CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

The impact of ESG score on financial performance: Evidence from the automotive industry

Bachelor's thesis

Author: Purev-Ochir Byambajav

Study program: Economics and Finance

Supervisor: MSc. Binyi Zhang

Year of defense: 2024

Declaration of Authorship

The author hereby declares that he or she compiled this thesis independently, using only the listed resources and literature, and the thesis has not been used to obtain any other academic title.

The author grants to Charles University permission to reproduce and to distribute copies of this thesis in whole or in part and agrees with the thesis being used for study and scientific purposes.

During the preparation of this thesis, the author used artificial intelligence program ChatGPT in order to correct codes in R, convert tables into TEX format, and double-check the grammar. After using this tool/service, the author reviewed and edited the content as necessary and takes full responsibility for the content of the publication.

Prague, April 28, 2024

Purev-Ochir Byambajav

Abstract

The aim of the thesis is to examine the impacts of Environmental, Social, and Governance (ESG) ratings on financial performance, specifically Return on Equity (ROE) and Return on Assets (ROA), of companies in the automotive industry. Although the previous literature on the topic of ESG and financial performance is vast and often inconclusive, studies focusing on the automotive industry are limited and do not address the differences on the sectoral and regional levels. The thesis examines the relationship by applying panel data analysis methods, specifically time and entity fixed effects models with clustered standard errors. The analysis results showed that for each sector, the impacts of ESG metrics differed in the sign of the impact and degree of significance. Additionally, the profitability of companies experienced similarly distinct impacts from the ESG metrics depending on the region. This thesis adds to the limited literature on the automotive industry and also offers practical insights for stakeholders and investors involved in the automotive industry.

JEL Classification	G32, Q56, M14
Keywords	ESG, Return on assets, Return on equity, Corporate financial performance
Title	The impact of ESG score on financial performance: Evidence from the automotive industry

Author's e-mail	13378063@fsv.cuni.cz
Thesis supervisor's e-mail	69674391@fsv.cuni.cz

Abstrakt

Cílem této práce je prozkoumat dopady environmentálního, sociálního a správního (ESG) hodnocení na finanční výkonnost, konkrétně návratnost vlastního kapitálu (ROE) a návratnost aktiv (ROA), společností v automobilovém průmyslu. Ačkoliv předchozí literatura na téma ESG a finanční výkonnost je rozsáhlá a často neprůkazná, studie zaměřené na automobilový průmysl jsou omezené a nezabývají se rozdíly na odvětvové a regionální úrovni. Tato práce zkoumá tento vztah použitím metod analýzy panelových dat, konkrétně modelů s fixními vlivy času a entit s klastrovanými standardními chybami. Výsledky analýzy ukázaly, že pro každý sektor se dopady metrik ESG lišily ve znaménku dopadu a míře významnosti. Společnosti navíc zaznamenaly obdobně rozdílné dopady metrik ESG na jejich ziskovost v závislosti na regionu. Tato práce přispívá k omezené literatuře o automobilovém průmyslu a také nabízí praktické poznatky pro zainteresované strany a investory působící v automobilovém průmyslu.

Klasifikace JEL	G32, Q56, M14
Klíčová slova	ESG, Návratnost aktiv, Návratnost vlastního kapitálu, Firemní finanční výkonnost
Název práce	Dopad ESG skóre na finanční výkonnost: Důkazy z automobilového průmyslu

E-mail autora	13378063@fsv.cuni.cz
E-mail vedoucího práce	69674391@fsv.cuni.cz

Acknowledgments

The author is grateful especially to MSc. Binyi Zhang for his guidance, patience, and mentorship.

Typeset in FSV LaTeX template with great thanks to prof. Zuzana Havrankova and prof. Tomas Havranek of Institute of Economic Studies, Faculty of Social Sciences, Charles University.

Bibliographic Record
Byambajav, Purev-Ochir: *The impact of ESG score on financial performance: Evidence from the automotive industry.* Bachelor's thesis. Charles University, Faculty of Social Sciences, Institute of Economic Studies, Prague. 2024, pages 84. Advisor: MSc. Binyi Zhang

Contents

List of Tables

Acronyms

ADF Augmented Dickey-Fuller

B2B Business-to-business

CFP Corporate financial performance

CSR Corporate social responsibility

ESG Environment, social, and governance

EV Electric vehicle

FE Fixed effects

PP Phillips-Perron

ROA Return on assets

ROE Return on equity

VIF Variance inflation factor

Chapter 1

Introduction

The rising awareness of environmental, social, and governance (ESG) practices leads to criticism of the automotive industry due to its reliance on fossil fuels and large carbon footprint. The ESG movement presents a significant change in the behavior of all stakeholders, showing the rising preference for ESG practices. The pressures from high sustainability demands from society and regulations lead to difficult commitments, such as zero-emission vehicles and carbon neutrality, for the industry's future. Zero-emission vehicles involve a major shift from fossil fuel vehicles to electric vehicles, significantly changing the industry's fundamentals. However, replacing fossil fuel vehicles with electric vehicles is certainly not enough, as the emissions from cars are minimal compared to the emissions from production. ESG has also become a part of investor due diligence, significantly impacting the automotive industry, which relies heavily on capital investments.

The fundamental shift of companies towards ESG practices plays a crucial role in the future of carbon neutrality. However, studies on the effects of such practices on the company's performance, though vast, mostly overlook the automotive industry, despite its importance at both macro- and micro-level. Although there were several attempts to fill the research gap by focusing on the direct effects of ESG performances on the profitability of companies in the industry, they overlook the sectoral and regional differences and conclude that the effects are applicable in the industry as a whole.

This thesis aims to examine the effects of the overall ESG score and its pillar scores on the return on equity (ROE) and return on assets (ROA) in the automotive industry, just as in previous studies. However, this thesis differentiates by acknowledging the differences between sectors in the industry. Additionally, the thesis examines the effects of ESG metrics on the ROA and ROE of automotive industry companies in different regions. It is not unlikely that this approach was used for other industries; however, the thesis contributes to the existing ESG literature that focuses on the automotive industry by examining the ESG and finance relationship from multiple angles. Multiple approaches are examined using the dataset from Refinitiv Eikon.

The thesis is structured as follows: Chapter 2 reviews the academic literature regarding ESG and financial performance, different rating methodologies used by rating agencies, ESG disclosure, and ESG investing. Chapter 3 describes the data and methodology. Additionally, it presents the results of preliminary tests needed for regressions. Chapter 4 presents the results of the main regressions and relationship descriptions. Chapter 5 is a discussion of the results. In this chapter, the plausible causes and implications are discussed. Chapter 6 contains the limitations of the thesis and suggestions for future research. Chapter 7 summarizes the main empirical findings and concludes the thesis.

Chapter 2

Literature review

2.1 Theoretical framework

The shareholder theory holds that the primary responsibility of a business is to maximize profit (Friedman 2017). Thus the shareholder's interests are prioritized above other business objectives. However, critics state that the shareholder view overlooks the impacts of business practices on social and environmental dimensions, such as job displacement and environmental degradation, and argue that businesses should consider all the parties affected by the business decisions.

There are many theories explaining corporate behavior, however according to Whelan *et al.* (2021) the following four are used the most in studies to explain the relationship between ESG and financial performance: The stakeholder theory (Feng *et al.* 2022; Wang *et al.* 2016; Kao *et al.* 2018; Shakil 2021), the Legitimacy theory (Baldini *et al.* 2018; Shin *et al.* 2023; Shakil 2021), Porter's hypothesis (Chen *et al.* 2022), and the Resource-based view.

The stakeholder theory takes into consideration the interests of all stakeholders (Freeman 2010). It emphasizes the importance of sustainable and ethical business practices to create a community allegiance, ultimately benefiting all the stakeholders. The rising awareness of the Corporate Social Responsibility (CSR) movement, which aims to improve socially accountable business practices and initiatives that contribute to society's and the environment's well-being, has enriched the stakeholder theory. Since CSR measures mainly rely on companies' self-reported sustainability reports, companies thus may attempt to appear more conscious about sustainability than they are (a practice known as "greenwashing"). Another limitation of stakeholder theory is the collision of interests of managers and owners, a so-called Agency problem (Berk & DeMarzo 2019).

The Legitimacy theory suggests that a company's long-term success relies on the public perception that the company's actions are desirable and within the social norms and values (Suchman 1995). Legitimacy, thus, can vary based on social norms where a company operates. Like the "cancel culture," an undesirable action by a company that violates social norms or values would lead to a negative perception of the company, ultimately resulting in a penalization. However, according to Servaes & Tamayo (2013) the impact of CSR activities on firm value is correlated with the existing customer awareness levels. The benefits of CSR activity are positive if the company already has an excellent public perception, whereas CSR activities have non-positive effects for a company with a bad reputation. The ESG initiative grew from the CSR movement as a framework for assessing companies' CSR due to its measurability and increased transparency.

Porter's hypothesis suggests that strict environmental regulations may positively affect firms' performance, mainly in terms of competitiveness and operational efficiency, by stimulating innovations (Porter & Linde 1995). Porter & Linde (1995) state that pollution results from imperfect utilization of resources, in other words, inefficient business practices. Thus, strict regulations could force companies to invest in research and development, ultimately increasing efficiency, the benefits of which were to offset the costs of implementing them. This "innovation offset" may even give the companies an advantage, not only due to the efficiency but also to the innovation, over their foreign competitors, who are unaffected by the regulations (Porter & Linde 1995). Wang *et al.* (2019) mention that environmental regulations, up to a certain level of stringency, positively impact green productivity growth. However, beyond the stringency level the cost of compliance becomes higher than the innovation offset effect.

2.2 ESG and financial performance

Many studies have focused on the relationship between ESG and financial performance in terms of profitability, stock returns, market valuation, risk reduction and operational efficiency. However, the research is inconclusive, though the general sentiment is that ESG improves financial performance.

The comprehensive meta-analyses (Friede *et al.* 2015; Whelan *et al.* 2021;

Wang *et al.* 2016) find that most studies reveal a positive correlation between ESG performance and corporate financial performance (CFP). The positive outcomes include better financial performance, management quality, reputation, and stakeholder trust, as well as a reduction of risks (Zumente & Bistrova 2021).

ESG impacts on financial performance appear to be more pronounced in the long term (Friede *et al.* 2015; Whelan *et al.* 2021). Dorfleitner *et al.* (2018) show that ESG-focused companies experienced up to 3.8% higher mid- and long-term stock returns. Therefore, sustainability seems to be one of the essential factors for a company's long-term planning strategy and for an investor's decision-making.

Broadstock *et al.* (2021), Havlinova & Kukacka (2023), and Whelan *et al.* (2021) find that companies with greater ESG scores had better-performing stocks than their lower-scored counterparts. Nevertheless, it is noteworthy that stocks of firms with higher ESG ratings are expected to be more susceptible to rating downgrade. Such heightened sensitivity to ESG rating downgrades starkly contrasts with the marginal impact of ESG rating upgrades on the stock returns of these leading firms, as noted by Shanaev & Ghimire (2022) and Serafeim & Yoon (2023).

The stocks of leading ESG companies, valued at a premium, already account for the strong ESG profile (Serafeim & Yoon 2023), leading to higher expectations from investors and the public. Therefore, ESG rating improvement might not have such a significant impact as it is already expected and adjusted for in the valuation. However, ESG rating downgrade deviates from the high standards, and the combination of market overreaction and "negativity bias" phenomenon leads to the expectation that the ESG downgrades will affect the leading companies significantly.

The ESG also plays a significant role in risk reductions (Apergis *et al.* 2022; Dinh 2023; Feng *et al.* 2022). While most studies highlight the positive impact of ESG/CSR activities on CFP, some studies find no significant relationship between corporate sustainability performance (CSP) and excess stock returns (Nollet *et al.* 2016; Torre *et al.* 2020). Using fully specified returns regression, Demers *et al.* (2021) show that during the COVID-19 pandemic, ESG performance did not "protect" the stocks and that investments in intangible assets served as a better resiliency factor.

Feng *et al.* (2022) find a significant negative correlation between corporate ESG performance and stock price risk by using the negative skewness and price down-to-up volatility dynamics as proxies of stock crash risks. In addition, companies with good ESG performance are generally perceived as less risky among individual and institutional financial investors (Citterio & King 2023).

Nollet *et al.* (2016), Zhou *et al.* (2023), Kumar *et al.* (2022), and Franco *et al.* (2020) find a U-shaped relationship between the CSP and CFP, precisely ESG and ROA (Nollet *et al.* 2016), and ESG and ROE (Franco *et al.* 2020). The authors explain that the pay-offs of investments in CSR would materialize when a certain threshold level of CSP is reached. On the other hand, Zhou *et al.* (2023) and Kumar *et al.* (2022) find an inverted U-shape relationship between the CSP and CFP among Chinese-listed companies and the energy sector, respectively. Both Zhou *et al.* (2023) and Kumar *et al.* (2022) state that the impacts of ESG on CFP turn negative when ESG exceeds a certain value.

However, not practicing sustainability may even benefit financial performance, as the above-mentioned U-shape relationships suggest. Companies that engage in unethical business practices, such as alcohol, tobacco, and adult services, are expected to have higher stock returns than regular companies (Hong & Kacperczyk 2009). Companies with higher carbon emissions also appear to have higher stock returns after controlling for size, book-to-market, and other return predictors (Bolton & Kacperczyk 2023; Bolton & Kacperczyk 2021). The reason could be associated with the increased minimum returns for equity owners due to carbon emission risks (Berk & DeMarzo 2019).

These studies show a complex relationship between the ESG score and CFP, and empirical findings remain inconclusive. The relationship may depend on many factors, such as the structure of ESG, geography, and the industry, among others. Some studies point out that from an ESG measurement perspective, the governance factors appear to impact the market value of companies the most (Nollet *et al.* 2016; Ionescu *et al.* 2019). Nollet *et al.* (2016) state that the contribution of governance factors can be explained through stakeholder influence capacity (SIC). The environmental pillar seems to have a complex relationship with financial performance, as Zhou *et al.* (2023) find that the pillar mainly drives the negative impact on CFP. In addition to Zhou *et al.* (2023), Agliardi *et al.* (2023) show that companies with a low E pillar score have a better financial performance, while high-rated companies exhibit a greater degree of resilience and reduced downside risk. On the other hand, Liu *et al.* (2022) state that for the Chinese new energy companies, the impact of the S pillar on CFP is more important than those of the E and G pillars.

2.3 ESG rating divergence

Measuring corporate ESG performance can be challenging due to variation in definitions, standards, and measurement methods (Berg *et al.* 2022). This leads to discrepancies among the ESG ratings of a company received by the agencies.

Many studies thus question the reliability of the ESG ratings due to the discrepancies and underscore the need for further research for a standardized ESG rating method (Sandberg *et al.* 2023; Friede *et al.* 2015; Billio *et al.* 2021; Berg *et al.* 2022). Greater stock returns have been observed to correlate with ESG rating disagreements, with the Environmental rating being the main source of the disagreement (Gibson Brandon *et al.* 2021; Christensen *et al.* 2022). The finding could be explained through the lenses of risk premium, stemming from the heterogeneous belief and Knightian uncertainty, as the theoretical models show that the rating disparity leads to increased uncertainty, which would impose additional risks (Gibson Brandon *et al.* 2021).

Christensen *et al.* (2022) find that the ESG rating heterogeneity is also connected to the company's level of ESG disclosure, as more disclosure leads to either clarity and consensus or higher disagreement. Increased data from the disclosures gives the rating agencies room for interpretation.

Even though the question of a standardized ESG rating system is still unanswered, the recent papers point to the incorporation of technological innovations, including the Audit 4.0 technologies, such as satellite imagery, that could enhance the accuracy of ESG reporting and assurance (Gu *et al.* 2023) or the alternative AI-based ESG rating methodologies, that utilize the external data unlike the traditional rating systems relying more on the company disclosures, could serve as a complement to the traditional ratings and together contribute to a more standardized and transparent results (Hughes *et al.* 2021). For Refinitiv Eikon rating system refer to section 3.4.

2.4 ESG disclosure

The research on the impact of disclosure on financial performance is again inconclusive. Whelan *et al.* (2021) state that out of studies focusing on only disclosure, 26% find positive effects, 14% find adverse effects, and 60% either neutral or mixed effects on the financial performance.

