/1086026613510301](https://doi.org/10.1177/1086026613510301)
5. Almeyda R, Darmansyah A: The influence of environmental, social, and governance (ESG) disclosure on firm financial performance. *IPTEK Journal of Proceedings Series*. 2019, 278-90.
6. Atan R, Alam MM, Said J, Zamri M: The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. *Management of Environmental Quality An International Journal*. 2018, 29:182-94. [10.1108/meq-03-2017-0035](https://doi.org/10.1108/meq-03-2017-0035)
7. Amritha, Balasubramanian A: A study on relationship between corporate financial performance and environmental social & governance score (ESG score). *Fostering Economic Transformation through Inclusive Business: Innovate and Inspire (FIFI 2019)*. Nayak R, Shelley S (ed): Centre for Advanced Research in Financial Inclusion, School of Management, Manipal Academy of Higher Education, Manipal, Karnataka; 2019. 264-79.
8. Balatbat M, Siew R, Carmichael D: ESG scores and its influence on firm performance: Australian evidence. *Australian School of Business School of Accounting*. 2012,
9. Behl A, Kumari PR, Makhija H, Sharma D: Exploring the relationship of ESG score and firm value using cross-lagged panel analyses: case of the Indian energy sector. *Annals of Operations Research*. 2022, 313:231-56. [10.1007/s10479-021-04189-8](https://doi.org/10.1007/s10479-021-04189-8)
10. Bloomberg Terminal. (2024). Accessed: July-August: <https://www.bloomberg.com/professional/terminal-introduction/>.
11. Bruna MG, Loprevite S, Raucci D, Ricca B, Rupo D: Investigating the marginal impact of ESG results on corporate financial performance. *Finance Research Letters*. 2022, 47:102828. [10.1016/j.frl.2022.102828](https://doi.org/10.1016/j.frl.2022.102828)
12. Cesarone F, Martino ML, Ricca F, Scozzari A: Managing ESG ratings disagreement in sustainable portfolio selection. *Computers & Operations Research*. 2024, 170:106766. [10.1016/j.cor.2024.106766](https://doi.org/10.1016/j.cor.2024.106766)
13. Clément A, Robinot É, Trespeuch L: The use of ESG scores in academic literature: a systematic literature review. *Journal of Enterprising Communities People and Places in the Global Economy*. 2025, 19:92-110. [10.1108/jec-10-2022-0147](https://doi.org/10.1108/jec-10-2022-0147)
14. Dalal KA, Thaker NA: ESG and corporate financial performance: A panel study of Indian companies. *IUP Journal of Corporate Governance*. 2019, 18:44-59.
15. Dincă MS, Vezeteu CD, Dincă D: The relationship between ESG and firm value. Case study of the automotive industry. *Frontiers in Environmental Science*. 2022, 10:10.3389/fenvs.2022.1059906
16. Donaldson T, Preston LE: The stakeholder theory of the corporation: Concepts, evidence, and implications. *The Academy of Management Review*. 1995, 20:65-91. [10.5465/amr.1995.9503271992](https://doi.org/10.5465/amr.1995.9503271992)
17. Dowell GW, Muthulingam S: Will firms go green if it pays? The impact of disruption, cost, and external factors on the adoption of environmental initiatives. *Strategic Management Journal*. 2017, 38:1287-304. [10.1002/smj.2603](https://doi.org/10.1002/smj.2603)
18. Dowling J, Pfeffer J: Organizational legitimacy: Social values and organizational behavior. *The Pacific Sociological Review*. 1975, 18:122-36. [10.2307/1388226](https://doi.org/10.2307/1388226)
19. Engelhardt N, Ekkenga J, Posch P: ESG ratings and stock performance during the covid-19 crisis. *Sustainability*. 2021, 13:7133. [10.3390/su13137133](https://doi.org/10.3390/su13137133)
20. Fischer TM, Sawczyn AA: The relationship between corporate social performance and corporate financial performance and the role of innovation: evidence from German listed firms. *Journal of Management Control*. 2013, 24:27-52. [10.1007/s00187-013-0171-5](https://doi.org/10.1007/s00187-013-0171-5)
21. Freeman R, Velamuri S: A new approach to CSR: Company stakeholder responsibility. *R Edward Freeman's Selected Works on Stakeholder Theory and Business Ethics*. Springer, 2023. 251-64. [10.1007/978-3-031-04564-6_12](https://doi.org/10.1007/978-3-031-04564-6_12)
22. Freeman RE, McVea J: A stakeholder approach to strategic management. *SSRN Electronic Journal*. 2001, [10.2139/ssrn.263511](https://doi.org/10.2139/ssrn.263511)
23. Hamaker EL, Kuipers RM, Grasman RP: A critique of the cross-lagged panel model. *Psychological Methods*. 2015, 20:102-16. [10.1037/a0038889](https://doi.org/10.1037/a0038889)
24. Jha CSR: ESG Board's Responsibility - India and Globally. *Chartered Secretary. The Institute of Company Secretaries of India, New Delhi, India*; 2023. 111-16.
