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Article

Exploring the correlation between ESG, environmental performance scores and financial variables in Pacific alliance companies

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Abstract: The purpose of this research was to explore the link between Environmental, Social, and Governance (ESG) performance and corporate financial performance in the Pacific Alliance countries (Mexico, Colombia, Peru, Chile). The study used regression models to examine the correlation between ESG scores, environmental pillar scores, and financial performance metrics like return on assets (ROA) and EBITDA for 86 companies over 2016-2022. Control variables like firm size and leverage were included. Data was obtained from Refinitiv and Bloomberg databases. The regression models showed no significant positive correlations between overall ESG or environmental pillar scores and the financial valuation measures. The inconclusive results on ESG-firm value connections underscore the need for continued research using larger samples, localized models, and exploring which ESG aspects drive financial performance Pacific Alliance.

Keywords: governance; social, environmental; firm's value; EBITDA; ROA

1. Introduction

In recent decades, there has been a growing interest in and recognition of the importance of sustainable and responsible business practices from an environmental perspective. As awareness of global environmental issues and the need for collective action has intensified, investors, regulators, and society at large have begun to increasingly value the environmental performance of companies. This represents a key factor in organizational decision-making and the way they project themselves to stakeholders (Khamisu et al., 2024).

In this context, a comprehensive approach known as ESG (Environmental, Social, and Governance) has been developed to evaluate business practices in environmental, social, and governance terms. The ESG score is a quantitative measure that evaluates a company's performance in these three domains, providing a score that reflects its level of commitment to and management of relevant environmental issues (Tsang et al., 2022). Numerous research studies have been conducted to explore the effects of implementing environmental initiatives on the value of companies, quantify this type of action, maximize benefits, and ensure sustainability and competitiveness in the marketplace (Khanifah et al., 2020). For more than 20 years, models establishing correlations between firm value and the quality of environmental initiatives have been developed and have shown diverse results (Clarkson et al., 2008; Dechezleprêtre et al., 2019; Plumlee et al., 2015).

Existing research on the link between ESG and firm value has largely focused on developed markets and multinational companies. However, the dynamics between

ESG and financial value may differ significantly in emerging economies like those in Latin America. Specific structural challenges in Latin American markets pose limitations when applying global ESG-value models, including lower ESG transparency and disclosure, weaker regulation and enforcement, higher currency volatility, and differences in stakeholder pressures (Aysen, 2013; Garzon and Zorio, 2021; Mesquita et al., 2007; Zicari, 2017).

This research aims to explore the link between ESG performance and corporate financial performance in the Pacific Alliance countries (Mexico, Colombia, Peru, Chile). Specifically, it investigates whether the positive correlations between ESG factors and financial outcomes observed globally are also evident in these countries.

The study focuses on:

- Assessing the direct effects of ESG and the Environmental Pillar (EP) score on financial metrics like return on assets (ROA) and EBITDA in the corporate sectors of Chile, Mexico, Colombia, and Peru. This study also checks if the positive correlations seen in other research between ESG, its pillars, and financial variables hold for representative firms from the Pacific Alliance countries.
- Examining the variability of these relationships across different countries and industries within the Pacific Alliance.
- Emphasizing the importance of developing ESG evaluation models that are specifically adapted to the Latin American and Pacific Alliance contexts, recognizing the unique economic and regulatory landscapes of these countries.

To verify the correlation of ESG, EP, and financial variables in the context of companies in Pacific Alliance countries, the Aydoğmuş et al. model was used, as it aligns with those found in other studies and incorporates data from some Latin American companies (Aydoğmuş et al., 2022). These authors employed fixed effects models within a panel data framework to analyze the relationship between ESG performance and two key financial variables: Firm value and profitability. The dependent variables in the study were Tobin's Q, as an indicator of firm value, and ROA, as a measure of profitability. The independent variables included the ESG score and the individual scores for each of the ESG pillars, while the control variables included the size of the company and its leverage.

ESG performance, EP, and firm value are hypothesized to be positively related based on instrumental stakeholder theory. This suggests that ethical management of stakeholders benefits the firm through things like lower risks and costs, improved productivity, customer loyalty, license to operate, and access to resources. Thus, firms with higher ESG ratings are expected to also have higher valuations, profits, and shareholder returns. The study will empirically examine this relationship.

First, the methodologies used to measure environmental performance and firm valuation are defined, then the composition of the data sample used for the analysis is shown, the models used to explore the correlations between the variables of interest are explained, and finally, the results obtained are discussed and concluded.

1.1. Theoretical framework

1.1.1. Variables

To explore the potential environmental performance impact of companies on their value, it is necessary to be able to quantify these two aspects. Research by Nishitani and Kokubu (2020) used a rating of the environmental performance of companies in Indonesia based on CO_2 emissions and resource use efficiency and relates this rating to financial indicators such as ROA and Tobin's Q. Li et al. (2018) used an ESG disclosure quality rating of Chinese firms to assess their impact on the market value of firms measured with market cap. On the other hand, Yoon et al. (2018) employ ESG scores from Bloomberg and Inrate to relate them to Korean firm valuations based on P/E and PBR. This background demonstrates the various methods that can be used to quantify the environmental performance and value of companies, how this paper approaches the topic is explained below.

