

Evans, Dylan; Kramer, Grace Anna; Lanfranchi, Marco; Brijlal, Pradeep

## Article

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## Environmental, Social and Corporate Governance (ESG) on the Financial Performance of Listed Mining Firms in South Africa

Dylan Evans<sup>1</sup>, Grace Anna Kramer<sup>2</sup>, Marco Lanfranchi<sup>3</sup>, Pradeep Brijlal (PhD)<sup>+4</sup>

<sup>1,2,3,4</sup> Department of Finance and Tax, University of Cape Town, South Africa

ARTICLE INFO	ABSTRACT
<p>Article History</p> <p>Received 22 September 2023 Accepted 12 January 2024</p> <hr/> <p><i>JEL Classifications</i> G10, G30, G34, M14</p> <p><b>Keywords:</b> ESG; financial performance; asset utilisation, panel regression</p>	<p><b>Purpose:</b> This study aimed to determine the relationship between the environmental, social, and governance factors (ESG) and the financial performance of mining firms within South Africa. Prior research has focussed primarily on the ESG components and lacked further investigation on the sub-components of ESG as it applies to specific sectors.</p> <p><b>Design/methodology/approach:</b> Convenience and judgment sampling were used to draw a sample from a publicly available database. Based on a criterion for robust analysis, 13 of 41 JSE listed mining companies were selected. This study used a two-way random effects panel regression analysis to determine the relationship between ESG variables and firm financial performance on JSE-listed mining firms, in South Africa from 2008 to 2020.</p> <p><b>Findings:</b> There was no statistical relationship between overall ESG score and firm performance. However, only the Governance score illustrated a statistically significant relationship with financial performance. Within the sub-components, the following had a significant negative relationship with firm performance: emissions; environmental innovation; working conditions; and shareholder responsibility. However, human rights and CSR strategy significantly positively correlated with financial performance.</p> <p><b>Research limitations/implications:</b> This research was conducted specifically on South African mining companies, and therefore cannot be generalised to other industries or markets in developing and developed countries. Managers and policymakers within the mining industry should consider the practical implications and interpretations of the findings and may offer incentives to implement improvements regarding emissions, environmental innovation, and working conditions.</p> <p><b>Originality/value:</b> This research delved deeper into the sub-components of the ESG pillars to get a better understanding of each sub-component on firm performance.</p>

### 1. Introduction

A firm's environmental, social, and governance (hereafter referred to as ESG) factors have become an increasingly important consideration for investors, shareholders, and business managers globally. Investors can use ESG factors to assess potential risks and opportunities for a firm to create long-term shareholder value. Further, managers can position their firms to account for the ESG requirements outlined by regulatory bodies and those particularly preferred by investors. ESG is a multidimensional factor that includes environmental concerns such as carbon emissions and sustainable material sourcing, social issues such as labour practices and product safety, and governance matters such as board diversity and tax transparency. The ESG challenges a company faces vary widely based on industry and company maturity; therefore, there is no one size or type which fits all (PWC, 2020).

According to Chartered Accountants of Canada (2010), there are five main reasons for the use of ESG information by investors, namely, to inform risk and return potential, evaluate management quality, engage with companies and inform proxy voting, develop customised investment products or portfolios and assess asset managers.

Rating agencies determine a firm's ESG ratings by accounting for the firm's performance on various ESG components. The ratings are then adjusted to the characteristics of the firm's industry so that components can be weighted based on their relevance to the industry. The final score is expressed through a numerical scale and a letter ranking system (Farnham, 2020). A listed firm can thus disclose an overall ESG score and separate scores for the

three components that make up the overall score. A company's score potentially offers investors a more profound and precise analysis of a firm's performance, specifically concerning environmental, social, and governance concerns.

Consumer behaviour is changing, and consumers are shifting focus to increase sustainable consumption choices and decrease their negative environmental impact (MSCI, 2021). Changing consumer behaviour correlates with firm financial performance, as revenues may be linked to consumers' changing spending habits. ESG scores are becoming increasingly important to other stakeholders, such as suppliers and governments, and managers and investors need to account for this moving forward (Farnham, 2020). This increased importance of ESG considerations emphasises the need to understand the relationship between a firm's ESG scores and financial performance.

Previous research in developing markets by Dalal & Thaker (2019); Zhao et al. (2018) found a positive relationship between ESG and firm financial performance in Indian and Chinese securities markets across different industries. In the developed markets, such as the USA and Europe, similar results were found by Alareeni & Hamdan (2020) and Bartlett et al. (2020).

