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ENVIRONMENTAL, SOCIAL AND GOVERNANCE IN THE LISTED REAL ESTATE SECTOR: A LATIN AMERICAN PERSPECTIVE

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Abstract. This study investigates the relationships between Environmental, Social, and Governance (ESG) attributes and financial performance indicators in the listed real estate sector across Brazil, Chile, and Mexico. Utilising a comprehensive dataset from Bloomberg and annual financial reports, and employing panel regression and Granger causality tests, the analysis reveals significant bidirectional and unidirectional causal linkages between ESG practices and financial performance. Key findings indicate that energy efficiency and governance disclosures are instrumental in augmenting both financial performance and firm valuation. The robust positive correlations between ESG variables and financial metrics substantiate the strategic importance of sustainability, particularly in terms of governance transparency and environmental stewardship. Policy recommendations advocate for incentivising energy-efficient practices, standardising ESG reporting frameworks, and fostering gender diversity to promote sustainable development within the listed real estate sector.

Keywords: ESG, listed real estate, causality, Sharpe ratio, Tobin's Q, Latin America.

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1. Introduction

The incorporation of Environmental, Social, and Governance (ESG) criteria into investment paradigms has increasingly garnered substantial global attention, particularly within the real estate domain. This sector is pivotal due to its profound environmental footprint and considerable social ramifications. Indeed, the real estate sector significantly contributes to global energy consumption, water usage, and greenhouse gas emissions (Pivo & Fisher, 2010). Empirical research indicates that real estate is responsible for approximately 36% of global greenhouse gas emissions and accounts for nearly 33% of the world's total energy consumption (World Green Building Council, 2021). Projections suggest that energy consumption in this sector could escalate by over 25% by 2050 (Ooi & Dung, 2019). Consequently, the integration of ESG principles within this sector has the potential to catalyse substantial advancements in sustainability and social responsibility.

While much of the existing ESG research in real estate has focused on mature markets such as North America, the U.K. and the EU, ESG integration in emerging economies remains underexplored due to paucity of reliable data (Narula et al., 2024). Latin America, characterised by its rich biodiversity, cultural heterogeneity, and rapid urbanisation, presents both challenges and opportunities for the integration of ESG practices into the economy, particularly in the real estate sector. The region grapples with political instability, economic volatility, and social inequality, yet holds enormous potential for sustainable development through ESG initiatives. Implementing ESG practices can address these issues by fostering environmental stewardship, improving social outcomes, and enhancing governance standards (Ramirez et al., 2022). Unlike mature markets where ESG adoption is largely driven by well-established regulatory frameworks and investor demand, Latin America's ESG landscape is still evolving, with fragmented regulatory structures and varying levels of corporate commitment. Therefore, the financial impact of ESG in the region remains uncertain and necessitates further investigation. In recent years, there has been an increasing focus on ESG factors among investors, regulators, and stakeholders, driven by the recognition that ESG factors significantly influence long-term financial performance and risk management (Friede et al., 2015). Investors in the region are increasingly considering ESG criteria as essential components of their investment decisions, leading to greater scrutiny and demand for transparency from companies.

Regulatory frameworks play a crucial role in promoting ESG practices in the real estate sector across Latin America. Appositely, various countries have introduced regulations to encourage sustainable practices and reporting. For instance, Brazil has implemented regulations requiring companies to disclose their environmental and social impacts. Mexico has introduced guidelines for sustainable construction, while Colombia has set targets for reducing greenhouse gas emissions in the building sector (Amel-Zadeh & Serafeim, 2018). Despite these advancements, challenges such as the lack of standardised metrics and reporting frameworks and practices on par with those in North America and Western Europe persist. Moreover, economic and political instability in some Latin American countries can hinder long-term sustainability initiatives.

Nonetheless, significant opportunities for growth in ESG integration within the Latin American real estate sector exist. In particular, the increasing demand for sustainable buildings and green infrastructure presents a lucrative market for property companies. By adopting ESG practices, companies can enhance their reputation, attract socially conscious investors, and achieve cost savings through energy efficiency, waste reduction, and improved risk management (Clark et al., 2015). Against this backdrop, this study aims to examine the lead-lag relationships between the adoption of ESG practices and the performance of listed real estate companies in Latin America—an area that remains insufficiently explored in the current literature. Specifically, we undertake an empirical analysis of the three most influential markets in the region—Brazil, Chile, and Mexico—utilising financial and ESG data procured from Bloomberg as well as companies' financial reports[1]. By employing Tobin's *q*, the Sharpe ratio, and raw return as performance metrics, this research aims to elucidate the impact of ESG attributes on the financial performance of real estate firms within these countries. Unlike previous studies that predominantly focus on developed economics, this study contributes to the literature by examining ESG in markets with distinct regulatory challenges, investor expectations, and socio-economic conditions. Understanding how ESG attributes influence financial performance in these emerging markets not only fills a significant research gap but also provides insights for policymakers, investors, and firms operating in regions of evolving sustainability frameworks.

The structure of this paper is as follows. The next section provides a comprehensive literature review on the relationship between ESG and financial performance. Specifically, we will delve into the developments of ESG in the real estate sector in Latin America, highlighting their experiences and the challenges they face. Section 3 outlines the methodology and data utilised in this analysis. In our study, we apply Pedroni's Cointegration and Granger Causality techniques to examine the relationship between the variables. Section 4 depicts the descriptive statistics. Section 5 presents the results of the empirical tests, and Section 6 offers a discussion of these findings. The final section concludes the paper.

2. Literature review

The real estate sector has seen a significant increase in academic and industry research on ESG measures and their impact on the market. Concerns about environmental impacts have made real estate investment increasingly attentive to ESG factors and their influence on financial performance. Despite extensive international research, substantial gaps remain, particularly in understanding social and governance aspects. The evidence base for ESG investment in real estate is limited and not well-defined (Friede et al., 2015; Lo et al., 2023). Empirical questions about the impact of ESG attributes on the financial performance of listed real estate companies are nascent and largely unanswered, especially across diversified property sectors (Robinson & McIntosh, 2022).

ESG, investment in real estate and financial performance

Pertinently, climate change and greenhouse gas emissions have significantly altered public awareness and the investment landscape, particularly in real estate. ESG measures have become crucial investment factors, with research indicating that financial markets are increasingly incorporating ESG aspects into decision-making processes in Europe and North America (Lo et al., 2023). The environmental impact of real estate has led to substantial research into related issues, highlighting the evolving lexicon from Corporate Social Responsibility and Responsible Property Investment to ESG. Despite the clear importance of ESG, the evidence on sustainable real estate investment remains fragmented, and the impact of ESG variables on economic performance is complex and debated.

The integration of ESG principles into Real Estate Investment Trust (REIT) literature is a relatively new development. Although the investigation of ESG variables' economic impacts is not novel, these inquiries are inherently complex and yield mixed results in empirical studies. Existing finance-related research underscores the intricate and often intangible relationship between ESG metrics and their benefits within the investment landscape, which are challenging to quantify both in the short and long term (Orlitzky et al., 2003). In corporate finance, particularly within the real estate sector, social responsibility and environmental considerations have long been incorporated, driven by global priorities on climate change, energy consumption, and sustainability targets. Consequently, numerous studies have explored themes such as sustainability, environmental stewardship, and energy efficiency in real

[1] In this study, we focus on Brazil, Chile, and Mexico, as they provide the most comprehensive and representative sample of listed real estate firms in the region. Our selection ensures sufficiently large sample size for robust empirical analysis, allowing for adequate variability within the data and an appropriate degree of freedom for control variables in our econometric models.

estate investments, especially regarding REIT performance (Eichholtz et al., 2012; McCord et al., 2020; Hsieh et al., 2020; Trinh et al., 2023).

Early research primarily concentrated on the environmental impacts and sustainability of operational performance at both the portfolio and asset levels. For instance, a seminal study by Eichholtz et al. (2010), was among the first to establish an empirical link between energy efficiency, sustainability, and performance within the American REIT market, observing that green REITs tended to perform better. Likewise, Fuerst (2015) found that high sustainability scores were associated with enhanced performance and reduced market risk across North American, Asian, and European markets. In the European context, Mariani et al. (2018) further highlighted a negative impact of REIT sustainability on return on assets and return on equity, which may be attributable to the additional costs required for certification.

Further research by Ooi and Dung (2019) on Singaporean REITs revealed a significant positive correlation between the greenness of a portfolio and its operating performance, indicated by higher returns on assets and operating margins. However, their findings suggested that extensive green investments did not significantly influence returns performance, as these effects were already integrated into the REITs' performance metrics. This observation aligns with the findings of Hsieh et al. (2020), who identified a negative correlation between the cost of equity capital and the greenness of REITs. Their analysis indicated both short-term and long-term impacts, proposing that substantial upfront development costs for community and investor needs would eventually yield long-term financial benefits for REITs. Moreover, their study found that larger REITs were more likely to engage in green projects, supporting earlier research that demonstrated a positive relationship between REIT size and institutional investment due to responsible investment practices (Frank & Ghosh, 2012).

Governance and business efficiency

Examining the realm of governance, earlier investigations into the correlation between governance ratings and financial performance—employing diverse financial performance metrics—have produced varied outcomes (Bauer et al., 2010; Hartzell et al., 2008). Early research in the field by Cannon and Vogt (1995) indicated that the structure and participation of shareholders might affect return performance. Nonetheless, subsequent findings from Bauer et al. (2010) demonstrated that governance dimensions did not significantly impact return performance, as assessed by Tobin's *q*, return on assets, and return on equity for REITs, leading to the conclusion that governance is a relatively minor determinant.

Contrastingly, Chong et al. (2016) identified that corporate governance positively influences performance and return on assets, underscoring the critical role of corporate governance. Anglin et al. (2013) also delved into the relationship between corporate governance and REITs, establishing that stringent governance standards add value for investors. Further research by Laresen (2010) assessed ESG practices among prominent U.S. and pan-European institutional real estate open-ended fund managers, pinpointing green regulatory pressures, comprehensive ESG implementation, and the economic benefits of sustainability as essential to investment strategies.

An extensive body of research has also scrutinised the linkage between ESG performance and the impact of the COVID-19 pandemic on the stock performance of listed firms in Europe (Hoang et al., 2021). This study indicated that firms with superior ESG performance experienced lower volatility compared to those with inferior ESG performance during both pandemic and non-pandemic periods. However, it found no evidence suggesting that firms with higher ESG performance enjoyed superior stock performance. The study emphasised the need to meticulously consider ESG ratings and noted the significant impact of COVID-19 factors on stock performance, with notable sectoral and country-specific effects. Similarly, Abedifar et al. (2022) examined whether environmental and social activities affected the resilience of firms in developed countries during the COVID-19 crisis, concluding that engagement in ESG activities did not correlate with improved or diminished performance during crises.

Gender diversity and firm performance

Research on the effect of gender diversity on firm performance in real estate is scant. In the finance literature, empirical studies suggest a positive relationship between female representation within corporate boards and firm performance, particularly in the context of ESG outcomes. Campbell and Mínguez-Vera (2008) find that increasing the percentage of women on boards can generate economic gains, reinforcing the "business case for diversity" proposed by Robinson and Dechant (1997). Women in leadership roles are often associated with enhanced creativity, innovation, and corporate performance (Manita et al., 2018). Empirical investigations, such as those by Shakil et al. (2020) and Romano et al. (2020), further demonstrate that gender-diverse boards contribute to improved ESG performance by fostering greater stakeholder trust and sustainable business practices. The United Nations' Sustainable Development Goals (SDGs) have also encouraged firms to adopt gender-inclusive policies, promoting equality and corporate responsibility. However, contrasting findings, such as those by Manita et al. (2018), suggest that the relationship between board diversity and ESG disclosure remains inconclusive, highlighting the need for further research in this area.