Measurement of environmental performance

To quantify the environmental performance of companies, this paper uses two proxy variables: the ESG score and the EP score.

ESG refers to the three central factors in measuring the sustainability and ethical impact of an investment in a company. ESG metrics are used to evaluate a company's operations in terms of environmental stewardship, social responsibility, and governance practices. These factors can influence investor decisions, consumer perceptions, and regulatory outcomes (Tsang et al., 2022).

The data needed to estimate the ESG score is obtained from various sources, such as sustainability reports, financial reports, corporate governance information, and other public and private sources, **Table 1** shows the categories that are considered to estimate the value of each pillar (Refinitiv, 2022). It should be noted that obtaining this data depends on the willingness and quality of disclosure of necessary information by companies. Considering that most countries in the Latin American region are not required to make mandatory disclosure of this information, this may influence the ability to accurately determine the ESG score (Fatemi et al., 2018). It is also important to remember that these scores' accuracy may be biased by the providers, who use different methods for their calculation (Erhart, 2022).

Due to the wide range of categories considered by the ESG score, a second variable is used as a proxy to quantify the environmental performance of companies, the EP score. This variable is a score from 0 to 100 given to the Environmental Pillar of the ESG score, so it can be understood as a score that focuses exclusively on the environmental aspects of companies (Agliardi et al., 2023).

An advantage of using EP for environmental performance is that it collects a greater amount of hard disclosure data. This allows for a more objective assessment of a company's relationship with the environment. Some of the most important aspects considered to rate the EP score is:

- Greenhouse gas emissions (GHG): The company's GHG emissions are evaluated, including carbon dioxide, methane, and nitrous oxide, among others.
- Energy consumption: Total energy consumption is considered, as well as the company's energy efficiency and the amount of energy used from renewable sources.

- Waste management: Aspects such as the production of tons of waste, waste reduction, recycling, adequate waste treatment, and responsible management of chemical products are evaluated.
- Water use: Monitoring and reduction of water consumption, efficient management of water resources, and prevention of water pollution are evaluated.

It should be noted that the magnitudes of the aspects listed are considered both in total and concerning company revenues so that the scores are not biased toward larger companies (Refinitiv, 2022).

Table 1. Description of the categories and weighting of each pillar within the Refinitiv ESG Score calculation.

Pilar	Category	Category weight	Pilar weight
Environmental	Emissions	15%	43%
	Innovation	15%	
	Resources	13%	
Social	Community	9%	31%
	Human rights	5%	
	Product responsability	4%	
	Workforce	13%	
Governance	Corporate Social Responsibility Strategy	5%	25%
	Management	3%	
	Shareholders	17%	

Measurement of firm value

The firm's value refers to the estimated monetary value of the company. This value can be represented by different indicators. In this work, this value was quantified by using two different proxy variables: Return on Assets (ROA) and earnings before interest, taxes, depreciation, and amortization (EBITDA).

ROA is a financial indicator used to measure the efficiency of a company's use of its assets to generate profits. ROA is important for evaluating a company's profitability concerning its assets. It is an important measure of operational efficiency, showing how capable a company is at converting the money it invests in assets into profits. ROA is calculated as net income over total assets (Singh et al., 2024). Net income is taken from the income statement, and total assets (TASST) are taken from the balance sheet. Husna and Satria (2019) analyzed the effect of ROA on the stock returns of companies listed on the Indonesia Stock Exchange. They found a significant positive relationship between ROA and stock returns, so they conclude that ROA is a good indicator of firm value.

EBITDA is a financial indicator that represents a company's operating profit before considering expenses, taxes, depreciation, and amortization of assets. It is used as a first measure of a company's profitability and cash-generating capacity. EBITDA is used in measuring the value of a firm because it eliminates factors unrelated to the operation of the business, such as the impact of capital structure and accounting decisions related to depreciation and amortization (Bouwens et al., 2019). In doing so,

it provides a clearer and more comparable view of the firm's profit-generating capacity. EBITDA has proven to be an adequate indicator of firm value. Alcalde et al. (2013) examined the determinants of EBITDA margin in Brazilian firms and identified that it depends on the sector and other characteristics of the firms.

ROA and EBITDA were selected as accounting-based measures of firm financial performance and value in this study due to the limitations of market-based indicators for Pacific Alliance companies. Metrics like price/earnings ratios and Tobin's Q have significant drawbacks in these markets, including: Low liquidity (Thin trading can cause market prices to not accurately reflect fundamental value), weak informational efficiency (Limited analyst coverage and transparency hampers price discovery) (Borlea and Achim, 2017; Moeen, 2023).

While ROA and EBITDA have their limitations as well, they mitigate some of these issues by relying on audited financial statement data rather than potentially distorted market pricing (Bouwens et al., 2019; Singh et al., 2024). ROA provides a helpful baseline profitability measure by relating net income to assets—a useful proxy for how efficiently a firm generates earnings from invested capital (Schabek, 2020). Though affected by accounting policies, EBITDA helps isolate operating profit trends (Moraes, 2005; Schmalensee, 1985).