However, studies in South Africa by Johnson et al. (2019) and Chetty et al. (2014) found a negative relationship between ESG and firm performance, contradicting the findings of other countries. Researchers such as Johnson (2020), Sayed (2018), and Nkomani (2013) did not probe the effects of the individual ESG sub-pillars on the firm's financial performance. Furthermore, these studies did not investigate the impact of ESG on the key drivers of firm performance, such as asset utilisation, profitability, and leverage. This study addresses a gap in South African and foreign literature, focusing primarily on a single industry, the mining sector, with more detailed ESG and firm performance depth. This study thus aimed to determine the relationship between the ESG scores, and the financial performance of mining firms listed on the JSE, South Africa. Firms could also use these findings to prepare to mitigate the negative financial implications of specific ESG subcomponents before policies are introduced.

The mining sector relies heavily on its social pillar, particularly its labour force and environmental pillar, as raw materials are used throughout production (Stafford, 2021). Further, governance issues are a cause for concern in many South African mining firms, highlighting the need for research in this sector. The core operations of the mining sector correlate very well with the individual pillars and sub-components of ESG, thereby serving as a suitable industry for further exploration. Mills (2021) states that ESG issues across the different pillars offer the mining sector some of its biggest challenges regarding its daily operations and activities.

The remainder of the article is arranged as follows: The following section offers a critical overview of the literature on the relationship between ESG and firm performance, including theories underpinning the explanations for the different relationships. After that, the research methodology will be discussed, the collection of the quantitative ESG scores and the data analysis. The results, discussions, and conclusions, including study implications, limitations, recommendations for future studies, and concluding remarks, follow this.

## **2. Review of Literature**

Literature on possible relationships between ESG and firm financial performance is explored in this section. The stakeholder theory put forward by Moskowitz (1972) is discussed, followed by Jones's (1995) agency cost theory; these theories explain the positive and negative relationships between ESG scores and firm financial performance. Global research on the overall ESG score in emerging and developing markets, including South Africa, is discussed, followed by an exploration of the literature on the relationships between the individual E, S, and G pillars and financial performance and the specific sub-components of these pillars.

### **2.1 Theoretical background**

Two main theories explain the relationship between ESG and the financial performance of firms; the first is the stakeholder theory, and the second is the agency cost theory. The stakeholder theory states that every firm has different stakeholders that influence the actions of the firm and are influenced by the activities of the firm, for example, its customers, suppliers, and workers (Moskowitz, 1972). This theory supports the positive relationship between ESG and firm performance. The positive relationship revolves around how greater ESG compliance improves mutual trust and increases cooperation between the firm and the various stakeholders. The positive relationship reduces implicit and explicit costs experienced by the firm primarily attributed to these stakeholders, thus making the firm more profitable (Li et al., 2018).

Research conducted by Jones (1995) supported the stakeholder theory concluding that ESG better satisfies the interests of nonowner stakeholders, i.e., debtors, employers, customers, and regulators. Thus, the ESG factors allow for more efficient contracting and open new paths for further business growth, risk reduction, and long-term value creation.

The agency cost theory states managers will only partake in ESG compliance if it benefits their positions. Therefore, they will focus the firm's resources on ESG projects instead of other more relevant profit-producing projects (Naila, 2013), adding that this negatively affects the firm's price and profitability, as competitors who don't comply with ESG requirements will not incur the same costs and, in turn, may generate more returns for their shareholders. This theory supports the negative relationship between ESG and firm financial performance. Friedman (1970) best summarises this opposing relationship argument by claiming that maximisation of the firm's profits is the firm's only social responsibility. The agency cost theory, therefore, notes that these increased benefits from better

ESG compliance, such as positive social and environmental impacts, will not outweigh the increased costs to the firm and will therefore reduce its overall profitability and performance (Friedman, 1970).

Research conducted in developed markets and developing markets is presented below. European and North American countries were referenced to describe best-developed market findings, whilst BRICS member countries were assumed to describe emerging market findings best.

## 2.2 Developed market findings.

Alareeni & Hamdan (2020) analysed annual data for five hundred S&P 500 firms from 2009 to 2018, using the overall ESG scores presented on Bloomberg as the major indices in identifying environmental, corporate social responsibility (CSR), and corporate governance. The study evaluated the firm financial performance based on Return on Equity (ROE) and Return on Assets (ROA), using firm size, financial leverage, and asset growth as control variables. Their results showed that overall ESG scores tended to be higher for firms with greater financial leverage and a more extensive asset base. Firms with higher ESG scores showed better performance when utilising ROE and ROA.

Fatemi et al. (2018) research on 403 US-Listed, for the period 2006 to 2011, investigated the effects of ESG disclosure on ROE and firm value and found that increased ESG disclosure decreased firm value and ROE. The explanation was that the market might interpret increased disclosure as the firm's attempt to justify over-investment in ESG. The ESG disclosure may be perceived as a negative signal to the market, which drives down firm value through a reduced share price for listed firms.