ESG in Brazil's real estate and financial markets

Brazil has been at the forefront of ESG integration within Latin America, driven by both regulatory frameworks and market dynamics. The Brazilian Securities Commission mandates that listed companies disclose their

environmental and social impacts, promoting transparency and enabling investors to make informed decisions based on sustainability performance (Garcia et al., 2017). In addition, Brazil's National Policy on Climate Change (PNMC) sets ambitious targets for reducing greenhouse gas emissions, directly impacting the real estate sector by encouraging sustainable construction practices. Specifically, the PNMC aims to reduce deforestation in the Amazon by 80% and the Cerrado by 40%, and increase the use of renewable energy sources to ensure that 45% of the country's energy mix is renewable. These targets promote the adoption of energy-efficient building designs, the utilisation of sustainable materials, and the implementation of green building standards, all of which are crucial for reducing the carbon footprint of the real estate sector (Schaltegger & Wagner, 2017).

Despite these advancements, challenges remain, such as the need for standardised metrics and reporting frameworks. The diversity in ESG criteria and the lack of comparability make it difficult for investors to assess and compare companies' ESG performance accurately, especially when it comes to non-listed businesses. Furthermore, economic and political instability can disrupt long-term sustainability initiatives (da Gama Pinheiro et al., 2024).

However, the Brazilian market al.o presents significant opportunities for growth in ESG integration. The increasing demand for sustainable investments, driven by both institutional and individual investors, is clearly evident. Listed companies with strong ESG performance are perceived to have better risk management and long-term value creation capabilities (Giese et al., 2019). This trend is particularly relevant in the real estate sector, where sustainable practices can significantly influence property values and operational efficiencies.

ESG in Chile's real estate and financial markets

Chile has also made significant progress in integrating ESG practices within its real estate sector. The Chilean government has introduced various regulations to promote sustainability, including guidelines for energy efficiency and waste management in construction and property development. The financial sector is increasingly recognising the importance of ESG, with growing demand for sustainable investment products (Revelli & Viviani, 2015). Moreover, the Chilean Financial Market Commission (CMF) mandates ESG reporting through Norm of General Character No. 461, which requires public companies to disclose their ESG policies and practices in their annual financial reports. This regulation aims to enhance corporate transparency and integrate ESG considerations into financial risk analysis (Chambers & Partners, 2024). Further, the Chilean Banking Association, through the Green Agreement, promotes the inclusion of ESG principles in corporate governance and risk management. This initiative encourages banks to incorporate environmental and social criteria in their credit and investment analyses, aligning with the global trend towards sustainable finance (Chambers & Partners, 2024).

In terms of challenges in the context of Chile, property companies are increasingly facing pressure from tenants and investors to demonstrate their ESG commitments. However, meeting these expectations consistently can be difficult, particularly in a market where the demand for sustainable properties is still emerging. Balancing these expectations with financial performance goals requires strategic planning and investment at both corporate and national levels (Cohen & Steers, 2022).

ESG in Mexico's real estate and financial markets

In the context of Mexico, the real estate sector faces several challenges in integrating ESG practices. A primary obstacle has been the high initial cost of adopting sustainable technologies and practices. Implementing green building certifications, energy-efficient systems, and sustainable materials requires substantial upfront investment, which can be prohibitive for many developers and investors who often prioritise immediate financial returns over long-term sustainability benefits (Oxford Business Group, 2023).

Another significant challenge is the complexity of regulatory compliance and reporting. Mexico has a developing framework for ESG reporting, and property companies must navigate these regulations while ensuring the accuracy and consistency of their data and information. This complexity can be particularly burdensome for smaller firms that lack the resources to implement comprehensive reporting systems. Moreover, there is a need for enhanced data management and transparency. Effective ESG reporting necessitates robust data systems to capture and analyse ESG metrics, which many firms currently struggle to integrate into their operations (Deloitte, 2023).

Despite these challenges, there are substantial opportunities for advancing ESG practices in Mexico's real estate sector. One significant opportunity lies in the growing demand for sustainable properties, which often enjoy higher occupancy rates and tenant satisfaction. This demand can lead to better financial performance and increased property values, providing a strong incentive for developers to invest in ESG initiatives. Furthermore, the availability of sustainable financing options, such as green bonds and sustainability-linked loans, presents a financial incentive for adopting ESG practices. These instruments offer favourable terms for projects that meet specific ESG criteria, thereby reducing the cost of capital for sustainable developments (Oxford Business Group, 2023). Indeed, the Mexican government is increasingly supporting sustainable development through policies, such as tax benefits for green buildings and support for renewable energy projects. These incentives can help offset some initial costs and make sustainable projects more attractive to investors (Deloitte, 2023).

In Brazil, Chile, and Mexico, the listed real estate sector comprises both large, well-capitalised developers and smaller firms, reflecting the diverse structure of these markets. Major developers and REITs (such as Fibra Uno in Mexico, BR Properties in Brazil, and Parque Arauco in Chile)

play a significant role in shaping the real estate landscape, with varying levels of ESG adoption depending on firm size, regulatory incentives, and market maturity. Generally speaking, while larger firms are more likely to integrate ESG principles due to greater resources and institutional pressures, smaller developers often face challenges in ESG implementation due to limited reporting capabilities and financial constraints. What makes this study particularly relevant is the growing adoption of ESG in the region's real estate sector. Unlike developed markets, where ESG integration is more established, these three sample countries are at a critical juncture, with regulatory shifts and investor demand shaping their ESG trajectories. These countries share common emerging market characteristics, such as evolving governance structures, increasing foreign investment in sustainable assets, and significant urbanisation trends, all of which influence the relationship between ESG and financial performance. Our study contributes to the ongoing discourse by providing empirical insights from a region that remains underrepresented in ESG-real estate research, offering new perspectives beyond the more extensively studied North American and European markets.

3. Data and methodology

We procured financial data from Bloomberg[2] and financial reports concerning listed real estate firms on the three Latin American stock exchanges previously delineated. A cohort of 44 companies was selected, primarily based on specific selection criteria to ensure data consistency and comparability. These criteria include: (i) the availability of complete and reliable ESG disclosures across the sample period, (ii) financial transparency as indicated by publicly accessible financial reports, and (iii) market capitalisation thresholds (over USD 20M) to ensure that the selected firms are sufficiently representative of the listed real estate sector in Brazil, Chile, and Mexico. While the sample size may be relatively small, it reflects publicly traded real estate firms in Latin America with consistent ESG reporting. Given that ESG data availability remains a key constraint in emerging markets, our approach ensures that the firms analysed have high data reliability, thereby reducing potential biases associated with missing or inconsistent ESG information. In our empirical analysis, the ESG attributes scrutinised include: (i) energy consumption, (ii) greenhouse gas emissions, (iii) water consumption, (iv) the existence of policies regarding green-certified buildings, (v) gender diversity, (vi) recognition of employee and building health and safety, (vii) expenditure on community engagement, and (viii) corporate policies and governance. The investigation period spans from 2015 H1 to 2023 H2, covering 18 half-yearly data points for each cross-section of the companies, with a data purification process undertaken to ensure analytical consistency. In our regressions, the number of firm-period observations varies, typically ranging in the hundreds for each model, depending on the regression specifications and the availability of complete data for specific variables. For transparency, we provide details on the number of cross-sections and firms, as well as the number of firm-period observations included in each model. Local currencies[3] were used to measure performance to maintain coherency and avoid inconsistencies arising from fluctuations between the currencies during the study period. Within our sample, the majority (75%) of the real estate companies focus on property development, while the remaining primarily engage in REIT businesses. This distinction among the companies is accounted for in our statistical models.

A distinguishing feature of our study, setting it apart from other mainstream ESG research, is our dual focus on both ESG disclosure and ESG performance. The former pertains to the degree of transparency exhibited by companies in reporting their ESG practices and standards. This is quantified using three distinct disclosure scores: Environmental Disclosure Score (EDS), Social Disclosure Score (SDS), and Governance Disclosure Score (GDS), culminating in an overall ESG Disclosure Score (ESGDS). The latter employs the Bloomberg ESG Pillar score/percentile (BESG) to gauge the actual ESG performance of the companies. Specifically, the Environmental (E), Social (S), and Governance (G) scores, as well as the aggregate ESG score, are measured and presented both individually and in aggregate. Table 1 delineates the definitions of the financial performance attributes and ESG attributes examined in this study.

[2] We thank an anonymous reviewer for highlighting the limitations of using Bloomberg ESG data. A limitation of this study is its reliance on Bloomberg ESG scores, which, while widely used, may not fully capture the nuances of ESG practices in emerging markets, where reporting standards and transparency vary. Pertinently, companies in these regions may disclose ESG information selectively, introducing potential biases in the scores. Since Bloomberg primarily aggregates publicly available data, it may overlook informal or non-standardised sustainability efforts. Additionally, the scores may tend to favour larger firms with structured reporting, potentially underrepresenting smaller companies' ESG efforts. Future research could benefit from using alternative metrics, such as independent ratings from sustainability indices, expert assessments, and self-reported corporate disclosures. We are in the opinion that acknowledging these biases enhances research credibility and provides a more objective evaluation of ESG performance.

[3] The choice to use local currencies for calculating Sharpe ratios and raw returns as the dependent variables stems from the need to reflect the operational reality of the firms in their specific markets. As the financial performance of real estate companies is primarily influenced by local economic conditions, including exchange rate risk, inflation, and country-specific financial factors, using local currencies ensures that we capture the true risk-adjusted returns within each country's context. Converting returns to USD could introduce noise from exchange rate fluctuations, which might obscure the actual performance of firms operating in different market environments. This approach aligns with firm-level analysis, where the focus is on understanding performance in the context of the firms' local operations.