Companies with strong ESG profiles, see negative effects of ESG disclosure on company valuation (Fatemi *et al.* 2018). This aligns with the Legitimacy theory, which suggests that overemphasizing ESG disclosure may lead to skepticism due to concerns over "greenwashing". On the other hand, companies with weaker ESG profiles experienced positive effects of the disclosure (Fatemi *et al.* 2018). According to Stakeholder theory, openly addressing ESG weaknesses can be perceived as sincere (Fatemi *et al.* 2018). Fatemi *et al.* (2018) also state that the disclosures on their own had a negative valuation effect. Chen *et al.* (2018) reveal that mandatory disclosure leads to environmental benefits, such as reductions in water wastage and SO_2 emissions, and harms firm profitability, suggesting a trade-off between shareholder and environmental benefits. The decrease in profitability appears to be mainly due to the company shutting down some of its production facilities and increased spending on pollution control and labor force (Chen *et al.* 2018).

Some studies, however, find that ESG disclosure could enhance financial performance by attracting ESG investors and increasing ESG investments (Chen & Xie 2022). A further development of ESG disclosure could be towards industry 5.0, as it enhances the ESG disclosure's "authenticity, enabling real-time reporting and prospective insights, greater customizability, extending the scope to broader supply chains, and reducing disclosure costs" (Asif *et al.* 2023). However, the shift appears double-edged due to high implementation costs, with uncertain value creation through the enhancements (Asif *et al.* 2023).

2.5 ESG investing

There are a few possible explanations for some investors' focus on ESG investing, such as a positive intent of an investor toward the environmental and social good, an ultimate financial profit, or a mix of both. Even though there is a spectrum of other motivations, the current author distinguishes two simple groups based on the first three motivations: green investors, partly influenced by environmental and social well-being, and brown investors, who are primarily driven by the short and medium-term financial returns and focus primarily on the companies with high carbon emissions.

The goal of investing strategies of both green and brown investors appears to converge in terms of financial profit; however, both use distinctive methods driven by the effects of ESG on financial performance discussed earlier.

Zerbib (2019) finds that green investors are willing to receive fewer financial returns to fund green investments. This does not necessarily contradict the enhanced returns of sin stocks (Bolton & Kacperczyk 2021; Bolton & Kacperczyk 2023) but rather shows that investors either emphasize the moral and social considerations more than the financial profit (Kräussl *et al.* 2024; Zerbib 2019) or want to appear by the social and ethical norms.

ESG portfolios appear to not outperform nor underperform the conventional portfolios (Friede *et al.* 2015). Friede *et al.* (2015) state two reasons why positives on the firm level, may disappear when dealing with portfolios. First, sub-optimal diversification in the portfolio might cause "drowned by noise" effect due to overlapping market and non-market effects. Additionally, the portfolios are usually positive and negative ESG-screened, thus negative effects of the flawed diversification counteract the benefits of ESG. Second, studies on portfolios typically do not include the management fees and other costs, which may neutralize the positive effects of ESG (Friede *et al.* 2015).

2.6 Hypotheses

The main objective of the thesis is to understand the relationship between ESG and CFP in the automotive industry. The automotive industry includes five sub-industries: Heavy Machinery & Vehicles, Auto & Truck Manufacturers, Auto, Truck & Motorcycle Parts, Tires & Rubber Products, and Auto Vehicles, Parts & Service Retailers. The companies in the dataset are located in five continents. Based on the literature review, the following hypotheses were formulated:

$H1_a$: ESG score has a positive effect on the ROE of companies in the automotive industry.

$H1_b$: E score has a positive effect on the ROE of companies in the automotive industry.

$H1_c$: S score has a positive effect on the ROE of companies in the automotive industry.

$H1_d$: G score has a positive effect on the ROE of companies in the automotive industry.

$H2_a$: ESG score has a positive effect on the ROA of companies in the automotive industry.

$H2_b$: E score has a positive effect on the ROA of companies in the automotive industry.

$H2_c$: S score has a positive effect on the ROA of companies in the automotive industry.

$H2_d$: G score has a positive effect on the ROA of companies in the automotive industry.

H3: ROE & ROA of companies in different sectors of the automotive industry have different sensitivities to ESG metrics.

H4: Impact of ESG metrics on ROE & ROA varies across continents.

Chapter 3

Data & Methodology

3.1 Dataset

The primary data source for this thesis is Refinitiv Eikon, accessed through the Institute of Economic Studies at Charles University.

The sample consisted of 1832 public companies from the Automotive industry and its sub-industries. These companies were from 77 countries, with the majority of the companies concentrated in 5 countries: China — 327 companies, The United States of America — 227, India — 189, Japan — 186, and South Korea — 168. The data from 2013 to 2022 consists of the ESG scores, individual pillar scores, total reported assets, return on assets, return on equity, leverage, and beta. The data obtained were all the necessary data for the main research question.

Each company had a different fiscal year period, which caused either a shift of the most recent fiscal year forward or backward, while certain companies did have the fiscal year 0 as 2022. The ESG data from 2013 and 2014 were missing for 1701 companies. Therefore, after aligning the data, the current author narrowed the period to 2015 to 2021, ensuring that the latest data would be consistent across the sample. This adjustment resulted in the greatest number of usable companies. Companies with missing values were not considered. Removing companies with missing data left 131 companies from 20 countries.

3.2 Dependent variables — ROA & ROE

The dependent variables of the thesis are Return on Assets (ROA) and Return on Equity (ROE). ROA and ROE are corporate financial performance

(CFP) measures widely used in many CFP $\sim$ ESG/CSR studies (Nollet *et al.* 2016; Sandberg *et al.* 2023; Kumar *et al.* 2022; Chen *et al.* 2018).

The return on assets is a profitability measure that shows how efficiently the company uses its assets to create profit. It is calculated as

$$\frac{\text{Net income}}{\text{Average total assets}}$$

Refinitiv Eikon uses this formula; however, there is a discrepancy as the Net Income in the numerator "belongs" to the shareholders, while in the denominator, shareholders and creditors finance the Assets. Thus, in the academic sphere, the adjusted ROA appears to be preferable by including interest expenses (return to creditors) in the numerator:

$$\frac{\text{Net income} + \text{Interest expenses} \times (1 - \text{TR})}{\text{Total assets}}$$

Return on equity, calculated as

$$\frac{\text{Net income}}{\text{Total equity}}$$

measures the owners' profitability, and both the numerator and the denominator are shareholder metrics. Refinitiv Eikon uses a slightly adjusted formula:

$$\frac{\text{Net income before extraordinary items}}{\text{Total equity}}$$

3.3 Independent & control variables

The ESG performance metrics, including the overall ESG score, the environmental pillar score, the social pillar score, and the governance pillar score, were selected as the independent variables for this study. Section 3.4 covers Refinitiv's scoring methods and issues.

Selected control variables are firm size, leverage, beta, and region. The firm size will be the logarithm of the total assets of a company. The size variable is an essential metric for a company's financial performance, as larger firms have larger economies of scale. Leverage is calculated as the Debt-to-Equity ratio and captures the intensity of external financing. Beta is "the expected percent change in the excess return of a security for a 1% change in the excess return of the market (or other benchmark) portfolio" (Berk & DeMarzo 2019).

The inclusion of leverage and beta captures the risk factors. Region dummy variables help us control the influence of country-specific factors on financial performance.

3.4 Refinitiv Eikon—ESG scoring methodology

Refinitiv Eikon uses 186 out of 630 ESG measures[1], grouped into ten categories, to create the individual pillar scores. The Environmental pillar is composed of 3 categories: Resource use — 20 measures, Emissions — 28, and Innovation — 20. The Social pillar is composed of 4 categories: Workforce — 30 measures, Human rights — 8, Community — 14, and Product responsibility — 10. The Governance pillar has three categories: Management — 35 measures, Shareholders — 12, and CSR strategy — 9.

The Environmental and Social pillar categories have distinct weights per industry, while the Governance pillar categories' weights are the same across all industries. A company scores between 0 and 100 for each category, a score which then is multiplied by the weight. The overall ESG score is the sum of the weighted scores, thus again between 0 and 100. The pillar scores are calculated differently; the weights are adjusted by dividing the weight by the sum of the weights to create new category weights. The pillar score is the sum of the weighted scores. According to Refinitiv's indicative ESG category weight matrix, the greatest category weights of each pillar for the automobile and auto parts industry are Innovation, Human rights, and Management.

The data used to create ESG scores are handled differently based on the type and availability. For the Boolean data, "Yes/No" or "True/False" data, a numerical value, either 0 or 1, is assigned. Both the Yes and the No answers can be assigned 1 or 0, depending on the questioned attribute and the polarity. In other words, if the question is regarding a positive attribute, i.e., "Does your company offer data privacy?", the assigned value for answering "Yes" is 1. However, if the question is regarding a negative attribute, i.e., "Does your company engage in child labor?", then the assigned value for companies Not engaging in child labor would be 1. Refinitiv assigns the company a negative (undesirable) value for partial information or fully missing data, depending on the attractiveness of the questioned attribute and its polarity. The numeric data are treated as such and have a polarity, i.e., a higher number could be

[1]https://www.lseg.com/content/dam/data-analytics/en$_us/documents/methodology/lseg-esg-scores-methodology.pdf$

either a positive or negative attribute. However, if numeric data is unavailable, Refinitiv does not include the metric in the calculation.

3.5 Descriptive statistics

In this section, I will present the descriptive statistics of my dataset. Table 3.1 presents 917 observations for each variable. The average ESG and the pillar scores are slightly above 50. This value is typical for companies in carbon-intensive industries, such as automotive. ESG and the E, S, and G pillars have maximum values of 95.18, 98.97, 97.77, and 97.32 respectively. The minimum values of ESG and pillars are 9.5, 0.28, 0.33, and 3.56. Most companies with an excellent ESG score of above 90 have their headquarters in Europe. In contrast, ESG score- wise weakest companies have their headquarters in Asia with scores of less than 15. Apart from beta, there is a large spread in other financial variables, which is anticipated due to the diversity in the companies' business financing and operating practices. The large spread leads to the expectation of a non-normal distribution.

Table 3.1: Descriptive statistics

Variable	*N*	*Mean*	*Median*	*St.dev.*	*Min*	*Max*
ROE	917	0.1193	0.1127	0.1504	-1.2819	1.0238
ROA	917	0.0509	0.0448	0.0541	-0.3693	0.2991
ESG	917	53.56	53.92	19.23	9.50	95.18
Env	917	55.25	56.54	26.11	0.28	98.97
Soc	917	51.25	48.88	23.71	0.33	97.77
Gov	917	54.37	54.95	20.76	3.56	97.32
Beta	917	1.23	1.25	0.44	0.07	3.98
Leverage	917	0.9345	0.6013	1.0193	0	9.6199
Total Assets	917	33780.4	8834.7	77032.4	152.3	607125.1

Total Assets in USD Million

Table 3.2 presents a Pearson correlation matrix. There is a high correlation between the ROA and ROE. Such a high correlation is expected because ROA and ROE are profitability measures. Similarly, a high correlation between the ESG score and its pillars can be observed. The high correlation suggests that our model should not include the ESG score with the pillar scores due to a possible issue of multicollinearity, which will be further explored using the Variance Inflation Factor (VIF). There is a moderate correlation between Total assets and the ESG score, Environmental pillar score, and Social pillar score. This finding shows that either bigger companies engage more in ESG-positive practices or that ESG practices enhance a company's growth. The model structure will become clearer after the statistical evaluation of the dataset.

Table 3.2: Pearson correlation matrix

	ROE	ROA	ESG	Env	Soc	Gov	Beta	Lev	TA
ROE	1	0.82	0.01	-0.01	0.01	0.06	-0.19	-0.02	0.01
ROA	0.82	1	-0.14	-0.13	-0.13	-0.03	-0.28	-0.29	-0.13
ESG	0.01	-0.14	1	0.85	0.91	0.56	0.15	0.21	0.46
Env	-0.01	-0.13	0.85	1	0.68	0.22	0.14	0.12	0.40
Soc	0.01	-0.13	0.91	0.68	1	0.37	0.17	0.23	0.43
Gov	0.06	-0.03	0.56	0.22	0.37	1	-0.02	0.10	0.23
Beta	-0.19	-0.28	0.15	0.14	0.17	-0.02	1	0.17	0.02
Lev	-0.02	-0.29	0.21	0.12	0.23	0.10	0.17	1	0.24
TA	0.02	-0.13	0.46	0.40	0.43	0.23	0.02	0.24	1

TA — Total Assets, Lev — Leverage

3.6 Diagnostics

Wooldridge (2015) states that a certain level of stability over time is needed in order to understand the relationship between variables. Stationary variables have constant joint probability distribution, which ensures the stability needed for the analysis.

First, the Augmented Dickey-Fuller (ADF) test was employed on all variables to check for unit roots. ADF tests for the null hypothesis of unit root. The results suggest that unit root is not present, implying stationarity. These results were further supported by the Phillips-Perron (PP) test, which tests for the same null hypothesis as ADF, confirming the stationarity of the variables.

Next, the Shapiro-Wilk normality test was conducted on all variables. Unlike the normality of error terms, the normality of variables is not a needed condition. However normally distributed variables could enhance the reliability of the analysis. The test showed the non-normality of every variable. However the non-normality of variables will not be an issue due to the large sample size of 917 observations, the already volatile nature of financial metrics, and the COVID-19 period.

An early model must be established to take the next step in model specification. To examine the high correlation between ESG and its pillars more precisely, the preliminary model should include all sustainability metrics for the VIF test.

$$\begin{aligned} ROA_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 E_{it} + \beta_3 S_{it} + \beta_4 G_{it} + \beta_5 \text{Beta}_{it} \\ + \beta_6 \text{Leverage}_{it} + \beta_7 \text{Size}_{it} + \epsilon_{it} \end{aligned} \tag{3.1}$$

VIF test was performed on the pooled OLS model 3.1 to confirm the suspected multicollinearity issue. VIF result shows a multicollinearity issue if the value for a variable is higher than five. However, the VIF test does not specify which other variable or variables the problematic variable is collinear with. Thus, identifying the problematic pair or group of variables relies on theoretical grounds.

VIF did show multicollinearity issues for ESG and the pillars. Removing the overall ESG score should resolve this issue since Refinitiv Eikon's pillar score calculation involves the same sustainability metrics used to calculate the overall ESG score. The multicollinearity could be among the pillars. However each pillar uses a different set of metrics. Therefore, the main multicollinearity issue is predicted to be between the ESG score and the Environmental pillar score, Social pillar score, and Governance pillar score.

No further multicollinearity issues were present once the ESG score was separated from its pillars, as VIF results are all less than five per Table 3.3. Therefore, the baseline model should not include the overall ESG score along the three pillars, but there should be two distinct models: one with the overall ESG score and another with each pillar score. This approach should serve an accurate interpretation of both the overall ESG effects and the pillar effects while accounting for multicollinearity issues.

Table 3.3: VIF Results

Variable	ESG & pillars	Pillars	ESG
ESG	308.11	-	1.62
Env	62.88	2.33	-
Soc	79.30	2.21	-
Gov	25.94	1.17	-
Beta	1.06	1.06	1.04
Lev	1.16	1.14	1.11
Size	1.81	1.81	1.67

SIZE — Ln(Total Assets), Lev — Leverage

The baseline models can be formulated based on the literature and test results. The following models are designed to observe the relationship between CFP and ESG. Using natural logarithms on ESG metrics lowers the variance and standardizes the variables. The CFP $\sim$ ESG relationship will thus be on a level-log basis. Since ESG ratings are updated annually, it is rational to test the current ESG score and lagged ESG scores' effects on CFP.

$$CFP_{it} = \beta_0 + \beta_1 \ln(ESG_{it-1}) + \beta_2 \text{Control}_{it} + a_i + \gamma_t + u_{it} \tag{3.2}$$

$$CFP_{it} = \beta_0 + \beta_1 \ln(ESG_{it}) + \beta_2 \text{Control}_{it} + a_i + \gamma_t + u_{it} \tag{3.3}$$

$$\begin{aligned} CFP_{it} = {} & \beta_0 + \beta_1 \ln(E_{it-1}) + \beta_2 \ln(S_{it-1}) + \beta_3 \ln(G_{it-1}) + \\ & + \beta_4 \text{Control}_{it} + a_i + \gamma_t + u_{it} \end{aligned} \tag{3.4}$$

$$\begin{aligned} CFP_{it} = {} & \beta_0 + \beta_1 \ln(E_{it}) + \beta_2 \ln(S_{it}) + \beta_3 \ln(G_{it}) + \beta_4 \text{Control}_{it} + \\ & + a_i + \gamma_t + u_{it} \end{aligned} \tag{3.5}$$

Where CFP represents the corporate financial performance measure, in this case, ROA and ROE of company i in time t. ESG and E, S, and G stand for the ESG score, Environmental, Social, and Governance pillar scores of the company i in time t and t-1. Control represents the control variables, such as size, beta, and leverage of company i in time t, and region dummy variables of company i. The a_i and γ_t capture the time-invariant fixed effects of the company i and time-invariant fixed effects of time t, respectively.