Control variables

The study used two control variables: Size and Leverage, as other similar studies have done (Atan et al., 2018; Naeem et al., 2021). Size is measured as the logarithm of the total assets of the company. Taking the logarithm of total assets helps normalize data for analytical purposes, making trends easier to identify and interpret, especially in companies of different sizes (Dang et al., 2018).

On the other hand, leverage is measured as TDTA: net debt to total assets. This ratio measures the extent of a company's reliance on debt to fund its operations. Leverage is an important indicator of financial health, showing how much a company depends on debt to continue its operations. High leverage can indicate high risk but also high potential for returns on equity (Ibhagui and Olokoyo, 2018).

Table 2 provides a description of each variable considered in the study, including their calculation methods and the databases from which they were sourced.

Table 2. Description of the variables used in the models.

Variable	Description	Data source
ESG	The accumulated score of the company's 3 ESG pillars	Refinitiv
EP	Company's environmental pillar score	Refinitiv
TASST	Total assets for each company	Bloomberg
Net Debt	Net debt for each company	Bloomberg
Net Income	Net income for each company	Bloomberg
TDTA	Leverage of the company. The ratio of net debt to total assets of the company.	$TDTA = \frac{Net\ Debt}{TASST} \times 100$
ROA	The ratio of the company's net income to its total assets	$ROA = \frac{Net\ Income}{TASST} \times 100$
EBITDA	Company's earnings before interest on debt, taxes, depreciation, and amortization.	Bloomberg

1.1.2. Stakeholder theory

This study is grounded in stakeholder theory, which posits that businesses have responsibilities to a broad range of stakeholders beyond just shareholders (Darnall et al., 2010; Mahajan et al., 2023). Managing relationships with stakeholders—such as employees, suppliers, customers, communities—can confer strategic benefits to the firm.

Specifically, we draw on instrumental stakeholder theory (Beck, 2024; Mahajan et al., 2023) which suggests engaging with stakeholders can directly improve the bottom line through several mechanisms:

- Reducing risks and costs (e.g., through eco-efficiency, employee retention
- Enhancing revenue and market share (e.g., via customer loyalty and good reputation)
- Gaining intangible strategic assets (e.g., brand value, social license to operate)
- Building invaluable knowledge and innovation networks

Therefore, instrumental stakeholder theory predicts that sustainability, EP and ESG Scores, as an indicator of effective stakeholder management, will be positively associated with financial performance (Darnall et al., 2010).

This has been empirically supported by several studies, typically using ESG score or Environmental Pillar Score (EP) as a proxy for stakeholder management, and various accounting or market measures as indicators of financial performance (Alonso et al., 2018; Banerjee et al., 2022; Sachs and Rühli, 2011).

Instrumental stakeholder theory uses ESG scores to measure stakeholder management and relates them to financial metrics, thus allowing us to have a guide to conduct the study. This research use ESG and Environmental Pillar scores from Refinitiv database, based on this theory's premise that higher ESG performance indicates more effective stakeholder engagement. Our dependent variables of ROA, and EBITDA represent financial performance metrics that we hypothesize will be positively impacted by stakeholder management. Control variables like firm size and leverage are included to account for other potential factors influencing financial performance, isolating the ESG effect. This is in order to verify the models proposed by other authors that support the stakeholder theory and that indicate positive correlations between ESG, PE and financial indicators. The model proposed by Aydoğmuş et al. (2022) will be tested in the representative companies of the Pacific Alliance.

In this sense, two hypotheses were proposed for this study:

H1: Higher overall ESG and EP scores will be positively associated with higher return on assets (ROA) for Pacific Alliance firms.

H2: Higher overall ESG and EP scores will be positively associated with higher EBITDA for Pacific Alliance firms.

2. Materials and methods

2.1. Sample data

Data was obtained from Refinitiv and Bloomberg databases. Bloomberg and Refinitiv databases are valuable for financial and ESG values, respectively, due to

their extensive coverage and robust data quality. Bloomberg's database provides a comprehensive platform for financial data analysis, making it ideal for evaluating the association between corporate ESG performance disclosure and profitability (Gholami et al., 2022). On the other hand, Refinitiv's database offers detailed ESG scores at both company and national levels, enabling researchers to assess the impact of ESG factors on various financial outcomes, such as currency returns (Duygun et al., 2024; Filippou and Taylor, 2021). By utilizing Bloomberg for financial data and Refinitiv for ESG values, we can conduct in-depth analyses that provide insights into the relationship between ESG performance and financial metrics.

In these databases, information was collected on as many companies as possible from the Pacific Alliance (Chile, Colombia, Mexico, and Peru) between the years 2016 to 2022. This time window was chosen considering that data on ESG indicators have been reported more consistently since 2016 for many of the companies in the sample.

The sample of companies was selected from the main stock market indexes of each Pacific Alliance country. The stock market indexes are a weighted average of the share prices of a selected portfolio of shares, representative of a specific market. These indices are calculated using a weighted average based on the market capitalization of the component companies. They function as an indicator of overall market performance and act as the primary benchmark for comparing the performance of various financial instruments. Depending on each country, the index was selected to be the primary benchmark for those markets.

