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Comparative Empirical Analysis of ESG Integration's Impact on Financial Performance in the Truck Manufacturing Sector: A Study of European and US Companies

Master Thesis

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Abstract

This thesis examines the impact of environmental, social, and governance practices by truck manufacturers on their financial performance across Europe and the United States. By comparing companies in these regions, the study reveals how ESG integration affects financial market performance metrics such as ROA and Tobin's Q. The research draws on Stakeholder Theory and Shareholder Theory to frame the discussion that will investigate how ESG considerations may affect investment decisions and corporate strategies. Data was collected over the past eight years from various manufacturers of trucks.

For the analysis, both fixed-effects and random-effects models have been used to account for differences across companies. Key variables such as market capitalization and debt-to-equity ratio were included to ensure a comprehensive analysis.

The study results show that ESG factors and financial performance are not always directly related. For example, higher environmental scores benefit ROA in some models but negatively in other models. Additionally, different effects are shown by governance scores, indicating a complex and multifaceted influence of ESG components.

The study provides suggestions for enhancing financial performance through moral decisions and describes best practices for taking ESG into account for the business plans. Companies can more effectively satisfy the demands of contemporary investors and stakeholders by establishing a balance between profitability and social responsibility, environmental care, and effective governance.

In conclusion, the thesis highlights how ESG integration is becoming more and more significant in the truck manufacturing sector, and how it can improve financial performance. It offers useful information to businesses looking to improve their position in the market and draw in sustainable investment. To develop a more thorough understanding of how ESG affects corporate success, future research should keep examining these dynamics in various industries and geographical areas.

Preface

This thesis marks the end of a significant period in my academics: intense research, hard work, and constant learning. It has been a time of much hard work and huge payoffs, and as I think back, gratitude overflows for the support and direction that I have received in the process.

First, I would like to thank my husband; he has been with me throughout and believes in me as an inspiration. Without his constant belief in my abilities and endless patience, this journey would have been a rocky one.

I owe a lot to my supervisor, Dr. Kwabena Aboah Addo, for his insight and constructive criticism that have molded this thesis. His guidance was priceless in directing my research work, and His advice has been most important for finalizing my work in the strictest academic line. I also wish to thank Dr. Győző Gyöngyösi for his continuous support.

I am also thankful to the faculty at Utrecht University for giving me the chance of pursuing my education in master level and to my colleagues for their support, collaboration, and camaraderie. The knowledge and experiences shared within this academic community have significantly enriched my understanding in financial management which is reflected in this thesis.

Taravat Salimiyan

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Chapter 1

1 Introduction

1.1 Problem definition

The relationship between Corporate Financial Performance (CFP) and Environmental, Social, and Governance (ESG) performance has become a central focus of research in academia and business strategy, indicating a wider movement towards sustainable development and responsible investment methods. From the standpoint of investments, the amount of assets under management that are associated with ESG investing is a good indicator of the growing interest in ESG. The amount of assets under management associated with ESG has increased significantly, particularly since the last financial crisis. Between 2012 and 2014, the amount of these assets under management nearly doubled in the US[1](Friede et al., 2015). Although the relationship between ESG and CFP has been thoroughly examined, different empirical results and theoretical interpretations continue to evolve. This persistent confusion emphasizes how difficult it is to measure how ESG integration affects financial results and how investor attitudes toward ESG standards are changing.

A number of factors have contributed to the rise in ESG investing, including regulatory developments, increased awareness of reputational risks, and institutional investors' fiduciary duties. The approaches used to incorporate ESG factors into investment strategies -which include engagement strategies, positive screening, and negative screening- showcase a strategic diversity intended to balance financial goals with societal advantages. Assets that don't adhere to a particular ESG standard are removed from an investment portfolio in the event of a negative screening. When a screening comes back positive, assets that adhere to a particular

[1] In the United States the assets under management increases between 2012 and 2014 from 2.8 trillion USD to 5.5 trillion USD.

ESG standard are chosen to build a portfolio. On the other hand, an engagement strategy aims to raise the ESG ratings of the portfolio's present assets.

Within the larger automotive industry, the truck manufacturing sector is the subject of this thesis. As one of the major contributors to global CO_2 emissions, the truck manufacturing sector is crucial to understanding the implications of ESG integration. Given that the automotive industry contributes significantly to CO_2 emissions, we must address environmental issues and adjust to the regulatory pressures for sustainability(Statistia, 2024) Despite the unknown impact on financial performance, investors are willing to invest in ESG to benefit society. Institutional investors, like individual investors, are willing to contribute their assets to society. Institutional investors prioritize financial implications of ESG investing compared to individual investors, as they often have multiple obligations. As a result, it is critical to determine whether ESG and its specific drivers have a positive impact on financial results while also contributing to a better society. This is while the dynamic structure of the automotive industry, marked by rapid technological progress and growing societal expectations of corporate social responsibility, offers a distinctive setting for examining the complexities of ESG integration and its effects on finances.

This change also brings with it a responsibility to deliver results and technological innovation, raising the question of whether companies should maximize profits or take on more social responsibility. Forbes (Pohl, 2021) published an article highlighting the ongoing changes in the automotive sector, and they identified activities that the industry conducts, such as collaboration between industries and the use of advanced technology to increase visibility throughout the supply chain. A survey revealed that two-thirds of manufacturing managers believe that having a sustainable supply chain is beneficial.

Strong ESG suggestions establish a framework that clarifies how ESG initiatives contribute to financial outcomes through mechanisms like top-line growth, cost efficiency, and risk mitigation(Henisz et al., 2019). Strong ESG propositions are intrinsically connected to higher value creation. With the increasing amount of sustainable investments and the positive relationship between equity returns and ESG performance, this study has the opportunity to investigate how these dynamics play out in the truck manufacturing industry.

This study is motivated by the need to understand the empirical relationship between ESG practices and financial performance, particularly in the truck manufacturing industry. This goal is translated into two questions which below will be explained how they will be approached.

1. *To empirically analyze the impact of ESG integration on financial performance within this sector.*
2. *Evaluating the relationship between the separate E-, S-, and G- pillars on financial performance within the Europe and US Truck manufacturers sector.*

For answering the project question, panel data regression involved to use fixed-effects models to control for company-specific characteristics and generalized least squares (GLS) models to address heteroskedasticity and serial correlation issues. This method will help determine the relationship between ESG factors and financial performance metrics such as ROA, EPS, and Tobin's Q which are chosen indicators.

This thesis tries to close the empirical gap in the literature about the financial impacts of ESG integration while also offering stakeholders in the truck manufacturing sector useful information. This study aims to provide insight into the strategic choices made by businesses that seek to strike a balance between profitability and social responsibility, environmental stewardship, and corporate governance. It does this by clarifying the complex connections between ESG performance and financial outcomes.

The analysis reveals that while some ESG factors positively influence Return on Assets (ROA) and Earnings Per Share (EPS), others exhibit a negative or neutral relationship. The detailed regression analyses help in understanding these dynamics comprehensively. The analysis and findings of this study can be defined in two groups as below:

Theoretical Contributions:

- Enhances understanding of the ESG-financial performance relationship within the truck manufacturing industry.
- Contributes to the existing literature by providing empirical evidence from a sector-specific perspective.
- Offers insights into the effectiveness of different regression models (FE and GLS) in analyzing panel data related to ESG and financial performance.

Practical Contributions:

- Provides actionable insights for truck manufacturers on the potential financial benefits and drawbacks of integrating ESG factors.
- Helps policymakers understand the importance of ESG criteria in enhancing financial performance, potentially guiding future regulations and incentives.
- Offers a framework for investors to evaluate the financial implications of ESG investments in the truck manufacturing sector.

For investigating the challenges related to Environmental, Social, and Governance (ESG) factors and their effect on the value and financial performance of firms, an extensive literature review has been conducted in this report. In the literature review section, after providing an overview on the relation between ESG and firms finance performance, the studies on automotive industry investigated to ensure that it better covers the project's objectives and is aligned with them. Subsequently, various analytical techniques used in earlier studies for determining the connection between ESG practices and financial results for firms have been explained, considering specific challenges that each methodology presents.

In the next chapter, the target companies and time frame, the data collection plan for use in the final project has been presented. By collecting the correct data below actions will take place to show their results in the last section as results and recommendations.