Pasquini-Descomps (2013) study in the Swiss market for the period 2007 to 2011 utilised ESG news-based scores instead of the ESG compliance-based scores used by Fatemi et al. (2017) and, Alareeni & Hamdan (2020). The news-based scores were based on positive and negative news articles about a company found in newspapers and other media sources containing keywords concerning the environment, social, and governance. Pasquini-Descomps's study investigating how news-based scores in ESG would influence the yearly financial return found a significant negative relationship between improved labour ratings (included in the social component of ESG, which will impact the ESG score as a whole) and ROA. This would mean that a firm engaging in ESG activities could potentially increase its financial performance, supporting the stakeholder theory as previously discussed.

## 2.3 Developing market findings

In the emerging market group (BRICS), Dalal & Thaker (2019) conducted a panel study, analysing 65 listed Indian firms from 2015 to 2017, exploring the impact of ESG factors on the firm's profitability, performance, and value. The study found a positive relationship between good corporate ESG performance and financial performance assessed through market-based and accounting measures. Similarly, Zhao et al. (2018) examined China's listed power generation groups from 2007 to 2016 through a panel regression model. They found that better ESG compliance-based scores improved the financial performance of the power generation firms in China.

Studies conducted in South Africa by Demetriades & Auret (2014), Du Toit & Lekoloane (2018) used the JSE Socially Responsible Index (SRI) as a proxy for ESG. SRI constituents attained a higher ROE and ROA than conventional firms, concluding that social performance was positively - and sometimes significantly - correlated with ROE. Demetriades & Auret (2014) found a significant positive relationship between SRI and ROE when total assets were used as a proxy for size. Conversely, there was a significant negative relationship between ROA and the SRI when firm turnover was used as a proxy for size. Another study by Nkomani (2013) compared the financial performance of firms that were either members of the SRI or non-members of the SRI over the period 2002 to 2011 and found a significant negative relationship between members of the SRI Index and accounting-based ROA.

A South African study by Erasmus et al. (2017) investigated the relationship between a firm's CSR score and its financial performance using ROA, ROE, earning per share (EPS), and total shareholder return (TSR), using 230 firms from 6 different sectors, found a significant positive relationship between CSR and accounting-based EPS and ROA. There was also a significant negative relationship between CSR and market-based total shareholder return. In contrast, an earlier South African CSR study by Chetty et al. (2014) found that CSR activities do not significantly differ in financial performance.

Sayed (2018) compared the ROE and ROA of firms that had been ESG-compliant for more than five years between 2007 and 2017 with non-ESG-compliant firms. The study used a multiple linear regression model with ESG compliance as a dummy variable, market capitalisation as a proxy for size, and the debt-to-asset ratio used as a proxy for risk. The study found no significant relationship between ESG compliance and financial performance.

Most of the relevant South African research, such as that by Sayed (2018), Johnson (2020), and Nkomani (2013), broadly explored the relationship between ESG scores and financial performance. These papers investigated the relationship between industries and performance measurements in broad terms and did not probe the drivers of firm performance, such as profitability, asset efficiency, and leverage. Although researchers such as Du Toit & Lekoloane (2018) and Chetty et al. (2014) took individual industries into account in their analysis by using a control variable in the various statistical models, little industry-specific research and therefore, insight was provided.

Erasmus et al. (2019) studied six industries in South Africa using accounting, market, and value-based metrics. A panel regression analysis uncovered the individual E, S, and G scores' relationships with the firm financial performance metrics. The study concluded a significantly positive relationship between social scores and accounting-based EPS, market-based earning yield, and value-based return on invested capital, and a positive relationship

between governance scores and ROA, return on invested capital (ROIC), and market value added (MVA) for the consumer goods sector. Firms in the consumer sector tended to benefit financially from high social scores.

In limited European studies, Bartlett et al. (2020) have explored the individual sub-components of the E, S, and G pillars using 1038 companies. These sub-components can clarify the relationship between ESG and firm financial performance. Scores for the environmental pillar included resource use, emissions, and environmental innovation; the social pillar included employee productivity, human rights, and worker diversity; and governance scores included quality of management and CSR strategy. ROA and ROE metrics were utilised to capture firm performance. The main findings revealed a positive relationship between environmental innovation, employee productivity, worker diversity and firm performance.

Detailed industry-specific analysis exploring the relationship between ESG scores, and financial performance has not been conducted on the mining sector in South Africa. This lack of research is surprising considering the size and importance of the industry to the South African economy. South Africa is estimated to have the world's 5th largest mining sector in terms of GDP (Langenhoven, 2020). In 2020, mining contributed to almost 8.7% of the country's total GDP and employed around half a million people in its workforce (Statistica, 2021).