Colombia: MSCI COLCAP. The index is the main reference for the Colombian market and is composed of 20 issuers and the 25 most liquid stocks in the market, weighting the stocks by adjusted market capitalization with no participation limit (Msci Colcap, 2024).

Chile: S&P IPSA, this stock market indicator measures the performance of the largest and most liquid stocks traded on the Santiago Stock Exchange (S&P Dow Jones Indices, 2024a).

Peru: S&P/BVL, this was designed to be the broad benchmark of the Lima Stock Exchange, it is a free-float adjusted market capitalization weighted index. It also considers liquidity requirements and trading frequency of its components. The index portfolio usually consists of no less than 29 and no more than 41 stocks (S&P Dow Jones Indices, 2024b).

Mexico: S&P/BMV IPC, this index seeks to measure the performance of the largest and most liquid stocks listed exclusively on the Mexican Stock Exchange (BMV). The components are weighted by market capitalization adjusted for free float. This index generally includes between 30 and 35 shares of Mexican companies (Grupo BMV, 2024).

From the index constituents, companies were screened based on the following criteria:

- Available ESG disclosure data on Refinitiv database from 2016–2022. Companies lacking sufficient ESG data across the period were excluded.
- Availability of financial data on Bloomberg database over the timeframe for the financial variables required in the analysis.
- Companies that underwent major merger/acquisition deals or corporate

restructuring during 2016–2022 were excluded due to data continuity issues.

The screening process resulted in a final sample of 86 companies across the 4 countries. **Table 3** shows the distribution of those companies by country and sector.

Table 3. Distribution of sample companies by country and sector.

Country	Sector	Number of companies	Total
Chile	Commerce	7	22
	Utilities	8	
	Financial	2	
	Food and Beverage	3	
	Telecommunications	1	
	Forestry	1	
Colombia	Commerce	1	13
	Oil and Gas	4	
	Utilities	3	
	Construction	2	
	Financial	1	
	Food and Beverage	1	
	Telecommunications	1	
México	Commerce	3	28
	Oil and Gas	2	
	Construction	4	
	Financial	2	
	Food and Beverage	6	
	Telecommunications	4	
	Transport	4	
	Forestry	1	
	Mining	2	
Perú	Commerce	1	23
	Utilities	3	
	Construction	3	
	Financial	1	
	Food and Beverage	2	
	Metal production	2	
	Mining	10	
	Agriculture	1	

2.3. Regression models

It aimed to recreate the methodology proposed by Aydoğmuş et al. (2022) to determine the correlation between environmental performance and firm value. To do so, 4 different linear regression models were run using Python. The panel dataset in this study had observations over multiple time periods (years) for each company. This longitudinal structure allowed the use of fixed effects models. Dummy variables were

created for categorical variables such as Company, Year, and Sector to capture fixed effects. These dummies allowed us to control unobserved heterogeneity across companies, years, and sectors.

The differences between these models are that they use different dependent and independent variables as shown below. The models were structured to capture the effect of environmental performance on firm value while controlling for firm-specific, year-specific, and sector-specific fixed effects. To explore the heterogeneity of different countries, interaction terms between country dummies and key independent variables were included. This allows to see if the relationship between environmental performance and firm value varies across countries.

$$ROA_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 \log(TASST)_{it} + \beta_3 Leverage\_TDTA_{it} + \sum_{j=1}^{N-1} \gamma_j Company_j + \sum_{k=1}^{T-1} \delta_k Year_k + \sum_{l=1}^{S-1} \zeta_l Sector_l + \sum_{m=1}^{C} \phi_m (Country_m \, X \, EP_{it}) + \varepsilon_{it} \quad \text{Model 1}$$

$$ROA_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 \log(TASST)_{it} + \beta_3 Leverage\_TDTA_{it} + \sum_{j=1}^{N-1} \gamma_j Company_j + \sum_{k=1}^{T-1} \delta_k Year_k + \sum_{l=1}^{S-1} \zeta_l Sector_l + \sum_{m=1}^{C} \phi_m (Country_m \, X \, ESG_{it}) + \varepsilon_{it} \quad \text{Model 2}$$

$$EBITDA_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 \log(TASST)_{it} + \beta_3 Leverage\_TDTA_{it} + \sum_{j=1}^{N-1} \gamma_j Company_j + \sum_{k=1}^{T-1} \delta_k Year_k + \sum_{l=1}^{S-1} \zeta_l Sector_l + \sum_{m=1}^{C} \phi_m (Country_m \, X \, EP_{it}) + \varepsilon_{it} \quad \text{Model 3}$$

$$EBITDA_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 \log(TASST)_{it} + \beta_3 Leverage\_TDTA_{it} + \sum_{j=1}^{N-1} \gamma_j Company_j + \sum_{k=1}^{T-1} \delta_k Year_k + \sum_{l=1}^{S-1} \zeta_l Sector_l + \sum_{m=1}^{C} \phi_m (Country_m \, X \, EP_{it}) + \varepsilon_{it} \quad \text{Model 4}$$

where:

- ROA_{it} and $EBITDA_{it}$ were the dependent variables normalized for company i at time t.
- EP_{it}, ESG_{it}, $TASST_{it}$, and Leverage_$TDTA_{it}$, were the independent variables for company i at time t.
- $Company_j$, $Year_k$, and $Sector_l$ were dummy variables for the fixed effects of each company j, year k, and sector l.
- $Country_m \times EP_{it}$ were the interaction terms between country dummies and the environmental score.
- $Country_m \times ESG_{it}$ were the interaction terms between country dummies and the *ESG* score.
- β_0, β_1, β_2, β_3, γ_j, δ_k, ζ_l, and ϕ_m were the coefficients to be estimated.
- ε_{it} was the error term.