- **Panel Data Analysis:** Utilizing a panel data set comprising yearly observations for each company, fixed-effects models will be employed to analyze the impact of ESG integration on financial performance indicators such as earning per share (EPS), return on assets (ROA), and Tobin's Q.
- **Comparative Analysis:** Differences in ESG integration impact between European and US companies will be examined through subgroup analyses and interaction terms within regression models.
- **Qualitative Analysis:** Case studies of selected companies exhibiting high levels of ESG integration and financial performance will be conducted to provide deeper insights into successful strategies and practices.

In a dedicated chapter, the findings from the quantitative and qualitative analyses, including detailed regression results are discussed. And the last chapter Summarizes the key findings, discusses the implications, and provides recommendations for future research.

This methodical approach guarantees a comprehensive analysis of how ESG influences financial performance which provides a solid foundation for this thesis.

Chapter 2

2 Literature review

In the following literature, several perspectives on the general ESG and its relationship with financial performance have been provided. According to the traditionalist neoclassical view, additional costs will be imposed on firms by Corporate Social Responsibility (CSR[1]) initiatives(Palmer et al., 2018). Cajias et al. (Cajias et al., 2014) state that implementation of an active ESG strategy will have direct and indirect costs. The direct costs contain implementation and monitoring of the ESG, while rejecting lucrative investment opportunities that don't align with the ESG standards and objectives brings indirect costs(Sander Kaj Geres, 2022).

2.1 Theories on the ESG effect on Firms Financial Performance

Shareholder theory and stakeholder theories are two main theories on the effect of ESG performance on financial firm performance. The shareholder theory which emphasized by Friedman(Friedman, 2017) states that ESG concerns interfere with managers' primary responsibility to maximize profits and shareholder value. This means that managers make decisions that lead to improve themselves but could destroy shareholder value because of additional costs as a result of the lack of information between them and the shareholders. So, as Friedman(Friedman, 2017) indicated; CSR will be used by managers to advance their own political, social, or professional goals.

On the other hand, the stakeholder theory explains a positive effect of ESG performance on financial performance of firms. Bowen et al. (Bowen, 1953) who published one of the earliest research papers on this topic, mainly focuses on the leading executives' social responsibilities and how they have a direct effect on the quality of the life of people, stakeholders, and

[1] Corporate Social Responsibility (CSR) is a company's commitment to manage the social, environmental, and economic effects of its operations responsibly and in alignment with public expectations.

customers. According to Bowen(Bowen, 1953; Bowen et al., 2013)businesses should fulfill their social obligations in accordance with societal values. Moreover that, when the public's pressure and expectations of corporations' social responsibility are shifted toward companies, businesspeople may be convinced to take on additional responsibilities(Bowen, 1953; Bowen et al., 2013).

Following Bowen's publication, additional research on corporate social responsibility was carried out by the Brundtland Commission, which was supported by the United Nations to increase focus on sustainability and its relationship to economic development (Michelle E. Jarvie, 2014). The Brundtland Commission was founded in response to the growing worldwide awareness that economic development cannot be separated from social and environmental concerns. According to the report, multinational corporations are key players as the have the potential to positively impact and consequently play a significant role in enhancing sustainability efforts, particularly in developing countries where they depend more heavily on foreign capital (Michelle E. Jarvie, 2014).

Nowadays, corporations are expected to take on more responsibility. On top of the expected responsibilities list, the environmental, and how corporations manage their impact on the climate takes place. Beyond the environment, businesses are expected to be responsible for their employees and stakeholders. In addition to environmental and social responsibility, corporate governance is also an important aspect of responsibility. Companies that practice good corporate governance can avoid shareholder and stakeholder stress, as well as potentially damaging governance crimes. These three pillars are now referred to as the ESG criteria, which stands for Environmental, Social, and Governance(Schaltegger, 2011). As a positive outcome, ESG policies can lead to win-win situations by improving both financial performance and social welfare(Granelli et al., n.d.-a)

2.2 ESG and Financial Performance

As the ESG research field is developing, McKinsey et al.(Henisz et al., 2019) report provides the light on the various ways that ESG initiatives contribute to value creation in various industries. In the comprehensive report of McKinsey et al (Henisz et al., 2019) five crucial ways that ESG integration helps businesses in real and concrete ways are outlined as: by increasing top-line growth, cutting operational costs, lowering the risk of legal and regulatory issues, increasing worker productivity, and improving investment and asset management. These findings, which are based on a meta-analysis of more than 2,000 empirical studies, present a convincing picture of how ESG engagement doesn't negatively affect financial returns but instead increases equity returns, lowers downside risks, and is linked to better loan terms and credit ratings.

On 2017, Jasper van Huijgevoort(Jasper van Huijgevoort, 2017) did research on, the relationship between ESG-factors and the corporate financial performance to show how environmental, social and governance (ESG) performance is related to the financial performance by focusing on small capitalization firms located in Europe. The study showed that the effect of ESG ratings on corporate financial performance is positive. But further analyses reveal mixed results as financial performance is negatively impacted by

environmental factors and certain sub-drivers, like human rights and product innovation, while it is positively impacted by governance. According to research by Simone et al.(Di Simone et al., 2022), social responsibility and innovation positively affectt on economic sustainability in 909 global firms, with notable effects in Europe and Japan. Findings of their study emphasize the importance of social responsibility and innovation for sustainable performance.

An empirical examination has been performed by Phoebe Koundouri et al. (Koundouri et al., 2022) to assess the impact of ESG performance on the financial performance of top 50 companies in the European area. In the performed evaluation, the correlation between ESG metrics and key financial parameters such as profitability, valuation, capital efficiency, and risk has been investigated. As an outcome of that study, the existence of a positive relationship between strong ESG performance and certain financial outcomes has been confirmed. Koundouri et al. (Koundouri et al., 2022) indicating that Higher ESG ratings can lead to lower equity risk and improved financial performance in some sectors, despite varied impacts on financial metrics.

2.3 ESG effect on Financial Performance in Automotive Industry

As the focus of this study will be on the ESG effect on Truck manufacturer's financial performance, a sector that is undergoing rapid transformation and facing increased scrutiny regarding its sustainability practices, it is worthful to understand the previous studies on this relation for Automotive industry companies. The study by Held et al. (Held et al., 2018) used expert interviews and online survey among sustainable product development in the German automotive sector to assess the integration of ESG principles. The main conclusions highlight the absence of a single definition for sustainability, organizational difficulties integrating ESG, and the importance of market and regulatory pressures as sustainability drivers. A notable gap between academic sustainability approaches and their real-world implementation points to challenges in utilizing ESG for profit. Nonetheless, the study suggests that successful ESG integration may have a favorable effect on financial performance if it is in line with strategic business goals as well as external factors.

A strong positive link between ESG ratings and stock returns was discovered by La Torre et al. (Torre et al., 2020) in 2020, indicating that businesses that invested in ESG saw higher profits. European firms were the focus of a study by Engelhardt et al. (Engelhardt et al., 2021) which found a correlation between better ESG ratings for companies with higher stock returns and lower stock volatility. According to Maha Faisal Alsayegh et al.(Alsayegh et al., 2020), implementing environmental and social activities within a successful corporate governance framework improved the firm's corporate sustainability performance. The outcome of a study by Ruhaya Atan et al. (Atan et al., 2018) confirmed the total ESG score had a beneficial and substantial effect on a company's cost of capital (WACC[2]). According to Capelle-Blancard G. and Petit A. (Capelle-Blancard & Petit, 2019) considering ESG score as positive or negative information from firms could promote or damage corporate value respectively. Nonetheless, some research adopted a different approach. According to Sahut Jean-Michel et al.(Sahut &

[2] Weighted Average Cost of Capital, represents a firm's average after-tax cost of capital from all sources, including equity and debt, weighted according to their proportion in the company's capital structure.

Pasquini-Descomps, 2015), the impact of news based ESG performance scores varied by country between 2007 and 2011; in the US, the impact was less significant, while in the UK, it was significant.

Recently, Cheng Chi et al.(Chi et al., 2024) studied on two automative companies in China and find out that ESG performance positively influences firm value, with a company's ESG rating affecting financial performance and market perception, especially when compared to its rivals. A novel dataset comprising financial and ESG data for 131 publicly listed automotive companies worldwide, covering the years 2015 to 2020 which has been done by Dinca et al(Dincă et al., 2022) dissect the relationship between each ESG component (Environmental, Social, Governance) and firm value. In that study, ESG scores came from Sustainalytics, and financial data came from Morningstar Direct. A comprehensive view of each company's sustainability practices is provided by the ESG scores, which contain distinct metrics for environmental, social, and governance performance. The outcome of the research done by Dinca et al. (Dincă et al., 2022) is illustrated in Table 1.