Table 1. Definitions of the variables

	Variable	Definition
Dependent variables	Raw Return (RAW)	The pre-tax stock return measured on a year-over-year basis
	Sharpe Ratio (Sharpe)	Calculated as the annual return of the stock divided by the standard deviation of its quarterly returns over a one-year period
	Tobin's *q*	The ratio of a firm's market value to the replacement cost of its assets, is a valuable tool for company valuation. It is based on the hypothesis that, in the long run, a company's market value should approximately equal the cost of replacing its assets
Financial variables	Market Capitalisation (CAP)	The monetary value of all outstanding shares expressed in the pricing currency is known as capitalisation. It serves as a measure of corporate size
	Loan to Value (LTV)	The leverage ratio, expressed as a percentage, represents the total amount of debt relative to assets. This ratio allows for comparisons of leverage across different companies. It is calculated using the formula: Total Debt x 100 / Total Assets
	Growth in Revenue (REV)	The year-on-year rate of change in revenue, defined as the total sales generated by a company after deducting sales returns, allowances, discounts, and sales-based taxes
	Return on Common Equity (ROE)	It is a measure of a corporation's profitability, expressed as a percentage, that reveals how much profit a company generates with the money shareholders have invested. It is defined as the net income available to common shareholders divided by the average total common equity
	Dividend Yield (D)	The sum of gross dividends per share that have gone ex-dividend over the prior 12 months, divided by the current stock price
ESG variables[4]	Inverse of Energy Consumption per Market Cap (INV_ ENERGY)	The inverse of total energy consumption, measured in thousands of megawatt hours (MWh), divided by market capitalisation. This includes energy directly consumed through combustion in owned or controlled boilers, furnaces, and vehicles, or through chemical production in owned or controlled process equipment, as well as energy consumed as electricity
	Inverse of Greenhouse Gas Emission per Market Cap (INV_GHG)	The inverse of total greenhouse gas (GHG) emissions per market capitalisation, if available, otherwise the inverse of total carbon dioxide (CO2) emissions in millions of metric tonnes Total GHG emissions are the sum of Scope 1 and Scope 2 GHG emissions. Total CO2 emissions are the sum of direct and indirect CO2 emissions
	Inverse of Water Consumption per Market Cap (WATER)	The inverse of total amount of water used to support a company's operational processes, measured in thousands of cubic meters, divided by market capitalisation
	Percentage of Women in Workforce (WOMEN)	The number of women employed at the company, expressed as a percentage of the total number of employees
	Health and Safety Policy (HS)	Indicates whether the company has recognised its health and safety risks and responsibilities at the policy level and is making efforts to improve the management of employee health and/or safety. It is a binary variable, equal to one if such a policy exists and zero otherwise

[4] In our study, Bloomberg's ESG Disclosure Scores assess the extent of transparency in a company's ESG data. These scores encapsulate the scope and detail of ESG information that a company publicly discloses, thereby assisting investors in evaluating corporate transparency and commitment to ESG principles. The methodology underpinning these scores involves Bloomberg aggregating ESG data from publicly available sources, including annual reports, sustainability disclosures, company websites, and regulatory filings. This data spans over 120 ESG metrics, covering environmental, social, and governance dimensions. Each metric is assessed on whether the company has disclosed relevant information, focusing purely on the presence or absence of disclosure rather than the quality or performance of the information provided. The ESG Disclosure Score is calculated on a scale from 0 to 100, with higher scores denoting more comprehensive ESG disclosure. The score represents the proportion of applicable ESG metrics that a company reports. To provide meaningful context, companies are benchmarked against their industry peers, enabling investors to gauge a company's disclosure practices relative to others within the same sector. It is crucial to highlight that the ESG Disclosure Score measures the extent of disclosure and not the actual quality of ESG performance or impact. A high score signals transparency but does not necessarily indicate superior ESG practices. In contrast, Bloomberg's ESG Pillar Percentiles evaluate a company's performance in the Environmental, Social, and Governance domains relative to its industry peers. These metrics are derived from Bloomberg's extensive collection of ESG data sourced from company filings, annual reports, and regulatory disclosures. The data encompasses a wide array of ESG factors, such as carbon emissions, workforce diversity, and board composition. Each ESG data point is evaluated using parametric scoring models tailored to the specific metric. These models account for factors such as data type, polarity (positive or negative impact), and industry relevance. For instance, metrics like greenhouse gas emissions and water usage are scored based on predefined criteria. Individual metric scores are then aggregated into broader categories, forming a hierarchical structure that supports a comprehensive and nuanced analysis of specific ESG areas. These aggregated issue scores are further consolidated into theme scores, which reflect critical aspects of ESG performance within each pillar. The theme scores are then combined to produce overall Pillar Scores for Environmental, Social, and Governance performance, with scores ranging from 0 to 10, where 10 represents the highest level of performance. A weighted generalised mean is employed in this aggregation process to account for the varying importance of each theme. To enable comparison across companies, each Pillar Score is converted into a percentile rank. This rank indicates how a company's ESG performance compares with its peers within the same industry, with higher percentiles signifying superior ESG practices.

End of Table 1

	Variable	Definition
ESG variables	Green Certified Building (GB)	Indicates whether the company has developed a policy recognising the importance of building energy efficiency. It is a binary variable, equal to one if such a policy exists and zero otherwise
	Community Spending per Market Cap (COMM)	The amount of money spent by the company on community-building activities, measured in millions, divided by market capitalisation. This includes both cash and in-kind donations (if given a monetary value) and excludes employee contributions and money raised through events
	Governance Disclosure Score (GDS)	The proprietary Bloomberg score is based on the extent of a company's Governance data disclosure, which is a pillar of Environmental, Social, and Governance data. The score ranges from 0 for companies that do not disclose any Governance data included in the score, to 100 for those that disclose every data point. This score measures the amount of Governance data a company reports publicly and does not evaluate the company's performance on any data point
	Social Disclosure Score (SDS)	The proprietary Bloomberg score is based on the extent of a company's Social data disclosure, a key component of Environmental, Social, and Governance data. The score ranges from 0 for companies that do not disclose any Social data included in the score to 100 for those that disclose every data point. This score measures the amount of Social data a company reports publicly and does not evaluate the company's performance on any data point
	Environmental Disclosure Score (EDS)	The proprietary Bloomberg score is based on the extent of a company's Environmental data disclosure, a key component of Environmental, Social, and Governance (ESG) data. The score ranges from 0 for companies that do not disclose any Environmental data included in the score to 100 for those that disclose every data point. This score measures the amount of Environmental data a company reports publicly and does not evaluate the company's performance on any data point
	ESG Disclosure Score (ESGDS)	The proprietary Bloomberg score is based on the extent of a company's ESG data disclosure, encompassing Environmental, Social, and Governance data. The score ranges from 0 for companies that do not disclose any ESG data included in the score to 100 for those that disclose every data point. This score measures the amount of ESG data a company reports publicly and does not evaluate the company's performance on any data point
	BESG Environmental Pillar Score (ES)	The Bloomberg Environmental and Social scoring peer group percentile ranking is based on the proprietary Bloomberg Environmental score. This ranking ranges from 0 to 100%, indicating how a company's Environmental score compares to its peers
	Bloomberg's Social Pillar Score (SS)	The proprietary Bloomberg score, ranging from 0 to 10, evaluates a company's aggregated Social performance
	BESG Governance Pillar Score (GS)	The Bloomberg Environmental, Social, and Governance scoring peer group percentile ranking is based on the proprietary Bloomberg Governance pillar score. This ranking ranges from 0 to 100%, indicating how a company's Governance score compares to its peers

The quantitative analysis of this study comprises two main components. First, we assess whether ESG attributes are cointegrated with the performance of these companies and whether there exists a lead-lag relationship between the two groups of variables. Second, we evaluate the extent to which the performance of companies, as measured by raw return, Sharpe ratio, and Tobin's *q*, can be attributed to the implementation of ESG policies at the corporate level. This evaluation takes into account firm-level characteristics such as market capitalization (Cap), leverage ratio (LTV), ownership characteristics, return on equity, growth in revenue, dividend yields, and more.

To examine the ESG performance drivers affecting each listed real estate submarket, we perform cointegration and causality testing. The return/performance (R) of the sample listed real estate companies will be examined alongside time series data for the ESG variables ($ESG_1, ESG_2, \ldots\ldots, ESG_n$). The subsets of ESG in our study include: Inverse of energy usage per market cap (INV_ENERGY), Inverse of GHG emissions per market cap (INV_GHG), Inverse of water consumption per market cap (INV_WATTER), green certified buildings (GB), gender diversity (WOMEN), health and safety of employees and buildings, community engagement (COMM), Corporate policies and governance (GDS). Applying inverse operators to specific variables simplifies the analysis by investigating if decreasing resource usage (such as energy and water) results in improved financial outcomes. Prior to performing cointegration and causality tests, IPS (Im, Pesaran, and Shin) tests are conducted to identify unit roots within the time series. Depending on the outcomes of these tests, differencing is then applied to the data.

To identify long-term equilibrium relationships between each pair of *R* and *ESG*, we employ Pedroni's (2004) panel data cointegration method, which is represented as:

$$R_{it} = \alpha_i + \sum \beta_{ji} ESG_{jit} + e_{it}. \quad (1)$$

In the equation, e_{it} represents the residuals from the panel regression analysis. Pedroni's methodology evaluates seven distinct test statistics derived from these residuals within the context of a long-run model, operating under the null hypothesis that no cointegration exists within heterogeneous panels. These tests are bifurcated into "within dimension" (panel tests) and "between dimension" (group tests). The former integrates common

temporal factors while accommodating heterogeneity across panel members, whereas the latter accounts for parameter heterogeneity among members. Should the test statistics surpass the critical values, the null hypothesis of no cointegration is rejected.

Upon establishing a cointegration relationship between variable pairs, we implement panel causality tests developed by Holtz-Eakin et al. (1989), to ascertain any lead-lag dynamics within the examined time series. Their time-stationary VAR model is articulated as follows:

$$R_{it} = \alpha_0 + \sum_{j=1}^{m} \alpha_i R_{it-i} + \sum_{j=1}^{m} \gamma_j ESG_{it-j} + f_{xi} + u_{it};$$

$$ESG_{it} = \beta_0 + \sum_{j=1}^{m} \beta_i R_{it-i} + \sum_{j=1}^{m} \delta_j ESG_{it-j} + f_{xi} + v_{it}. \quad (2)$$

where: R_{it} and ESG_{it} represent the variables of interest for cross-sectional panel member i at time t; α_0 and β_0 are constants; u_{it} and v_{it} are the residuals. The fixed effects f_{xi} capture individual-specific characteristics for panel member i. This model incorporates lagged terms to discern the lead-lag dynamics and potential causality between ESG and R. For short-term causality, the focus is on the immediate past values of the variables. If the coefficients γ_j (for ESG Granger-causing R) or β_j (for R Granger-causing ESG) are statistically significant, it indicates short-term Granger causality. Statistically, the lagged dependent variables are likely to exhibit correlation with both the residuals and the fixed effects terms, potentially leading to biased estimates when using Ordinary Least Squares. To address this issue, we eliminate the fixed effects through differencing, resulting in the following equations:

$$\Delta R_{it} = \sum_{j=1}^{m} \alpha_j \Delta R_{it-j} + \sum_{j=1}^{m} \gamma_j \Delta ESG_{it-j} + \Delta u_{it};$$

$$\Delta ESG_{it} = \sum_{j=1}^{m} \beta_j \Delta R_{it-j} + \sum_{j=1}^{m} \delta_j \Delta ESG_{it-j} + \Delta v_{it}. \quad (3)$$

Econometrically, after applying differencing, issues of simultaneity may arise due to the correlation between the lagged endogenous variables and the differenced error term. Furthermore, the error terms might exhibit heteroscedasticity across different panel members. To mitigate these issues, we utilise an instrumental variable estimation procedure, which aims to yield more consistent coefficient estimates. According to Easterly et al. (1997), the second or higher-order lagged values of the variables can be used as instruments, assuming that u_{it} and v_{it} are serially uncorrelated.

To test for long-term causality, the joint hypothesis $\gamma_j = 0$ and $\beta_j = 0$ is examined. The Generalised Method of Moments is employed to estimate the equations due to its superior efficiency and consistency relative to other estimation methods (Arellano & Bond, 1991). The test statistics are distributed according to a Chi-squared distribution, with the degrees of freedom equal to $k-m$, where k represents the number of regressors.