The study employs fixed effects models within a panel data framework to explore the relationship between ESG performance and corporate financial performance in Pacific Alliance companies. This modeling approach offers several distinct advantages:

Control for unobserved heterogeneity

Fixed effects models are particularly effective in controlling for time-invariant unobserved heterogeneity (Nygård and Thoresen, 2023). By including company-specific fixed effects, it is possible to account for characteristics that remain constant over time but vary between companies, such as corporate culture, management practices, and operational strategies. This enables a more accurate isolation of the impact of ESG performance on financial outcomes.

Mitigation of omitted variable bias

Including fixed effects for years and sectors allows the model to account for time-

specific and industry-specific factors that could influence financial performance. This helps mitigate omitted variable bias, which occurs when relevant variables correlated with both the independent and dependent variables are left out of the model.

Examination of country-specific effects

By incorporating interaction terms between country dummies and key independent variables, the study examines whether the relationship between ESG performance and financial outcomes varies across different countries. This is crucial given the unique economic and regulatory environments in the Pacific Alliance countries.

Alignment with previous research

While building on the methodology used by (Aydoğmuş et al., 2022), this study extends the application to a different geographical context. This alignment with established research enhances the robustness of the results and allows for meaningful comparisons.

Addressing specific research questions

The research aims to understand the impact of ESG performance on financial variables like ROA and EBITDA, considering the unique environment of the Pacific Alliance. The fixed effects model is well-suited to addressing these specific research questions by controlling for various confounding factors.

By employing this robust modeling approach, the study not only adheres to established methodologies but also adapts them to the unique context of the Pacific Alliance, thereby providing valuable insights into the ESG-financial performance relationship in these emerging markets.

2.4. Statistical analysis

For each model was determined: the mean squared error (MSE), the coefficient of determination (R^2), the correlation between variables by Pearson correlation, normality tests of residuals (Omnibus), kurtosis coefficient of the residuals, and the *p*-values with a statistical significance of 95 and 99% (Paul and Zhang, 2010).

To correct the problems of heteroscedasticity and serial correlation in the linear regression model, a white robust correction (vcovHC) was performed (Zeileis, 2004).

3. Results

This section presents the findings of the statistical analysis conducted to explore the relationship between environmental performance and the value of Pacific Alliance companies. Descriptive results of the variables used, the correlation analysis between them, and the results of applying linear regression models. The main coefficients and relationships identified are discussed and compared with previous studies. The results found provide mixed evidence on the existence of a correlation between environmental sustainability and financial value for the companies analyzed.

3.1. Sample data

The sectoral distribution aimed to broadly align with the sector composition of the overall indexes, ensuring representation from all major industries. However, the

final sample is constrained by data availability, particularly concerning ESG disclosures, and the small sample size is a significant limitation of this study. The sample represents the accessible population that meets the ESG and financial data requirements. This sample is considerably smaller than that used in other studies focusing on different regions (Jiang et al., 2023), although it surpasses the 54 Latin American companies considered in Aydoğmuş et al. (2022) work. The number of companies included by country and their classification by sector are shown in **Table 3**.

When comparing the sectors of the companies with the sectors that contribute the most to Gross Domestic Product (GDP) in each of the Pacific Alliance countries, similarities in composition can be seen. This shows the representativeness of the sample of companies in the economies of the countries.

In the case of Chile, approximately 54% of GDP is contributed by companies in the commerce, financial, utilities and telecommunications sectors (ODEPA, Oficina de Estudios y Políticas Agrarias, 2024). These represent 82% of the total number of Chilean companies in the sample.

Historically, 60% of Colombia's GDP has been made up of the service sector (Dane, 2024), which is equivalent to approximately 46% of the companies in the sample, and the primary sector, with an approximate participation of 14%–18% of GDP, which is equivalent to approximately 31% of the companies in the sample.

On the other hand, Peru's GDP is distributed in the services sector with an approximate weight of 50%, the manufacturing sector with 12.4% and the mining and hydrocarbons sector with 11.3%. Ninety-five percent of the companies in the sample used in this study for Peru belong to these sectors, which lead the country's GDP (Banco central de Reserva del Perú, 2024).

In the case of Mexico, its GDP is comprised of approximately 62.3% of the service sector (commerce, transportation, mass media information, corporate, financial and all services) , which is equivalent to 46% of the companies in the sample. The secondary sector (manufacturing, construction, electricity, water, gas), represents about one third of the GDP and corresponds to 36% of the sample (México Como Vamos, 2024).