Table 1: Summary of the Impact of ESG Scores on Firm Value in the Automotive Sector reported by Dinca et al. (Dincă et al., 2022)

Year	Environmental Score Impact	Governance Score Impact	Social Score Impact	Overall Impact on Firm Value
2015-2016	Significant positive influence	Mixed effects	Not consistently predictive	Varying impacts, not straightforward
Post-2016	Not specified	Mixed effects	Not consistently predictive	Varying impacts, highlighting complexity

"Mixed effects" indicate that governance scores variably influenced firm value, showing positive impact in some periods and inconsistent effects in others, reflecting the complexity of assessing ESG's financial impact

2.4 Methodology

As in this study the goal is to investigate the potential relationship between ESG and financial performance within Truck-manufacturers in the Europe and US, only the related information collected. So, no observations have been excluded due to the size of the company or its geographic location.

2.4.1 Hypothesis

According to Studenmund et al. (Studenmund, 2014), to prevent manipulation of the hypothesis to align with the methodological test results, the hypothesis should be established before the test is conducted. There should always be one or more null hypotheses developed when modeling the hypotheses. Also, there needs to be a backup hypothesis if the null hypothesis is true. This means that the null hypothesis (H0) states that there is no positive effect. Hypothesis testing is used to determine whether to reject the null hypothesis based on sample data.

As described in Chapter 1, the main goal of this study is to investigate if the financial performance of Truck manufacturers impacted by the ESG factor according to the last 8 years

data[3]. As a secondary goal, the effect of each E, S, and G factors on the Truck manufacture's financial performance will be evaluated.

For the first goal of this project about "investigating the relationship between ESG and financial performance within the Europe and US Truck manufacturers sector" below hypothesis are formulated, in which if there is a posetive relationship and the p-value is less than 0.05, the null hypothesis will be rejected in this study.

- H01: There is no positive relationship between ESG and Tobin's Q
- H02: There is no positive relationship between ESG and ROA
- H03: There is no positive relationship between ESG and EPS

For the secondary purpose of this investigation to "evaluate the relationship between the separate E-, S-, and G- ratings and financial performance within the Europe and US Truck manufacturers sector" the hypothesis would be observing posetive effect of each E, S, and G factor on the financial performance parameters.

In the next chapter the research design, data collection, and analytical techniques used to investigate the research questions will be discussed.

[3] The ESG score is determined by allocating 50% of the weight to the environment (E), 30% to the social (S) component, and 20% to the government (G) component.(Roland Berger, 2020).

Chapter 3

3 Data and Methodology

In this chapter, the sources of data collection which have been used in literature and for this study will be outlined. Subsequently, the target group of companies and the time frame of the study will be identified, which aids in selecting the most credible data sources and time window. Next, the most effective methodology of data analysis and evaluation will be explained in detail.

3.1 Target Group Companies and Time frame

The goal of this study is to cover a notable cross-section of publicly listed truck manufacturing companies in Europe and the US that have shown a commitment to ESG principles over 9 years from 2015 until 2023.

These companies which are listed in Table 2 have shown varying degrees of commitment to integrating ESG principles into their operations. The performed policies include reducing greenhouse gas emissions and enhancing fuel efficiency by adopting electric vehicle technologies and improving corporate governance practices.

Table 2: List of Truck Manufacturers which will be evaluated.

Company	Country	Parent Company	Remarks
Volvo Group	Sweden	-	Continues to be a leader in sustainability efforts, focusing on electric and autonomous truck development
Daimler Truck AG	Germany	-	Committed to electrification and reducing emissions across its range, including Mercedes-Benz Trucks
Scania AB	Sweden	Traton SE	Invests heavily in sustainable transport solutions and alternative fuels
DAF Trucks N.V.	Netherlands	PACCAR Inc	Part of PACCAR, working on improving fuel efficiency and reducing environmental impact
Renault Trucks	France	Volvo Group	Has taken significant steps toward electrification of its range to reduce carbon emissions
MAN SE	Germany	Traton SE	Focusing on digitalization and sustainable mobility solutions to enhance efficiency and reduce environmental footprint
Iveco S.p.A.	Italy	-	Offers a range of electric and natural gas-powered vehicles as part of its commitment to sustainability
PACCAR Inc	USA	-	Parent company of Kenworth and Peterbilt, notable for its energy-efficient designs and sustainability reporting
Navistar International Corporation	USA	Traton SE	Focuses on electrification and has partnerships aimed at developing cleaner transportation technologies
Ford Motor Company	USA	-	Increasing its investment in electric vehicles and committed to reducing its environmental footprint, particularly in the commercial and truck sectors with initiatives like the Ford F-150 Lightning and other sustainability-focused projects
Mack Trucks	USA	Volvo Group	(Owned by Volvo Group): While it's a subsidiary of Volvo, Mack Trucks deserves a separate mention for its efforts in the U.S. market, including its advancements in fuel efficiency and electric truck development
Kenworth	USA	PACCAR Inc	Known for its high-quality trucks and commitment to fuel efficiency and reducing emissions
Peterbilt Trucks	USA	PACCAR Inc	Noted for their innovation in truck design and strong emphasis on fuel efficiency and sustainability
Traton SE	Germany	Traton SE	A leading global truck manufacturer, investing in innovative solutions for sustainable transportation, including electric and autonomous trucks

3.2 Financial Performance Metrics

The economic variable of Financial firm performance shows how well a company uses its human and material resources to meet its goals and targets. Also, the performance of financial firms considers how well business resources are used during the production and consumption processes.

The common evaluation methodologies among most of the performed studies are using earnings per share (EPS), Tobin's Q, and return on assets (ROA) indicators. In the following a brief description of each one is presented.

3.2.1 Tobin's Q

James Tobin (Tobin, 1969) introduced the q ratio in 1969 as a predictor of a firm's future investments. Since then, it has been used to explain a wide range of phenomena like business performance (Van Der Heide, n.d.). Tobin's Q is measured as the ratio of a firm's market value of outstanding shares to its equity and liabilities book value (Wang et al., 2015). The original theory of Tobin was based on the evaluation of investment choices in connection with a company's market value. According to the theory, companies with higher Q ratio are more likely to invest in new assets because the market believes these assets will perform better than their purchase price (Tobin, 1969). Tobin's Q is a widely used firm performance metric in corporate finance, particularly when assessing mergers and acquisitions (Lang et al., 1989). Firms with a high Tobin's Q ratio is often viewed as having promising investment opportunities and efficient management and promising investment opportunities, making such firms attractive targets for acquisitions.

Tobin's Q has been incorporated into the analysis of Environmental, Social, and Governance (ESG) factors in recent studies, which have looked at the effects of sustainable practices on firm value. According to Edmans (Edmans, 2011), companies that have achieved high ESG scores tend to have a higher Q ratio, indicating that the market motivates sustainable operations.

Theoretically Tobin's Q is the ratio of the Market Value of Equity (current stock price multiplied by the number of outstanding shares) plus the Book Value of Total Debt to the Book Value of Assets. This metric assesses the market valuation versus the asset base. As Tobin's Q aims to measure the market value of a company's assets relative to their replacement cost, the inclusion of the book value of debt in the Tobin's Q calculation is important. The formula typically includes both equity (market capitalization) and debt to capture the total market value of the firm's assets. As shown in below equation:

- ***Market Capitalization*** reflects the market value of equity.
- ***Book Value of Debt*** represents the value of the company's debt.