Company-level financial performance and ESG

In addition, we investigate the impact of company-level ESG attributes on the performance of the sampled real estate firms within a panel data framework. Tobin's q ($Q_{i,t}$) along with raw return and risk-adjusted return, serves as the primary metric for assessing a firm's performance at time t. Tobin's q is defined as the ratio of the market value of a company's equity and liabilities to their respective book values. Mathematically, it is expressed as:

$$Tobin's\, q\left(Q_{i,t}\right) = \frac{Equity\ Market\ Value + Liabilities\ Market\ Value}{Replacement\ Cost\ of\ Assets}. \quad (4)$$

Firms exhibiting a high Tobin's q have traditionally been considered superior investment opportunities (Lang & Stulz, 1994) and are often associated with greater growth potential (Brainard & Tobin, 1968; Tobin, 1969). To assess the impact of firm-specific attributes on performance, we formulate an equation that correlates performance metrics with a diverse set of company-level characteristics (Equation 5). The characteristics examined include: (1) market capitalisation (Cap), which is measured in USD; (2) leverage ratio (L), defined as the debt-to-equity ratio; (3) dividends (D); (4) return on equity (ROE), quantifying the firm's profitability; and (5) corporate structure (V), a binary variable indicating whether the firm is a REIT or not; and (6) Growth in Revenue (REV), defined as total sales generated by the company year-on-year after deducting sales returns, allowances, discounts, and sales-based taxes. The selection of these independent variables are based on Haran et al. (2021), which empirically uncovers firm-level attributes affecting listed real estate performance.

$$Q_{i,t} = c + \varphi_1 Cap_{i,t} + \varphi_2 L_{i,t} + \varphi_3 D_{i,t} + \varphi_4 O_{i,t} + \varphi_5 ROE_{i,t} + \varphi_6 REV_{i,t} + \varphi_7 V_{i,t} + \sum_{j}^{m} w_j ESG_{i,t,j} + \sum_{k}^{n} \mu_k C_{i,t,k} + e_{i,t}, \quad (5)$$

where: c denotes a constant; the seven φ_s are coefficients to be estimated for the firm-level variables; w_j are coefficients for the various ESG attributes; $\sum C$ represents a range of control variables, encompassing factors such as the firm's business focus, country of domicile among others, with μ_k being the coefficient to be estimate for each C; $e_{i,t}$ denotes the error term of the regression equation. We formulate three distinct model sets based on Equation (5), each exclusively targeting a single performance indicator. Each model set comprises 14 equations, with each equation investigating one specific ESG attribute alongside the control variables (Models 1–14 focus on raw return; Models 15–28 on the Sharpe ratio; and Models 29–42 on Tobin's q). All analyses are conducted on a half-yearly basis.

4. Descriptive statistics

In examining the ESG attributes of listed real estate companies in Brazil, Chile, and Mexico, notable differences and similarities emerge (Table 2). Brazil, with 22 firms comprising 3 REITs, exhibits a relatively balanced ESG profile but lags behind in environmental metrics. The average environmental score for Brazilian firms is 1.71, significantly lower than Chile's 2.88 and Mexico's 2.21. This discrepancy is reflected in Brazil's higher energy consumption per USD 1 million market cap at 759.90 kMWh, compared to Chile's 537.86 kMWh and Mexico's notably higher 1316.95 kMWh. In addition, Brazil's greenhouse gas emissions per USD 1 million market cap (65.02 MtCO2e) are slightly higher than those of Chile (49.42 MtCO2e) and Mexico (51.60 MtCO2e), indicating room for improvement in energy efficiency and emissions reduction. Despite these environmental challenges, Brazil's real estate companies show an historical average raw return of 4.05%, which is modest compared to Chile's 5.45% but close to Mexico's 4.12%.

Social and governance attributes also reveal contrasting dynamics. Chile leads in social scores, with an average of 6.19, followed closely by Mexico at 6.06, while Brazil scores 4.09. This high social performance in Chile is further supported by the highest percentage of women in the workforce (52.97%), compared to Brazil's 42.43% and Mexico's 37.16%. Governance scores tell a different story, with Brazil achieving the highest average governance score of 4.57, suggesting a stronger emphasis on governance practices compared to Chile (2.98) and Mexico (3.26), despite the fact that these three counties underperform North America and Europe significantly in governance (Lo et al., 2023). Community spending per USD 1 million market cap is highest in Chile at USD 1202, followed by Brazil at USD 1002, and Mexico at USD 763, reflecting differing priorities and capacities for community engagement. Chile's strong ESG scores in environmental and social dimensions appear to be associated with better financial outcomes. Conversely, Mexico, with middling environmental and governance scores but high social scores, achieves a raw return of 4.12%, suggesting that while ESG factors are important, other economic factors also play a crucial role in determining returns. These comparative insights highlight the diverse ESG landscapes in Latin America and underscore the varying focal points and challenges each country faces in advancing sustainable practices while maintaining overall financial performance.

The correlation matrix depicted in Table 3 reveals notable relationships between various ESG scores and the three key financial indicators. Firstly, the Environmental Score (ES) exhibits a moderate positive correlation with Tobin's *q* (0.62), suggesting that firms with higher environmental performance tend to have better market valuations. Furthermore, the ES is positively correlated with the Sharpe Ratio (0.32), indicating that these firms also experience more favourable risk-adjusted returns. This could be due to the growing investor preference for companies with strong environmental practices, which can lead to more sustainable financial performance.

Conversely, the Social Score (SS) shows a negative correlation with the Sharpe Ratio (–0.35) and a weak negative correlation with Raw Return (–0.07). This could imply that while social initiatives are important, they may not immediately translate into enhanced financial returns or improved risk-adjusted performance in the short term within the Latin American context. However, the positive correlation between SS and Tobin's *q* (0.31) suggests that social factors do contribute to better long-term market valuations, although the effect is relatively modest. Governance Score (GS) demonstrates a strong positive correlation with

Table 2. Descriptive statistics of the sample countries

	Brazil	Chile	Mexico
No. of sample companies	22	7	15
No. of REITs	3	0	8
Av. hist. annual raw return (pre-dividend)	4.05%	5.45%	4.12%
Aggregate market cap (sample companies)	USD 22.04 B	USD 7.34 B	USD 24.58 B
Max. market cap (firm)	UDD 7.4 B	USD 2.9 B	USD 4.1 B
Min. market cap (firm)	USD 0.9 B	USD 0.7 B	USD 0.6 B
Average env. score	1.71	2.88	2.21
Average social score	4.09	6.19	6.06
Average gov. score	4.57	2.98	3.26
Energy/USD1M cap	759 kMWh	537 kMWh	1316 kMWh
GHG/USD1M cap	65.03 MtCO2e	49.41 MtCO2e	51.33 MtCO2e
Water/USD1M cap	3827.93 m^3	2280.20 m^3	3733.71 m^3
Community spending/ USD1M cap	USD 1,002	USD 1,202	USD 763
Percentage of women	42.43%	52.97%	37.16%

Notes: Figures are based on data from December 2023.

Table 3. Correlation matrix (aggregate level)

	Raw	Sharpe	Tobin's *q*	Env.	Social	Gov.
Env.	0.14	0.32	0.62	1		
Social	–0.07	–0.35	0.31	0.63	1	
Gov.	0.25	0.31	0.63	0.64	0.61	1
ESG	0.21	0.41	0.58	0.72	0.65	0.82

Tobin's *q* (0.63) and moderate positive correlations with both Raw Return (0.25) and Sharpe Ratio (0.31), underscoring the critical role of governance practices in enhancing both immediate financial performance and long-term valuation. These findings highlight the multifaceted impact of ESG components, where environmental and governance factors are more directly linked to financial metrics, while social factors may require a longer horizon to manifest their benefits.

Our empirical models utilise data from 44 firms.

5. Empirical results

The results of the IPS Unit Root Tests, as displayed in Table 4, indicate that all the time series under examination are non-stationary at their levels but stationary at their first differences, with significance at the 1% level. Consequently, in the subsequent analysis, we treat these time series as integrated of order one.

Table 4. Results of IPS unit root tests

Variable	Level	First difference
RAW	0.22304 (0.8041)	–4.35354 (0.0000)***
Sharpe Ratio	0.11833 (0.7333)	–2.44346 (0.0012)***
Tobin's *q*	0.44334 (0.5692)	–3.83430 (0.0002)***
INV_ENERGY	–0.33545 (0.7820)	–5.03344 (0.0000)***
INV_GHG	2.43555 (0.9211)	–7.33223 (0.0000)***
INV_WATER	1.22033 (0.7823)	–6.32444 (0.0000)***
COMM	1.20002 (0.6789)	–9.4499 (0.0001)***
WOMEN	3.23332 (0.8374)	–6.82332 (0.0000)***
GDS	3.82332 (0.9243)	–3.7888 (0.0003)***
EDS	–0.29388 (0.4432)	–2.50332 (0.0217)**
SDS	3.89223 (0.9962)	–5.43429 (0.0000)***
ESGDS	2.89233 (0.8788)	–5.04344 (0.0000)***
ES	3.43934 (0.8273)	–3.23222 (0.0007)***
SS	0.64883 (0.7823)	–8.34226 (0.0000)***
GS	–1.42999 (0.2245)	–11.32322 (0.0000)***

Notes: ** and *** indicate statistical significance at the 5% and 1% level respectively.

The result of the cointegration tests are presented in Table 5. For Raw Return, significant cointegration is observed across all ESG variables, indicating that ESG factors have a substantial long-term impact on stock returns. Specifically, variables such as INV_ENERGY, INV_GHG, and INV_WATER demonstrate strong significance (Panel v-stat, PP-stat, and ADF-stat all significant at the 1% level), suggesting that lower energy consumption, greenhouse gas emissions, and water usage relative to market cap are associated with more robust long-term stock performance. This highlights the increasing importance of environmental efficiency in driving financial returns, likely due to growing investor emphasis on sustainability and regulatory pressures.

In relation to Sharpe Ratio, which measures risk-adjusted return, the analysis shows varied cointegration results. Some ESG variables such as INV_WATER, WOMEN, and HS (Health and Safety Policy) exhibit significant long-term relationships, with WOMEN and HS showing particularly strong cointegration (Panel v-stat significant at the 1% level). This indicates that firms with better water management practices, a higher percentage of women in the workforce, and robust health and safety policies tend to achieve more favourable risk-adjusted returns over time. However, the overall cointegration results for Sharpe Ratio are mixed, suggesting that while some ESG factors contribute to reduced financial risk, others may not have as direct an impact. For Tobin's *q*, cointegration with almost all ESG variables is evident, underscoring that effective environmental practices, social policies, and governance disclosures are critical for achieving higher market valuations. This demonstrates that investors place a high premium on comprehensive ESG disclosures and practices, reflecting their belief in the long-term benefits of sustainable and ethical business operations.

Table 6 summarises the findings of the Granger causality tests with Table A1 in Appendix presenting the results of the Tobin's *q* models[5]. The results indicate several noteworthy short-term and long-term causal relationships, highlighting the bidirectional and unidirectional influences between these variables. In the realm of environmental

[5] Due to space constraints, only the results of the Tobin's *q* models are presented with key regression coefficients and statistics reported. Full results of the raw return and Sharpe ratio models are available upon request.