3.2. Regression model

Table 4 presents the summary statistics of the data used in the models. It is evident that the average ESG Score was 51 and the EP Score was 45.9 on average. The average ESG and EP values were higher in the Pacific Alliance companies compared to the UK companies analyzed by Li et al. (2018). In **Figure 1**, it is evident that the sectors with the highest average ESG and EP scores are forestry, construction, and oil and gas. These behaviors are similar to those reported by D'Amato et al. (2022) in STOXX Europe 600 Index companies. Evidencing that sectors with a historical track record of high environmental impacts have in turn the highest ESG and EP scores (Yoon et al., 2018).

On the other hand, EBITDA and ROA values averaged 1036.29 and 4.68, respectively. Both variables had a wide range of variation.

Table 4. Statistical summary for variables in the company dataset from 2016 to 2022.

	ESG Score	EP Score	Log (TASST)	TDTA	EBITDA	ROA
N	516	516	516	516	516	516
Mean	51.01	45.99	3.56	0.30	1036.29	4.68
SD	22.27	26.99	0.62	1.14	1984.52	6.20
Min	0.00	0.00	1.75	−0.41	−51.36	−21.96
25%	37.75	26.11	3.23	0.09	195.47	1.59
50%	55.89	48.14	3.53	0.21	409.78	3.91
75%	67.76	67.20	4.05	0.33	1115.28	6.97
Max	94.35	98.25	4.92	15.90	16306.94	53.28

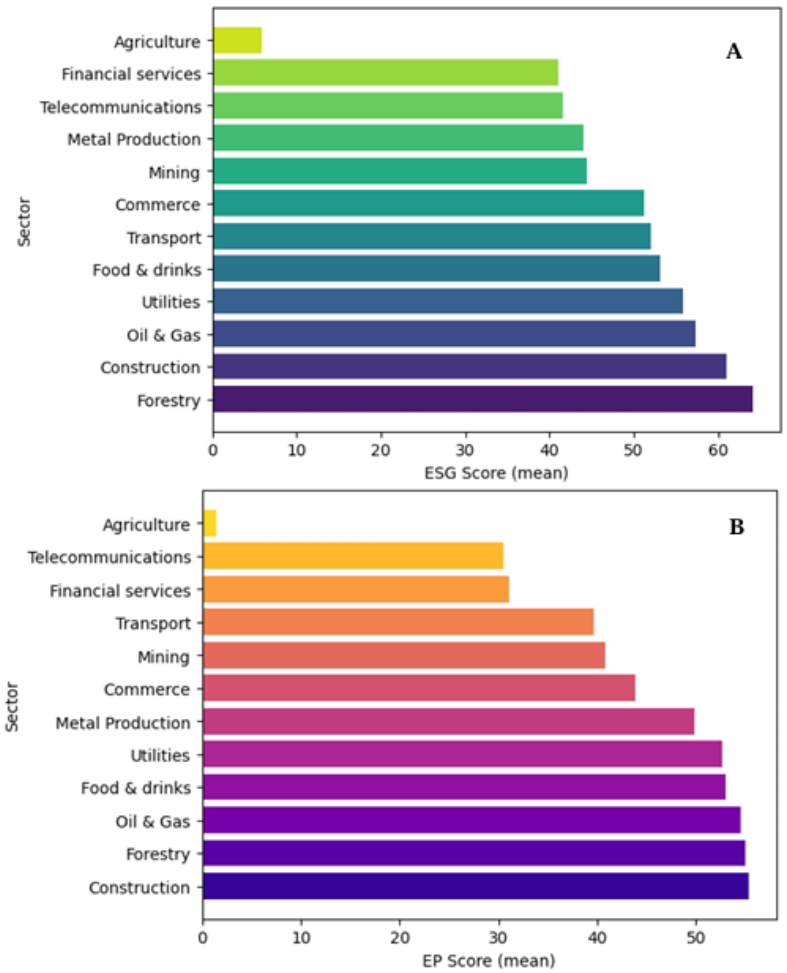

Figure 1. Average ESG score **(A)** and EP score **(B)** for each industrial sector.

Figure 2 shows the correlations between the different variables through a correlogram (the intensity of the color is proportional to the correlation coefficient between the variables). It also indicates the existence of linear dependence between the variables. In this sense, there is a slight positive correlation between EBITDA and the logarithm of total assets. This behavior can be explained by various factors such as economies of scale, greater debt capacity, and market diversification as companies

become larger (Bouwens et al., 2019; Brealey et al., 2018; Damodaran, 2012). On the other hand, a positive correlation between ESG Score and EP Score was evidenced. This behavior was expected because the EP Score is one of the pillars that make up the ESG Score (Agliardi et al., 2023).

Figure 2. Correlation for each variable in the model.

Table 5 shows the results from the linear regression analyses, summarizing the effects of ESG and EP scores, company-specific factors, and economic conditions on normalized EBITDA and ROA across Pacific Alliance companies.

Table 5. Results of the linear regression model between the dependent variables, control variables, and independent variables.