Together, they provide a comprehensive view of the company's total market value of assets (this is because assets are funded by both equity and debt). It is noteworthy to mention, if only equity is to be considered, it ignores the significant portion of assets funded by debt, leading to an incomplete assessment. In Figure 1, this effect is shown and clearly illustrates how the Tobin's Q value can change (and interpreted incorrectly) with that. If the ratio is higher than 1, it indicates that the market value of the company's assets is at a premium to their book value, which could be an indicator that the company is overvalued because investors are willing to pay more for the company than the cost to replace its assets. On the other hand, if the ratio is below 1, it suggests that the market values the assets at a discount to their book value, which could indicate that the company is undervalued because the market price is lower than the cost to replace the assets. The original calculation has been criticized for being too complex and requiring difficult-to-access information (Granelli et al., n.d.-a).

$$Tobin's\ Q = \frac{Market\ Capitalization + Book\ value\ of\ Debt}{Total\ Assets}$$

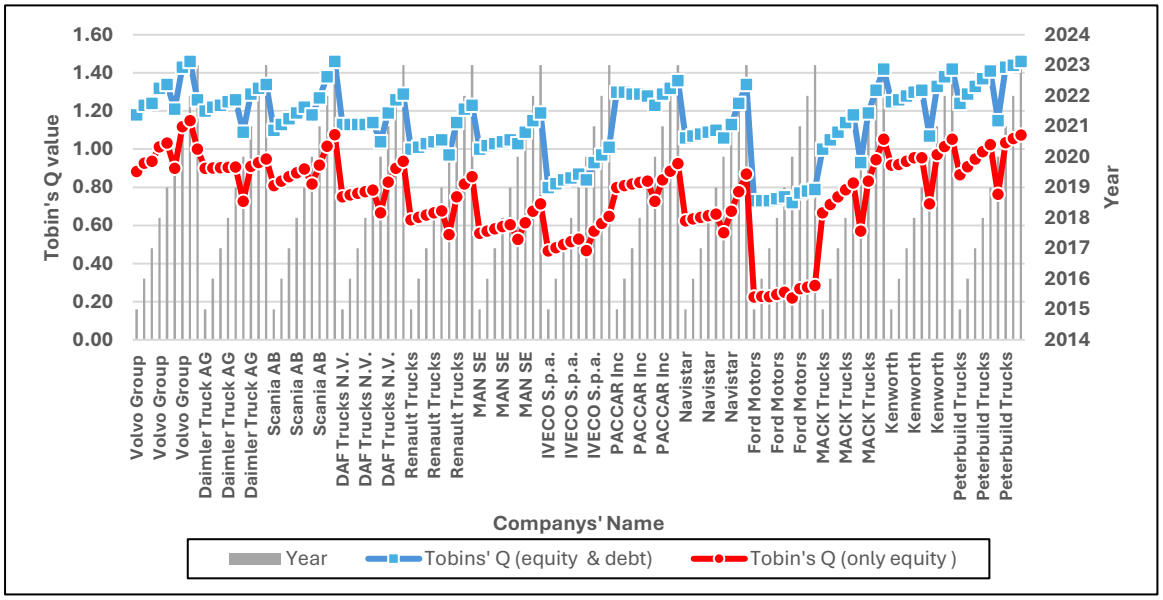

Figure 1: The effect of book value of Debt in Tobin's Q value for data of current study

3.2.2 Earnings per Share

Earnings per share (EPS) has been considered as one of the key market measures of firm performance. The fundamental analysis of stock valuation is the concept of EPS, to offer a straightforward measure of companies' profitability on a per-share basis. It provides insights into how effectively the company management generates profits with shareholder investments (Wright Hoffman, 1935). The relation between companies' dividend and EPS shows that firms with stable and increasing EPS are more likely to maintain or increase their dividend payouts, reflecting a positive signal to investors about the firm's financial health and prospects (Lintner, 1956). Studies show existence of a positive relationship between overall ESG performance and financial firm performance measured as earnings per share (Ahmad et al., 2021; Moore, 2001).

Earnings Per Share (EPS) is Calculated as Annual Net Income divided by the Weighted Average Number of Common Shares Outstanding. It indicates profitability on a per-share basis.

$$EPS = \frac{Net\ Income}{Number\ of\ outstanding\ shares}$$

3.2.3 Return on Assets

Return on Assets (ROA) is a critical indicator of financial health. ROA has been utilized extensively in comparative analyses within and across industries of the profitability of a company in relation to its total assets, from an accounting-based perspective. Return on Assets is calculated by dividing the company's net income by its total assets (Granelli et al., n.d.-a). A higher ROA indicates more efficient use of assets to generate profits (Blum & Lev, 1977).

According to Dhaliwal et al. (Dhaliwal et al., 2011), a positive relationship between ROA and ESG performance exists. This is because ESG initiatives help improve operational efficiencies,

lower costs, and mitigate risks which as a result, the returns on assets will increase. This connection emphasizes how profitable it is to integrate sustainable practices into company operations.

For calculating the Return on Assets (ROA) the net Income is divided by Total Assets. ROA measures how effectively a company uses its assets to generate earnings.

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

3.3 Data Collection

To accurately assess the impact of Environmental, Social, and Governance (ESG) integration on the financial performance of truck manufacturing companies in Europe and the U.S., a meticulous data collection plan is crucial. This plan which is also shown in Table 3 outlines the specific raw data required, its sources, and the purpose behind collecting each data type. The goal is to facilitate a detailed analysis using STATA for statistical evaluation.

Collection of the operational and financial data for this thesis has been done carefully to guarantee precision and applicability. The primary sources which have been used were publications specific to the industry, reliable financial databases, and annual reports from company websites. But some ESG scores, and company-specific information has been collected from financial databases such as Bloomberg, Wharton Research Data Services (WRDS), Factset, Mergent FISD, Compustat, LSEG, and Thomson Reuters Eikon.

Table 3: Data Collection Plan

Data Type	Raw Data Needed for Calculation	Sources	Rationale for Calculation
Financial Performance			
Net Income	- Annual net income	- Intelligence - Compustat - Factset - Annual Reports	For calculating EPS and ROA
Total Assets	- Annual total assets	- Compustat - Factset - Annual Reports	For calculating ROA
Equity Market Value	- Current stock price - Number of outstanding shares	- Refinitiv Eikon - Factset - Annual Reports	For calculating Tobin's Q
Book Value of Debt	- Long-term debt - Short-term debt	- Compustat - Factset - Annual Reports	For calculating Tobin's Q
ESG Scores	- Overall ESG score - Scores for E, S, and G pillars	- MSCI ESG Ratings - Datastream - Factset - Annual Reports	To assess ESG integration level
Control Variables			
Debt-to-Equity Ratio	- Total Debt - Shareholder's Equity	- Compustat - Factset - Annual Reports	To measure financial leverage
Market Capitalization	- Stock price - Number of outstanding shares	- Refinitiv Eikon - Factset - Annual Reports	To understand company's market size

3.3.1 Variables

In the following section, the dependent, independent, and control variables which have been used for this study will be introduced.

3.3.1.1 Independent Variables

As previously described, the purpose of this study is to look into the relationship between financial performance and ESG as well as the individual factors E, S, and G. The conclusion drown from this analysis will be used to determine how ESG factors are valued managers and investors in Truck-manufacturing sector. Thus, the independent variable in this study will be the ESG score. The combined ESG score with weighted components reflects the overall ESG performance.

3.3.1.2 Dependent Variables

Dependent variables are already determined in this study and will be Return on Assets (ROA), Earning per Shares (EPS), and Tobin's Q. The characterization of dependent variable is its value is affected by the independent variable.

- *ROA* measures how efficiently a company uses its assets to generate earnings.
- *Tobin's Q* indicates the company's market value relative to its asset replacement cost.
- *EPS* is a critical measure of a company's profitability on a per-share basis

3.3.1.3 Control Variables

The reason why this study has chosen to include additional independent variables to ESG is that theory and previous research have shown that it is not solely ESG that affects financial performance. The chosen control variables are:

- *Debt-to-Equity Ratio* which measures financial leverage and risk.
- *Market Cap* that describes the total value of a company's outstanding common shares owned by stockholders.

Chapter 4

4 Model and Results

As this study relies on ESG and financial performance data over a period of 8 years and is annually based, the research questions will be investigated in the form of a panel data collection. The collected data are from different countries in Europe and USA which their distribution is shown in Figure 2.

