



**FACULTY OF EDUCATION AND BUSINESS STUDIES**  
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**The impact of corporate governance characteristics on greenhouse gas emissions:  
Empirical evidence from Sweden**

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# Abstract

The purpose of this study is to examine the interactions and impact of six key corporate governance factors on greenhouse gas emissions in Swedish listed firms. Namely, board size, board gender diversity, CEO compensation, blockholder ownership, audit and non-audit fees. The study employs a quantitative research design and uses regression analysis to test the research hypotheses. The data for the study is obtained from a sample of 199 Swedish firms from 2014 to 2021 and data retrieved from the Nordic Compass Database, Swedish House of Finance Research Data Center. The findings reveal significant associations between corporate governance factors after controlling for firm size and industry with carbon emissions disclosure by firms. Concluding, these factors play a crucial role in tackling environmental sustainability performance in corporate practices.

## Key words:

Carbon emission, Corporate governance, Auditing fees, Environmental performance, CSR and ESG.

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# Chapter 1. Introduction to the research

In recent years, concerns about climate change and the impact of greenhouse gas emissions on the environment have led to increased attention to the role of businesses in addressing these issues (Naidoo & Gasparatos, 2018). Carbon emissions are a crucial issue, and companies are expected to take responsibility for their environmental impact by measuring and reporting their emissions, setting reduction targets, and implementing strategies (Naidoo & Gasparatos, 2018). The IPCC has identified several pathways for limiting global warming to below 1.5 degrees Celsius, with a focus on transitioning to low-carbon energy systems and adopting sustainable practices (IPCC, 2018). Firms are under pressure to reduce their carbon footprint and adopt sustainable practices, not only to comply with regulations but also to meet stakeholder expectations and remain legitimate in the market (Freiberg et al., 2020).

## 1.1 Corporate governance and Environmental Performance

Corporate governance is the system that directs and controls a firm, including board size, CEO compensation, and risk management (OECD, 2012). The relationship between corporate governance and environmental performance is crucial, as environmental performance refers to a firm's impact on the natural environment (Epstein & Buhovac, 2014). Strong corporate governance practices are linked to sustainable practices and better environmental and financial performance, particularly in terms of greenhouse gas emissions, which are a major contributor to climate change (Khan et al., 2016).

Corporate governance factors such as board size, CEO characteristics and board gender diversity affect the organization's success and effectiveness. For instance, board size can impair decision-making and foster groupthink (Adams & Ferreira, 2009), CEO compensation may be associated with a greater focus on sustainable practices and environmental responsibility, resulting in lower carbon emissions (Berrone et al., 2010). Moreover, board gender diversity can enhance firm performance (Carter et al., 2003). The relationship between these concepts is strengthened by the presence of larger boards, which effectively demonstrate the diverse perspectives and engagement of a firm's stakeholders (De Villiers et al., 2011). Blockholders can monitor management and influence ESG factors and sustainability practices (Khan et al., 2016). Auditors play a key role in ensuring environmental responsibility and disclosure quality, which can affect audit fees (Truong et al., 2020). Audit fee studies examine various issues related to the audit market and auditor independence (Li et al., 2018; Ashbaugh et al., 2003). A growing body of literature has explored the role of non-audit services in sustainability reporting and financial reporting quality.

This includes studies on climate change risk pricing by auditors (Kannan et al., 2021), internal audit's role in GHG emissions reporting (Trotman & Trotman, 2015), and external auditors' role in managing ESG reputation risk (Asante-Appiah & Lambert, 2022) and ensuring accurate environmental performance reporting (Winterich, 2022). Therefore, it is essential for organizations to carefully consider these factors in their corporate governance practices to promote long-term sustainability and success.