3.7 Empirical analysis

The dataset structure has a cross-sectional dimension along the time dimension, i.e., panel data structure. Two distinct approaches were used to analyze the panel data.

3.7.1 Pooled ordinary least squares model

Pooled ordinary least squares regression is used as a benchmark analysis model. Pooled ordinary least squares applies linear OLS time series methods on each cross-sectional category. This method finds universal coefficients for each variable but does not distinguish cross-sectional category-specific effects. Since the data contains 131 companies from 20 countries, there are expected to be company-specific effects and country-specific effects due to different firms' operating and financing practices and different regulations in different countries.

A constant variance of residuals, known as homoskedasticity, is a key assumption of linear regression that ensures the efficiency and validity of OLS. Table A.1 shows that all eight models rejected the null hypothesis of homoskedasticity after conducting the Breush-Pagan test.

Serial correlation is another assumption that needs to be tested. It states that the error terms of each category must not be correlated across different time periods. No serial correlation is an important assumption for the efficiency of the model. Breush-Godfrey tests, also known as the Wooldridge tests, were used to determine the presence of serial correlation. The results are shown in Table A.2. Again, all eight models rejected the null hypothesis, implying the presence of serial correlation an violating another linear regression assumption.

The next potential issue could be the cross-sectional dependence of residuals. This dependence checks whether residuals of cross-sectional categories in the panel data are correlated. Since the data covers the period of COVID-19, a shock that affected a majority of countries and companies, the residuals are expected to be correlated to a certain degree. Pesaran CD test is used to examine the cross-sectional dependence. The results of the Pesaran CD tests are shown in Table A.3. The null hypothesis of cross-sectional independence was rejected for all eight models.

The results of the Shapiro-Wilk tests are shown in Table A.4. The normality of the residuals assumption was also violated, as all eight models rejected the null hypothesis of Shapiro-Wilk testing for normality. However, according to Wooldridge (2015), the normality of residuals can be asymptotically approximated if other key assumptions are accounted for. Therefore, the non-normality of residuals should not cause an issue.

The results of Breush-Pagan, Breush-Godfrey, and Pesaran CD tests suggest the inefficiency of pooled OLS. Clustered standard errors accounted for heteroskedasticity, serial correlation, and cross-sectional dependence. The non-normality of residuals, however, does not affect the efficiency. Due to the large sample size of 131 companies and small time periods of seven years, the results should be approximately valid (Wooldridge 2015).

However, the models for pooled OLS are affected by omitted variable bias, because of the uncontrolled variables that have significant effect on ROE. For that reason, either fixed effects or random effects approach is preferred.

3.7.2 Fixed effects model

Unlike the Pooled OLS model, fixed effects model (FEM) allows specific effects of individual entities. These effects are assumed to be constant (time-invariant) for each entity and are often unobserved. However, the fixed effects model accounts for these time-invariant characteristics through the process of within transformation, which effectively removes the unobserved influences. As a result, the fixed effects model focuses on the heterogeneity of the data over time.

As the main approaches to examine the relationship between ESG and CFP, fixed effects and random effects regressions were used. The Hausman test established the more suitable models between fixed and random effects models. Rejection of the null hypothesis of the Hausman tests in all eight models suggests a clear preference for fixed effects models over random effects models. The results of the Hausman tests can be seen in Table A.5. Therefore, further testing will be conducted only on fixed effects models.

Next, the homoskedasticity assumption is tested using Breush-Pagan tests on fixed effects models. Results of Breush-Pagan show heterogeneity in variances of residuals in all eight fixed effects models. To address the heteroskedasticity, clustered standard error is employed.

Breush-Godfrey tests were also used to test for serial correlation. Every fixed effects model shows signs of serial correlation according to the results of the tests. However, the clustered standard error already accounts for serial correlation.

Cross-sectional dependence must also be examined for potential issues. all eight fixed effects models rejected the null hypothesis of cross-sectional independence of the Pesaran CD test. Clustered standard error accounts for cross-sectional dependence as well.

The normality of the residuals assumption is again violated. However, this assumption is unnecessary for the fixed effects model, as asymptotic approximations can be reliable per Wooldridge (2015), provided large N and small T are present.

Chapter 4

Empirical results

4.1 Pooled OLS — results

This section presents the results of pooled OLS regressions, which employ clustered standard errors to enhance the validity of the results. The results of the baseline pooled OLS regressions are in the Appendix for comparative purposes and a more profound understanding.

4.1.1 Pooled OLS — ROE

Table A.10 presents the results of the pooled OLS approach for ROE. The current and lagged environmental pillar scores have significant positive effects on ROE. The current ESG score appears to have a significant positive effect as well. However, these results are invalid due to heteroskedasticity, serial correlation, and cross-sectional dependence.

To account for the issues, clustered standard errors were applied for the pooled OLS approach for ROE. This process eliminated the significance of all ESG metrics on ROE, presented in Table 4.1. Beta remains highly significant, along with the location of the headquarters. These results are meant to outline the ROE—ESG relationship benchmark and are not seriously considered due to the omitted variable bias.

Table 4.1: Pooled OLS — ROE — clust. s. e.

Dependent variable:	ROE			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.016			
	(0.014)			
$\ln(S_{Lagged})$	0.003			
	(0.013)			
$\ln(G_{Lagged})$	0.011			
	(0.017)			
ln(E)		0.018		
		(0.014)		
ln(S)		−0.003		
		(0.013)		
ln(G)		0.020		
		(0.018)		
$\ln(ESG_{Lagged})$			0.025	
			(0.030)	
ln(ESG)				0.029
				(0.030)
Beta	−0.085***	−0.080***	−0.084**	−0.080***
	(0.033)	(0.030)	(0.033)	(0.030)
Leverage	−0.006	−0.005	−0.006	−0.006
	(0.015)	(0.014)	(0.015)	(0.013)
Size	−0.001	0.001	0.0001	0.002
	(0.010)	(0.011)	(0.010)	(0.011)
ASIA	−0.060**	−0.053*	−0.057**	−0.051**
	(0.027)	(0.029)	(0.024)	(0.025)
EUROPE	−0.062**	−0.054**	−0.060**	−0.054**
	(0.026)	(0.027)	(0.025)	(0.025)
OCEANIA	−0.042	−0.036	−0.052	−0.047
	(0.039)	(0.040)	(0.051)	(0.050)
AFRICA	−0.122***	−0.106***	−0.116***	−0.103***
	(0.037)	(0.038)	(0.036)	(0.036)
Constant	0.194	0.115	0.174	0.116
	(0.196)	(0.207)	(0.174)	(0.183)
Observations	786	917	786	917
R^2	0.079	0.068	0.076	0.064
Adjusted R^2	0.068	0.058	0.067	0.055
F Statistic	6.69***	6.61***	8.01***	7.71***
	(df = 10; 775)	(df = 10; 906)	(df = 8; 777)	(df = 8; 908)

*Signif.: ***: 0.01, **: 0.05, *: 0.1*

4.1.2 Pooled OLS — ROA

The results of the pooled OLS approach for ROA are presented in Table A.11. The environmental pillar score is consistent for ROE and ROA. Its current and lagged scores have significant positive impacts on ROA. However, these results are again invalid, and clustered standard errors are employed.

Table 4.2 presents the pooled OLS approach for ROA, employing clustered standard errors. The significance of ESG metrics on ROA disappears after clustered standard error. Again, these results are not seriously considered due to the omitted variable bias.

Table 4.2: Pooled OLS — ROA — clust. s. e.

Dependent variable:	ROA			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.007			
	(0.007)			
$\ln(S_{Lagged})$	0.001			
	(0.006)			
$\ln(G_{Lagged})$	0.001			
	(0.006)			
ln(E)		0.008		
		(0.006)		
ln(S)		−0.001		
		(0.006)		
ln(G)		0.003		
		(0.007)		
$\ln(ESG_{Lagged})$			0.005	
			(0.010)	
ln(ESG)				0.006
				(0.010)
Beta	-0.034^{***}	-0.033^{***}	-0.033^{***}	-0.032^{***}
	(0.011)	(0.009)	(0.011)	(0.010)
Leverage	-0.013^{***}	-0.014^{***}	-0.013^{***}	-0.014^{***}
	(0.003)	(0.003)	(0.003)	(0.003)
Size	−0.005	−0.004	−0.003	−0.003
	(0.003)	(0.003)	(0.003)	(0.003)
ASIA	−0.015	−0.014	−0.013	−0.012
	(0.009)	(0.009)	(0.008)	(0.008)
EUROPE	-0.023^{**}	-0.022^{**}	-0.021^{**}	-0.020^{**}
	(0.009)	(0.009)	(0.009)	(0.009)
OCEANIA	−0.003	−0.003	−0.010	−0.010
	(0.025)	(0.026)	(0.030)	(0.030)
AFRICA	-0.049^{***}	-0.045^{***}	-0.045^{***}	-0.041^{***}
	(0.014)	(0.015)	(0.014)	(0.014)
Constant	0.188^{***}	0.161^{**}	0.174^{***}	0.152^{**}
	(0.063)	(0.074)	(0.059)	(0.067)
Observations	786	917	786	917
R^2	0.186	0.171	0.179	0.164
Adjusted R^2	0.175	0.162	0.170	0.157
F Statistic	17.66^{***}	18.75^{***}	21.12^{***}	22.34^{***}
	(df = 10; 775)	(df = 10; 906)	(df = 8; 777)	(df = 8; 908)

*Signif.: ***: 0.01, **: 0.05, *: 0.1*

4.2 Fixed effects — results

This section presents the results of company and country-level fixed effects, which employ clustered standard errors. Additionally, sub-industry and continent analyses are presented. The results of fixed effects models for ROE and

ROA with heteroskedasticity standard errors are presented in the Appendix for comparative purposes and deeper understanding.

4.2.1 Company-level FE — ROE

Table A.12 presents the results of the FE approach with company-level fixed effects for ROE. The ESG metrics show no significant impact on ROE. The results with clustered standard errors, presented in Table 4.3, show no significant effect of ESG metrics on ROE. Only leverage has a highly significant negative impact on ROE.

Table 4.3: FE company level — ROE — clust. s. e.

Dependent Variable:	ROE			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	-0.0048			
	(0.0201)			
$\ln(S_{Lagged})$	0.0011			
	(0.0144)			
$\ln(G_{Lagged})$	-0.0011			
	(0.0204)			
ln(E)		0.0051		
		(0.0173)		
ln(S)		-0.0004		
		(0.0128)		
ln(G)		0.0189		
		(0.0290)		
$\ln(ESG_{Lagged})$			-0.0009	
			(0.0205)	
ln(ESG)				0.0259
				(0.0271)
Beta	-0.0209	-0.0124	-0.0209	-0.0123
	(0.0363)	(0.0307)	(0.0365)	(0.0308)
Leverage	-0.0809***	-0.0781***	-0.0809***	-0.0784***
	(0.0135)	(0.0124)	(0.0137)	(0.0124)
Size	0.0254	0.0336	0.0242	0.0334
	(0.0468)	(0.0433)	(0.0478)	(0.0436)
Fixed-effects				
Company	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.60998	0.58598	0.60991	0.58568
Within R^2	0.13693	0.12315	0.13678	0.12251

Clustered (Company & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

4.2.2 Company-level FE — ROA

Table A.13 presents the results of the FE approach with company-level fixed effects for ROA. The ESG metrics show no significant impact on ROA. The results with clustered standard errors, presented in Table 4.4, show no significant effect of ESG metrics on ROA. Leverage has a highly significant negative impact on ROA. Leverage is consistently significant for both ROE and ROA.

Table 4.4: FE company level — ROA — clust. s. e.

Dependent Variable:	ROA			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.0025			
	(0.0099)			
$\ln(S_{Lagged})$	0.0005			
	(0.0070)			
$\ln(G_{Lagged})$	-0.0048			
	(0.0078)			
ln(E)		0.0045		
		(0.0072)		
ln(S)		0.0012		
		(0.0051)		
ln(G)		0.0006		
		(0.0096)		
$\ln(ESG_{Lagged})$			0.0002	
			(0.0081)	
ln(ESG)				0.0081
				(0.0104)
Beta	-0.0051	-0.0002	-0.0051	-0.0001
	(0.0094)	(0.0091)	(0.0095)	(0.0090)
Leverage	-0.0206***	-0.0211***	-0.0205***	-0.0212***
	(0.0029)	(0.0024)	(0.0028)	(0.0024)
Size	0.0065	0.0035	0.0069	0.0037
	(0.0161)	(0.0121)	(0.0160)	(0.0119)
Fixed-effects				
Company	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.69012	0.67475	0.68954	0.67456
Within R^2	0.09328	0.08906	0.09158	0.08853

Clustered (Company & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

4.2.3 Country-level FE — ROE

Table A.14 presents the results of the FE approach with country-level fixed effects for ROE. The present and lagged environmental pillar scores have significant positive impacts on ROE. Other ESG metrics show no significant impact on ROE. Since these results account for only heteroskedasticity, clustered standard errors should be applied. The results with clustered standard errors, presented in Table 4.4, show no significant effect of ESG metrics on ROE.

Table 4.5: FE country level — ROE — clust. s. e.

Dependent Variable:	ROE			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.0148			
	(0.0152)			
$\ln(S_{Lagged})$	-0.0071			
	(0.0106)			
$\ln(G_{Lagged})$	-0.0028			
	(0.0135)			
ln(E)		0.0184		
		(0.0115)		
ln(S)		-0.0128		
		(0.0116)		
ln(G)		0.0061		
		(0.0181)		
$\ln(ESG_{Lagged})$			-0.0018	
			(0.0175)	
ln(ESG)				0.0038
				(0.0165)
Beta	-0.0671	-0.0637*	-0.0671	-0.0642*
	(0.0362)	(0.0285)	(0.0376)	(0.0302)
Leverage	-0.0175*	-0.0188*	-0.0171*	-0.0187*
	(0.0074)	(0.0087)	(0.0068)	(0.0082)
Size	0.0077	0.0097	0.0094	0.0108
	(0.0063)	(0.0079)	(0.0053)	(0.0071)
Fixed-effects				
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.26402	0.23887	0.26131	0.23499
Within R^2	0.06493	0.06139	0.06150	0.05661

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

4.2.4 Country-level FE — ROA

Table A.15 presents the results of the FE approach with country-level fixed effects for ROA. The present and lagged environmental pillar scores have significant positive impacts on ROA. Other ESG metrics show no significant impact on ROA. Since these results account for only heteroskedasticity, clustered standard errors should be applied. The results with clustered standard errors, presented in Table 4.4, show no significant effect of ESG metrics on ROE.

Table 4.6: FE country level — ROA — clust. s. e.