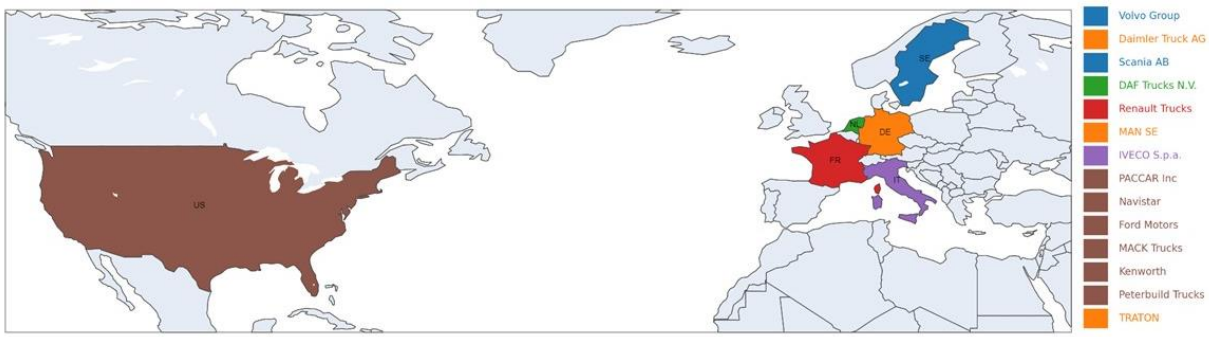

Figure 2: Distribution of under investigation companies across Europe and USA

4.1 Descriptive Statistics

Table 4 presents descriptive statistics for all independent and dependent variables used in the regression model. The number of observations, minimum value, maximum value, mean, and standard deviation are presented. The ESG rating contains 126 observations with a minimum of 66.9 out of 100 and a maximum of 82.1 out of 100 score. This indicates that even though every company in the study is in the same industry, the ESG ratings are different very competitively. These observations generate a mean ESG rating of 72.85. Of the separated ESG indicators, the Environmental rating has the highest mean of 74.61 and the social rating has the

lowest at 70.69. It is also worth noting that even though the Environmental score has the highest mean it also has the highest standard deviation of 3.44.

ROA has, as well as ESG also 126 observations with a mean of 6.88%, a minimum of 0.52%, a maximum of 21.05%, and a standard deviation of 3.76%. In total, 126 observations with a mean of 1.21, a minimum of 0.71, a maximum of 1.46, and a standard deviation of 0.205 made up Tobin's Q1 as well. The EPS also with 126 observations, shows a mean value equal to 6.49 and standard deviation equal to 5.42. The calculated minimum and maximum values for EPS are equal to 0.289 and 23.85 respectively.

To ensure the robustness of the regression model, it is essential to include control variables that can influence the dependent variables. The control variables in this study are "Market Capitalization" and "Debt-to-Equity Ratio". The Descriptive statistics for these control variables in Table 4 shows, the Market Capitalization variable, with 126 observations, has a mean value of €18,625.40 million, a standard deviation of €17,688.83 million, a minimum value of €2,000 million, and a maximum value of €80,000 million. This wide range indicates substantial variability in the market sizes of the companies included in the study.

The Debt-to-Equity Ratio variable also has 126 observations, with a mean of 0.738, a standard deviation of 0.33, a minimum value of 0.45, and a maximum value of 1.88. This ratio measures the financial leverage of the companies and indicates the relative proportion of shareholders' equity and debt used to finance the company's assets. By including these control variables, the analysis can more accurately isolate the effect of ESG factors on financial performance.

Table 4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Date	126	2019	2.592	2015	2023
Net income*	126	1690.127	2091.205	100	17900
Total assets*	126	35329.976	59080.726	3000	280000
ROA	126	6.885	3.762	0.52	21.053
Market cap*	126	18625.397	17688.83	2000	80000
Stock price**	126	64.715	35.926	10	148.1
Outstanding shares*	126	517.357	1113.953	94	4500
Tobin's Q (equity & debt)	126	1.121	0.205	0.71	1.46
EPS**	126	6.493	5.421	0.289	23.857
Tobin's Q (equity)	126	0.774	0.219	0.22	1.2
Book debt*	126	15098.413	29782.592	1000	140000
ESG- e	126	74.619	3.443	68	85
ESG- s	126	70.698	3.191	65	78
ESG- g	126	71.667	3.277	65	81
ESG combined	126	72.852	3.219	66.9	82.1
Debt to equity	126	0.738	0.33	0.45	1.88
Shareholders' equity*	126	18267.937	29410.797	2000	140000

*Million Euro ** Euro

The correlation between used variables in this study is shown in Table 5. The correlation matrix shows that each of the separated ESG factors has a high correlation with the combined ESG score. The highest correlation is between the combined ESG score and the Environmental rating score, followed by the Social and Government scores which suggest potential

[1] Based on debt and equity calculation

multicollinearity issues. This was expected because all three variables are a part of the combined ESG score. Apart from the ESG factors, Market cap has the highest correlation, with a correlation of 0.395 to the combined ESG score which is very close to the Debt-to-Equity ratio which has correlation equal to 0.37 with combined ESG score. Overall, the correlation in the table tends to be low and the financial measurement variables (ROA, EPS, and Tobin's Q) have moderate correlations with the other variables. Because of the reason that correlation only measures how two specific variables correlate with each other without any other parameters, it is difficult to draw any conclusions. It is worth noticing that in contradictory to former studies our statistics show a better correlation between ESG and the size of company with a correlation of 0,395. Past studies have shown a correlation pending around 0,30(Granelli et al., n.d.-b).

Table 5: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) esg_combined	1.000								
(2) esg_e	0.986	1.000							
(3) esg_s	0.950	0.900	1.000						
(4) esg_g	0.935	0.901	0.840	1.000					
(5) eps	0.222	0.209	0.085	0.418	1.000				
(6) debt_equity	0.370	0.409	0.411	0.142	-0.254	1.000			
(7) tobins_q_ed	0.062	0.046	0.039	0.126	0.189	-0.624	1.000		
(8) roa_cal	0.171	0.122	0.208	0.216	0.571	-0.353	0.419	1.000	
(9) market_cap	0.395	0.472	0.256	0.326	0.075	0.539	-0.150	-0.253	1.000

Stata Script: asdoc correlate esg_combined esg_e esg_s esg_g eps debt_equity tobins_q_ed roa_cal market_cap, save(correlate_matrixN.doc)

4.2 Test Result Regression Diagnostic

In the following section, the regression model's assumptions and outcomes will be. Moreover, the chosen variables will be proved and aims to generate the final regression model used in this study.

4.2.1 Multicollinearity

The correlation between independent variables in a multiple regression model is described by Multicollinearity. High multicollinearity can inflate the variance of the coefficient estimates and make the estimates very sensitive to changes in the model. A correlation coefficient of 0.6 or higher has been considered as high multicollinearity threshold in previous studies (Granelli et al., n.d.-b).

In this study, the variance inflation factors (VIF[2]) calculated based on the correlation matrix presented in Table 5, for the independent and control variables to assess multicollinearity. The VIF test results show a high correlation coefficient between the Variables.

[2] Variance Inflation Factor (VIF) provides a measure of multicollinearity among the independent variables in a multiple regression model. In general,(Timothy Li, n.d.):

- VIF equal to 1 = variables are not correlated
- VIF between 1 and 5 = variables are moderately correlated
- VIF greater than 5 = variables are highly correlated

As high multicollinearity can inflate the standard errors of the coefficients, making some variables appear less significant than they are, it is required to solve this problem with the panel data we have. To address multicollinearity in this study, Principal Component Analysis (PCA) was employed. PCA transforms the original correlated variables into a set of uncorrelated principal components. These components capture most of the variability in the data while mitigating the multicollinearity issue. The first few principal components, which explain most of the variance, were used in the subsequent regression analysis.

Principal Component Analysis (PCA):

PCA was performed in Stata on the independent variables (ESG scores) and control variables (debt-equity ratio and market capitalization) to address the multicollinearity issues and generating six principal components.

The PCA transformed these correlated variables into a set of uncorrelated principal components that capture most of the variability in the data. The first five principal components (PC1 to PC5) explained a cumulative 100% of the variance, making them suitable for use in subsequent regression analyses. Next, to Generating Principal Component Variables, the principal components were saved as new variables in the dataset.

Then a regression was conducted using the first five principal components as predictors for each dependent variable (ROA, EPS, Tobin's Q). These followed by checking the VIF values for the principal components showed all equal to 1, confirming that multicollinearity had been effectively eliminated.