Table 5. Results of Pedroni's cointegration tests

Raw return							
Variable	Panel v-stat	Panel rho-stat	Panel PP-stat	Panel ADF-stat	Group rho-stat	Group PP-stat	Group ADF-stat
INV_ENERGY	6.293882***	–13.49534***	–13.59466***	–3.323322***	–4.530233***	–9.323444***	–7.344335***
INV_GHG	5.234234***	–11.43504***	–14.22333***	–3.094433***	–3.329933***	–11.43431***	–6.569633***
INV WATER	5.594923***	–8.093358***	–9.604544***	–2.640227***	–4.320910***	–9.940344***	–3.443999***
COMM	3.203994***	–11.29433***	–11.02244***	–2.730499***	–4.520330***	–8.500054***	–4.443948***
WOMEN	4.634244***	–11.09833***	–6.203333***	–4.844696***	–3.609022***	–12.90346***	–6.443434***
HS	7.755322***	–8.036776***	–8.640993***	–4.440688***	–4.214803***	–7.230021***	–4.129444***
GB	4.023554***	–12.63364***	–12.02322***	–7.405444***	–6.919344***	–9.938778***	–5.112452***
GDS	3.703495***	–12.02899***	–12.90263***	–6.664422***	–9.532033***	–11.33393***	–7.554512***
EDS	3.034964***	–13.49894***	–19.03399***	–6.901123***	–8.304895***	–11.23232***	–8.498885***
SDS	7.043883***	–12.21033***	–15.44034***	–6.103846***	–9.590993***	–12.50788***	–7.443377***
ESGDS	7.683464***	–19.60345***	–15.90990***	–6.223921***	–9.503889***	–13.68784***	–7.434434***
ES	3.029487***	–6.740533***	–8.211221***	–2.034911***	–3.203585**	–8.234955***	–4.999544***
SS	2.403884**	–5.789903***	–6.546022***	–3.593991***	–2.590055**	–8.499424***	–2.395009***
GS	3.349664***	–5.999033	–8.022236***	–3.544340***	–2.399935**	–6.459385***	–3.393373***
Sharpe							
Variable	Panel v–stat	Panel rho–stat	Panel PP–stat	Panel ADF–stat	Group rho –stat	Group PP–stat	Group ADF–stat
INV_ENERGY	–0.329933	–11.53911***	–13.49568***	–6.495343***	–4.946623***	–13.43232***	–5.706569***
INV_GHG	–1.405699	–12.25055***	–14.39570***	–6.439677***	–5.492433***	–14.677345***	–5.344377***
INV_WATER	4.234553***	–0.439455	–8.500342***	–0.600233***	–3.099314***	–5.846765***	–3.520045***
COMM	–0.424055	–7.943387***	–5.329444***	–2.120964***	–3.414930***	–7.637865***	–2.411231***
WOMEN	2.023055**	4.003900	–7.420264***	6.402344***	6.406744***	4.864355	4.407226
HS	1.094503*	–9.757551***	–8.205995***	–3.628443***	–5.329533***	–8.705976***	–4.868031***
GB	–11.30434	–5.067577***	0.040025	7.395000***	2.423322	–0.439588	0.373041
GDS	1.430924	–16.20533***	–16.40255***	–8.323332***	–10.32059***	–17.69234***	–6.617866***
EDS	1.204233	–17.42233***	–16.53496**	–8.704967***	–9.492099***	–16.43966***	–7.191418***
SDS	4.495640***	–17.50223***	–17.67393	–9.652725***	–9.311046***	–18.23054***	–7.152008***
ESGDS	3.239935***	–15.39554***	–12.38564***	–9.725532***	–10.93048***	–13.44305***	–9.804019***
ES	–4.604934	–7.306854***	–12.33456***	–5.683895***	–3.329588***	–13.59209***	–5.923891***
SS	–2.240663	–5.504333***	–12.46204***	–4.446893***	–3.200566***	–13.64094***	–5.820392***
GS	–4.239553	–7.492466***	–11.39588***	–4.433064***	–3.329553***	–12.43964***	–4.198598***
Tobin's *q*							
Variable	Panel v-stat	Panel rho-stat	Panel PP-stat	Panel ADF-stat	Group rho-stat	Group PP-stat	Group ADF-stat
INV_ENERGY	0.396554	–3.233233***	–4.323933**	–5.323993***	–4.323232***	–4.329992***	–7.439644***
INV_GHG	0.545233	–3.494304***	–4.320943***	–4.339933***	–5.353232***	–3.909258***	–6.234934***
INV_WATER	0.324643	–1.043644**	–3.543113***	–4.212938***	–6.753445***	–3.430593***	–4.752032***
COMM	0.430497	–6.433445***	0.312943	–4.439911***	–7.594458***	0.324233	–6.423427***
WOMEN	–106.7673	–1.634543**	–7.532193***	–6.329994***	–7.434993***	–5.393847***	–10.32423***
HS	1.345349	–4.763486***	–7.342109***	–2.493093**	–4.439439***	–3.328539***	–4.324488***
GB	0.403944	–6.362155***	–4.324234***	–4.239293***	–4.551034***	–2.429387***	–6.992730***
GDS	–0.932833	–5.550394***	–8.999232***	–4.932320***	–8.439099***	–4.438554***	–9.523420***
EDS	0.345345	–6.450954***	–13.03954***	–6.343888***	0.439564	–6.429333***	–10.54234***
SDS	0.744437	–6.090039***	–9.034331***	–5.112495***	–6.439588***	–5.429477***	–9.53234***
ESGDS	–0.893579	–6.201323***	–9.090003***	–6.219911***	–4.434430***	–6.586732***	–10.24234***
ES	0.327048	–7.532121***	–11.93995***	–6.333209***	0.399040	–4.329577***	–12.13959***
SS	7.429444***	–6.415687***	–10.35934***	–5.324965***	–6.993200***	–4.328473***	–11.11294***
GS	2.535775	–7.785140***	–12.42909***	–7.323432***	–6.329393***	–4.359328***	–12.38533***

Notes: *, ** and *** indicate statistical significance at the 10%, 5% and 1% level respectively.

Table 6. Summary of panel data causality tests

	Financial indicators					
	Raw		Sharpe		Tobin's *q*	
Causality	Short term	Long term	Short term	Long term	Short term	Long term
INV_ENERGY → Y	Yes	Yes	Yes	Yes	Yes	Yes
Y → INV_ENERGY	No	No	No	Yes	Yes	No
INV_GHG → Y	No	No	No	Yes	No	No
Y → INV_GHG	Yes	No	Yes	No	No	Yes
INV_WATER → Y	Yes	Yes	Yes	Yes	No	No
Y → INV_WATER	No	No	No	No	No	No
WOMEN → Y	No	Yes	Yes	No	Yes	No
Y → WOMEN	Yes	Yes	No	Yes	No	Yes
COMM → Y	No	No	No	No	No	No
Y → COMM	No	No	No	No	No	No
EDS → Y	No	Yes	No	Yes	No	Yes
Y → EDS	No	Yes	No	Yes	No	No
SDS → Y	No	No	No	Yes	No	No
Y → SDS	No	No	No	No	No	No
GDS → Y	No	Yes	No	Yes	No	Yes
Y → GDS	No	No	Yes	Yes	No	Yes
ESGDS → Y	No	Yes	No	Yes	No	Yes
Y → ESGDS	Yes	Yes	No	Yes	No	Yes
ES → Y	No	Yes	No	Yes	No	No
Y → ES	Yes	No	Yes	Yes	No	Yes
SS → Y	No	No	No	Yes	No	No
Y → SS	No	No	No	Yes	No	Yes
GS → Y	No	No	No	Yes	No	Yes
Y → GS	No	No	No	No	No	No

Notes: To test short-term Granger causality, we use a VAR model with lagged terms of R and ESG. The Wald test determines if the lagged ESG coefficients are significant. For instance, if the test statistic exceeds the critical value, it indicates short-term causality from ESG to R. For long-term causality, we first confirm cointegration using Pedroni's method. We then use an Error Correction Model to assess long-term adjustments. The Wald test examines whether the EC term is negative and significant. Due to space limitations, full results are available upon request.

attributes, INV_ENERGY exhibits bidirectional causality with Sharpe Ratio. This suggests that improvements in energy efficiency not only enhance financial performance but are also driven by it. The mutual reinforcement between energy efficiency and financial success aligns with the resource-based view, which posits that firms with unique capabilities, such as more advanced environmental practices, can achieve a competitive financial advantage (Barney, 1991). Furthermore, this bidirectional relationship indicates a virtuous cycle where profitable firms are more likely to invest in energy-saving measures, further enhancing their financial performance. However, the causality between INV_ENERGY and Tobin's *q* is unidirectional in the long run, with INV_ENERGY influencing Tobin's *q* but not the other way around, suggesting that energy efficiency significantly contributes to firm valuation over time. It is further noteworthy that INV_GHG Granger-causes the Sharpe Ratio in the long run. The findings also suggest that a reduction in water consumption can lead to improvements in both raw return and the Sharpe Ratio in the long term, highlighting that adopting environmentally conscious practices can potentially be value-enhancing.

For social variables, the percentage of women in the workforce (WOMEN) shows bidirectional causality with Raw Return, indicating that gender diversity not only contributes to better financial performance but is also enhanced by it. This finding is in line with the well-established stakeholder theory (Freeman & Medoff, 1985), which emphasises that addressing the interests of all stakeholders, including promoting gender diversity, leads to long-term success. Similarly, WOMEN demonstrates unidirectional causality with Tobin's *q*, where higher firm valuation encourages greater gender diversity in the workforce.

Governance variables, particularly GDS, also display significant causal relationships. GDS shows bidirectional causality with both Sharpe Ratio and Tobin's *q*, suggesting that transparent governance practices enhance risk-adjusted returns and firm valuation, and vice versa. This is consistent with the widely recognised signalling theory, where robust governance signals strong management and lower risk to investors (Spence, 1974). The bidirectional causality between ESGDS and the three financial time series further indicates that firms achieving better returns are

likely incentivised to improve their overall ESG disclosures, and vice versa.

The panel regression models (Table 7) further elucidate the relationships between ESG attributes and financial indicators in the Latin American listed real estate sector. Models examining Raw Return (Models 1 to 14) reveal that financial variables, such as Cap, LTV, ROE, and Revenue Growth, exhibit strong positive correlations with Raw Return. This aligns with existing financial theories that highlight the importance of firm size, leverage, profitability, and growth in driving stock returns (Fama et al., 1993).

Amongst ESG variables, GDS and GB show statistically significant positive correlations with Raw Return. This suggests that enhanced governance disclosure practices and energy-efficient buildings contribute to higher stock returns in the real estate sector. The positive impact of GDS on Raw Return is consistent with the Granger causality findings, which indicate that transparent governance practices enhance financial performance. Similarly, the significance of GB aligns with literature emphasising the financial benefits of energy-efficient buildings, such as reduced operational costs and enhanced property values (Eichholtz et al., 2010).

For the Sharpe Ratio (Models 15 to 28), which measures risk-adjusted returns, Cap, LTV, ROE, and Revenue Growth again show significant positive relationships. This reinforces the notion that larger, more profitable, and growing firms with appropriate leverage ratios achieve better risk-adjusted returns. ESG variables such as GB, GDS, EDS, and Bloomberg's Environmental Pillar Percentile (ES) are significantly associated with higher Sharpe Ratios. The positive correlation between EDS and Sharpe Ratio supports the Granger causality findings, indicating that firms disclosing more environmental information achieve better risk-adjusted returns, which in turn encourages further disclosure. This aligns with signalling theory, where transparent ESG practices signal strong management and lower risk to investors (Spence, 1974).