During the launch of the "Fossil Free Sweden" initiative in 2017, which aims to make Sweden a fossil fuel-free welfare state by 2045, the former prime minister Stefan Löfven stated, "Our ambition is to become the world's first fossil-free welfare state." By that, it means a society where emissions have fallen to such a low level that it no longer threatens the climate system and where the economy is powered by renewable energy. This is not a pipe dream, it is a totally realistic scenario that we can achieve by 2045 if we just continue to harness the power of human ingenuity and technology and if we take bold and decisive action now" (Sverigesradio, 2015).

Sweden's sustainable performance regulations established in 2017, have significantly improved the environmental performance of companies in the country (Simnett et al., 2021). Sweden's comprehensive climate policy framework, which includes a climate act and targets, aims to achieve net-zero greenhouse gas emissions by 2045 at the latest (Swedish Environmental Protection Agency, 2023). This has led to many Swedish companies, including Volvo Cars, IKEA, and H&M, committing to reducing their environmental impact (Volvo Cars, 2023; IKEA, 2023; H&M Group, 2022). The Swedish government has also implemented policies such as a carbon tax and subsidies for renewable energy to encourage sustainable practices (Swedish Energy Agency, 2022). Sweden has been ranked as one of the most sustainable countries in the world for the past 10 years running (Yale Center for Environmental Law and Policy, 2020), and 43% of respondents in a survey conducted in Sweden indicated paying close attention to environmental issues (Kantar Sifo, 2022).

## 1.2. The research purpose

This study aims to contribute to the existing literature by examining the impact of key corporate governance factors on greenhouse gas emissions in Swedish listed firms. The study focuses on six factors that have been identified as potential determinants of environmental performance: board size, board gender diversity, CEO compensation, blockholder ownership, and audit and non-audit fees as well. These factors are all crucial elements of corporate governance that can impact a firm's performance and sustainability. According to Adams and Ferreira (2009) and Ben-Amar et al.

(2017), board size and board gender diversity are positively associated with (ESG) performance. Furthermore, CEO compensation can incentivize sustainable practices and performance, as noted in a study by Luo (2012). Blockholder ownership (Masulis & Reza, 2015), and audit and non-audit fees (Eierle et al., 2022) are also important factors in shaping a firm's corporate governance practices and sustainability performance. By examining these factors, valuable insights and recommendations for improving corporate governance practices and sustainability performance can be provided.

Overall, this research aims to fill a gap in the literature by examining the specific corporate governance factors that influence greenhouse gas emissions in Swedish listed firms. That led to the research question, "What is the impact of corporate governance factors on greenhouse gas emissions in Swedish publicly listed firms?" The findings of this study can provide useful insights for policymakers, investors, companies and can contribute to the ongoing efforts to promote sustainable development and tackle climate change.

### 1.3. Layout of the thesis

The research study comprises five chapters. Chapter one introduced the study topic, the opportunity analysis and the main research question. Chapter two explains the theoretical framework and literature review, establishing the groundwork for this study, formulating and developing hypotheses to address and answer the main research question. The third chapter will provide the methodology of this study. Chapter four focuses on presenting and analyzing the gathered data. This study ends by providing a comprehensive answer to the research question in chapter five.

## Chapter 2. Theoretical Framework

The goal of this chapter is to create the theoretical foundation for the research within the arenas of six factors that have been identified as potential determinants of environmental performance: board size, board gender diversity, CEO compensation, blockholder ownership, and audit and non-audit fees. The databases used to conduct our research are ResearchGate, American Accounting Association, JSTOR, ProQuest, ScienceDirect, and academic books.

### 2.1. Three main theoretical perspectives

#### 2.1.1. Agency theory

Agency theory focuses on solving the problems that may occur in an agency relationship. An agency relationship can be defined as a contract in which one or more persons (the principal) hire another person (the agent) to carry out services on their behalf, this also involves the authority of decision making by the agent (Jensen & Meckling, 1976).