4.2.2 Heteroskedasticity Test

Heteroskedasticity occurs when the error terms variance, in a regression model varies across data points. This variability can impact the accuracy of estimates and the validity of errors affecting hypothesis testing and confidence intervals. The Breusch Pagan[3] test is commonly used to identify heteroskedasticity. It tests the hypothesis that the residuals have variance. If the p value is below 0.05 we reject the hypothesis suggesting the presence of heteroskedasticity.

In the current study, the regression model for ROA includes ESG factors (E, S, G), EPS, Debt-to-Equity ratio, Tobin's Q, and Market Capitalization. The Breusch-Pagan test was conducted to check for heteroskedasticity.

The ROA regression which is shown in Table 6 reveals significantly positive relationships between ROA and ESG social scores, esg_s, and EPS. On the other hand, a negative and significant relationship exists between ROA and ESG governance scores, esg_g, and the debt-

[3] In the Breusch-Pagan test (Greene, 2012), the chi-squared (χ^2) value is a test statistic used to detect heteroskedasticity in a regression model, which occurs when the variance of the error terms varies across observations. The test involves fitting an initial regression model to obtain the residuals, and then performing an auxiliary regression where the squared residuals are regressed on the original independent variables. The chi-squared statistic is calculated as $\chi 2 = n \cdot R_{aux}^2$ where n is the number of observations and R_{aux}^2 is the R-squared from the auxiliary regression. This statistic is compared to a critical value from the chi-squared distribution with degrees of freedom equal to the number of predictors. A higher chi-squared value indicates a greater likelihood of heteroskedasticity, suggesting that the variance of the residuals is not constant across all levels of the independent variables.

equity ratio. These results suggest that higher social scores and EPS are associated with higher ROA, while higher governance scores and debt-equity ratios are associated with lower ROA. As shown in Table 6 the R-squared value is 0.684, indicating that approximately 68.4% of the variance in ROA is explained by the model. Moreover, the Breusch-Pagan test shows a chi2 value of 29.27 with a p-value of 0.0001, indicating the presence of heteroskedasticity in the model for ROA.

The EPS regression results in Table 6 reveals there is a significant negative relationship between EPS and ESG environmental scores (esg_e) and social scores (esg_s). Conversely, significant positive relationships exist between EPS and ESG governance scores (esg_g), debt-equity ratio, and ROA. These results indicate that higher governance scores, debt-equity ratios, and ROA are associated with higher EPS, while higher environmental and social scores are associated with lower EPS. Furthermore, the R-squared value is 0.746 which means that approximately 74.6% of the variance in EPS is explained by the model. The Breusch-Pagan test results also show a chi2 value of 41.51 with a p-value of 0.0000, indicating the presence of heteroskedasticity in the model for EPS.

The regression analysis for Tobin's Q in Table 6 indicates significant positive relationships between Tobin's Q and ESG social scores (esg_s) and EPS. Conversely, significant negative relationships exist between Tobin's Q and ESG governance scores (esg_g), debt-equity ratio, and market capitalization. These results suggest that higher social scores and EPS are associated with higher Tobin's Q, while higher governance scores, debt-equity ratios, and market capitalization are associated with lower Tobin's Q. The R-squared value is 0.645, indicating that approximately 64.5% of the variance in Tobin's Q is explained by the model. The Breusch-Pagan test shows a chi2 value of 24.35 with a p-value of 0.0010, indicating the presence of heteroskedasticity in the model for Tobin's Q.

Table 6: Regressions and Breusch-Pagan results for Heteroskedasticity test [Notation: Coef.(St.Err.)]*

Variables	ROA Regression	EPS Regression	Tobin's Q Regression
esg_e	0.225 (0.213)	-0.489 (0.273)*	0.035 (0.012)***
esg_s	1.485 (0.203)***	-2.116 (0.25)***	0.048 (0.013)***
esg_g	-1.485 (0.231)***	2.546 (0.256)***	-0.064 (0.014)***
eps	0.571 (0.048)***	-	0.003 (0.004)
debt_equity	-5.98 (1.524)***	7.377 (1.983)***	-0.736 (0.065)***
tobins_q_ed	0.678 (1.59)	1.487 (2.053)	-
market_cap	0 (0)	0 (0)	0 (0)***
roa_cal	-	0.955 (0.08)***	0.002 (0.005)
Constant	-8.414 (4.911)*	-3.396 (6.421)	-3.396 (6.421)
R_squared	0.684	0.746	0.645
chi2	29.27 [p=0.0001]	41.51 [p=0.000]	24.35 [p=0.0010]

**** p<.01, ** p<.05, * p<.1*

The results from the regression analyses revealed the relationships between the ESG factors, control variables, and the dependent variables (ROA, EPS, and Tobin's Q). The Breusch-Pagan tests for heteroskedasticity indicated the presence of heteroskedasticity in all three models, suggesting that the assumption of constant variance of the error terms is violated. This indicates that further steps, such as using robust standard errors, may be necessary to address heteroskedasticity in the models.

The Shapiro-Wilk test was used to assess the normality of the dataset. The results indicated that the ESG variables are approximately normally distributed, while EPS, ROA, Tobin's Q, Debt-to-Equity Ratio, and Market Capitalization are not. Appropriate transformations were applied to these variables to achieve normality. Furthermore, the Wooldridge test for autocorrelation was conducted. Results showed that ROA and Tobin's Q exhibit first-order autocorrelation, while EPS does not.

4.2.3 Final Regression Models

The Wooldridge test for autocorrelation in panel data has been conducted to ensure the robustness and reliability of our regression models. The presence of serial correlation can violate regression assumptions and lead to inefficient estimates. The results of the Wooldridge test showed that the Return on Assets (ROA) and Tobin's Q model have significant first-order autocorrelation. In contrast, no considerable autocorrelation was observed in the Earnings per Share (EPS) model.

Given these results, we applied robust standard errors to address the serial correlation in the ROA and Tobin's Q models. Additionally, alternative regression methods such as Generalized Least Squares (GLS) and Prais-Winsten regression were considered to further ensure the accuracy and reliability of our findings. These methods adjust for the presence of serial correlations and provide more robust estimates of relations between the ESG factors and financial performance in the truck manufacturing sector. The final model, therefore, meets the assumptions required to produce reliable results. In the following section, all variables that will be included in the regression model are presented.

$$\boldsymbol{ROA} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 esg_e} + \boldsymbol{\beta_2 esg_s} + \boldsymbol{\beta_3 esg_g} + \boldsymbol{\beta_4} \frac{\mathbf{1}}{(\boldsymbol{Debt2Equity})^2} + \boldsymbol{\beta_5 log_{marketCap}} + \boldsymbol{\epsilon ROA}$$

$$\boldsymbol{Log_{EPS}} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 esg_e} + \boldsymbol{\beta_2 esg_s} + \boldsymbol{\beta_3 esg_g} + \boldsymbol{\beta_4} \frac{\mathbf{1}}{(\boldsymbol{Debt2Equity})^2} + \boldsymbol{\beta_5 log_{marketCap}} + \boldsymbol{\epsilon log_{EPS}}$$

$$\boldsymbol{Qubic_{Tobin'sQ\,[ed]}} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 esg_e} + \boldsymbol{\beta_2 esg_s} + \boldsymbol{\beta_3 esg_g} + \boldsymbol{\beta_4} \frac{\mathbf{1}}{(\boldsymbol{Debt2Equity})^2} + \boldsymbol{\beta_5 log_{marketCap}} + \boldsymbol{\epsilon Qubic_{Tobin'sQ[ed]}}$$

In where:

- $\boldsymbol{\alpha}$ **:** Constant - This is the baseline when all predictors are zero.
- $\boldsymbol{\beta_1}$ **:** The independent variable of Environmental from ESG.
- $\boldsymbol{\beta_2}$ **:** The independent variable of Social from ESG.
- $\boldsymbol{\beta_3}$: The independent variable of Government from ESG.
- $\boldsymbol{\beta_4}$: The independent variable of $\frac{\mathbf{1}}{(\boldsymbol{Debt2Equity})^2}$.

- $\boldsymbol{\beta_5}$: The independent variable logarithmic market cap

As indicated, in the context of this study, three types of regression analyses were conducted. The conducted regressions are Fixed Effects Regression, Generalized Least Squares (GLS) Regression, and Prais-Winsten Regression. Each of these regression types has specific advantages and addresses different methodological concerns in panel data analysis which are explained briefly in the following (Greene, 2012; Wooldridge, 2003).