Model	**1**	**2**	**3**	**4**
EP Score	−0.012 (0.007)		0.385 (1.067)	
ESG Score		−0.012 (0.032)		0.694 (0.763)
Log_TASST	1.4155** (0.168)	1.439** (0.503)	1822.634** (115.994)	1819.332** (110.974)
Leverage_TDTA	−0.2485* (0.085)	−0.249** (0.278)	198.012** (21.889)	197.037** (23.010)
Company	1.4768 ± 1.0275	0.1524 ± 0.8541	0.0229 ± 0.8840	0.0266 ± 0.8680
Year	−0.0683 ± 0.2106	−0.0294 ± 0.2087	0.0854 ± 0.0800	0.0909 ± 0.0799
Sector	0.0858 ± 0.6052	0.1806 ± 0.5677	−0.0093 ± 0.3715	−0.0119 ± 0.4024
EP or ESG X Country	0.0124 ± 0.0155	0.0089 ± 0.0063**	0.0017 ± 0.0008**	−0.0002 ± 0.0040**
Observations	516	516	516	516
R^2	0.613	0.609	0.960	0.960

For ROA (Models 1 and 2), the models showed a moderate explanatory power with an R-squared value of 0.613. ESG and EP scores on ROA were not statistically significant.

Models 3 and 4 demonstrated a strong fit with a high R-squared value of 0.960, indicating that 96% of the variability in normalized EBITDA across companies can be explained by the predictors included in the model. The significant predictors encompassed various company-specific factors, suggesting that company performance

significantly impacts EBITDA outcomes, overshadowing the impact of ESG and EP scores which did not reach statistical significance.

Each value represents the coefficient for the model. * and ** indicates significant differences (p-value < 0.05 and p-value < 0.01 respectively). Data in parenthesis indicates the F-statistic. For company, year and country values indicates the mean value and standard deviation for all coefficients in each category.

4. Discussion

4.1. Regression models

The ROA values obtained were higher on average than those reported by Anita et al. (2023) in Indian companies. Likewise, the Leverage_TDTA was lower than that reported by the researchers. In general, a higher ROA indicates greater effectiveness in generating profits with its assets in an accounting period. A value higher than 5% in this indicator is considered desirable (Aydoğmuş et al., 2022). ROA values had variations between −21.96 to 53.28, however, the mean of this indicator was below 5% indicating that Pacific Alliance companies are not as efficient with their assets for the accounting periods analyzed. Regarding EBITDA, values ranged from −51.36 to 16306.96, indicating a wide range of variation among Pacific Alliance companies. Negative values of this indicator represent fundamental problems in companies' earnings before interest, taxes, depreciation, and amortization; however, positive values do not necessarily indicate revenue generation (Bianconi and Tan, 2019). The variation in ROA and EBITDA data can be partly explained by the anomalous data evidenced in 2020 due to issues related to the COVID-19 pandemic (Lanchimba et al., 2020). This fact generally resulted in better returns for sectors such as retail and food and beverages and lower returns for sectors such as financials, construction, and mining.

It is important to mention that the model was run excluding the years 2020–2021, to verify if the COVID-19 pandemic significantly affected the statistical model and its correlations. Finally, it was concluded that, excluding these two time periods, both models continued to yield the same correlations and there were no significant differences in the overall results of both. It was therefore decided to consider both years (**Table 5**)

The ESG coefficient is non-significant in all models, providing no evidence for a correlation between overall ESG score and firm value for these Pacific Alliance firms. The EP coefficient is also non-significant in all models, suggesting no linkage between focused environmental performance and financial returns.

The results found differ from those reported by Aydoğmuş et al. (2022) and Li et al. (2018). These authors evidenced that ESG and EP correlated positively and significantly with ROA. In addition to this, the researchers reported a negative and significant correlation between firm size (Log_TASST) and firm value determined by ROA. This behavior is contrary to that found in this study, where the relationship between both variables is positive and significant.

However, it is important to note that the authors' sample was of companies with a market cap greater than USD 2.85 billion or companies from the United Kingdom. For the Pacific Alliance, despite in general the ESG and EP scores were higher on

average than those of the companies taken by Aydoğmuş et al. (2022) and Li et al. (2018) none of the companies presented these market cap values.

The regression models demonstrate significant heterogeneity among companies from different countries, as evidenced by the variability in the coefficients associated with the dummy variables for each company and country. This variability indicates that EBITDA and ROA are affected differently depending on the company and the national context in which it operates (**Table 5**).

Some companies that show this are America Movil from Mexico and Ecopetrol from Colombia. These companies had a very high (7.0490) and significant coefficient, suggesting a strong positive impact on EBITDA and ROA. On the other hand, several companies have small or insignificant coefficients, indicating they do not have a significant impact on EBITDA within their respective countries.

Regarding the ESG and EP scores, the country-specific variables for these variables also show small and non-significant coefficients, suggesting that differences in ESG and EP scores at the country level do not significantly impact EBITDA or ROA.

The lack of significant ESG-value relationships in this analysis raises questions about the applicability of instrumental stakeholder theory in the Latin American and Pacific Alliance context. The theory suggests higher ESG engagement with stakeholders should improve financial performance, but this expected linkage was not evidenced here.