The mining sector by itself is very relevant to particular ESG factors. Firstly, a high level of interaction occurs with environmental factors such as carbon emissions and water pollution. Secondly, social factors are relevant given the high level of employment in the mining process and the high probability of disrupting local communities through extensive land use. Thirdly, infringements of human rights arising from questionable employment conditions are an essential issue. Lastly, governance issues, particularly legal compliance, corruption, anti-bribery, and transparency, are relevant (Walker, 2021). Companies have historically ranked very poorly on environmental, social, and governance indicators, which is why they may have been reluctant to disclose the information in the first place (Walker, 2021). The research illustrates poor compliance with the shift to a more environmentally and socially responsible world and the need for change in the sector. Propelled by investor demand and supported by a changing global economy, there is now widespread recognition in the mining industry globally that ESG has to be a core component of any mining company's strategy. South Africa will likely follow suit in this regard (Stafford, 2021), which is sufficient motivation for investigating these mining firms regarding their ESG and firm performance relationship.

The conflicting research incorporating an overall ESG score in both developed and developing markets is particularly interesting. Sayed (2018) had inconclusive findings, whilst Chetty et al. (2014) and Erasmus et al. (2019) found some positive relationships between ESG and firm performance and Biggs et al. (2017) found negative relationships. A variety of methods to test the relationship, particularly in measuring ESG as a score with several metrics deemed suitable, for example, ROE or ROA (2018) utilised a variety of compliance-based approaches, whilst Du Toit & Lekoloane (2018) used news-based strategies. The combination of methods illustrates the highly subjective nature of the most accurate way to capture ESG performance. However, using ROA and ROE for firm performance was a common choice amongst most global and domestic researchers (Demetriades & Auret, 2014; Erasmus et al., 2017). It also highlights that changing the metrics for firm performance could significantly alter the conclusions of the studies. Therefore, it is deemed appropriate to consider the key drivers of firm performance and show how ESG impacts these drivers.

The following research question is proposed from the gaps identified: Is there a significant relationship between environmental, social, and governance (ESG) scores and the financial performance of mining firms listed on the Johannesburg Stock Exchange (JSE)? The following hypotheses are formulated to answer the research question.

Hypothesis 1: There is a statistically significant relationship between the overall ESG score and the firm performance metrics of JSE-listed mining firms.

Hypothesis 2: There is a statistically significant relationship between either the E, S, or G pillar scores and firm performance metrics of JSE-listed mining firms.

Hypothesis 3: There is a statistically significant relationship between ESG sub-component scores and the firm performance of JSE-listed mining firms.

### 3. Methodology

The population for this study consisted of all JSE-listed mining firms from 2008 to 2020. The start of the research period coincides with the introduction of publicly available ESG scores of JSE-listed mining firms on the Refinitiv Eikon (2021) financial platform for South Africa. Convenience and judgment sampling were used to draw a sample from the publicly available database. The firm observations were selected based on the judgment criteria listed below.

- Data needed to be available from 9 years before 2021 for each mining company in South Africa.
- Complete information about all ESG disclosure scores and financial performance measurements had to be available on the Refinitiv Eikon (2021) database.
- The mining firm had to be listed on the JSE and have its headquarters in South Africa.

Based on the judging criteria above, only 13 out of the current 41 JSE-listed mining firms were headquartered within South Africa (other mining firms listed but headquartered elsewhere would have different activities, regulations, and practices that would compromise the validity of the investigation) and had the complete financial and

ESG data required for the study. Of the 13 firms in this study, 6 were gold mining firms, 1 was an iron ore miner, 4 were platinum miners, and 2 were multi-commodity mining firms.

The financial performance measurements used in the study were return on equity (ROE) and return on assets (ROA) used in previous studies by Alareeni & Hamdan (2020), Du Toit & Lekoloane (2018), and Pasquini-Descomps (2013), and asset turnover, financial leverage, operating profit, and net profit.

A panel regression analysis of 9 individual regression models investigated the relationship between the independent (various ESG scores) and dependent variables (financial performance variables). A two-way random-effects model was implemented to conduct our analysis. The chosen model increases the validity of the analysis since the Amemiya transformation reduces both the individual and two-way effects on the analysis, as used by Johnson (2020) and Erasmus et al. (2019).

The control variables for firm size and leverage were utilised in the analysis to improve the validity of the results. As firms become larger, they expect to receive more attention from various stakeholders and, in turn, be under tremendous pressure to comply with ESG requirements (Erasmus et al. (2019). In line with Du Toit & Lekoloane (2018), market capitalisation was used as a proxy for firm size, and the Debt to Assets ratio was used as a proxy for firm leverage. Ethical clearance was not required as all information was secondary data publicly available on the Thomson Reuters Refinitiv Eikon Platform.