25. Kalia D, Aggarwal D: Examining impact of ESG score on financial performance of healthcare companies. *Journal of Global Responsibility*. 2023, 14:155-76. [10.1108/jgr-05-2022-0045](https://doi.org/10.1108/jgr-05-2022-0045)
26. Kline RB: *Principles and Practice of Structural Equation Modeling*. The Guilford Press, 2005.
27. Mitchell RK, Agle BR, Wood DJ: Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *The Academy of Management Review*. 1997, 22:853-86. [10.5465/amr.1997.9711022105](https://doi.org/10.5465/amr.1997.9711022105)
28. Moir L: What do we mean by corporate social responsibility?. *Corporate Governance*. 2001, 1:16-22. [10.1108/eum000000005486](https://doi.org/10.1108/eum000000005486)
29. Nascimento LD, Acruz CS, Silva JVS, et al.: Historical context of social, environmental and corporate governance (ESG) and its impacts on organizations: A literature review. *Seven Editora*. 2024. 106-13. [10.56238/SEVENED2024.010-007](https://doi.org/10.56238/SEVENED2024.010-007)
30. Porter T, Derry R: Sustainability and business in a complex world. *Business and Society Review*. 2012, 117:33-53. [10.1111/j.1467-8594.2012.00398.x](https://doi.org/10.1111/j.1467-8594.2012.00398.x)
31. Sinha Ray R, Goel S: Impact of ESG score on financial performance of Indian firms: static and dynamic panel regression analyses. *Applied Economics*. 2022, 55:1742-755. [10.1080/00056846.2022.2101611](https://doi.org/10.1080/00056846.2022.2101611)
32. Rudyanto A, Siregar SV: The effect of stakeholder pressure and corporate governance on the sustainability report quality. *International Journal of Ethics and Systems*. 2018, 34:233-49. [10.1108/ijoes-05-2017-0071](https://doi.org/10.1108/ijoes-05-2017-0071)
33. Shanaev S, Ghimire B: When ESG meets AAA: The effect of ESG rating changes on stock returns. *Finance Research Letters*. 2022, 46:102302. [10.1016/j.frl.2021.102302](https://doi.org/10.1016/j.frl.2021.102302)
34. Sharma S, Henriques I: Stakeholder influences on sustainability practices in the Canadian forest products industry. *Strategic Management Journal*. 2005, 26:159-80. [10.1002/smj.439](https://doi.org/10.1002/smj.439)
35. Velte P: Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility*. 2017, 8:169-78. [10.1108/jgr-11-2016-0029](https://doi.org/10.1108/jgr-11-2016-0029)
36. Yin XN, Li JP, Su CW: How does ESG performance affect stock returns? Empirical evidence from listed companies in China. *Heliyon*. 2023, 9:e16320.

37. Zumente I, Bistрова J: ESG importance for long-term shareholder value creation: Literature vs. practice. Journal of Open Innovation Technology Market and Complexity. 2021, 7:127. [10.3390/joitmc7020127](https://doi.org/10.3390/joitmc7020127)
38. Zumente I, Lăce N: ESG rating—necessity for the investor or the company?. Sustainability. 2021, 13:8940. [10.3390/su13168940](https://doi.org/10.3390/su13168940)