Dependent Variable:	ROA			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.0094			
	(0.0083)			
$\ln(S_{Lagged})$	-0.0028			
	(0.0056)			
$\ln(G_{Lagged})$	-0.0028			
	(0.0039)			
ln(E)		0.0105		
		(0.0073)		
ln(S)		-0.0049		
		(0.0057)		
ln(G)		-0.0011		
		(0.0056)		
$\ln(ESG_{Lagged})$			-0.0019	
			(0.0081)	
ln(ESG)				-0.0013
				(0.0083)
Beta	-0.0303*	-0.0302**	-0.0300*	-0.0297**
	(0.0122)	(0.0095)	(0.0129)	(0.0103)
Leverage	-0.0169***	-0.0180***	-0.0167***	-0.0178***
	(0.0040)	(0.0046)	(0.0039)	(0.0044)
Size	-0.0025	-0.0014	-0.0010	-8.41×10^{-5}
	(0.0040)	(0.0045)	(0.0039)	(0.0043)
Fixed-effects				
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.34150	0.32119	0.33288	0.31180
Within R^2	0.20763	0.20023	0.19725	0.18917

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

4.2.5 Sub-industry analysis — ROE — current pillars

Since the automotive industry comprises five different sub-industries, the next step in the analysis should be an analysis and comparison of the sub-industries. The following sections are focused on the effects of ESG metrics on ROE and ROA in each of the following sectors of the automotive industry: Heavy Machinery & Vehicles, Auto & Truck Manufacturers, Auto, Truck & Motorcycle Parts, Tires & Rubber Products, and Auto Vehicles, Parts & Service Retailers. The fixed effects are on the country level, and the results are clustered by country and year.

Tires & Rubber Products and Auto Vehicles, Parts & Service Retailers sectors have a considerably smaller sample than others. Therefore, the effects of these two sectors should be discussed with caution.

The Table 4.7 shows the results of country-level fixed effects models with clustered standard errors. In the Auto & Truck Manufacturers sub-industry, ESG metrics are insignificant. The current governance pillar score has a slightly negative impact on the ROE in the Tires & Rubber Products and Auto Vehicles sector only. The current environmental pillar score has a significant positive effect on ROE in the Auto, Truck & Motorcycle Parts sub-industry and a slightly significant positive effect in the Heavy Machinery & Vehicles sector. If significant, the current environmental pillar score has a consistent positive impact on ROE across sectors. On the other hand, the social pillar score has a slightly significant adverse effect in the Heavy Machinery & Vehicles and Truck & Motorcycle Parts sectors and slight and moderate positive effects in the Tires & Rubber Products and Auto Vehicles, Parts & Service Retailers sectors. This inconsistency suggests that each sector in the automotive industry has a different sensitivity to each ESG pillar.

Table 4.7: Current pillars for sub-industries — clust. s. e.

Dependent Variable:			ROE		
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	0.0724*	-0.0543	0.0381***	-0.0464	0.0257
	(0.0369)	(0.0550)	(0.0066)	(0.0311)	(0.0150)
ln(S)	-0.0507*	0.0368	-0.0401*	0.0242*	0.0627**
	(0.0210)	(0.0537)	(0.0188)	(0.0114)	(0.0188)
ln(G)	-0.0310	0.0087	0.0173	-0.0538*	0.0911
	(0.0222)	(0.0477)	(0.0205)	(0.0213)	(0.0510)
Beta	-0.0788**	-0.0125	-0.0757***	-0.0825	0.0431
	(0.0309)	(0.0844)	(0.0178)	(0.0586)	(0.0305)
Leverage	0.0237*	-0.0111	-0.0703***	-0.1713**	-0.0340
	(0.0104)	(0.0253)	(0.0091)	(0.0569)	(0.0202)
Size	-0.0097	-0.0081	0.0377	-0.0106	0.0366
	(0.0109)	(0.0138)	(0.0200)	(0.0102)	(0.0227)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	217	259	301	77	63
R^2	0.40558	0.33100	0.46415	0.46868	0.55432
Within R^2	0.16401	0.02257	0.31951	0.25359	0.29480

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

4.2.6 Sub-industry analysis — ROE — lagged pillars

According to Table 4.8, the lagged score of the social pillar has a highly significant negative impact on ROE in the Auto, Truck & Motorcycle Parts sector, but a significant positive effect on ROE in Tires & Rubber Products and Auto Vehicles, Parts & Service Retailers sectors. The lagged environmental pillar score shows a positive impact on ROE at 10% and a negative impact on ROE at 10% for the Auto, Truck & Motorcycle Parts and Tires & Rubber Products sectors, respectively. The lagged scores of environmental and social pillars appear to have effects in opposite directions in the same sector. The lagged governance pillar score significantly negatively impacts ROE only in the Tires & Rubber Products sector.

Highly significant leverage is also showing contradicting directions of effects on ROE. In the Auto, Truck & Motorcycle Parts, Tires & Rubber Products, and Auto Vehicles, Parts & Service Retailers sectors, leverage significantly negatively affects ROE. In contrast, in the Heavy Machinery & Vehicles sector, leverage has a significant positive impact on ROE. For the first time, size is a significant factor for ROE in the Auto, Truck & Motorcycle Parts sector.

Table 4.8: Lagged pillars for sub-industries — clust. s. e.

Dependent Variable:	ROE				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	0.0590	-0.0464	0.0352*	-0.0621*	-0.0015
	(0.0388)	(0.0403)	(0.0154)	(0.0306)	(0.0422)
$\ln(S_{Lagged})$	-0.0354	0.0448	-0.0342***	0.0301**	0.2493**
	(0.0263)	(0.0495)	(0.0061)	(0.0116)	(0.0775)
$\ln(G_{Lagged})$	-0.0536	0.0069	0.0230	-0.0839**	-0.0134
	(0.0272)	(0.0322)	(0.0241)	(0.0296)	(0.0424)
Beta	-0.0916	-0.0422	-0.0864*	-0.0687	0.0822**
	(0.0488)	(0.0690)	(0.0337)	(0.0756)	(0.0247)
Leverage	0.0284**	-0.0187	-0.0679***	-0.2545**	-0.0502**
	(0.0101)	(0.0163)	(0.0103)	(0.0639)	(0.0142)
Size	-0.0127	-0.0164	0.0293*	-0.0083	0.0486
	(0.0158)	(0.0198)	(0.0132)	(0.0053)	(0.0250)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	186	222	258	66	54
R^2	0.38519	0.41666	0.47806	0.54126	0.56753
Within R^2	0.17932	0.05301	0.33718	0.35343	0.30555

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

4.2.7 Sub-industry analysis — ROE — overall ESG

The current and lagged overall ESG scores have significant positive impacts in the Auto Vehicles, Parts & Service Retailers sector per Table A.16 and Table A.17. There is not a significant effect of the overall ESG score on ROE in any other sector. Leverage has a significant negative effect on ROE in most of the sectors.

4.2.8 Sub-industry analysis — ROA — current pillars

The environmental pillar significantly affects ROA in Heavy Machinery & Vehicles and Auto, Truck & Motorcycle Parts sectors. The effect is positive in both sectors. The current social and governance pillar scores also show significant positive effects in the Auto Vehicles, Parts & Service Retailers sector, as Table 4.9 presents.

Table 4.9: Current pillars for sub-industries — clust. s. e.

Dependent Variable:			ROA		
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	0.0244*	-0.0375	0.0273***	-0.0136	0.0108
	(0.0113)	(0.0239)	(0.0064)	(0.0141)	(0.0059)
ln(S)	-0.0148	0.0096	-0.0160	0.0085	0.0307*
	(0.0079)	(0.0175)	(0.0109)	(0.0055)	(0.0148)
ln(G)	-0.0007	-0.0072	0.0016	-0.0238	0.0234***
	(0.0074)	(0.0103)	(0.0076)	(0.0121)	(0.0029)
Beta	-0.0266**	-0.0216	-0.0359***	-0.0182	-0.0071
	(0.0096)	(0.0222)	(0.0092)	(0.0173)	(0.0080)
Leverage	-0.0037*	-0.0143	-0.0298***	-0.0899*	-0.0054*
	(0.0015)	(0.0074)	(0.0060)	(0.0351)	(0.0026)
Size	-0.0073	-0.0069	0.0049	0.0007	-0.0080
	(0.0038)	(0.0075)	(0.0109)	(0.0065)	(0.0051)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	217	259	301	77	63
R^2	0.37379	0.50292	0.48835	0.56163	0.67169
Within R^2	0.20360	0.22688	0.35412	0.25921	0.55597

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

4.2.9 Sub-industry analysis — ROA — lagged pillars

The lagged environmental pillar appears consistent with the current environmental pillar score in the Auto, Truck & Motorcycle Parts sector. Additionally, the lag of the pillar score appears to have a slightly significant positive effect on ROA in the Auto Vehicles, Parts & Service Retailers sector. The lagged social pillar score positively impacts the Auto Vehicles, Parts & Service Retailers sector at 10%. On the other hand, the lagged governance pillar negatively affects the ROA in the Tires & Rubber Products sector.

Table 4.10: Lagged pillars for sub-industries — clust. s. e.

Dependent Variable:			ROA		
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	0.0205	-0.0380	0.0269**	-0.0197	0.0080*
	(0.0138)	(0.0227)	(0.0097)	(0.0179)	(0.0033)
$\ln(S_{Lagged})$	-0.0156	0.0144	-0.0129	0.0135	0.0553*
	(0.0083)	(0.0161)	(0.0076)	(0.0072)	(0.0221)
$\ln(G_{Lagged})$	-0.0074	-0.0043	0.0040	-0.0451*	0.0091
	(0.0084)	(0.0082)	(0.0078)	(0.0223)	(0.0138)
Beta	-0.0306*	-0.0278	-0.0418**	-0.0079	-0.0027
	(0.0146)	(0.0211)	(0.0129)	(0.0235)	(0.0061)
Leverage	-0.0026	-0.0158*	-0.0266***	-0.1323**	-0.0076*
	(0.0016)	(0.0069)	(0.0025)	(0.0486)	(0.0032)
Size	-0.0075	-0.0088	0.0005	0.0033	-0.0073
	(0.0046)	(0.0086)	(0.0071)	(0.0058)	(0.0069)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	186	222	258	66	54
R^2	0.37369	0.52235	0.54198	0.62770	0.68250
Within R^2	0.22402	0.25150	0.40866	0.37213	0.56895

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

4.2.10 Sub-industry analysis — ROA — overall ESG

Table A.18 presents the effects of the current overall ESG score on ROA in different sectors. The current ESG overall score shows a highly significant positive effect in the Auto Vehicles, Parts & Service Retailers sector and a significant adverse effect in the Auto & Truck Manufacturers and Tires & Rubber Products sectors. The lagged overall ESG score, according to Table A.19, has a highly significant positive impact on ROA only in the Auto Vehicles, Parts & Service Retailers sector.

4.2.11 Continent analysis — ROE — current pillars

The companies in the dataset are from distinct continental regions: Asia, Europe, North America, South America, Africa, and Oceania. Only one company has its headquarters in South America. Therefore South and North America were combined. The final step of this comprehensive study is to analyze and compare the differences among continents. Africa and Oceania have a tiny sample size. Therefore the results for these continents should be discussed with caution. The fixed effects are on the industry level, and data is clustered by industry.

Table 4.11: Current pillars for continents — clust. s. e.

Dependent Variable:			ROE		
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	-0.0052	0.0339	-0.0098	0.0046	0.0204
	(0.0163)	(0.0233)	(0.0345)	(0.0210)	(0.0340)
ln(S)	0.0309	-0.0226	0.0588	-0.0156	-0.0565
	(0.0164)	(0.0246)	(0.0963)	(0.0481)	(0.0561)
ln(G)	-0.0153	0.1179	0.0256	0.0193	0.0161
	(0.0141)	(0.0851)	(0.0712)	(0.0580)	(0.0985)
Beta	-0.0699*	-0.1329**	-0.0503	0.0771*	0.1165
	(0.0290)	(0.0308)	(0.0505)	(0.0290)	(0.0458)
Leverage	-0.0072	-0.0030	-0.0467	-0.0174	-0.0515
	(0.0147)	(0.0301)	(0.0195)	(0.0200)	(0.1014)
Size	-0.0307	0.0379	0.0084	0.0219	0.1224
	(0.0153)	(0.0225)	(0.1025)	(0.0190)	(0.1020)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	455	245	21	168	28
R^2	0.17832	0.28061	0.93806	0.23821	0.76669
Within R^2	0.12403	0.24183	0.58906	0.07434	0.69614

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

4.2.12 Continent analysis — ROE — lagged pillars

The lagged environmental pillar score appears to impact ROE for companies with headquarters in Africa significantly. Other lagged pillar scores have no significant impact on ROE in other continents. The results are in Table 4.12.

Table 4.12: Lagged pillars for continents — clust. s. e.

Dependent Variable:			ROE		
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	-0.0075	0.0192	0.1290**	-0.0194	0.0111
	(0.0115)	(0.0298)	(0.0220)	(0.0178)	(0.0224)
$\ln(S_{Lagged})$	0.0319	0.0036	-0.0155	0.0155	-0.0472
	(0.0155)	(0.0172)	(0.0758)	(0.0572)	(0.0181)
$\ln(G_{Lagged})$	-0.0157	0.0701	0.1066	-0.0172	-0.0840
	(0.0122)	(0.0751)	(0.0402)	(0.0450)	(0.0442)
Beta	-0.0725*	-0.1523***	0.1759**	0.0925**	0.0962
	(0.0336)	(0.0296)	(0.0185)	(0.0326)	(0.0284)
Leverage	-0.0050	-0.0029	-0.0131	-0.0308	-0.0140
	(0.0149)	(0.0318)	(0.0169)	(0.0183)	(0.0909)
Size	-0.0336*	0.0255	-0.0712	0.0299	0.1461
	(0.0154)	(0.0202)	(0.0319)	(0.0214)	(0.0669)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	390	210	18	144	24
R^2	0.17945	0.28625	0.98527	0.26673	0.87147
Within R^2	0.13576	0.24413	0.87999	0.09954	0.84308

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

4.2.13 Continent analysis — ROE — overall ESG

According to Table A.20 and Table A.21, only the lagged overall ESG score has a significant positive impact on ROE for African companies. There is no other significant effect of the overall ESG score on ROE in any other continent.

4.2.14 Continent analysis — ROA — current pillars

Results from Table 4.13 show that the current environmental pillar score is significant and positively impacts ROA for American companies. ESG pillar scores have no significant effect on ROA for companies located in other continents.

Table 4.13: Current pillars for continents — clust. s. e.

Dependent Variable:	ROA				
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	-0.0153	0.0161**	-0.0079	0.0015	0.0275
	(0.0075)	(0.0047)	(0.0185)	(0.0107)	(0.0202)
ln(S)	0.0149	-0.0085	0.0219	0.0082	-0.0486
	(0.0084)	(0.0043)	(0.0456)	(0.0162)	(0.0307)
ln(G)	-0.0062	0.0386	0.0103	0.0012	-0.0177
	(0.0082)	(0.0221)	(0.0330)	(0.0179)	(0.0363)
Beta	-0.0241*	-0.0543**	-0.0171	0.0177**	0.0386
	(0.0091)	(0.0144)	(0.0303)	(0.0063)	(0.0207)
Leverage	-0.0189**	-0.0101	-0.0214	-0.0075	-0.0435
	(0.0051)	(0.0056)	(0.0129)	(0.0059)	(0.0644)
Size	-0.0129*	0.0036	0.0024	-0.0002	0.0282
	(0.0052)	(0.0045)	(0.0529)	(0.0086)	(0.0625)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	455	245	21	168	28
R^2	0.30804	0.35446	0.94188	0.37284	0.81860
Within R^2	0.25267	0.30469	0.46163	0.08126	0.77294

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

4.2.15 Continent analysis — ROA — lagged pillars

Lagged pillar scores seem to have a distinct effect on the ROA of companies in different continents per Table 4.14. A lagged environmental pillar score significantly positively affects ROA in African companies. However, it also significantly negatively affects ROA in Asian companies. The governance pillar score significantly positively impacts ROA for companies in Africa.

Table 4.14: Lagged pillars for continents — clust. s. e.