#### 4. Results and discussion

The following section tested the relationships between the ESG scores and financial performance metrics of South African mining sector firms. Firstly, an overall ESG score's relationship with financial performance was analysed, followed by an analysis of the individual E, S, and G pillar scores and their sub-components with financial performance. Panel regression analysis was conducted, implementing a two-way random-effects model with an Amemiya transformation to test the hypotheses at the 5% significance level.

The relationships between the overall ESG score and the financial performance measurements chosen for the study are shown in Table I below.

**Table I: ESG scores and dependent variables**

	<i>Dependent variable:</i>							
	Return On Assets	Return On Equity	Equity Turnover	Asset Turnover	Financial Leverage	Net Profit Margin	Operating Profit Margin	Interest Burden
Firm Size	<b>0.100***</b> (0.015)	<b>-0.578***</b> (0.104)	-0.015 (0.024)	<b>-0.344***</b> (0.077)	<b>0.074***</b> (0.018)	<b>0.101***</b> (0.024)	-0.141 (0.105)	-0.015 (0.047)
Leverage	-0.230* (0.127)	<b>3.458***</b> (0.831)	-0.127 (0.187)	<b>4.968***</b> (0.626)	<b>-0.324**</b> (0.161)	-0.008 (0.221)	-0.285 (0.986)	-0.083 (0.444)
ESG Score	0.001 (0.002)	-0.004 (0.011)	0.004 (0.003)	-0.009 (0.008)	0.002 (0.002)	0.005 (0.003)	0.017 (0.014)	-0.007 (0.006)
Constant	<b>-2.059***</b> (0.323)	<b>13.333***</b> (2.282)	0.779 (0.542)	<b>8.978***</b> (1.690)	<b>-1.644***</b> (0.377)	<b>-2.352***</b> (0.505)	2.868* (1.708)	1.447* (0.762)
Observations	117	117	117	117	117	117	117	117
R <sup>2</sup>	0.326	0.332	0.030	0.471	0.205	0.181	0.020	0.033
Adjusted R <sup>2</sup>	0.308	0.314	0.004	0.457	0.184	0.160	-0.006	0.007
F Statistic	54.576***	56.215***	3.489	100.673***	29.180***	25.041***	2.349	3.867

*Note: (Values in bold represent significant findings)*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

The results indicated no statistically significant relationships at the 5% level between the overall ESG score and the financial performance measurements. The findings may suggest that a mining firm's overall ESG score does not directly impact firm performance. These results align with Naila (2013) and Sayed (2018), who noted no significant relationship between the overall ESG score and ROE and ROA. However, studies by Alareeni & Hamdan (2020) had contrasting results; finding a significant negative relationship between the overall ESG scores and ROE.

However, according to Fernandez-Izuierdo et al. (2016), an overall ESG score could conceal different dimensions of ESG practices, reducing the accuracy of the overall score. In addition, Dahal & Thakar (2019) argue that the conflicting results of previous studies highlight the importance of investigating the individual 'Environmental',

'Social', and 'Governance' pillars rather than only focusing on the overall ESG score. An additional panel regression analysis was conducted on the individual 'Environmental', 'Social' and 'Governance' pillars and the selected financial performance measurements. The results of the regression analysis are presented in Table II below.

**Table II: Regression results for the ESG Scores on firm performance**

	<i>Dependent variable:</i>								
	Return On Assets	Return On Equity	Equity Turnover	Asset Turnover	Financial Leverage	Net Profit Margin	Operating Profit Margin	Interest Burden	Tax Burden
Firm Size	<b>0.102***</b> (0.015)	<b>0.163***</b> (0.019)	<b>-0.575***</b> (0.107)	-0.005 (0.023)	<b>-0.360***</b> (0.078)	<b>0.080***</b> (0.018)	<b>0.108***</b> (0.024)	-0.152 (0.113)	-0.001 (0.050)
Leverage	-0.183 (0.135)	<b>-0.362**</b> (0.168)	<b>3.699***</b> (0.889)	0.111 (0.188)	<b>4.737***</b> (0.664)	-0.246 (0.168)	0.116 (0.229)	-0.220 (1.038)	-0.0005 (0.462)
E-Score	-0.001 (0.002)	-0.003 (0.002)	-0.007 (0.011)	-0.004* (0.002)	0.006 (0.008)	-0.003 (0.002)	-0.004 (0.003)	0.011 (0.012)	-0.007 (0.006)
S-Score	0.001 (0.001)	0.002 (0.002)	0.006 (0.009)	<b>0.008***</b> (0.002)	-0.008 (0.007)	0.002 (0.002)	<b>0.004**</b> (0.002)	0.008 (0.012)	0.0004 (0.005)
G-Score	0.00003 (0.001)	-0.00003 (0.001)	-0.006 (0.006)	-0.002 (0.001)	-0.004 (0.005)	0.002 (0.001)	0.002 (0.002)	-0.002 (0.009)	-0.002 (0.004)
Constant	<b>-2.075***</b> (0.323)	<b>-3.280***</b> (0.424)	<b>13.340***</b> (2.324)	0.641 (0.515)	<b>9.117***</b> (1.685)	<b>-1.686***</b> (0.377)	<b>-2.404***</b> (0.498)	3.028 (1.851)	1.205 (0.813)
Observations	117	117	117	117	117	117	117	117	117
R <sup>2</sup>	0.333	0.443	0.340	0.157	0.478	0.227	0.209	0.025	0.040
Adjusted R <sup>2</sup>	0.303	0.417	0.310	0.119	0.455	0.192	0.173	-0.019	-0.003
F Statistic	55.429***	88.109***	57.075***	20.628***	101.771***	32.544***	29.264***	2.872	4.637