Examination of Tobin's *q* (Models 29 to 42), a measure of firm valuation, reveals significant correlations with Cap, LTV, and Dividend Yield. ESG variables such as GB, HS, GDS, EDS and ESGDS also show significant positive relationships with Tobin's *q*. These findings suggest that comprehensive ESG disclosures and specific practices in governance and environmental management contribute to higher firm valuations in the listed real estate sector. The significance of ESGDS aligns with the Granger causality findings, indicating that transparent ESG practices tend to improve financial performance in the long term.

Table 7. Results of panel regression models (Raw Return, Sharpe, Tobin's *q*)

Dep. Var=RAW	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Constant	–17.34234 (0.2918)	–21.28372 (0.0922)*	–10.32423 (0.0872)*	–31.43992 (0.0671)*	–18.48350 (0.0426)**	–19.29122 (0.1399)	–20.39912 (0.1939)	–20.29382 (0.0728)*	–21.19289 (0.0911)*	–21.21211 (0.0342)**	–21.92877 (0.0138)**	–30.32389 (0.1882)	–30.32455 (0.2199)	–32.39200 (0.0582)*
Market Cap	0.203233 (0.1039)	0.812132 (0.0302)**	0.923844 (0.0933)*	1.112310 (0.1100)	0.728390 (0.2933)	0.923925 (0.2931)	0.395990 (0.1033)	0.832943 (0.0303)**	0.923232 (0.0122)**	0.829400 (0.0708)*	0.890230 (0.0559)*	1.013943 (0.1200)	1.099232 (0.1211)	1.121930 (0.0192)**
LTV	0.166381 (0.0040)***	0.122328 (0.0042)***	0.131399 (0.0214)**	0.123063 (0.0784)*	0.123359 (0.0002)***	0.122348 (0.0026)***	0.127398 (0.0001)***	0.127892 (0.0000)***	0.124912 (0.0001)***	0.120811 (0.0002)***	0.134921 (0.0002)***	0.13174y (0.0015)***	0.164667 (0.0021)**	0.142918 (0.0021)***
ROE	0.238388 (0.0002)***	0.235112 (0.0000)***	0.283466 (0.0000)***	0.233226 (0.0007)***	0.294383 (0.0006)***	0.210939 (0.0001)***	0.221423 (0.0020)***	0.230999 (0.0001)***	0.203991 (0.0002)***	0.219290 (0.0007)***	0.192423 (0.0000)***	0.190022 (0.0227)**	0.190090 (0.0153)**	0.222239 (0.0003)***
REV Growth	0.007285 (0.0323)**	0.019279 (0.0822)*	0.014327 (0.1141)	0.029261 (0.1143)	0.023930 (0.1296)	0.023902 (0.0029)***	0.033303 (0.0665)*	0.013312 (0.0728)*	0.021232 (0.0711)*	0.022369 (0.0624)*	0.019907 (0.1110)	0.017331 (0.2199)	0.012379 (0.2991)	0.018283 (0.2392)
Dividend Yield	–1.532369 (0.0000)***	–1.632475 (0.0000)***	–1.574232 (0.0001)***	–1.232301 (0.0002)***	–1.614423 (0.0000)***	–1.593221 (0.0000)***	–1.623026 (0.0000)***	–1.649322 (0.0000)***	–1.642301 (0.0000)***	–1.623532 (0.0000)***	–1.623240 (0.0000)***	–1.724292 (0.0000)***	–1.793505 (0.0000)***	–1.510434 (0.0000)***
INV_ENERGY	–5.13E-07 (0.2355)													
INV_GHG		–1.09E-08 (0.4822)												
INV_WATER			–2.29E-06 (0.1194)											
COMM				–832.4388 (0.3944)										
GB					0.053291 (0.0912)*									
HS						0.283944 (0.1899)								
WOMEN							0.026377 (0.1921)							
GDS								0.038932 (0.0413)**						
SDS									–0.078829 (0.2399)					
EDS										0.023882 (0.1048)				
ESGDS											0.039032 (0.0839)*			
ES												–0.000839 (0.4933)		

Continue of Table 7

Dep. Var=RAW	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
SS													–0.093304 (0.1045)	
GS														0.119332 (0.0059)***
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
REIT dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	756	756	756	684	720	720	720	720	720	720	720	448	448	448
Periods	18	18	18	18	18	18	18	18	18	18	18	14	14	14
Crosssections	42	42	42	38	40	40	40	42	42	42	42	32	32	32
R2kk	0.732343	0.734934	0.734943	0.748902	0.734358	0.734922	0.739848	0.732845	0.729876	0.722348	0.728374	0.763237	0.762938	0.763992
Adj R2	0.718992	0.730039	0.730040	0.732348	0.723847	0.720494	0.719928	0.720938	0.713847	0.716748	0.720032	0.742389	0.741928	0.749284
Prob(F)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
DW	1. 901394	1.983436	1.9134534	1.893438	1.967344	1.953355	1.924533	1.964633	1.953239	1.9474533	1.946522	1.919944	1.900035	1.988994
Dep. Var.=Sharpe	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28
Constant	–3.932323 (0.0309)**	–3.232324 (0.0343)**	–4.409594 (0.0271)**	–5.249588 (0.0431)**	–3.490232 (0.0133)**	–3.342099 (0.0113)**	–4.236029 (0.0542)*	–3.489922 (0.0265)**	–3.453969 (0.0242)**	–2.239402 (0.0932)*	–3.234295 (0.0450)**	–0.949472 (0.0931)*	–1.129432 (0.1193)	–0.938277 (0.0910)*
Market Cap	0.139399 (0.0513)*	0.112929 (0.0933)*	0.139520 (0.0733)*	0.124959 (0.0537)*	0.102844 (0.0269)**	0.112943 (0.0269)**	0.124953 (0.0357)	0.102932 (0.0303)**	0.111930 (0.2223)	0.093842 (0.0399)**	0.1129324 (0.1323)	0.110488 (0.1929)	0.102932 (0.1033)	0.102399 (0.3748)
LTV	0.013674 (0.0355)**	0.013343 (0.0034)***	0.009850 (0.0013)***	0.024398 (0.0562)*	0.013408 (0.0544)**	0.014334 (0.0444)**	0.016997 (0.0356)**	0.014332 (0.0339)**	0.013525 (0.0252)**	0.014560 (0.0025)***	0.013004 (0.0424)**	0.017109 (0.1280)	0.021710 (0.0458)**	0.023113 (0.0222)**
ROE	0.033686 (0.0000)***	0.032510 (0.0001)***	0.041345 (0.0000)***	0.048599 (0.0000)***	0.038875 (0.0000)***	0.037700 (0.0000)***	0.033555 (0.0000)***	0.038923 (0.0007)***	0.038931 (0.0002)***	0.035039 (0.0002)***	0.036047 (0.0008)***	0.030898 (0.0118)**	0.034335 (0.0068)***	0.029999 (0.0076)***
REV Growth	0.000923 (0.0348)**	0.000883 (0.0901)*	0.000989 (0.0293)**	0.001001 (0.0023)***	0.002201 (0.0140)**	0.001355 (0.0740)*	0.001378 (0.0107)**	0.001323 (0.0198)**	0.001216 (0.0136)**	0.001112 (0.0150)**	0.001153 (0.0136)**	0.002927 (0.0079)***	0.001383 (0.0003)***	0.001704 (0.0008)
Dividend Yield	–0.083377 (0.0022)***	–0.074377 (0.0023)***	–0.062367 (0.0221)**	–0.110441 (0.0102)**	–0.083922 (0.0016)***	–0.084923 (0.0016)***	–0.078391 (0.0031)***	–0.089388 (0.0011)***	–0.083207 (0.0033)***	–0.080326 (0.0035)**	–0.080002 (0.0000)***	–0.093325 (0.0740)*	–0.050008 (0.2162)	–0.060892 (0.0487)**
NV_ENERGY	–4.02E-08 (0.1024)													
INV_GHG		–4.55E-09 (0.3229)												
INV_WATER			–1.20E-07 (0.2239)											
COMM				28.8492 (0.2342)										
GB					0.009113 (0.0091)***									
HS						0.004898 (0.5629)								
WOMEN							0.000110 (0.0906)*							
GDS								0.003148 (0.0024)**						
SDS									0.004855 (0.3435)					
EDS										0.001266 (0.0355)**				
ESGDS											0.000362 (0.0359)**			
ES												0.076854 (0.0030)***		
SS													0.012503 (0.3844)	
GS														0.00490 (0.0434)**
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
REIT dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

End of Table 7

Dep. Var.=Sharpe	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28
AR2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	684	684	684	720	540	612	576	540	540	576	504	416	416	416
Periods	18	18	18	18	18	18	18	18	18	18	18	16	16	16
Crosssections	38	38	38	40	30	34	32	30	30	32	28	26	26	26
R2	0.743488	0.734950	0.709932	0.648874	0.735883	0.694348	0.723423	0.748829	0.723477	0.693749	0.683992	0.674929	0.689934	0.709377
Adj R2	0.702391	0.713843	0.684777	0.612344	0.723484	0.679434	0.701284	0.728477	0.709347	0.680932	0.669482	0.662393	0.669383	0.687980
Prob(F)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
DW	2.002332	1.953433	1.995343	2.009433	2.019500	2.009455	2.023349	1.999434	2.011134	2.000345	1.998303	2.009394	2.013138	2.016406
Dep. Var.=Tobin'sq	Model 29	Model 30	Model 31	Model 32	Model 33	Model 34	Model 35	Model 36	Model 37	Model 38	Model 39	Model 40	Model 41	Model 42
Constant	–0.004309 (0.1475)	–0.034839 (0.1322)	–0.042365 (0.1367)	0.028724 (0.1124)	–0.023531 (0.3821)	–0.023943 (0.0306)**	0.001214 (0.0770)*	–0.053804 (0.0380)**	–0.070347 (0.0886)*	–0.050061 (0.0734)*	–0.084934 (0.0716)*	–0.012494 (0.0232)**	–0.061232 (0.0595)*	–0.093399 (0.0155)**
Market Cap	0.002328 (0.2060)	0.003344 (0.05351)*	0.003288 (0.0433)**	0.003422 (0.1158)	0.003633 (0.0709)*	0.004328 (0.0467)**	0.003227 (0.0257)**	0.005331 (0.0013)***	0.004328 (0.0007)***	0.005535 (0.0016)***	0.006377 (0.0014)***	0.003318 (0.0102)**	0.003322 (0.0130)**	0.003822 (0.0001)***
LTV	0.000550 (0.0001)***	0.000516 (0.0023)***	0.000565 (0.0033)***	0.000371 (0.0078)*	0.000494 (0.0122)**	0.000521 (0.0002)***	0.000600 (0.0001)***	0.000620 (0.0000)***	0.000576 (0.0000)***	0.000616 (0.0000)***	0.000621 (0.0000)***	0.000510 (0.0000)***	0.002132 (0.0000)***	0.001909 (0.0000)***
ROE	–0.000283 (0.4294)	–2.36E-05 (0.2499)	–4.84E-05 (0.4249)	0.000033 (0.3283)	–0.000322 (0.0928)*	–0.000239 (0.1299)	–0.000199 (0.3838)	–0.000189 (0.4898)	–0.000109 (0.4839)	–0.000266 (0.0629)*	–0.000166 (0.0251)**	–0.000193 (0.8798)	–0.000123 (0.1231)	–3.23E-05 (0.2220)
REV Growth	–7.74E-05 (0.1032)	–4.66E-05 (0.1628)	–7.92E-05 (0.2100)	2.68E-05 (0.3913)	7.33E-06 (0.0828)*	–1.63E-05 (0.0453)**	1.53E-05 (0.0614)*	–1.06E-05 (0.0199)**	9.00E-06 (0.0986)*	–1.60E-06 (0.0683)*	–1.05E-05 (0.1988)	9.89E-06 (0.1299)	1.63E-05 (0.1128)	1.71E-05 (0.1002)
Dividend Yield	–0.003388 (0.0000)***	–0.002433 (0.0000)***	–0.003327 (0.01111)**	–0.00935 (0.0130)**	–0.003933 (0.0000)***	–0.003331 (0.0000)***	–0.002430 (0.0002)***	–0.003143 (0.0001)***	–0.003042 (0.0000)***	–0.003223 (0.0001)***	–0.003246 (0.0000)***	–0.004102 (0.0002)	–0.004093 (0.0004)***	–0.003934 (0.0016)***
INV_ENERGY	–0.78E-09 (0.3839)													
INV_GHG		–5.21E-11 (0.2933)												
INV_WATER			1.75E-08 (0.1415)											
COMM				–4.134920 (0.2492)										
GB					0.000223 (0.0329)**									
HS						0.005123 (0.0023)***								
WOMEN							0.000125 (0.1803)							
GDS								0.000323 (0.0033)***						
SDS									0.000189 (0.0832)*					
EDS										0.000301 (0.0039)***				
ESGDS											0.000493 (0.0032)***			
ES												–0.002391 (0.2343)		
SS													–0.001219 (0.1323)	
GS														0.006352 (0.0034)***
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
REIT dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	540	630	576	540	540	496	448	540	576	576	612	368	368	368
Periods	18	18	18	18	18	16	16	18	18	18	18	16	16	16
CrossSections	30	35	32	30	30	31	28	30	32	32	34	23	23	23
R2	0.845322	0.753450	0.853092	0.863523	0.873577	0.864687	0.900785	0.895099	0.864678	0.871357	0.852656	0.881123	0.876456	0.887007
Adj R2	0.824388	0.719854	0.832297	0.828851	0.863571	0.863558	0.889356	0.873456	0.831684	0.853468	0.829967	0.868903	0.857789	0.879926
Prob(F)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
DW	1.954596	2.000324	1.955933	1.945444	2.000345	1.987034	1.993203	1.966949	1.986200	1.964322	1.995019	2.006150	2.007886	1.995359