One potential explanation is that the unique economic and cultural conditions in countries in the Pacific Alliance alter how ESG/EP engagement impacts stakeholders like employees, suppliers, and customers, weakening the theoretical mechanisms that are supposed to translate into financial gains (Maso et al., 2017; Reyes et al., 2018). Even in the Pacific Alliance countries, the disclosure and adoption of environmental initiatives is not mandatory. More research into stakeholder dynamics in Pacific Alliance firms could provide insights into why instrumental stakeholder theory may not directly translate.

The findings also highlight the difficulty of accurately measuring firm financial value in Pacific Alliance firms using metrics like ROA and EBITDA. As noted earlier, these accounting measures have advantages over market valuation metrics in the region but are still impacted by factors like currency fluctuations (Franz, 2021; Starr, 2021). ROA and EBITDA may limit the ability to accurately capture the financial performance effects of ESG/EP engagement.

Comparing to other Latin American studies, our findings align more with Duque and Aguilera (2021) who also found non-positive ESG-financial performance relationships. This contrasts with Correa and Vásquez (2020) who evidenced positive correlations. More research is needed to understand the different dynamics across countries and industries within Pacific Alliance firms.

5.Contributions

5.1. Practical contributions

This study provides several practical contributions:

The findings offer valuable insights for corporate managers and policymakers in

the Pacific Alliance countries. Understanding that ESG and EP scores may not have a significant immediate impact on financial performance highlights the need for companies to balance sustainability initiatives with other strategic business investments.

For investors, the results underscore the importance of considering multiple factors beyond ESG scores when evaluating potential investments. This could lead to more informed and balanced investment strategies that consider both financial and non-financial metrics.

The study's findings can inform policymakers about the current state of ESG practices and their impact on financial performance in the Pacific Alliance. This can help in designing better regulatory frameworks and incentives to promote sustainable business practices.

5.2. Theoretical contributions

This research also makes significant theoretical contributions:

By applying stakeholder theory to the context of the Pacific Alliance, the study extends the theoretical framework to emerging markets. It challenges the assumption that the positive relationships observed in developed markets automatically apply to emerging markets, highlighting the need for localized models.

The study provides empirical evidence on the relationship between ESG performance and financial outcomes in the unique economic and cultural conditions of the Pacific Alliance countries. This contributes to the broader literature by offering context-specific insights that enrich the global understanding of ESG impacts.

The use of fixed effects models and the detailed consideration of control variables such as firm size and leverage provide a robust methodological approach. This can serve as a reference for future studies aiming to explore similar relationships in different contexts.

5.3. Limitations and future directions

Despite its contributions, this study has several limitations that suggest avenues for future research:

The sample size of 86 companies, although representative, is relatively small. Future research could expand the sample size and include more companies from different sectors to enhance the generalizability of the findings.

The study covers a time frame from 2016 to 2022. Including a longer period could provide more comprehensive insights into the long-term effects of ESG practices on financial performance.

Future research should consider including additional firm characteristics such as ownership structure, years of establishment, and export values to provide a more nuanced understanding of how these factors influence the relationship between ESG performance and financial outcomes.

6. Conclusion

This work contributes to the literature by addressing empirical studies in the applicability of global ESG-financial performance models on a sample of Pacific

Alliance firms, determining they do not directly translate to this context. Providing initial evidence that ESG dynamics and firm valuations may follow distinct patterns in Pacific Alliance countries vs other regions. Demonstrating the challenges of ESG data availability and identifying appropriate financial valuation metrics for Pacific Alliance companies. Highlighting Pacific Alliance firms as an important context requiring further research to understand ESG-financial linkages in emerging markets.

Some key points highlighted within the research work include that regression models showed no significant correlation between overall ESG or EP scores and accounting-based firm value measures of ROA and EBITDA. This contrasts with some previous studies in other regions that found positive ESG-financial performance links.

The inconclusive results on ESG-firm value connections underscore the need for continued research using larger samples, localized models, and exploring which ESG aspects drive financial performance Pacific Alliance.

Studying faces certain inherent challenges. While the sample size of 86 companies may appear small, it is crucial to recognize the deliberate selection of a representative subset of the most influential and active firms in terms of capitalization and stock market transactions within the Pacific Alliance countries. These firms were chosen for their size and significant economic impact in the region. However, it's important to note that the availability of information was a key factor in defining this select group. This constraint, while presenting challenges, underscores the need to develop more localized and specific valuation proxies. Such development would support future research with larger and more comprehensive samples over time, providing stronger evidence.

Based on the findings in this study and the limitations, some aspects can be addressed for future research. Expanding the sample size, incorporating more companies from the Pacific Alliance countries. Incorporating longer periods to better understand ESG-financial trends over full business cycles. Testing additional financial valuation metrics tailored to emerging markets, like return on invested capital. Surveying Pacific Alliance countries' stakeholders like employees and customers to understand cultural perceptions of ESG. Developing theoretical frameworks adapted to the Pacific Alliance countries' context to better inform empirical models**.**

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