*Note: (Values in bold represent significant findings)*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

The analysis found no statistically significant relationship between the 'Environmental' pillar score and the financial performance measurements measured by ROA and ROE. The findings could suggest that a mining firm's 'Environmental' score does not have a conclusive impact on its financial performance. The findings differ from Bartlett et al. (2020), who found a statistically significant positive relationship between the 'Environmental' score and ROE and ROA.

The 'Social pillar' analysis showed no statistically significant relationship between the 'Social' pillar score and ROE and ROA, similar to Du Toit & Lekoloane (2018). This could suggest that a mining firm's 'Social' score does not have a conclusive impact on ROE or ROA. The findings contrast Demetriades & Auret (2014), and Nkomani (2013), who found a statistically significant negative relationship between the 'Social' score and ROE.

The 'Governance pillar' analysis showed a significant positive relationship between the governance score and asset turnover at the 1% level, suggesting that mining firms with higher Governance scores report a higher asset turnover over a given financial year. Furthermore, there was a significant positive relationship between Governance score and operating profit margin at the 5% level, suggesting that mining firms with higher Governance scores report higher operating profit margins over a given financial year. This result supports Bartlett et al. (2020) research, which noted a statistically significant positive relationship between the 'Governance' score and ROE and ROA and Erasmus et al. (2017) with ROA only.

The following section shows the results of a panel regression analysis between the ten sub-components of the overall ESG score and the chosen financial performance measurements of asset utilisation and profitability. The results of this analysis are presented in Table III below.

**Table III: Regression Results for ESG sub-components on key financial performance measurements**

<i>Dependent variable:</i>									
	<i>Asset Utilisation</i>					<i>Profitability</i>			
	Return On Assets	Return On Equity	Equity Turnover	Asset Turnover	Financial Leverage	Net Profit Margin	Operating Profit Margin	Interest Burden	Tax Burden
Firm Size	<b>0.108***</b> (0.014)	<b>0.164***</b> (0.019)	<b>-0.658***</b> (0.099)	-0.018 (0.022)	<b>-0.408***</b> (0.076)	<b>0.089***</b> (0.018)	<b>0.123***</b> (0.024)	-0.100 (0.136)	0.020 (0.059)
Leverage	<b>-0.339***</b> (0.128)	<b>-0.507***</b> (0.175)	<b>2.881***</b> (0.861)	0.027 (0.194)	<b>4.096***</b> (0.672)	-0.277 (0.177)	0.051 (0.241)	0.290 (1.385)	-0.105 (0.618)
Resource Use	0.002 (0.001)	0.001 (0.002)	0.011 (0.009)	0.003 (0.002)	0.008 (0.007)	0.0002 (0.002)	0.001 (0.003)	0.002 (0.011)	-0.003 (0.005)
Emissions	-0.001 (0.001)	-0.003 (0.002)	-0.010 (0.008)	<b>-0.007***</b> (0.002)	0.004 (0.006)	0.001 (0.002)	0.0005 (0.002)	-0.008 (0.013)	-0.005 (0.006)
Environmental Innovation	-0.001 (0.001)	-0.001 (0.001)	-0.006 (0.005)	-0.00003 (0.001)	-0.005 (0.004)	<b>-0.003**</b> (0.001)	<b>-0.005***</b> (0.001)	-0.003 (0.007)	0.001 (0.003)
Working Conditions	<b>-0.007***</b> (0.001)	<b>-0.005**</b> (0.002)	<b>-0.030***</b> (0.009)	<b>0.004**</b> (0.002)	-0.031* (0.007)	<b>-0.006***</b> (0.002)	<b>-0.007***</b> (0.003)	0.020 (0.015)	-0.006 (0.007)
Human Rights	<b>0.002***</b> (0.001)	<b>0.002**</b> (0.001)	0.008 (0.005)	<b>0.003***</b> (0.001)	0.001 (0.004)	<b>0.003***</b> (0.001)	<b>0.005***</b> (0.001)	0.003 (0.007)	-0.0001 (0.003)
Community Impact	0.0002 (0.001)	0.001 (0.001)	-0.001 (0.007)	0.001 (0.002)	-0.001 (0.005)	-0.0002 (0.001)	-0.001 (0.002)	0.007 (0.010)	0.002 (0.005)
Product Responsibility	-0.0001 (0.001)	-0.0003 (0.001)	0.003 (0.004)	0.0003 (0.001)	0.002 (0.003)	0.0003 (0.001)	-0.0001 (0.001)	-0.005 (0.005)	0.002 (0.002)
Management Responsibility	-0.0001 (0.001)	-0.0003 (0.001)	-0.005 (0.004)	-0.001 (0.001)	-0.004 (0.003)	0.001 (0.001)	0.001 (0.001)	-0.0003 (0.007)	-0.001 (0.003)
Shareholder Responsibility	-0.0005 (0.0004)	-0.0004 (0.001)	<b>-0.007**</b> (0.003)	<b>-0.001**</b> (0.001)	<b>-0.005**</b> (0.002)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.005)	0.002 (0.002)
CSR Strategy	<b>0.003**</b> (0.001)	0.002 (0.001)	<b>0.023***</b> (0.007)	0.002 (0.002)	0.010* (0.006)	0.002 (0.001)	0.001 (0.002)	-0.006 (0.011)	-0.004 (0.005)
Constant	<b>-1.897***</b> (0.347)	<b>-3.115***</b> (0.469)	<b>15.815***</b> (2.406)	0.691 (0.544)	<b>11.393***</b> (1.811)	<b>-1.691***</b> (0.442)	<b>-2.304***</b> (0.596)	1.866 (2.558)	1.267 (1.132)
Observations	117	117	117	117	117	117	117	117	117
R <sup>2</sup>	0.541	0.532	0.523	0.277	0.594	0.397	0.382	0.044	0.061