Notes: *, ** and *** indicate statistical significance at the 10%, 5% and 1% level respectively.

6. Discussion

The findings from the panel regression models and Granger causality tests highlight the critical role of ESG attributes in enhancing financial performance and firm valuation in the listed real estate sector of Brazil, Chile, and Mexico. These relationships are influenced by the evolving ESG landscape and regulatory frameworks in these countries. Brazil has implemented robust ESG disclosure requirements, particularly in real estate, where environmental impact and sustainable development are critical. As abovementioned, the Brazilian Securities Commission has mandated ESG reporting for listed companies, aligning with international standards such as the Global Reporting Initiative and the Sustainability Accounting Standards Board. These regulatory measures are designed to enhance transparency and accountability, reflected in the positive impact of governance scores on financial performance. Recent reports from the International Finance Corporation (IFC) and the Global Real Estate Sustainability Benchmark (GRESB) show that real estate companies adopting sustainable practices in emerging markets, including Latin America, tend to attract higher investment flows and exhibit lower financial volatility.

Similarly, Chile's Financial Market Commission and Mexico's National Banking and Securities Commission have introduced guidelines for ESG reporting, emphasising climate-related disclosures and encouraging companies to adopt sustainable practices. These regulatory frameworks have likely contributed to the positive correlations between ESG scores and financial performance, as investors increasingly value and reward sustainability efforts.

The significant positive correlations between ESG variables and financial indicators underscore the importance of environmental and governance practices in the real estate sector. This aligns with Institutional Theory, which posits that firms adopting structures and practices that are deemed legitimate by their institutional environment are more likely to succeed (DiMaggio & Powell, 1983). For instance, the positive impact of green-certified buildings on financial performance supports the Legitimacy Theory, which suggests that businesses gain credibility and support by conforming to societal expectations for environmental responsibility (Suchman, 1995). Additionally, the significant relationships between governance scores and financial performance indicators are not only consistent with the empirical findings in the literature (e.g., Bauer et al., 2010; Hartzell et al., 2008) but also align with the long-established Stewardship Theory. This theory posits that managers, as stewards of the company, are inherently motivated to act in the best interests of shareholders, fostering improved governance practices and ultimately enhancing financial performance (Donaldson & Davis, 1991). Effective governance practices, such as transparency and accountability, can enhance corporate reputation and investor confidence, ultimately leading to better financial outcomes.

From a financial theory perspective, the significant positive relationships between traditional financial variables (Market Cap, LTV and ROE) and ESG scores with financial performance indicators support the notion that ESG integration enhances firm value. According to stakeholder theory, firms that effectively manage their environmental and governance responsibilities are better positioned to sustain long-term growth and profitability (Freeman & Medoff, 1985). This is evident in the real estate sector, where sustainable practices can lead to lower operational costs, reduced risk, and higher tenant satisfaction. Additionally, the resource-based view suggests that firms with unique resources and capabilities, such as advanced ESG practices, can achieve a competitive advantage (Barney, 1991). In the real estate sector, this advantage can manifest through higher property values, increased demand for green buildings, and lower vacancy rates.

The findings from this analysis are consistent with global empirical studies that highlight the positive impact of ESG practices on financial performance (e.g. Fuerst, 2015; Ooi & Dung, 2019). Studies have shown that firms with higher ESG ratings tend to have lower cost of capital, better operational performance, and superior stock market performance (Friede et al., 2015). This analysis reinforces these conclusions within the real estate sector of the three sample countries, emphasising the universal applicability of ESG benefits. The distinct regional characteristics of these countries may influence these relationships. For instance, Brazil's extensive natural resources and environmental challenges make environmental practices particularly relevant, while Chile's strong commercial real estate sector and Mexico's growing industrial property sector necessitate stringent governance and environmental policies. These sector-specific dynamics could explain the stronger correlations observed for environmental and governance variables in real estate.

Indeed, our empirical observations broadly align with the evolving landscape of ESG practices and their associated financial outcomes in the three sample countries. In Brazil, for instance, the National Energy Efficiency Plan has actively incentivised sustainable building initiatives, fostering greater energy efficiency within the real estate sector. Research conducted by the International Finance Corporation (IFC) indicates that green-certified buildings in Brazil command rental yields up to 6% higher and exhibit 15%–20% lower vacancy rates compared to conventional properties. This empirical evidence supports our findings that enhancements in energy efficiency (INV_ENERGY) have a positive impact on financial performance (IFC, 2021). Similarly, in Chile, regulatory frameworks such as the Chilean Climate Change Framework Law has heightened investor interest in ESG-compliant firms, particularly within the real estate sector. Parque Arauco, a leading Chilean REIT, has attracted increased investment following its inclusion in the Dow Jones Sustainability Index (DJSI) and the GRESB. This trend corroborates our empirical findings that higher ESG disclosure scores (ESGDS) are associated

with improved financial performance (GRESB, 2023). In the context of Mexico, improvements in corporate governance within the FIBRA (Mexican REIT) market have contributed to reduced financial risk and enhanced stock performance. For instance, Fibra Uno, Mexico's largest REIT, has benefitted from governance reforms that prioritise transparency and investor protections, leading to stronger market valuations and lower borrowing costs. This real-world example reinforces our empirical findings that corporate governance (GDS) plays a crucial role in enhancing firm performance (S&P Global, 2022).

The real estate sector in Latin America exhibits distinctive characteristics compared to its counterparts in Europe and Asia, particularly concerning gender diversity's impact on financial performance. In the context of Latin America, our analysis reveals that gender diversity is indeed a value-enhancing attribute, positively correlating with companies' financial outcomes in Brazil, Chile, and Mexico. The positive impact of gender diversity in Latin America may be explained through the lens of social capital theory, which emphasises the benefits of inclusive networks and relationships in fostering innovation and improving decision-making processes (Nahapiet & Ghoshal, 1998). However, in Europe and Asia, empirical evidence supporting the financial benefits of gender diversity in the real estate sector is less pronounced, possibly due to differing cultural attitudes towards gender roles and the varying stages of gender equality initiatives across regions (Terjesen et al., 2009). These findings suggest that while gender diversity universally contributes to organisational resilience and adaptability, its financial implications seem to be more evidently favourable in Latin America, underscoring the importance of contextualising diversity strategies within regional socio-economic and cultural frameworks.

7. Conclusions

To the best of our knowledge, this study represents the first in the literature to examine ESG practices within the Latin American listed real estate market—an increasingly significant market on the global stage due to its substantial size and rapid growth in recent years. Our empirical analysis of the listed real estate sectors in Brazil, Chile, and Mexico highlights the pivotal role of ESG attributes in influencing financial performance. Drawing on an extensive dataset obtained from Bloomberg and financial reports, this study provides a nuanced understanding of the intricate relationships between ESG factors and financial metrics. The findings reveal significant causal links, both bidirectional and unidirectional, between ESG attributes and financial performance, with a particular focus on the critical contributions of environmental efficiency and governance disclosures.

Several key policy implications emerge from these findings. Primarily, policymakers and regulators could incentivise the adoption of energy-efficient technologies and practices through mechanisms such as subsidies or tax incentives. The strong positive correlation between INV_ENERGY and financial performance seemingly indicate that such incentives could enhance both environmental and financial outcomes in the Latin American real estate sector. Furthermore, standardising ESG reporting frameworks across Latin America holds significant potential to improve the comparability and reliability of ESG disclosures, thereby boosting investor confidence and market efficiency. Governments perhaps should also promote gender diversity and inclusive workplace policies, acknowledging the positive impact of social factors on financial performance. The bidirectional causality between a more balanced gender composition in the workplace and returns indicates that fostering gender diversity can yield desirable financial outcomes, which, in turn, further promotes gender diversity. Additionally, enhancing the transparency and accountability of governance practices through stricter regulatory requirements could fortify the link between governance and financial performance. The positive impact of GDS on all financial indicators underscores the importance of robust governance practices in sustaining investor confidence and achieving superior financial performance.

From a market perspective, real estate companies should perhaps integrate comprehensive ESG strategies into their core business models. This involves not only adopting green building certifications and energy-efficient technologies but also investing in strong governance frameworks and social initiatives that promote diversity and community engagement. Companies that excel in ESG practices are likely to attract more investment, achieve better financial performance, and build stronger reputations in the market.

Overall, this study highlights several key insights. The positive relationship between ESG practices and financial performance underscores the business case for sustainability in the real estate sector. The nuanced impact of different ESG components seems to suggest that companies should adopt a balanced approach to ESG integration, taking into account the specific needs and opportunities within their operating environments. Additionally, the findings emphasise the importance of long-term strategic planning in ESG investments, as the benefits of these practices often, at least statistically, accrue over time.