Dependent Variable:	ROA				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	-0.0158*	0.0111	0.0578**	-0.0025	0.0239
	(0.0065)	(0.0078)	(0.0111)	(0.0097)	(0.0114)
$\ln(S_{Lagged})$	0.0152	0.0035	-0.0179	0.0109	-0.0488
	(0.0086)	(0.0064)	(0.0369)	(0.0154)	(0.0098)
$\ln(G_{Lagged})$	-0.0069	0.0248	0.0524*	-0.0060	-0.0772
	(0.0073)	(0.0186)	(0.0161)	(0.0172)	(0.0145)
Beta	-0.0245*	-0.0633**	0.0873***	0.0212*	0.0285
	(0.0105)	(0.0138)	(0.0087)	(0.0088)	(0.0122)
Leverage	-0.0173**	-0.0086	-0.0041	-0.0103	-0.0169
	(0.0049)	(0.0055)	(0.0110)	(0.0055)	(0.0420)
Size	-0.0139*	-0.0021*	-0.0299	0.0021	0.0358
	(0.0053)	(0.0009)	(0.0136)	(0.0084)	(0.0342)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	390	210	18	144	24
R^2	0.29861	0.43078	0.98309	0.37429	0.93201
Within R^2	0.25299	0.37860	0.81383	0.10073	0.91975

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

4.2.16 Continent analysis — ROA — overall ESG

According to Tables A.22 and A.23, current and lagged overall ESG scores significantly positively affect ROA for American companies. A lagged score also appears to have a significant positive effect on African companies.

4.2.17 Further analysis

The continental analysis could seem broad; thus, even though not a part of the hypotheses, countries with at least five companies were analyzed. The results are presented in Tables A.24, A.25, A.26, and A.27. The countries are Japan, the United States of America, China, South Korea, India, Taiwan, France, Canada, and Germany. The United Kingdom was also added to the list, even though only four companies are in the UK. The five Asian companies were grouped for a more straightforward and comparable overview of results.

The E pillar significantly positively impacts the ROA and ROE of Chinese and Indian companies. However, the pillar negatively affects the ROA and ROE of companies in the United Kingdom. The social pillar has a distinct, immediate positive effect on the ROE and ROA of Indian companies. However, a lagged social pillar has adverse effects on the ROE of those companies. The ROA of French companies also faces adverse effects from the social pillar; in contrast, the ROA of companies from the United Kingdom benefits from the pillar. The governance pillar has a consistently positive impact on the CFP of Indian companies and a negative impact on Chinese and Taiwanese companies.

Chapter 5

Discussion

5.1 Pooled OLS & fixed effects — discussion

The initial results of Pooled OLS and Fixed effects on the company and country level showed the influence of ESG factors on financial performance metrics. However, the potential influence disappeared after accounting for heteroskedasticity, serial correlation, and cross-sectional dependence.

These findings raise several questions regarding the fundamentals of ESG practices. If ESG practices are necessary, why do the results show an insignificant impact on financial performance? On the other hand, if ESG practices were not essential, why should companies focus on them?

The previous literature suggests that ESG practices can positively impact a company's financial performance through multiple channels, such as increased profit, management quality, reputation, stakeholder trust, and reduction of risks (Zumente & Bistrova 2021). Nevertheless, in the automotive industry, ESG practices do not exhibit significant positive or negative effects on profitability metrics such as ROA and ROE. This insignificance does not implicate that ESG practices should be ditched but instead puts forward the scope and impact of such practices at the sub-industry levels. Hypotheses one and two are rejected, as ESG metrics did not show positive effects on ROA or the ROE of companies in the automotive industry.

5.2 Sub-industry analysis — discussion

The results change dramatically when the focus is not on the industry as a whole but on sectors within the industry. The ESG metrics, current and lagged, display significant impacts on various sectors. However, these impacts are inconsistent in the direction of the effect for different sectors.

Whether lagged or current, the environmental pillar improves ROE and ROA in the Heavy Machinery & Vehicles, Auto, Truck & Motorcycle Parts, and Auto Vehicles, Parts & Service Retailers sectors. In contrast, the pillar adversely affects ROE in the Tires & Rubber Products sector.

The social pillar positively affects ROE and ROA in the Tires & Rubber Products and Auto Vehicles, Parts & Service Retailers sectors, while negatively impacting the financial performance in the Heavy Machinery & Vehicles and Auto, Truck & Motorcycle Parts sectors.

The governance pillar harms ROE and ROA in the Tires & Rubber Products sector but enhances the company's ROA in the Auto Vehicles, Parts & Service Retailers sector. The Tires & Rubber Products, and Auto Vehicles, Parts & Service Retailers sectors have a small sample. Thus, the findings might not capture the actual effects of the pillars on CFP in those sectors.

The findings suggest the different directions of specific ESG metrics among different sectors and different ESG metrics in a specific sector. The author predicts that the fundamental nature of each sector is the source of the heterogeneity.

The social pillar consistently positively impacts the ROA and ROE in the Auto Vehicles, Parts & Service Retailers and Tires & Rubber Products sectors. As the stakeholder theory explains, social initiatives are essential for both sectors as they improve customer interaction. Thus, the social pillar directly affects the CFP through the stakeholder's trust and reputation channels.

The Tires & Rubber Products sector also partly works on a business-to-business (B2B) basis by selling directly to manufacturers, similar to the Auto, Truck & Motorcycle Parts sector. However, the Auto, Truck & Motorcycle Parts sector experience adverse effects from the social pillar, unlike the Tires & Rubber Products sector. This contradiction leads to examining how these two sectors operate.

The Auto, Truck & Motorcycle Parts sector operates more heavily on a B2B basis. However, the average social pillar score of the Auto, Truck & Motorcycle Parts sector is significantly worse than that of the Tires & Rubber Products sector (over 10 score points lower). Han & Lee (2021) state that social performance is crucial for B2B companies. Additionally, low performance in ESG could harm the relationships of B2B companies with other companies (Iurkov *et al.* 2024).

The Heavy Machinery & Vehicles sector also faces an immediate negative effect from the social pillar. This sector operates primarily on the B2B level. Thus, the previous arguments apply to this sector as well. Additionally, there are regulatory differences between sectors, as Saidani *et al.* (2018) state that the heavy vehicles sector is often not included in European regulations for the automotive industry.

The environmental pillar has a consistent positive impact on financial performance in every sector except for the Auto & Truck Manufacturers sector and the Tires & Rubber Products sector. The positive impacts are most likely connected to investor behavior and innovation offset. However, this should also be applicable in the Auto & Truck Manufacturers and Tires & Rubber Products sectors. Therefore, the discussion focuses on why Auto & Truck Manufacturers and the Tires & Rubber Products companies do not benefit from environmental initiatives. Both sectors rely on capital investments, and investors favor environmental practices and innovations. Therefore, the issue may lie in the social reputation of the car manufacturers, the reliability of electric vehicles, and incentives for potential customers; as Higueras-Castillo *et al.* (2020) state, these three factors impact potential customers' attitudes the most. Car manufacturer controversies, such as "Dieselgate" and issues with the autonomous electric vehicles, harm the social reputation of car manufacturers. Once a company's public perception drops, it becomes hard to recover its reputation, as noted by the legitimacy theory and "greenwashing" skepticism.

These issues, with the combination of the upcoming ban on diesel cars, make customers more likely not to upgrade their cars but wait for the stabilization and further advancements in the car market, thus stagnating the ROA and ROE. The slow and uncertain transformation from diesel to electric vehicles thus negates the positive impacts of environmentally friendly innovations such as the electric vehicle itself. Another explanation revolves around different regulations[1] for different sectors. However, this requires a complex investigation, which is beyond the research scope of this study; however, it is encouraged for further research.

The governance pillar significantly affects the ROE and ROA in the Auto Vehicles, Parts & Service Retailers and Tires & Rubber Products sectors. However, they differ in the direction of the effect, as retailers experience positive effects while the tire sector experiences negative effects. Improving the governance of companies in the retail sector can have an immediate positive effect

[1] https://www.acea.auto/files/ACEA-Regulatory-Guide-2022.pdf

due to the frequent customer interaction. In contrast, the Tires & Rubber Products sector faces strict regulations like other sectors except the retail sector, with high compliance costs. Thus, the governance pillar might introduce costs in the short term, while the positive effects become more apparent in a longer time frame (Friede *et al.* 2015).

These findings provide enough evidence to confirm the third hypothesis. Upon revisiting, the appropriate conclusion for hypotheses one and two is that the effects of ESG metrics on ROA and ROE depend on the sector within the industry. Therefore, future research focusing on "ESG and finance" within an industry should delve deeper into the sectors of that industry.

5.3 Continent analysis — discussion

Specific ESG metrics are more significant in some regions than in other regions. Africa and Oceania have a tiny sample size; therefore, the results for these two regions may not capture the actual effects of ESG metrics on ROA and ROE.

The environmental pillar has an immediate positive effect on the ROA of companies in North and South America. However, the lagged environmental pillar showed a positive significant effect on ROA and ROE for African companies. In contrast, the lagged pillar significantly negatively affected ROA for Asian companies. The governance pillar positively affects ROA for African companies, and the social pillar appears insignificant for all regions. The overall ESG score, on the other hand, showed a positive impact on the ROA of American and African countries.

These results point to three topics to discuss. First, the contrasting results of Africa and Asia, and second, the contrasting results of America and Asia. Moreover, the third topic is the insignificance of ESG in Europe.

The development of the regions is an essential factor. The positive effects on African companies suggest slight improvements in ESG practices significantly improve profitability due to the region's underdevelopment. Even though, as mentioned in the Descriptive statistics section, ESG score-wise weakest companies are located in Asia, the average ESG score of Asian companies is only behind European and African companies. Therefore, the direct explanations for the disparities between Asian and American companies are likely not in the development but in the regulatory situations in the regions or investor preferences.

The insignificant results for European companies are not surprising. Most companies with excellent ESG scores are located in Europe, and Europe as a region is the highest-performing region ESG score-wise. Therefore, these companies already operate at such high standards that further improvements do not affect profitability.

On top of differences across regions, differences across countries within the region are present per Tables A.24, A.25, A.26, and A.27. The variety of different impacts of ESG among regions and countries leads to three main possible explanations:

- The human behavior factor. The general stance towards a sustainable environment differs across regions. Therefore, the distinct results may be due to stakeholders' cultural differences (Shin *et al.* 2023), which increase or lower ESG practices and their effects.

- The development of a region. ESG practices and innovations require advanced technology; thus, developed regions are better positioned to outperform others (Singhania & Saini 2023).

- The regulatory differences. Countries differ in their regulatory approaches towards ESG (Singhania & Saini 2023). However, the regulations and their differences are beyond this study's scope and will not be discussed further.

There is enough evidence to confirm the third hypothesis of the variety of ESG impacts across regions.

5.4 Other variables — discussion

One of the fundamental concepts in finance is that higher risk is compensated by higher returns (Berk & DeMarzo 2019). The results of this study, however, suggest otherwise. Both leverage and beta harm ROA and ROE, i.e., increased risk results in lower returns. This contradiction, also called "low volatility anomaly," is primarily driven by the irrationality of human behavior, specifically, preference for lotteries, representativeness, and overconfidence (Baker *et al.* 2011).

Surprisingly, according to the empirical results, size is insignificant in a company's profitability. Even though larger companies have larger economies of scale, there might be a tipping point beyond which the additional costs of increased size outweigh the benefits. Therefore, established companies are expected to operate efficiently regardless of size, thus making size insignificant.

5.5 Implications

First, the insignificance of ESG in the automotive industry as a whole suggests that either ESG does not have any impact on profitability, or that companies do not have enough incentives to engage in ESG practices to a higher degree than just complying with regulations, or that companies in the automotive industry are already performing at a higher expectation ESG score-wise. Thus, the improvements in the ESG scores do not impact profitability. The first option falls apart when the sectors within the industry are the focus of the analyses. The third option is not unlikely to be accurate, as the highest performing sector, with over 15 score points above the automotive industry average, is the car manufacturer sector, a sector in which ESG metrics had no significant impacts. However, the author predicts that the second option is a viable explanation. Only complying with the regulations may not create meaningful positive impacts on a company's profitability, therefore companies should also engage in ESG practices, such as investing in R&D.

The obvious implications are that companies should focus on ESG regardless of the effects ESG has on profitability due to the environmental crisis present in the world and that incentives for ESG practices should be introduced. However, specific implications for each sector will be discussed in this section.

Sectors such as Heavy Machinery & Vehicles and Auto, Truck & Motorcycle Parts use equipment with a longer life cycle. However, after the useful life of the equipment, the recycling and reusing of the materials is limited. Saidani *et al.* (2018) state that the end-life management of heavy vehicles is less developed and barely controlled than that of light vehicles. Companies could, thus, enhance the benefits gained from the environmental pillar score. These sectors also operate on a B2B basis; thus, increasing the visibility of ESG initiatives, such as transparency of end-life management (Saidani *et al.* 2018), could improve the reputation of the companies and the trust of customers. Additionally, the ESG initiatives could improve the relationships by aligning with the goals of corporate companies that buy car parts and heavy machinery (Iurkov *et al.* 2024).

The recycling process of tires is a costly process. Therefore, tires that are "expired" are often left in landfills. However, tires are not bio-degradable

(Mohajerani *et al.* 2020). Therefore, for the Tire & Rubber products sector, innovation and recycling processes should be the primary focus points. Currently, "expired" tires have a few uses in construction and geology (Mohajerani *et al.* 2020), however, reusing tires is minimal. An Ethiopian company, "SoleRebels," produces shoe soles from tires. A similar approach to reuse old tires could improve the waste situation while creating a new source of profit.

The retail sector can benefit the most from immediate social and governance initiatives. Therefore, training employees, initiating community programs, and improving general management can positively influence customer behavior (Nugroho *et al.* 2024).

The profitability of the Auto & Truck Manufacturers sector is not directly dependent on ESG practices; however, as discussed, the skepticism around ESG indirectly influences profitability. Auto & Truck Manufacturers should focus on disclosing information about electric vehicles to improve the public's view of EVs. Additionally, investing in R&D in other alternative fuels or materials, such as hydrogen and taraxagum[2], will help the sector align with the future of carbon neutrality.

[2]https://www.continental-tires.com/stories/sustainable-materials-in-cars/

Chapter 6

Limitations & future research

6.1 Limitations of the study

The major limitation of this study is data source and availability. The study solely relies on the singular source of data, Refinitiv Eikon. Although Refinitiv Eikon is a reliable source, using multiple sources could provide additional reliability and robustness to the study. If additional sources are used, there might be discrepancies among the ESG ratings from different agencies. The lack of a standardized methodology for the ESG rating system is a limitation for every research on ESG. The study sample size includes 131 companies. While the size is moderate, a greater number would benefit a large-scope analysis, such as this study, to generalize the findings to a broader scope. There is an assumption that the companies with complete data are similar on average to companies with missing data, i.e., not violating random sampling. However, the current author is unable to confirm the similarity. The thesis covers seven years, a moderate length; however, a more extended period might capture the long-term effects more accurately.

The models may face certain issues. Although the models are built on past studies, they lack an automotive industry-specific variable, potentially lowering the results' validity. The linear nature of the model might oversimplify the true relationship between ESG and CFP. Some studies found a non-linear relationship. Thus, additional non-linear models could more accurately explore the relationship's complexity.

For Boolean data, Refinitiv Eikon assigns a negative attribute to a company if the information is partial or entirely missing, even though the negative attribute does not apply to the company. This practice could make the ESG metrics right-skewed, i.e., lower the scores if companies had missing data.

This thesis could benefit from more advanced econometrics methods, such as impulse response functions (IRF) and autoregressive distributed lag approaches (ARDL), to uncover the complexities of the relationships.

6.2 Possible future research

Future research could explore the differences in the ESG and CFP relationships between pure electric and regular car manufacturers. This suggestion was partly examined during the study, but only three pure EV manufacturer companies were available out of 131 companies; thus, the results were not included.

Exploring the direct effects of regulations on ESG and financial performance in the automotive industry could enrich the current study's findings and shed some light on the discussion. Examining the differences between the effects of universal and local regulations would also deepen the regional analysis.

Analyzing the effects of ESG on stock price and other profitability metrics would deepen the understanding of its impact. The effects could be examined on channels other than profitability, such as surveys of employees and other stakeholders, to examine how each ESG initiative improved their productivity and the workplace in general. However, qualitative data might create difficulties.

The study's results align with Stakeholder theory and Legitimacy theory, however, consumer behavior theories could be further examined. Additionally, it would be interesting to see whether these results are present in other technology industries.