4.2.3.1 Fixed Effects Regression (FE)

The Fixed Effects (FE) model is used to control the time-invariant characteristics of the individuals or entities in the dataset, which could potentially bias the results.

Importance:

- **Control for Unobserved Heterogeneity:** The FE model accounts for individual-specific effects that are constant over time but may vary across entities. This helps to isolate the impact of the independent variables on the dependent variable.
- **Removes Time-Invariant Bias:** By differencing out the time-invariant characteristics, the FE model ensures that the results are not biased by factors that do not change over time.
- **Within-Group Variation:** It focuses on the within-group variation, making it suitable for studying the impact of variables that vary over time within the same entity.

This regression can be used when the primary concern is to control unobserved heterogeneity across entities that could confound the results. Also, when the data contains repeated observations of the same entities over time, this regression will be a good choice.

Application in this Study:

- The FE regression was applied to examine the impact of ESG factors on financial performance metrics such as ROA, EPS, and Tobin's Q. This helped to control the time-invariant characteristics of the truck manufacturers, ensuring that the results were not biased by unobserved factors specific to each company.

4.2.3.2 Generalized Least Squares (GLS) Regression

GLS regression is used to address issues of heteroskedasticity (non-constant variance of errors) and serial correlation (correlation of errors across time periods).

Importance:

- **Handling Heteroskedasticity:** GLS provides more efficient and unbiased estimates in the presence of heteroskedasticity by adjusting the estimation procedure to account for varying error variances.
- **Addressing Serial Correlation:** By incorporating correlations between observations over time, GLS improves the reliability of the parameter estimates in the presence of autocorrelation.
- **Cross-Sectional Correlation:** GLS can also handle correlation between entities at the same point in time, making it suitable for panel data with cross-sectional dependence.

If there is evidence of heteroskedasticity and/or serial correlation in the panel data, using this regression will be beneficial. Furthermore, in the case if efficiency and reliability of estimates

are of concern due to the presence of non-constant error variances and correlated errors it is wise to choose this regression.

Application in the Study:

- The GLS regression was used to assess the impact of ESG factors on financial performance while accounting for potential heteroskedasticity and serial correlation in the data. This provided more efficient estimates and helped to validate the robustness of the findings from the FE model.

4.3 Empirical Results

This section presents the empirical results of the study. The results from three different regression models which explained will be discussed. Each model addresses specific concerns such as heteroskedasticity and serial correlation, providing a comprehensive understanding of the relationship between ESG factors and financial performance.

4.3.1 Presentation of the Hypotheses

The results of each hypothesis are assessed based on whether the null hypothesis can be rejected, with details on the level of significance. The primary hypotheses are related to the overall ESG impact on financial performance, while secondary hypotheses focus on individual ESG components.

4.3.1.1 ESG & ROA [Accounting based Results]

As in Table 7 the summary of the results of used regressions, the Fixed Effects model shows significant positive impact of esg_e and significant negative impact of esg_g on ROA. The GLS model, however, indicates a significant negative impact of esg_e and positive impact of esg_s and esg_g.

OneOverSq_debt_equity shows a significant positive impact on ROA in the GLS model, while it shows a significant negative impact in the Fixed Effects model. log_market_cap is positively significant across all models, indicating that larger firms tend to have better operational efficiency.

4.3.1.2 ESG & EPS [Accounting based Results]

Results of the conducted regressions are shown in Table 7, which according to the that, the esg_e has a significant positive impact on EPS in the Fixed Effects model but shows a significant negative relationship in the GLS model.

4.3.1.3 ESG & Tobin’s Q [Market based Results]

The regression results for Tobin’s Q which are summarized in Table 7. As outcomes, the esg_e shows a negative relationship with cubed Tobin's Q in the Fixed Effects model, but a positive relationship in the GLS model. Also, the esg_s shows significant negative impact in the Fixed Effects model and significant positive impact in the GLS model. Moreover, the esg_g shows a consistent positive relationship in all models, though the magnitude and significance vary.

Table 7: Final Regression models [Notation: Coef.(St.Err.)]*

Variables	FE Model			GLS Model		
	ROA Regression	**EPS Regression**	**Tobin's Q Regression**	**ROA Regression**	**EPS Regression**	**Tobin's Q Regression**
esg_e	1.229 (0.345)***	0.232 (0.079)**	-0.261 (0.0065)***	-1.466 (0.121)***	-0.307 (0.006)***	0.347 (0.071)***
esg_s	0.578 (0.312)*	-0.221 (0.071)***	-0.188 (0.061)***	1.061 (0.116)***	0.14 (0.019)***	0.138 (0.0031)***
esg_g	-1.291 (0.264)***	-0.084 (0.061)	0.353 (0.048)***	0.796 (0.074)***	0.338 (0.015)***	-0.443 (0.058)***
OneOverSq_debt_equi	-3.087 (0.939)***	-0.282 (0.216)	-0.511 (0.17)***	1.555 (0.159)***	0.335 (0.027)***	-0.001 (0.028)
log_market_cap	14.351 (1.585)***	2.341 (0.254)***	2.177 (0.0314)***	1.967 (0.201)***	0.284 (0.021)***	0.594 (0.023)***
Constant	-79.698 (12.568)***	-15.561 (1.986)***	-10.351 (2.726)***	-38.421 (2.838)***	-13.277 (0.38)***	-7.689 (0.367)***

*** p<.01, ** p<.05, * p<.1*

4.3.2 Results of Hypothesis

All hypotheses have been tested with the selected models. Table 8 shows whether each null hypothesis can be accepted or rejected. The main hypotheses of the study are H01, H02, and H03, which address the research question: "What is the relationship between ESG rating and financial performance within the Truck manufacturing sector?" The remaining hypotheses (H04 to H012) explore the relationships between individual E, S, and G ratings and financial performance within the sector.

To clarify, in the context of the regression results, "Not Significant" means that the coefficient's p-value is greater than the common significance thresholds (e.g., 0.05, 0.01, 0.001), indicating that the effect of the variable is not statistically significant at those levels.

4.3.3 Implications For Truck Manufacturers

The regression results showed a detailed influence of ESG factors on the financial results of the truck manufacturers with respect to operational efficiency, earnings, and market perception.

For Environmental Scores (esg_e), the Fixed Effects (FE) Model indicated a positive impact on Return on Assets (ROA), suggesting immediate operational benefits from environmental initiatives. Conversely, the Generalized Least Squares (GLS) Model showed a negative impact on ROA but a positive impact on Tobin's Q, indicating that while there may be initial operational costs, the market perceives long-term benefits from environmental practices.

Regarding Social Scores (esg_s), the FE Model revealed a negative impact on Earnings Per Share (EPS) and Tobin's Q but a positive impact on ROA. This suggests that social initiatives may initially reduce earnings and market valuation but can enhance operational efficiency. In contrast, the GLS Model showed a positive impact across ROA, EPS, and Tobin's Q,

emphasizing the importance of effective stakeholder engagement and communication about the long-term benefits of social initiatives.

For Governance Scores (esg_g), the FE Model showed a negative impact on ROA and a positive impact on Tobin's Q, suggesting that while governance initiatives may incur operational costs, they build market trust and stability. The GLS Model, however, indicated a positive impact on both ROA and EPS and a negative impact on Tobin's Q, highlighting the market's initial cost perception but recognizing the operational and earnings benefits of strong governance practices.

Control variables also played a significant role. The Debt-Equity Ratio (OneOverSq_debt_equity) demonstrated that a lower ratio enhances ROA and EPS, indicating the importance of managing financial leverage to maintain stability and inspire investor confidence, although its significance on Tobin's Q was mixed. Market Capitalization (log_market_cap) was consistently positive and significant across all models and dependent variables, showing that larger truck manufacturers benefit from economies of scale. This is reflected in improved ROA, EPS, and Tobin's Q, suggesting that investing in growth and expanding market presence can yield significant financial benefits.

Key Takeaways:

From the Strategic ESG Management point of view, it can be mentioned Truck manufacturers should manage their ESG initiatives strategically, highlighting long-term benefits and mitigating initial market perceptions.

Also, Operational Efficiency vs. Market Perception analysis shows, while ESG investments might not immediately boost market valuation (Tobin's Q), they can enhance operational efficiency (ROA), suggesting long-term benefits.