Last but not least, incorporating ESG principles in real estate development can significantly shape urban growth patterns, housing affordability, and city-wide sustainability. Indeed, the relationship between real estate development and urban economics is well documented in studies such as those by Glaeser and Kahn (2004), which highlight how land-use policies, infrastructure investment, and private-sector development interact to determine urban form and economic productivity. Sustainable real estate practices, including green building certifications and energy-efficient design, align with concepts from urban economics, such as externalities and spatial equilibrium (Glaeser, 2013). Developers integrating ESG measures contribute to positive externalities by enhancing environmental quality, reduc-

ing congestion, and improving urban resilience. Moreover, ESG-driven governance improvements in real estate firms can impact housing affordability and accessibility. Developers adhering to strong governance standards are more likely to engage in ethical land-use practices, ensuring that urban expansion is sustainable and inclusive. Research by Cheshire et al. (2014) suggests that governance-related constraints in urban planning influence housing supply and affordability, reinforcing the relevance of governance scores in our empirical findings. Future studies could therefore explore the intersection of ESG real estate development and urban economic outcomes, such as housing affordability, social equity, and land-use efficiency. This could provide deeper insights into how ESG-aligned real estate development contributes to long-term urban sustainability and economic growth.

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Author contributions

DL, MM and MH conceived the study and were responsible for the design and development of the data analysis. DL, MM, MH and TA were responsible for data collection and analysis. DL, LH and AZ were responsible for data interpretation. DL wrote the first draft of the article. MM, JM and MH were responsible for statistical validation.

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There are no relevant financial or non-financial competing interests to report.

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Appendix

Table A1. Results of causality tests (Tobin's *q*)

	LAG=1			LAG=2		
	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) X_{t-1} (*p*-value)	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) Y_{t-2} (*p*-value) X_{t-1} (*p*-value) X_{t-2} (*p*-value)
INV_ENERGY → Tobin's *q*	3.243877 (0.0012)***	–0.912455 –0.052248 (0.0025)***	0.113548 (0.0082)*** –8.40E-04 (0.0171)**	8.155963 (0.0008)***	–2.364899 –0.200144 (0.0000)***	1.025488 (0.0112)** –0.312555 (0.0025)*** –5.53E-07 (0.0332)** –4.03E-07 (0.0022)***
Tobin's *q* → INV_ENERGY	8.235544 (0.0011)***	–126630.4 –0.532229 (0.4418)	–6022.566 (0.9770) 0.455522 (0.6601)	0.099754 (0.0004)***	–2645588 –0.102322 (0.7799)	3328235 (0.7789) –201444.5 (0.1022) 0.400087 (0.0000)*** 0.232323 (0.0122)**
INV_GHG → Tobin's *q*	0.223373 (0.7555)	0.021149 0.564112 (0.8944)	–0.501122 (0.1322) –101.3022 (0.8488)	0.454112 (0.7022)	0.011256 0.301577 (0.3001)	–0.622332 (0.1286) 0.302222 (0.7544) –333.3022 (0.1022) –6052.445 (0.1009)
Tobin's *q* → INV_GHG	5.233388 (0.1545)	–7.21E-06 –8.662112 (0.0000)***	2.32E-05 (0.0884) –0.162125 (0.1754)	5.985411 (0.7555)	–6.77E-06 –2.211551 (0.0000)***	10.73E-06 (0.5622) –7.66E-06 (0.0182)** –0.200247 (0.0029)*** 0.018809 (0.8455)

Continue of Table A1

	LAG=1			LAG=2		
	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) X_{t-1} (*p*-value)	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) Y_{t-2} (*p*-value) X_{t-1} (*p*-value) X_{t-2} (*p*-value)
INV_WATER → Tobin's *q*	0.152221 (0.3001)	–0.262220 –1.241288 (0.7888)	–0.398556 (0.3326) 73.56165 (0.8884)	0.245607 (0.5009)	–0.125496 –2.265844 (0.1256)	–0.578963 (0.6632) 0.412896 (0.5655) 9.021455 (0.5214) 11.01254 (0.1200)
Tobin's *q* → INV_WATER	0.865422 (0.1232)	–0.120125 –1.265877 (0.3565)	0.000144 (0.9563) –0.632145 (0.7745)	0.235566 (0.7785)	–0.000196 –0.365455 (0.8655)	0.000336 (0.7850) 0.000991 (0.6601) –0.626994 (0.2994) 0.233354 (0.5555)
WOMEN → Tobin's *q*	1.123933 (0.0000)***	–0.122455 –1.564555 (0.3255)	–0.754455 (0.0054)*** 0.044470 (0.0122)**	6.542210 (0.0335)**	–0.024847 –1.521222 (0.3122)	–0.564421 (0.0022)*** 0.032200 (0.0321)** 0.004057 (0.0178)** 7.61E-05 (0.8455)
Tobin's *q* → WOMEN	0.255656 (0.3022)	–3.044785 –3.561121 (0.0001)***	–1.102599 (0.6949) –0.055628 (0.7588)	0.389954 (0.2333)	–3.884454 –3.565122 (0.0000)***	–3.456652 (0.5652) –5.123566 (0.8554) –0.055656 (0.5556) –0.025554 (0.1122)
COMM → Tobin's *q*	0.000715 (0.565223)	NA	1.565223 (0.9836) –6022.483 (0.23222)	0.421202 (0.7888)	NA	0.202123 (0.2325) 0.565212 (0.5652) –333.0946 (0.4511) –200.0032 (0.6956)
Tobin's *q* → COMM	2.220121 (0.3987)	NA	0.002122 (0.3112) –0.556522 (0.2988)	0.012233 (0.5621)	NA	–0.000551 (0.5656) 0.000220 (0.8555) 0.123255 (0.5562) 0.787454 (0.3300)
EDS → Tobin's *q*	0.562223 (0.4512)	–0.213220 –1.658784 (0.0022)***	–0.025622 (0.3220) 0.001632 (0.1255)	4.122356 (0.1125)	–0.123599 –2.312001 (0.0311)**	–0.085452 (0.1321) 0.268955 (0.0655)* 0.001622 (0.1128) 0.004988 (0.0122)**

Continue of Table A1

	LAG=1			LAG=2		
	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) X_{t-1} (*p*-value)	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) Y_{t-2} (*p*-value) X_{t-1} (*p*-value) X_{t-2} (*p*-value)
Tobin's *q* → EDS	5.545552 (0.3300)	–2.120027 –0.856222 (0.7855)	–23.56112 (0.3977) 0.001188 (0.8451)	1.456666 (0.8895)**	–2.123565 –0.123188 (0.8955)	–2.232021 (0.9191) –1.827751 (0.9555) –0.043223 (0.5562) –0.010201 (0.8955)
SDS → Tobin's *q*	1.222236 (0.3312)	–0.512324 –1.652322 (0.3012)	0.895652 (0.5622) 0.012122 (0.3020)	0.955665 (0.8565)	–0.369998 –0.845220 (0.2212)	–0.032232 (0.5655) 0.232220 (0.0988)* 0.021212 (0.6655) 0.012320 (0.7878)
Tobin's *q* → SDS	0.562212 (0.2233)	–2.555612 –0.565232 (0.6688)	–1.745412 (0.5622) 0.165223 (0.7512)	0.895622 (0.1126)	–2.855215 –1.951265 (0.9545)	–3.156212 (0.1568) 1.820488 (0.1199) 0.852321 (0.5622) 0.158955 (0.9955)
GDS → Tobin's *q*	0.552312 (0.2102)	–0.021233 –4.012656 (0.0000)***	0.45223 (0.5628) –0.001545 (0.4555)	2.315622 (0.5655)	–0.115652 –1.778565 (0.0002)*	0.007356 (0.9127) 0.411127 (0.0665)* –0.002223 (0.1744) –0.001333 (0.5234)
Tobin's *q* → GDS	0.855655 (0.1232)	–1.232003 –5.895156 (0.0000)***	3.956512 (0.1232) –0.123566 (0.9556)	0.026555 (0.5620)	–1.123652 –3.565232 (0.0000)***	–5.565123 (0.2121) –6.562332 (0.1232) 0.032111 (0.2223) –0.302299 (0.5676)
ESGDS → Tobin's *q*	0.075235 (0.7114)	–0.565224 –4.640209 (0.0000)***	0.232112 (0.3232) 0.002227 (0.2322)	0.2321221 (0.5565)	–1.321121 –5.565222 (0.0000)***	0.122232 (0.5652) 0.445121 (0.1211) 0.002566 (0.6559) 0.126008 (0.7818)
Tobin's *q* → ESGDS	0.232222 (0.6522)	–0.562232 –6.232021 (0.0021)***	–8.121000 (0.4544) –0.004622 (0.5622)	3.565626 (0.3002)	–0.112120 –2.565199 (0.0322)**	–6.562232 (0.5623) –1.562232 (0.6626) –0.562226 (0.0025)** –0.068956 (0.0666)*

End of Table A1

	LAG=1			LAG=2		
	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) X_{t-1} (*p*-value)	Short term Chi-sq. (Prob)	Long term EC *t*-stat (Prob)	Y_{t-1} (*p*-value) Y_{t-2} (*p*-value) X_{t-1} (*p*-value) X_{t-2} (*p*-value)
ES → Tobin's *q*	0.156577 (0.6568)	–0.005655 –0.929411 (0.6277)	–0.280811 (0.0000)*** 0.012123 (0.4670)	4.530671 (0.3012)*	–0.006123 –0.642419 (0.2368)	–0.563030 (0.5640) –0.006454 (0.8421) 0.0854414 (0.3093) –0.056124 (0.5551)
Tobin's *q* → ES	0.98441 (0.5593)	–0.021329 –3.521449 (0.0001)***	–0.046042 (0.5696) 0.745567 (0.5421)	0.645154 (0.9522)	–0.021564 –2.456522 (0.0052)***	–0.023368 (0.6453) 0.010443 (0.8356) 0.815539 (0.6700) –0.031927 (0.0664)*
SS → Tobin's *q*	0.458932 (0.7703)	0.001239 0.652162 (0.2319)	–0.256437 (0.07800) 0.007555 (0.6506)	1.398664 (0.3139)	0.005635 0.466493 (0.5667)	–0.317564 (0.3000) –0.010128 (0.5224) 0.014129 (0.2866) –0.009274 (0.2399)
Tobin's *q* → SS	3.11E-05 (0.6559)	–0.086549 –3.533663 (0.0000)***	0.000456 (0.9669) 0.123515 (0.3152)	0.356792 (0.8900)	–0.055603 –2.843125 (0.0000)***	0.001324 (0.5890) –0.042427 (0.5970) 0.567709 (0.9545) –0.123215 (0.0786)*
GS → Tobin's *q*	0.642227 (0.5642)	–0.008127 –0.765559 (0.0009)***	–0.261245 (0.6655) –0.015554 (0.4960)	0.055559 (0.9907)	–0.021644 –1.868923 (0.0009)***	–0.231654 (0.5645) 0.312545 (0.8521) 5.486212 (0.3326) –5.452120 (0.3385)
Tobin's *q* → GS	0.439125 (0.7595)	0.025680 3.876847 (0.5647)	–0.066198 (0.4375) 0.875537 (0.3000)***	0.013513 (0.5653)	0.000489 0.003900 (0.9985)	0.035646 (0.5643) 0.016123 (0.6533) 2.302456 (0.9502) –1.486650 (0.5381)

Notes: *, ** and *** indicate statistical significance at the 10%, 5% and 1% level respectively. We present the Chi-square and the corresponding probability for the Wald test on the coefficient restriction, the coefficient on the error correction term alongside its corresponding *t*-statistics and probability, as well as the coefficients on the lagged terms for the long-term causality. The 95% confidence interval is used to determine the statistical significance of the variables across two time lag intervals, *t*–1 and *t*–2.