Chapter 7

Conclusion

The purpose of this study is to examine the impact of environmental, social, and governance (ESG) performance on the return on equity (ROE) and return on assets (ROA) of companies in the automotive industry. The sample comprises 131 companies and covers seven years from 2015 to 2021. The study relies on the Refinitiv Eikon database, which is the only data source used.

The fixed effects approach with clustered standard errors was used on models with ROA and ROE as the dependent variables. The regressions were used on the dataset of the automotive industry as a whole, the individual sectors of the industry, the specific regions of the industry, and lastly, on the ten countries with the most companies in the automotive industry. The regression result on the industry level showed an insignificant impact of ESG metrics on ROA and ROE. However, the impacts became significant in the sector and region-level analyses.

The environmental pillar positively impacted the ROA and ROE of companies in the heavy vehicles, car parts, and retail sectors while negatively impacting the companies in the tire sector. The social pillar improved the ROA and ROE of companies in the tire and retail sectors while harming the profitability of companies in the heavy vehicles and car parts sectors. The governance pillar has positively impacted the ROA of companies in the retail sector and negatively impacted the tire sector.

The environmental pillar positively impacted the profitability of American and African companies. The governance pillar also positively affected the ROA in African companies. In contrast, the pillar harmed Asian companies. Social factors were insignificant in each region.

The directions and degrees of significance differed for each ESG metric in a specific sector and region. These distinct results are most likely due to fundamental differences between sectors, cultural and behavioral differences of stakeholders, development of regions, regional regulatory differences, and sectoral regulatory differences. The results of the sector analysis align with the Stakeholder theory and Legitimacy theory.

Car manufacturers showed a consistently insignificant impact of ESG metrics on ROA and ROE. This insignificance is not unlikely to be due to the declining public perception of those companies due to the skepticism around electric vehicles and controversies of leading car manufacturers.

The study can be a foundation for ESG investors and stakeholders involved in the automotive industry. There are three levels of implications that should guide investors and stakeholders. First is the general implication applicable to every sector and region. Companies should engage in ESG voluntarily and not just comply with ESG regulations. Additionally, the regulations should include specific incentives to push the ESG movement. Second, sector-specific implications discussed in Section 5.5 could enhance the benefits of ESG practices, i.e., managers should first identify the fundamental principles of their companies and include them in ESG practices and strategies. Last is the financial structuring of companies in the automotive industry. The prevalence of "low volatility anomaly" in companies in the automotive industry suggests rethinking the financing strategies, as results showed that higher debt in the capital structure lowers profitability.

Bibliography

Agliardi, E., T. Alexopoulos, & K. Karvelas (2023): "The environmental pillar of ESG and financial performance: A portfolio analysis." *Energy Economics* **120**: p. 106598.

Apergis, N., T. Poufinas, & A. Antonopoulos (2022): "ESG scores and cost of debt." *Energy Economics* **112**: p. 106186.

Asif, M., C. Searcy, & P. Castka (2023): "ESG and Industry 5.0: The role of technologies in enhancing ESG disclosure." *Technological Forecasting and Social Change* **195**: p. 122806.

Baker, M., B. Bradley, & J. Wurgler (2011): "Benchmarks as limits to arbitrage: Understanding the low-volatility anomaly." *Financial Analysts Journal* **67(1)**: pp. 40–54.

Baldini, M., L. D. Maso, G. Liberatore, F. Mazzi, & S. Terzani (2018): "Role of country-and firm-level determinants in environmental, social, and governance disclosure." *Journal of Business Ethics* **150**: pp. 79–98.

Berg, F., J. F. Koelbel, & R. Rigobon (2022): "Aggregate confusion: The divergence of ESG ratings." *Review of Finance* **26(6)**: pp. 1315–1344.

Berk, J. & P. DeMarzo (2019): *Corporate Finance*. The Prentice Hall series in finance. Pearson.

Billio, M., M. Costola, I. Hristova, C. Latino, & L. Pelizzon (2021): "Inside the ESG ratings: (Dis) agreement and performance." *Corporate Social Responsibility and Environmental Management* **28(5)**: pp. 1426–1445.

Bolton, P. & M. Kacperczyk (2021): "Do investors care about carbon risk?" *Journal of Financial Economics* **142(2)**: pp. 517–549.

Bolton, P. & M. Kacperczyk (2023): "Global pricing of carbon-transition risk." *Journal of Finance* **78(6)**: pp. 3677–3754.

Broadstock, D. C., K. Chan, L. T. Cheng, & X. Wang (2021): "The role of ESG performance during times of financial crisis: Evidence from COVID-19 in china." *Finance Research Letters* **38**: p. 101716.

Chen, Y.-C., M. Hung, & Y. Wang (2018): "The effect of mandatory CSR disclosure on firm profitability and social externalities: Evidence from China." *Journal of Accounting and Economics* **65(1)**: pp. 169–190.

Chen, Y. P. V., Z. Zhuo, Z. Huang, & W. Li (2022): "Environmental regulation and ESG of SMEs in China: Porter hypothesis re-tested." *Science of the Total Environment* **850**: p. 157967.

Chen, Z. & G. Xie (2022): "ESG disclosure and financial performance: Moderating role of ESG investors." *International Review of Financial Analysis* **83**: p. 102291.

Christensen, D. M., G. Serafeim, & A. Sikochi (2022): "Why is corporate virtue in the eye of the beholder? the case of ESG ratings." *The Accounting Review* **97(1)**: pp. 147–175.

Citterio, A. & T. King (2023): "The role of Environmental, Social, and Governance (ESG) in predicting bank financial distress." *Finance Research Letters* **51**: p. 103411.

Demers, E., J. Hendrikse, P. Joos, & B. Lev (2021): "ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did." *Journal of Business Finance & Accounting* **48(3-4)**: pp. 433–462.

Dinh, M. T. H. (2023): "ESG, time horizons, risks and stock returns." *Research in International Business and Finance* **65**: p. 101981.

Dorfleitner, G., S. Utz, & M. Wimmer (2018): "Patience pays off–corporate social responsibility and long-term stock returns." *Journal of Sustainable Finance & Investment* **8(2)**: pp. 132–157.

Fatemi, A., M. Glaum, & S. Kaiser (2018): "ESG performance and firm value: The moderating role of disclosure." *Global Finance Journal* **38**: pp. 45–64.

Feng, J., J. W. Goodell, & D. Shen (2022): "ESG rating and stock price crash risk: Evidence from China." *Finance Research Letters* **46**: p. 102476.

Franco, S., M. G. Caroli, F. Cappa, & G. Del Chiappa (2020): "Are you good enough? CSR, quality management and corporate financial performance in the hospitality industry." *International Journal of Hospitality Management* **88**: p. 102395.

Freeman, R. E. (2010): *Strategic management: A stakeholder approach.* Cambridge University Press.

Friede, G., T. Busch, & A. Bassen (2015): "ESG and financial performance: Aggregated evidence from more than 2000 empirical studies." *Journal of Sustainable Finance & Investment* **5(4)**: pp. 210–233.

Friedman, M. (2017): *The social responsibility of business is to increase its profits.*

Gibson Brandon, R., P. Krueger, & P. S. Schmidt (2021): "ESG rating disagreement and stock returns." *Financial Analysts Journal* **77(4)**: pp. 104–127.

Gu, Y., J. Dai, & M. A. Vasarhelyi (2023): "Audit 4.0-based ESG assurance: An example of using satellite images on GHG emissions." *International Journal of Accounting Information Systems* **50**: p. 100625.

Han, S.-L. & J. W. Lee (2021): "Does corporate social responsibility matter even in the B2B market?: Effect of B2B CSR on customer trust." *Industrial Marketing Management* **93**: pp. 115–123.

Havlinova, A. & J. Kukacka (2023): "Corporate social responsibility and stock prices after the financial crisis: The role of strategic CSR activities." *Journal of Business Ethics* **182(1)**: pp. 223–242.

Higueras-Castillo, E., Z. Kalinic, V. Marinkovic, & F. J. LiĂ©bana-Cabanillas (2020): "A mixed analysis of perceptions of electric and hybrid vehicles." *Energy Policy* **136**.

Hong, H. & M. Kacperczyk (2009): "The price of sin: The effects of social norms on markets." *Journal of Financial Economics* **93(1)**: pp. 15–36.

Hughes, A., M. A. Urban, & D. WĂłjcik (2021): "Alternative ESG ratings: How technological innovation is reshaping sustainable investment." *Sustainability (Switzerland)* **13(6)**: p. 3551.

Ionescu, G. H., D. Firoiu, R. Pirvu, & R. D. Vilag (2019): "The impact of ESG factors on market value of companies from travel and tourism industry." *Technological and Economic Development of Economy* **25(5)**: pp. 820–849.

Iurkov, V., M. Koval, S. Misra, K. Pedada, & A. Sinha (2024): "Impact of ESG distinctiveness in alliances on shareholder value." *Journal of Business Research* **171**.

Kao, E. H., C.-C. Yeh, L.-H. Wang, & H.-G. Fung (2018): "The relationship between CSR and performance: Evidence in China." *Pacific-Basin Finance Journal* **51**: pp. 155–170.

Kräussl, R., T. Oladiran, & D. Stefanova (2024): "A review on ESG investing: Investors's expectations, beliefs and perceptions." *Journal of Economic Surveys* **38(2)**: pp. 476–502.

Kumar, A., J. Gupta, & N. Das (2022): "Revisiting the influence of corporate sustainability practices on corporate financial performance: An evidence from the global energy sector." *Business Strategy and the Environment* **31(7)**: pp. 3231–3253.

Liu, P., B. Zhu, M. Yang, & X. Chu (2022): "ESG and financial performance: A qualitative comparative analysis in China's new energy companies." *Journal of Cleaner Production* **379**: p. 134721.

Mohajerani, A., L. Burnett, J. V. Smith, S. Markovski, G. Rodwell, M. T. Rahman, H. Kurmus, M. Mirzababaei, A. Arulrajah, S. Horpibulsuk, & F. Maghool (2020): "Recycling waste rubber tyres in construction materials and associated environmental considerations: A review." *Resources, Conservation and Recycling* **155**.

Nollet, J., G. Filis, & E. Mitrokostas (2016): "Corporate social responsibility and financial performance: A non-linear and disaggregated approach." *Economic Modelling* **52**: pp. 400–407.

Nugroho, D. P. D., Y. Hsu, C. Hartauer, & A. Hartauer (2024): "Investigating the interconnection between Environmental, Social, and Governance

(ESG), and Corporate Social Responsibility (CSR) strategies: An examination of the influence on consumer behavior." *Sustainability (Switzerland)* **16(2)**.

Porter, M. E. & C. v. d. Linde (1995): "Toward a new conception of the environment-competitiveness relationship." *Journal of Economic Perspectives* **9(4)**: pp. 97–118.

Saidani, M., B. Yannou, Y. Leroy, & F. Cluzel (2018): "Heavy vehicles on the road towards the circular economy: Analysis and comparison with the automotive industry." *Resources, Conservation and Recycling* **135**: pp. 108–122.

Sandberg, H., A. Alnoor, & V. Tiberius (2023): "Environmental, social, and governance ratings and financial performance: Evidence from the European food industry." *Business Strategy and the Environment* **32(4)**: pp. 2471–2489.

Serafeim, G. & A. Yoon (2023): "Stock price reactions to ESG news: The role of ESG ratings and disagreement." *Review of Accounting Studies* **28(3)**: pp. 1500–1530.

Servaes, H. & A. Tamayo (2013): "The impact of corporate social responsibility on firm value: The role of customer awareness." *Management science* **59(5)**: pp. 1045–1061.

Shakil, M. H. (2021): "Environmental, social and governance performance and financial risk: Moderating role of ESG controversies and board gender diversity." *Resources Policy* **72**: p. 102144.

Shanaev, S. & B. Ghimire (2022): "When ESG meets AAA: The effect of ESG rating changes on stock returns." *Finance Research Letters* **46**: p. 102302.

Shin, J., J. J. Moon, & J. Kang (2023): "Where does ESG pay? the role of national culture in moderating the relationship between ESG performance and financial performance." *International Business Review* **32(3)**: p. 102071.

Singhania, M. & N. Saini (2023): "Institutional framework of ESG disclosures: Comparative analysis of developed and developing countries." *Journal of Sustainable Finance and Investment* **13(1)**: pp. 516–559.

SUCHMAN, M. C. (1995): "Managing legitimacy: Strategic and institutional approaches." *Academy of Management Review* **20(3)**: pp. 571–610.

TORRE, M. L., F. MANGO, A. CAFARO, & S. LEO (2020): "Does the ESG index affect stock return? evidence from the Eurostoxx50." *Sustainability (Switzerland)* **12(16)**: p. 6387.

WANG, Q., J. DOU, & S. JIA (2016): "A meta-analytic review of corporate social responsibility and corporate financial performance: The moderating effect of contextual factors." *Business and Society* **55(8)**: pp. 1083–1121.

WANG, Y., X. SUN, & X. GUO (2019): "Environmental regulation and green productivity growth: Empirical evidence on the Porter Hypothesis from OECD industrial sectors." *Energy Policy* **132**: pp. 611–619.

WHELAN, T., U. ATZ, T. VAN HOLT, & C. CLARK (2021): "ESG and financial performance: Uncovering the relationship by aggregating evidence from 1,000 plus studies published between 2015-2020." *NYU STERN Center for sustainable business* pp. 520–536.

WOOLDRIDGE, J. M. (2015): *Introductory Econometrics: A Modern Approach*. Cengage Learning, 6 edition.

ZERBIB, O. D. (2019): "The effect of pro-environmental preferences on bond prices: Evidence from green bonds." *Journal of Banking and Finance* **98**: pp. 39–60.

ZHOU, R., J. HOU, & F. DING (2023): "Understanding the nexus between environmental, social, and governance (ESG) and financial performance: Evidence from Chinese-listed companies." *Environmental Science and Pollution Research* **30(29)**: pp. 73231–73253.

ZUMENTE, I. & J. BISTROVA (2021): "ESG importance for long-term shareholder value creation: Literature vs. practice." *Journal of Open Innovation: Technology, Market, and Complexity* **7(2)**: p. 127.