Table 8: Results from hypothesis tests

Hypothesis	Regression Model	Coefficient (ESG_e)	Coefficient (ESG_s)	Coefficient (ESG_g)	Coefficient (Debt/Equity)	Coefficient (Log Market Cap)	Significance	Conclusion
H01: No positive relationship between ESG and Tobin's Q	FE	-0.261 (p < 0.01)	-0.188 (p < 0.01)	0.353 (p < 0.01)	-0.511 (p < 0.01)	2.177 (p < 0.01)	Significant	Mixed Results
	GLS	0.347 (p < 0.01)	0.138 (p < 0.01)	-0.443 (p < 0.01)	Not Significant	0.594 (p < 0.01)	Mixed Results	Reject
H02: No positive relationship between ESG and ROA	FE	1.229 (p < 0.01)	-0.578 (p < 0.1)	-1.291 (p < 0.01)	-3.087 (p < 0.01)	14.351 (p < 0.01)	Significant	Mixed Results
	GLS	-1.466 (p < 0.01)	1.061 (p < 0.01)	0.796 (p < 0.01)	1.555 (p < 0.01)	1.967 (p < 0.01)	Significant	Reject
H03: No positive relationship between ESG and EPS	FE	0.232 (p < 0.05)	-0.221 (p < 0.01)	Not Significant	Not Significant	2.341 (p < 0.01)	Significant	Mixed Results
	GLS	-0.307 (p < 0.01)	0.14 (p < 0.01)	0.338 (p < 0.01)	0.335 (p < 0.01)	0.284 (p < 0.01)	Significant	Reject
H04: No positive relationship between the E-factor and Tobin's Q	FE	-0.261 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Significant	Cannot Reject
	GLS	0.347 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Mixed Results	Reject
H05: No positive relationship between the E-factor and ROA	FE	1.229 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Significant	Reject
	GLS	-1.466 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Significant	Cannot Reject
H06: No positive relationship between the E-factor and EPS	FE	0.232 (p < 0.05)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Significant	Reject
	GLS	-0.307 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Significant	Cannot Reject
H07: No positive relationship between the S-factor and Tobin's Q	FE	Not Applicable	-0.188 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Significant	Cannot Reject
	GLS	Not Applicable	0.138 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Mixed Results	Reject
H08: No positive relationship between the S-factor and ROA	FE	Not Applicable	-0.578 (p < 0.1)	Not Applicable	Not Applicable	Not Applicable	Significant	Cannot Reject
	GLS	Not Applicable	1.061 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Significant	Reject
H09: No positive relationship between the S-factor and EPS	FE	Not Applicable	-0.221 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Significant	Cannot Reject
	GLS	Not Applicable	0.14 (p < 0.01)	Not Applicable	Not Applicable	Not Applicable	Mixed Results	Reject
H010: No positive relationship between the G-factor and Tobin's Q	FE	Not Applicable	Not Applicable	0.353 (p < 0.01)	Not Applicable	Not Applicable	Mixed Results	Reject
	GLS	Not Applicable	Not Applicable	-0.443 (p < 0.01)	Not Applicable	Not Applicable	Significant	Cannot Reject
H011: No positive relationship between the G-factor and ROA	FE	Not Applicable	Not Applicable	-1.291 (p < 0.01)	Not Applicable	Not Applicable	Significant	Cannot Reject
	GLS	Not Applicable	Not Applicable	0.796 (p < 0.01)	Not Applicable	Not Applicable	Significant	Reject
H012: No positive relationship between the G-factor and EPS	FE	Not Applicable	Not Applicable	Not Significant	Not Applicable	Not Applicable	Mixed Results	Cannot Reject
	GLS	Not Applicable	Not Applicable	0.338 (p < 0.01)	Not Applicable	Not Applicable	Significant	Reject

**** p<.01, ** p<.05, * p<.1, [p>0.1 then "Not Significant"]*

Chapter 5

5 Conclusion and Recommendations

In this study the relationship between the ESG rating and financial performance, including market-based and accounting-based performance have been examined through different models. Each regression type employed in this study serves a specific purpose and addresses different methodological concerns:

- **Fixed Effects Regression (FE):** Controls for unobserved, time-invariant heterogeneity across entities, focusing on within-group variation.
- **Generalized Least Squares (GLS):** Addresses heteroskedasticity and serial correlation, providing efficient and unbiased estimates.

These regressions are used for empirically ensuring that the results obtained are robust, reliable, and devoid of several possible biases and issues that are attached to panel data. This comprehensive approach provides a more accurate and nuanced understanding of the relationship between ESG factors and Truck manufacturing sector financial performance.

5.1 ESG & Financial Performance

As stated, the primary hypotheses of the relationship between the ESG rating and financial performance, including market-based and accounting-based performance are tested using multiple regression models to understand the impact of ESG factors on different financial metrics.

5.1.1 ESG & Tobin's Q

The relationship between ESG and Tobin's Q was tested using Fixed Effects and GLS regressions. The results from the GLS model indicate a positive impact of **esg_e** on Tobin's Q, while the FE regression shows a negative impact. This inconsistency suggests that while ESG

investments may initially appear to negatively impact market valuation, other factors or longer-term benefits might not be captured in some models.

5.1.2 ESG & ROA

The Fixed Effects model shows a positive impact of **esg_e** on ROA, indicating that higher environmental scores are associated with better operational efficiency. However, the GLS model shows a significant negative impact of **esg_e** on ROA, suggesting that higher ESG scores might initially seem costly. **OneOverSq_debt_equity** shows a significant positive impact on ROA in the GLS model, while it shows a significant negative impact in the Fixed Effects model. **log_market_cap** is positively significant across all models, indicating that larger firms tend to have better operational efficiency.

5.1.3 ESG & EPS

For EPS, the Fixed Effects model indicates a positive impact of **esg_e** and a negative impact of **esg_s**. The GLS model shows a significant negative impact of **esg_e** and a positive impact of **esg_s**. This suggests that the effect of ESG factors on EPS varies across models, highlighting the complexity of their impact.

5.2 Environment, Social, And Governance Factors

5.2.1 Environment (E) Factor

The **esg_e** factor shows significant impact across different financial metrics. It has a negative relationship with Tobin's Q and EPS in most models, suggesting that environmental initiatives might initially be viewed as costly. However, the positive impact on ROA in the Fixed Effects model indicates potential long-term operational benefits. The GLS model shows a significant negative impact of **esg_e** on ROA, indicating initial costs.

5.2.2 Social (S) Factor

The **esg_s** factor generally shows a negative impact on financial performance in the Fixed Effects models but a positive impact in the GLS models. This indicates that social initiatives might initially be perceived as detrimental to financial performance but could yield positive returns over time.

5.2.3 Governance (G) Factor

The **esg_g** factor shows a consistent positive relationship with ROA and EPS in the GLS model but a negative relationship with Tobin's Q. This suggests that good governance practices are generally beneficial for operational and market-based performance, though their immediate impact on market valuation might be negative.

5.3 Conclusion

This study investigates the complex relationship between ESG ratings and financial performance in the Truck manufacturing sector, using Fixed Effects and GLS regression models. The results indicate that the impact of ESG factors varies across different financial metrics and models, suggesting that their benefits may not be immediately apparent and might

depend on the specific context and time frame. This escalates the need for a balanced approach to ESG investments, considering both short-term and long-term impacts. This study contributes to the ongoing debate between Shareholder Theory and Stakeholder Theory, providing nuanced insights for practitioners and researchers.

5.3.1 Theoretical And Practical Contribution

Theoretical Contribution:

- The study supports the Shareholder Theory by showing a significant negative relationship between ESG ratings and market-based financial performance (Tobin's Q). However, the positive impact of certain ESG factors on ROA suggests that some elements of the Stakeholder Theory are also relevant.

Practical Contribution:

- The findings suggest that while ESG investments might not immediately boost market valuation, they can enhance operational efficiency. Truck manufacturers should consider the long-term benefits of ESG initiatives.

5.4 Future Research

As there are always some shortages in not very comprehensive studies, in current study the short amount of project time caused us to not be able collect data for a wider time period. So, future research could explore the long-term impact of ESG investments over multiple years, considering a wider time lag.

Using qualitative methods could provide deeper insights into the expectations of investors and the actual impact of ESG activities.

Including additional control variables such as R&D expenditure and volatility could improve the explanatory power of the models which can be done in future research.

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