Adjusted R <sup>2</sup>	0.488	0.478	0.468	0.194	0.547	0.327	0.311	-0.067	-0.047
F Statistic	122.675***	118.399***	113.957***	39.865***	152.014***	68.486***	64.376***	4.744	6.773

Note: (Values in bold represent significant findings)

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

#### 4.1 ROA and ROE

The analysis found a strong negative relationship between working conditions and ROA (1% significance level) & ROE (5% significance level), suggesting that mining firms with better working conditions report a lower ROA over a given financial year. This finding supports Pasquini-Descomps (2013) findings, which noted a significant negative relationship between improved labour conditions and ROA. A possible explanation for this finding by Nelson & Pelders (2019) suggests that the additional costs South African mining firms incurred to improve working conditions do not lead to increased revenue and improved performance.

A strong positive relationship was found between human rights and ROA (1% significance level) & ROE (5% significance level). This finding could suggest that firms with a higher human rights score report a higher ROA supporting the research by Bartlett et al. (2020), who found a significant positive relationship between human rights considerations and ROA. According to MSCI (2021), there is evidence that a high level of human rights in the mining process is an essential consideration for customers when purchasing a mining-related product. Due to the extensive reporting of human rights abuses, firms with poor human rights records could develop a negative reputation, negatively impacting firm performance, as revenues are linked to changing consumer spending habits (Erasmus et al., 2019).

A strong positive relationship was found between CSR strategy and ROA at the 5% significance level, suggesting that firms with a better CSR strategy report a higher ROA. This positive relationship could result from the increased transparency associated with improved CSR strategy. Transparency improves mutual trust and increases cooperation between the firm and various stakeholders. Transparency could reduce implicit and explicit costs experienced by the firm primarily attributed to these stakeholders, thus making the firm more profitable (Li et al., 2018).

The measures of asset utilisation are asset turnover and financial leverage.

#### 4.2 Asset turnover

A strong negative relationship was observed between emissions and asset turnover at the 1% significance level, suggesting that firms with a higher emissions score report a lower asset turnover. According to Richardson & Welker (2001), when firms invest in more environmentally friendly assets, they generate less revenue for firms than those invested in less environmentally friendly.

A strong positive relationship was observed between working conditions and asset turnover at the 5% significance level, suggesting that firms with higher working conditions scores report a higher asset turnover. An explanation for this relationship may be deduced from a finding by Refinitiv Eikon (2021), stating that the more emphasis a mining company places on health and safety systems, the lower the injuries per million hours experienced by workers. The lower injury count may increase the ability to generate more asset revenue (Asfaw et al., 2013).

In addition, a strong positive relationship was observed between human rights and asset turnover at the 1% significance level, suggesting firms that have a higher human rights score report a higher asset turnover over a given financial year. A strong negative relationship is found between shareholder responsibility and asset turnover at the 5% significance level. This finding suggests that firms with a higher shareholder responsibility score report a lower asset turnover over a given financial year, probably due to the higher cost of investing in assets.