Appendix A

Appendix

Table A.1: Breusch-Pagan Test Results

POLS Approach	BP	P-Value	Het. presence
ROE & ESG_{Lagged}	60.56	3.6e-10	Yes
ROA & ESG_{Lagged}	40.01	3.2e-06	Yes
ROE & ESG	59.59	5.6e-10	Yes
ROA & ESG	45.88	2.5e-07	Yes
ROE & $Pillars_{Lagged}$	65.17	3.8e-10	Yes
ROA & $Pillars_{Lagged}$	40.55	1.4e-05	Yes
ROE & Pillars	68.42	8.9e-11	Yes
ROA & Pillars	48.68	4.7e-07	Yes

Table A.2: Breusch-Godfrey Test Results

POLS Approach	Chi-Sq	P-Value	S. C. presence
ROE & ESG_{Lagged}	179.71	$< 2.2e-16$	Yes
ROA & ESG_{Lagged}	238.99	$< 2.2e-16$	Yes
ROE & ESG	278.78	$< 2.2e-16$	Yes
ROA & ESG	334.88	$< 2.2e-16$	Yes
ROE & $Pillars_{Lagged}$	176.73	$< 2.2e-16$	Yes
ROA & $Pillars_{Lagged}$	232.66	$< 2.2e-16$	Yes
ROE & Pillars	276.48	$< 2.2e-16$	Yes
ROA & Pillars	329.76	$< 2.2e-16$	Yes

Table A.3: Pesaran CD Test Results

POLS Approach	P-Value	C. D. Presence
ROE & ESG_{Lagged}	< 2.2e-16	Yes
ROA & ESG_{Lagged}	< 2.2e-16	Yes
ROE & ESG	< 2.2e-16	Yes
ROA & ESG	< 2.2e-16	Yes
ROE & $Pillars_{Lagged}$	< 2.2e-16	Yes
ROA & $Pillars_{Lagged}$	< 2.2e-16	Yes
ROE & Pillars	< 2.2e-16	Yes
ROA & Pillars	< 2.2e-16	Yes

Table A.4: Shapiro-Wilk Test Results

POLS Approach	W Statistic	P-Value	Normal dist.
ROE & ESG_{Lagged}	0.84	< 2.2e-16	No
ROA & ESG_{Lagged}	0.92	< 2.2e-16	No
ROE & ESG	0.82	< 2.2e-16	No
ROA & ESG	0.89	< 2.2e-16	No
ROE & $Pillars_{Lagged}$	0.84	< 2.2e-16	No
ROA & $Pillars_{Lagged}$	0.92	< 2.2e-16	No
ROE & Pillars	0.82	< 2.2e-16	No
ROA & Pillars	0.89	< 2.2e-16	No

Table A.5: Hausman Test Results

Model	Chi-Sq	d.f.	P-Value	Suitable Approach
ROE & ESG_{Lagged}	58.716	4	5.4e-12	FE
ROA & ESG_{Lagged}	91.276	6	< 2.2e-16	FE
ROE & ESG	58.883	4	5.0e-12	FE
ROA & ESG	16.597	4	0.0023	FE
ROE & $Pillars_{Lagged}$	61.12	6	2.7e-11	FE
ROA & $Pillars_{Lagged}$	14.194	6	0.0276	FE
ROE & Pillars	59.649	6	5.3e-11	FE
ROA & Pillars	18.579	6	0.0049	FE

Table A.6: Breusch-Pagan Test Results — FEM

FE Approach	**BP Statistic**	**P-Value**	**Het. Presence**
ROE & ESG_{Lagged}	62.38	9.2e-13	Yes
ROA & ESG_{Lagged}	38.40	9.3e-08	Yes
ROE & ESG	59.61	3.5e-12	Yes
ROA & ESG	42.89	1.1e-08	Yes
ROE & $Pillars_{Lagged}$	67.74	1.2e-12	Yes
ROA & $Pillars_{Lagged}$	40.35	3.9e-07	Yes
ROE & Pillars	68.95	6.7e-13	Yes
ROA & Pillars	46.53	2.3e-08	Yes

Table A.7: Breusch-Godfrey Test Results — FEM

FE Approach	**Chi-Sq**	**P-Value**	**S. C. presence**
ROE & ESG_{Lagged}	90.07	$<$ 2.2e-16	Yes
ROA & ESG_{Lagged}	91.28	$<$ 2.2e-16	Yes
ROE & ESG	109.85	$<$ 2.2e-16	Yes
ROA & ESG	113.65	$<$ 2.2e-16	Yes
ROE & $Pillars_{Lagged}$	89.57	$<$ 2.2e-16	Yes
ROA & $Pillars_{Lagged}$	91.44	$<$ 2.2e-16	Yes
ROE & Pillars	109.42	$<$ 2.2e-16	Yes
ROA & Pillars	114.43	$<$ 2.2e-16	Yes

Table A.8: Pesaran CD Test Results — FEM

FE Approach	**P-Value**	**CD Presence**
ROE & ESG_{Lagged}	$<$ 2.2e-16	Yes
ROA & ESG_{Lagged}	$<$ 2.2e-16	Yes
ROE & ESG	$<$ 2.2e-16	Yes
ROA & ESG	$<$ 2.2e-16	Yes
ROE & $Pillars_{Lagged}$	$<$ 2.2e-16	Yes
ROA & $Pillars_{Lagged}$	$<$ 2.2e-16	Yes
ROE & Pillars	$<$ 2.2e-16	Yes
ROA & Pillars	$<$ 2.2e-16	Yes

Table A.9: Shapiro-Wilk Test Results — FEM

FE Approach	**W Statistic**	**P-Value**	**Normal dist.**
ROE & ESG_{Lagged}	0.85	< 2.2e-16	No
ROA & ESG_{Lagged}	0.90	< 2.2e-16	No
ROE & ESG	0.85	< 2.2e-16	No
ROA & ESG	0.89	< 2.2e-16	No
ROE & $Pillars_{Lagged}$	0.85	< 2.2e-16	No
ROA & $Pillars_{Lagged}$	0.90	< 2.2e-16	No
ROE & Pillars	0.85	< 2.2e-16	No
ROA & Pillars	0.89	< 2.2e-16	No

Table A.10: Pooled OLS for ROE

Dependent variable:	ROE			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.016^{*}			
	(0.009)			
$\ln(S_{Lagged})$	0.003			
	(0.010)			
$\ln(G_{Lagged})$	0.011			
	(0.012)			
ln(E)		0.018^{**}		
		(0.009)		
ln(S)		−0.003		
		(0.010)		
ln(G)		0.020^{*}		
		(0.011)		
$\ln(ESG_{Lagged})$			0.025	
			(0.016)	
ln(ESG)				0.029^{*}
				(0.015)
Beta	-0.085^{***}	-0.080^{***}	-0.084^{***}	-0.080^{***}
	(0.012)	(0.012)	(0.012)	(0.012)
Leverage	−0.006	−0.005	−0.006	−0.006
	(0.006)	(0.005)	(0.006)	(0.005)
Size	−0.001	0.001	0.0001	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
ASIA	-0.060^{***}	-0.053^{***}	-0.057^{***}	-0.051^{***}
	(0.014)	(0.013)	(0.013)	(0.013)
EUROPE	-0.062^{***}	-0.054^{***}	-0.060^{***}	-0.054^{***}
	(0.017)	(0.015)	(0.017)	(0.016)
OCEANIA	−0.042	−0.036	−0.052	−0.047
	(0.034)	(0.032)	(0.033)	(0.031)
AFRICA	-0.122^{***}	-0.106^{***}	-0.116^{***}	-0.103^{***}
	(0.037)	(0.035)	(0.037)	(0.035)
Constant	0.194^{**}	0.115	0.174^{**}	0.116
	(0.092)	(0.086)	(0.087)	(0.081)
Observations	786	917	786	917
R^2	0.079	0.068	0.076	0.064
Adjusted R^2	0.068	0.058	0.067	0.055
F Statistic	6.69^{***}	6.61^{***}	8.01^{***}	7.71^{***}
	(df = 10; 775)	(df = 10; 906)	(df = 8; 777)	(df = 8; 908)

*Signif.: ***: 0.01, **: 0.05, *: 0.1*

Table A.11: Pooled OLS for ROA

Dependent variable:	ROA			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.007^{**}			
	(0.003)			
$\ln(S_{Lagged})$	0.001			
	(0.003)			
$\ln(G_{Lagged})$	0.001			
	(0.004)			
ln(E)		0.008^{***}		
		(0.003)		
ln(S)		−0.001		
		(0.003)		
ln(G)		0.003		
		(0.004)		
$\ln(ESG_{Lagged})$			0.005	
			(0.005)	
ln(ESG)				0.006
				(0.005)
Beta	-0.034^{***}	-0.033^{***}	-0.033^{***}	-0.032^{***}
	(0.004)	(0.004)	(0.004)	(0.004)
Leverage	-0.013^{***}	-0.014^{***}	-0.013^{***}	-0.014^{***}
	(0.002)	(0.002)	(0.002)	(0.002)
Size	-0.005^{***}	-0.004^{**}	-0.003^{**}	-0.003^{*}
	(0.001)	(0.001)	(0.001)	(0.001)
ASIA	-0.015^{***}	-0.014^{***}	-0.013^{***}	-0.012^{***}
	(0.005)	(0.005)	(0.004)	(0.004)
EUROPE	-0.023^{***}	-0.022^{***}	-0.021^{***}	-0.020^{***}
	(0.006)	(0.005)	(0.006)	(0.005)
OCEANIA	−0.003	−0.003	−0.010	−0.010
	(0.011)	(0.011)	(0.011)	(0.010)
AFRICA	-0.049^{***}	-0.045^{***}	-0.045^{***}	-0.041^{***}
	(0.013)	(0.012)	(0.013)	(0.012)
Constant	0.188^{***}	0.161^{***}	0.174^{***}	0.152^{***}
	(0.031)	(0.029)	(0.029)	(0.028)
Observations	786	917	786	917
R^2	0.186	0.171	0.179	0.164
Adjusted R^2	0.175	0.162	0.170	0.157
F Statistic	17.66^{***}	18.75^{***}	21.12^{***}	22.34^{***}
	(df = 10; 775)	(df = 10; 906)	(df = 8; 777)	(df = 8; 908)

*Signif.: ***: 0.01, **: 0.05, *: 0.1*

Table A.12: FE company level — ROE

Dependent Variable:	ROE			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{\text{Lagged}})$	-0.0048			
	(0.0134)			
$\ln(S_{\text{Lagged}})$	0.0011			
	(0.0103)			
$\ln(G_{\text{Lagged}})$	-0.0011			
	(0.0199)			
ln(E)		0.0051		
		(0.0125)		
ln(S)		-0.0004		
		(0.0096)		
ln(G)		0.0189		
		(0.0190)		
$\ln(ESG_{\text{Lagged}})$			-0.0009	
			(0.0241)	
ln(ESG)				0.0259
				(0.0256)
Beta	-0.0209	-0.0124	-0.0209	-0.0123
	(0.0215)	(0.0206)	(0.0215)	(0.0207)
Leverage	-0.0809***	-0.0781***	-0.0809***	-0.0784***
	(0.0115)	(0.0114)	(0.0115)	(0.0114)
Size	0.0254	0.0336	0.0242	0.0334
	(0.0335)	(0.0391)	(0.0335)	(0.0388)
Fixed-effects				
Company	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.60998	0.58598	0.60991	0.58568
Within R^2	0.13693	0.12315	0.13678	0.12251

Heteroskedasticity-robust standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

Table A.13: FE company level — ROA

Dependent Variable:	ROA			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.0025			
	(0.0055)			
$\ln(S_{Lagged})$	0.0005			
	(0.0042)			
$\ln(G_{Lagged})$	-0.0048			
	(0.0069)			
ln(E)		0.0045		
		(0.0047)		
ln(S)		0.0012		
		(0.0037)		
ln(G)		0.0006		
		(0.0062)		
$\ln(ESG_{Lagged})$			0.0002	
			(0.0078)	
ln(ESG)				0.0081
				(0.0092)
Beta	-0.0051	-0.0002	-0.0051	-0.0001
	(0.0061)	(0.0082)	(0.0060)	(0.0080)
Leverage	-0.0206***	-0.0211***	-0.0205***	-0.0212***
	(0.0028)	(0.0026)	(0.0028)	(0.0026)
Size	0.0065	0.0035	0.0069	0.0037
	(0.0107)	(0.0097)	(0.0108)	(0.0096)
Fixed-effects				
Company	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.69012	0.67475	0.68954	0.67456
Within R^2	0.09328	0.08906	0.09158	0.08853

Heteroskedasticity-robust standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

Table A.14: FE country level — ROE

Dependent Variable:	ROE			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{\text{Lagged}})$	0.0148*			
	(0.0087)			
$\ln(S_{\text{Lagged}})$	-0.0071			
	(0.0079)			
$\ln(G_{\text{Lagged}})$	-0.0028			
	(0.0114)			
ln(E)		0.0184**		
		(0.0080)		
ln(S)		-0.0128		
		(0.0082)		
ln(G)		0.0061		
		(0.0121)		
$\ln(ESG_{\text{Lagged}})$			-0.0018	
			(0.0148)	
ln(ESG)				0.0038
				(0.0149)
Beta	-0.0671***	-0.0637***	-0.0671***	-0.0642***
	(0.0189)	(0.0176)	(0.0193)	(0.0176)
Leverage	-0.0175	-0.0188*	-0.0171	-0.0187*
	(0.0119)	(0.0105)	(0.0120)	(0.0106)
Size	0.0077	0.0097	0.0094	0.0108*
	(0.0067)	(0.0063)	(0.0066)	(0.0062)
Fixed-effects				
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.26402	0.23887	0.26131	0.23499
Within R^2	0.06493	0.06139	0.06150	0.05661

Heteroskedasticity-robust standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

Table A.15: FE country level — ROA

Dependent Variable:	ROA			
Model:	(1)	(2)	(3)	(4)
$\ln(E_{Lagged})$	0.0094**			
	(0.0038)			
$\ln(S_{Lagged})$	-0.0028			
	(0.0034)			
$\ln(G_{Lagged})$	-0.0028			
	(0.0038)			
ln(E)		0.0105***		
		(0.0033)		
ln(S)		-0.0049		
		(0.0035)		
ln(G)		-0.0011		
		(0.0039)		
$\ln(ESG_{Lagged})$			-0.0019	
			(0.0053)	
ln(ESG)				-0.0013
				(0.0050)
Beta	-0.0303***	-0.0302***	-0.0300***	-0.0297***
	(0.0059)	(0.0055)	(0.0061)	(0.0056)
Leverage	-0.0169***	-0.0180***	-0.0167***	-0.0178***
	(0.0018)	(0.0018)	(0.0019)	(0.0019)
Size	-0.0025	-0.0014	-0.0010	-8.41×10^{-5}
	(0.0017)	(0.0019)	(0.0017)	(0.0019)
Fixed-effects				
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	786	917	786	917
R^2	0.34150	0.32119	0.33288	0.31180
Within R^2	0.20763	0.20023	0.19725	0.18917

Heteroskedasticity-robust standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*

Table A.16: Current ESG for sub-industries — ROE — clust. s. e.

Dependent Variable:	ROE				
Model:	(1)	(2)	(3)	(4)	(5)
ln(ESG)	0.0026	0.0140	-0.0003	-0.0309	0.1801**
	(0.0345)	(0.0580)	(0.0128)	(0.0163)	(0.0574)
Beta	-0.0864**	-0.0209	-0.0736**	-0.0746	0.0473
	(0.0346)	(0.0772)	(0.0268)	(0.0744)	(0.0279)
Leverage	0.0229*	-0.0135	-0.0717***	-0.1445**	-0.0346***
	(0.0112)	(0.0264)	(0.0091)	(0.0499)	(0.0077)
Size	-0.0050	-0.0077	0.0376	-0.0135	0.0334
	(0.0076)	(0.0144)	(0.0212)	(0.0187)	(0.0190)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	217	259	301	77	63
R^2	0.35998	0.32270	0.44130	0.43610	0.54568
Within R^2	0.09988	0.01043	0.29050	0.20783	0.28113

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

Table A.17: Lagged ESG for sub-industries — ROE — clust. s. e.

Dependent Variable:	ROE				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(ESG_{Lagged})$	-0.0168	0.0304	0.0046	-0.0555	0.1989^{**}
	(0.0670)	(0.0569)	(0.0091)	(0.0354)	(0.0615)
Beta	-0.1013	-0.0472	-0.0863^{*}	-0.0685	0.0594^{*}
	(0.0514)	(0.0677)	(0.0423)	(0.0842)	(0.0274)
Leverage	0.0277^{*}	-0.0210	-0.0686^{***}	-0.2240^{**}	-0.0295^{**}
	(0.0136)	(0.0180)	(0.0074)	(0.0661)	(0.0110)
Size	-0.0047	-0.0161	0.0296	-0.0165	0.0145
	(0.0126)	(0.0212)	(0.0150)	(0.0138)	(0.0339)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	186	222	258	66	54
R^2	0.33799	0.40792	0.45724	0.48424	0.54035
Within R^2	0.11632	0.03882	0.31074	0.27306	0.26190

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

Table A.18: Current ESG for sub-industries — ROA — clust. s. e.

Dependent Variable:			ROA		
Model:	(1)	(2)	(3)	(4)	(5)
ln(ESG)	0.0120	-0.0315**	0.0094	-0.0163*	0.0625***
	(0.0120)	(0.0126)	(0.0134)	(0.0065)	(0.0082)
Beta	-0.0293**	-0.0220	-0.0328**	-0.0157	-0.0101
	(0.0103)	(0.0233)	(0.0134)	(0.0228)	(0.0051)
Leverage	-0.0039**	-0.0155	-0.0312***	-0.0820**	-0.0057
	(0.0015)	(0.0082)	(0.0072)	(0.0287)	(0.0030)
Size	-0.0065*	-0.0055	0.0052	-0.0017	-0.0104
	(0.0028)	(0.0073)	(0.0113)	(0.0080)	(0.0062)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	217	259	301	77	63
R^2	0.32685	0.48494	0.42631	0.54603	0.64989
Within R^2	0.14390	0.19892	0.27580	0.23285	0.52649

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

Table A.19: Lagged ESG for sub-industries — ROA — clust. s. e.

Dependent Variable:	ROA				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(ESG_{Lagged})$	-0.0015	-0.0235	0.0137	-0.0304	0.0664***
	(0.0154)	(0.0167)	(0.0121)	(0.0170)	(0.0032)
Beta	-0.0352*	-0.0276	-0.0396*	-0.0093	-0.0081
	(0.0151)	(0.0229)	(0.0192)	(0.0264)	(0.0067)
Leverage	-0.0027	-0.0168*	-0.0279***	-0.1182**	-0.0040
	(0.0014)	(0.0074)	(0.0056)	(0.0423)	(0.0032)
Size	-0.0060	-0.0074	0.0009	-0.0026	-0.0160
	(0.0034)	(0.0089)	(0.0079)	(0.0058)	(0.0084)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	186	222	258	66	54
R^2	0.32480	0.50049	0.47687	0.57872	0.65565
Within R^2	0.16345	0.21724	0.32460	0.28952	0.53251

Clustered (Country & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Heavy Machinery & Vehicles, 2 = Auto & Truck Manufacturers, 3 = Auto, Truck & Motorcycle Parts, 4 = Tires & Rubber Products, 5 = Auto Vehicles, Parts & Service Retailers

Table A.20: Current ESG for continents — ROE — clust. s. e.

Dependent Variable:			ROE		
Model:	(1)	(2)	(3)	(4)	(5)
ln(ESG)	0.0369	0.0901	0.0608	0.0043	0.0319
	(0.0379)	(0.0593)	(0.0211)	(0.1013)	(0.0734)
Beta	-0.0630*	-0.1363**	-0.0323	0.0784**	0.1251
	(0.0242)	(0.0331)	(0.0280)	(0.0259)	(0.0294)
Leverage	-0.0095	-0.0051	-0.0387	-0.0205	-0.0851
	(0.0168)	(0.0294)	(0.0336)	(0.0166)	(0.0771)
Size	-0.0312	0.0345	-0.0189	0.0221	0.1443
	(0.0167)	(0.0233)	(0.0737)	(0.0198)	(0.0565)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	455	245	21	168	28
R^2	0.16367	0.25426	0.93832	0.23603	0.73144
Within R^2	0.10842	0.21406	0.59075	0.07168	0.65023

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

Table A.21: Lagged ESG for continents — ROE — clust. s. e.

Dependent Variable:			ROE		
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(ESG_{Lagged})$	0.0358	0.0687	0.1830**	-0.0228	-0.0433
	(0.0418)	(0.0502)	(0.0269)	(0.1029)	(0.0611)
Beta	-0.0646	-0.1561***	0.0867*	0.0903**	0.1150
	(0.0303)	(0.0322)	(0.0245)	(0.0271)	(0.0334)
Leverage	-0.0078	-0.0032	-0.0387	-0.0286	-0.0911
	(0.0168)	(0.0311)	(0.0208)	(0.0180)	(0.0646)
Size	-0.0339	0.0239	-0.0271	0.0303	0.1840
	(0.0174)	(0.0191)	(0.0314)	(0.0220)	(0.0426)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	390	210	18	144	24
R^2	0.16290	0.27674	0.97617	0.26436	0.83656
Within R^2	0.11833	0.23407	0.80585	0.09663	0.80045

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

Table A.22: Current ESG for continents — ROA — clust. s. e.

Dependent Variable:	ROA				
Model:	(1)	(2)	(3)	(4)	(5)
ln(ESG)	0.0049	0.0359**	0.0184	0.0126	0.0566
	(0.0059)	(0.0123)	(0.0105)	(0.0295)	(0.0649)
Beta	-0.0219**	-0.0553**	-0.0076	0.0173**	0.0672
	(0.0076)	(0.0152)	(0.0171)	(0.0058)	(0.0240)
Leverage	-0.0195**	-0.0108	-0.0166	-0.0073	-0.1117
	(0.0059)	(0.0057)	(0.0181)	(0.0049)	(0.0611)
Size	-0.0135*	0.0026	-0.0132	-0.0001	0.0707
	(0.0061)	(0.0046)	(0.0340)	(0.0090)	(0.0443)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	455	245	21	168	28
R^2	0.27696	0.32560	0.94154	0.37231	0.72497
Within R^2	0.21911	0.27361	0.45844	0.08048	0.65574

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

Table A.23: Lagged ESG for continents — ROA — clust. s. e.

Dependent Variable:	ROA				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(ESG_{Lagged})$	0.0043	0.0341**	0.0775**	0.0059	-0.0104
	(0.0075)	(0.0118)	(0.0143)	(0.0283)	(0.0398)
Beta	-0.0211*	-0.0644**	0.0461	0.0213*	0.0628
	(0.0083)	(0.0147)	(0.0183)	(0.0078)	(0.0273)
Leverage	-0.0184**	-0.0088	-0.0164	-0.0091	-0.1143
	(0.0057)	(0.0054)	(0.0143)	(0.0051)	(0.0602)
Size	-0.0143*	-0.0026**	-0.0147	0.0019	0.1007
	(0.0064)	(0.0006)	(0.0187)	(0.0093)	(0.0323)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	390	210	18	144	24
R^2	0.26461	0.41970	0.97354	0.37035	0.80616
Within R^2	0.21678	0.36649	0.70865	0.09507	0.77121

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = Asia, 2 = North & South America, 3 = Africa, 4 = Europe, 5 = Oceania

Table A.24: Pillars — 5 Asian countries — ROE — clust. s. e.

Dependent Variable:	ROE				
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	0.0211	0.0139	-0.1050	-0.0369	0.0110
	(0.0086)	(0.0321)	(0.0363)	(0.0583)	(0.0584)
ln(S)	-0.0138	-0.0310	0.1351*	0.0139	-0.0414
	(0.0131)	(0.0277)	(0.0396)	(0.0094)	(0.1221)
ln(G)	-0.0445	-0.0034	0.0357*	-0.0563	0.0476
	(0.0272)	(0.0169)	(0.0101)	(0.0308)	(0.1043)
Beta	0.0423	0.0250	-0.1661	0.1296	-0.1037*
	(0.0244)	(0.0240)	(0.0603)	(0.0610)	(0.0440)
Leverage	-0.0135	-0.0573	-0.0950**	-0.0503	-0.0037
	(0.0158)	(0.0328)	(0.0104)	(0.0209)	(0.0112)
Size	-0.0024	0.0160	0.0079	0.0214	0.0006
	(0.0190)	(0.0170)	(0.0203)	(0.0111)	(0.0306)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	70	210	49	42	56
R^2	0.30291	0.24554	0.75816	0.73609	0.42952
Within R^2	0.23649	0.07481	0.68198	0.40768	0.22758

Dependent Variable:	ROE				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	0.0191	0.0208	0.1275***	-0.0579	0.1215
	(0.0088)	(0.0229)	(0.0087)	(0.0278)	(0.0817)
$\ln(S_{Lagged})$	-0.0012	-0.0319	-0.0781**	0.0146	-0.0771
	(0.0081)	(0.0245)	(0.0133)	(0.0113)	(0.0926)
$\ln(G_{Lagged})$	-0.0296*	-0.0081	0.0032	-0.0760**	-0.1215
	(0.0088)	(0.0147)	(0.0167)	(0.0160)	(0.0522)
Beta	0.0314	0.0164	-0.1473*	0.2543**	-0.1260**
	(0.0187)	(0.0239)	(0.0450)	(0.0455)	(0.0306)
Leverage	-0.0264	-0.0529	-0.0748**	-0.0503*	0.0117
	(0.0143)	(0.0355)	(0.0079)	(0.0127)	(0.0116)
Size	-0.0133	0.0180	-0.0497**	0.0139	0.0043
	(0.0118)	(0.0180)	(0.0081)	(0.0081)	(0.0205)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	60	180	42	36	48
R^2	0.40854	0.21566	0.77772	0.76187	0.61312
Within R^2	0.27859	0.06791	0.70876	0.49143	0.47225

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = China, 2 = Japan, 3 = India, 4 = Taiwan, 5 = S. Korea

Table A.25: Pillars — 5 Asian countries — ROA — clust. s. e.

Dependent Variable:			ROA		
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	0.0132**	-0.0078	-0.0697	-0.0270	0.0351
	(0.0013)	(0.0147)	(0.0277)	(0.0180)	(0.0403)
ln(S)	-0.0032	-0.0107	0.0600*	0.0044	-0.0269
	(0.0054)	(0.0131)	(0.0190)	(0.0030)	(0.0589)
ln(G)	-0.0090	0.0038	0.0172*	-0.0171	-0.0043
	(0.0117)	(0.0079)	(0.0044)	(0.0085)	(0.0345)
Beta	0.0124	0.0077	-0.0074	0.0583	-0.0525*
	(0.0135)	(0.0107)	(0.0213)	(0.0318)	(0.0200)
Leverage	-0.0210*	-0.0380***	-0.0233**	-0.0189*	-0.0075
	(0.0068)	(0.0081)	(0.0024)	(0.0055)	(0.0050)
Size	-0.0097	0.0058	-0.0489**	0.0044	0.0066
	(0.0094)	(0.0063)	(0.0073)	(0.0048)	(0.0147)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	70	210	49	42	56
R^2	0.35713	0.29619	0.93030	0.62665	0.49185
Within R^2	0.31770	0.15034	0.91089	0.46328	0.27324

Dependent Variable:			ROA		
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	0.0106	-0.0022	-0.0198	-0.0212	0.0875
	(0.0047)	(0.0119)	(0.0116)	(0.0106)	(0.0464)
$\ln(S_{Lagged})$	0.0013	-0.0133	0.0149**	0.0079	-0.0550
	(0.0029)	(0.0124)	(0.0020)	(0.0044)	(0.0468)
$\ln(G_{Lagged})$	-0.0042	0.0020	-0.0020	-0.0310***	-0.0790
	(0.0050)	(0.0071)	(0.0063)	(0.0026)	(0.0352)
Beta	0.0052	0.0058	-0.0017	0.1060*	-0.0624**
	(0.0114)	(0.0118)	(0.0189)	(0.0324)	(0.0167)
Leverage	-0.0243*	-0.0363***	-0.0047	-0.0205*	-0.0040
	(0.0072)	(0.0076)	(0.0034)	(0.0060)	(0.0052)
Size	-0.0142	0.0071	-0.0722***	0.0017	0.0107
	(0.0058)	(0.0067)	(0.0023)	(0.0068)	(0.0112)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	60	180	42	36	48
R^2	0.42276	0.26964	0.93750	0.70940	0.67533
Within R^2	0.38768	0.13157	0.92145	0.58303	0.52251

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = China, 2 = Japan, 3 = India, 4 = Taiwan, 5 = S. Korea

Table A.26: Pillars — 5 non-Asian countries — ROE — clust. s. e.

Dependent Variable:	ROE				
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	0.0278	-0.3528	0.1161	0.2381	-0.3798*
	(0.0546)	(0.2246)	(0.1476)	(0.2163)	(0.1006)
ln(S)	0.0034	-0.2541	-0.0304	0.1254	0.2149
	(0.0635)	(0.1785)	(0.0909)	(0.2718)	(0.1188)
ln(G)	0.0648	0.1659	0.2300	0.0920	0.0503
	(0.0887)	(0.1141)	(0.0760)	(0.1016)	(0.0628)
Beta	-0.1209***	-0.2389	-0.0098	-0.0877	0.2843*
	(0.0253)	(0.1444)	(0.0699)	(0.0360)	(0.0954)
Leverage	0.0004	-0.0863	-0.2891	-0.0570	-0.0387
	(0.0326)	(0.0965)	(0.2909)	(0.0236)	(0.0331)
Size	0.0193	-0.0296	0.0771	-0.0558	-0.5231
	(0.0200)	(0.0617)	(0.0328)	(0.0530)	(0.2251)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	196	42	42	35	28
R^2	0.19283	0.73572	0.61803	0.69959	0.65151
Within R^2	0.11723	0.46619	0.55304	0.44150	0.52819

Dependent Variable:	ROE				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	0.0194	-0.3845	0.0585	0.1294	-0.6258
	(0.0510)	(0.2385)	(0.0870)	(0.1432)	(0.2166)
$\ln(S_{Lagged})$	0.0138	-0.1429	0.0700	0.0064	0.2520
	(0.0537)	(0.0623)	(0.0723)	(0.1979)	(0.2319)
$\ln(G_{Lagged})$	0.0209	0.1365	0.2095	0.0954	0.0066
	(0.0782)	(0.1891)	(0.0940)	(0.1251)	(0.1773)
Beta	-0.1370**	-0.2905	-0.0865	-0.1053	0.4372*
	(0.0390)	(0.1963)	(0.0558)	(0.0630)	(0.1050)
Leverage	-0.0026	-0.0510	-0.2060	-0.0374	-0.0451
	(0.0346)	(0.0931)	(0.3309)	(0.0266)	(0.0198)
Size	0.0152	-0.0925	0.0391	-0.0248	-0.8745*
	(0.0233)	(0.1254)	(0.0478)	(0.0216)	(0.2776)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	168	36	36	30	24
R^2	0.20272	0.70957	0.58442	0.76781	0.77689
Within R^2	0.12539	0.40002	0.50715	0.41914	0.69361

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = United States of America, 2 = France, 3 = Canada, 4 = Germany, 5 = United Kingdom

Table A.27: Pillars — 5 non-Asian countries — ROA — clust. s. e.

Dependent Variable:	ROA				
Model:	(1)	(2)	(3)	(4)	(5)
ln(E)	0.0168	-0.0629	0.0371	0.0475	-0.0552*
	(0.0158)	(0.0466)	(0.0513)	(0.0595)	(0.0185)
ln(S)	0.0034	-0.0739	-0.0322	0.0517	0.0633**
	(0.0194)	(0.0375)	(0.0595)	(0.0810)	(0.0138)
ln(G)	0.0126	0.0334	0.0885	0.0347	-0.0184
	(0.0176)	(0.0172)	(0.0297)	(0.0371)	(0.0121)
Beta	-0.0444***	-0.0518	0.0034	-0.0438	0.0588*
	(0.0071)	(0.0340)	(0.0354)	(0.0142)	(0.0158)
Leverage	-0.0082	-0.0197	-0.1056	-0.0243	-0.0110
	(0.0066)	(0.0220)	(0.0948)	(0.0068)	(0.0058)
Size	-0.0066**	-0.0003	0.0335	-0.0178	-0.1143*
	(0.0021)	(0.0152)	(0.0159)	(0.0113)	(0.0363)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	196	42	42	35	28
R^2	0.43171	0.79628	0.62427	0.70042	0.81013
Within R^2	0.28206	0.43447	0.58290	0.47589	0.73339

Dependent Variable:	ROA				
Model:	(1)	(2)	(3)	(4)	(5)
$\ln(E_{Lagged})$	0.0141	-0.0853	0.0162	0.0161	-0.0616
	(0.0185)	(0.0584)	(0.0281)	(0.0365)	(0.0448)
$\ln(S_{Lagged})$	0.0079	-0.0515**	0.0121	0.0138	0.0245
	(0.0192)	(0.0145)	(0.0246)	(0.0670)	(0.0472)
$\ln(G_{Lagged})$	0.0048	0.0289	0.0666	0.0432	-0.0067
	(0.0182)	(0.0493)	(0.0309)	(0.0517)	(0.0306)
Beta	-0.0508***	-0.0643	-0.0409	-0.0459	0.0611
	(0.0095)	(0.0467)	(0.0254)	(0.0264)	(0.0274)
Leverage	-0.0084	-0.0109	-0.0465	-0.0197	-0.0112**
	(0.0072)	(0.0223)	(0.0892)	(0.0189)	(0.0014)
Size	-0.0078**	-0.0137	0.0140	-0.0100	-0.1428
	(0.0020)	(0.0299)	(0.0181)	(0.0059)	(0.0543)
Fixed-effects					
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	168	36	36	30	24
R^2	0.45762	0.78425	0.61539	0.72450	0.79156
Within R^2	0.32490	0.38637	0.56931	0.47105	0.72558

Clustered (Industry & Year) standard-errors in parentheses
*Signif.: ***: 0.01, **: 0.05, *: 0.1*
1 = United States of America, 2 = France, 3 = Canada, 4 = Germany, 5 = United Kingdom