#### 4.3 Financial leverage ratio

A strong negative relationship was observed between shareholder responsibility and financial leverage at the 5% significance level, suggesting that firms with a higher shareholder responsibility score report lower financial leverage over a given financial year. Biggs, Botha & Scheepers (2017) noted that firms with a higher level of shareholder influence were less likely to take on leverage, as shareholders could potentially be more risk-averse than management.

Profitability was measured using net profit and operating margins.

#### 4.4 Net profit margin and operating profit margin

A strong negative relationship was observed between environmental innovation and net profit margin at the 5% significance level and operating profit margin at the 1% significance level, suggesting that firms which have a higher environmental innovation score report a lower net profit margin and operating profit margin over a given financial year. Erasmus et al. (2019) offered a possible explanation for this result: namely that the costs required to implement initiatives that reduced the environmental impact of a firm's operations could have a negative effect on the earnings realised by the firm.

A strong negative relationship was observed between working conditions, net profit margin, and operating profit margin at the 1% significance level. This finding suggests that firms with a higher working conditions score report a lower net profit margin and operating profits.

A strong positive relationship between human rights and net profit margin and operating profit margin, both at the 1% significance level, suggesting that firms with a higher human rights score report a higher net profit and operating profit margin.

### **5. Research hypotheses conclusions**

The first hypothesis states a statistically significant relationship exists between the overall ESG score and the firm performance metrics of JSE-listed mining firms. The analysis found no statistically significant relationships between the overall ESG score and financial performance measurements, thus rejecting the hypothesis.

The second hypothesis states a statistically significant relationship exists between the 'Environment', 'Social' or 'Governance' pillar scores and firm performance metrics of JSE-listed mining firms. The study found that although there was no statistically significant relationship between the 'Environmental' and 'Governance' pillars, the 'Social' pillar had a significant positive relationship with asset turnover and operating profit margin. Therefore, the study does not entirely reject the second hypothesis. It is concluded that a statistically significant relationship exists between the 'Social' pillar and the financial performance of mining firms listed on the JSE.

The third hypothesis states a statistically significant relationship exists between any ESG sub-components score and the firm performance of JSE-listed mining firms. The study showed significant negative relationships between financial performance and sub-components: emissions, environmental innovation; working conditions; and shareholder responsibility. The study also found significant positive relationships between financial performance and the following subcomponents: human rights and corporate social responsibility strategy. Therefore, the study does not reject the third hypothesis. It was concluded that there is a statistically significant relationship between an ESG sub-components score and the financial performance of mining firms listed on the JSE.

### **6. Implications and limitation**

The findings of this study have implications for a variety of stakeholders. As previously noted, the trends in sustainable investment are placing a stronger emphasis on the ESG practices of mining firms, compounded by pressure from consumers, governments, local communities, and employees. In the future, mining firms could be left with no option but to improve their ESG practices. This study could be helpful for these firms as it could give them an understanding of the possible changes in the drivers of financial performance, both positive and negative when improving their ESG practices. Firms could prioritise improving ESG sub-components to enhance their financial performance in the short term. Firms could also use these findings to prepare to mitigate the negative financial implications of specific ESG subcomponents before policies are introduced.

Future research could be conducted using data from reliable alternative databases such as Bloomberg to test the reliability of the relationships, thereby reducing the possibility of incorrect ESG data due to reporting errors.

### **7. Conclusion**

Environmental, social and governance-related challenges will continue to threaten the longevity of firms, especially those that are resource-intensive and employ a significant portion of a country's labour force, this being mining firms and the mining industry in particular. These challenges will only intensify as competition for resources grows, and the natural supply of these resources diminishes. Furthermore, as consumers shift their attention to more sustainable firms and policymakers focus on addressing these ESG challenges, mining firms must position themselves correctly to mitigate the potential downfalls these ESG challenges could create. Identifying the key drivers of mining firms' performance and breaking them down further illustrates the impact of the various individual ESG sub-components where more attention needs to be placed, and potential issues may arise.

The results reveal that when the overall ESG score is used, there was little to no statistical relationship between ESG and firm performance of the mining firms. When the individual Environmental, Social, and Governance pillar scores were analysed in isolation, only the social score illustrated a statistically significant relationship with firm performance and a positive relationship with asset turnover and operating profit margin. However, when the study delved deeper into the different sub-components of each E, S, and G pillar, it was noted that there were significant negative relationships between financial performance and the following sub-components: emissions; environmental innovation; working conditions; and shareholder responsibility and there were significant positive relationships between financial performance and the sub-components of human rights and CSR strategy.

Thus, corporate leaders and policymakers must acknowledge that ESG considerations combine diverse aspects, as shown by this study. To generate sustainable returns, mining firms must embrace the different subcomponents of ESG.

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