There are two types of problems that may arise. The first problem occurs when the behavior of an agent or agents can not be verified as appropriate to reach the desires or goals of the principal. The second problem arises when the agent and the principal have different approaches towards risk (Eisenhardt, 1989). To align the interest of the agent and the principal, corporate governance mechanisms can be used. The development of internal and external control mechanisms are used to control agency problems. A corporate government system must close the gap between managers and stakeholders interest and have an impact on corporate performance and value to be seen as effective (Denis, 2001). There is a lack of explicit research on the six corporate governance in relation to the agency theory and their impact on greenhouse gasses. The agency theory will help this research by explaining the relationship between the determinants of corporate governance and carbon emissions.

#### 2.1.2. Stakeholder theory

Stakeholder theory focuses on the interest and well-being of those who can help or obstruct (the stakeholder) as a means in the decision-making of the firm to achieve organizational goals and shareholder wealth maximization (Phillips et al., 2003).

There are two types of stakeholders; internal and external. Internal stakeholders are the employees and directors of the firm, who are involved in the process of corporate governance. External

stakeholders are the customers, suppliers, and community, who do not work directly with the firm but the actions and outcomes of the firm affects them (Heath & Norman, 2004). Corporate governance is used to align the stakeholders interest with the goals of a firm. It is the responsibility of the firms and managers that shareholders receive a good return on their investment, but in some cases the interest of stakeholders conflicts and have to be given up to ensure basic obligations to other stakeholders. Corporate law gives shareholders the opportunity to elect the member of the board of directors, which can hire and fire executives of the firm (Heath & Norman, 2004). There is a gap in the current research between stakeholder theory and the factors of corporate governance and their influence on carbon emission. In this research, the theory is used to narrow this gap by explaining the relationship between board size, board gender diversity, CEO compensation, blockholder ownership, and audit and non-audit fees and carbon emission in Swedish firms.

### 2.1.3. Legitimacy theory

Legitimacy theory focuses on the societal norms and values that a firm takes into account with their decision making and activities. In this theory, the firm is seen as part of the community and therefore applies the society norms (Deegan et al., 2002).

According to Ghazali and Chariri (2007), legitimacy theory can be seen as a social contract between the firm and the community. The firm runs in an external environment that changes regularly and has to make adjustments to their operation according to the norms of the society to be considered legitimate by their stakeholders. The benefit of legitimacy is the survival of the firm and the ability to continue the activities of the business. Corporate governance is used to minimize the legitimacy gap between the operations of the firm and expectations of the society. Legitimacy gap is the difference between norms of the community and the norms that the firm adopted. This gap will occur when the firm does not take into account the changes in norms and expectations from the society and stakeholders (Ang & Masella, 2015). There is a lack in the current literature of the legitimacy theory in relation to corporate performance and their influence on greenhouse gasses of Swedish public companies.. In this research, legitimacy theory will be used to narrow the gap in the literature explaining the alignment of corporate performance and carbon emissions.

## 2.2 Literature review and Hypothesis

### 2.2.1 Carbon Governance Literature and Implication

Carbon emissions are closely related to several of the United Nations Sustainable Development Goals (SDGs), particularly SDG 7 and SDG 13 (IPPC, 2018). Companies are increasingly using the SDGs to guide their ESG strategies, including carbon emissions management, with SDG 7 aiming to ensure access to affordable, reliable, sustainable, and modern energy for all and SDG 13 focusing on taking urgent action to combat climate change and its impacts. The deployment of renewable energy sources, such as solar, wind, and hydropower, is a key strategy for managing carbon emissions from the perspective of the SDGs, as it can help achieve SDG 7 while also reducing carbon emissions and supporting climate action.

Corporate governance plays a crucial role in promoting a sustainable economy by enabling firms to actively manage their carbon risk through strategic initiatives such as technological innovation, the adoption of circular business models, and improved environmental performance. These efforts not only reduce environmental impact but also enhance corporate reputation and legitimacy among stakeholders (European Commission, 2018, 2019, 2020). Additionally, increased disclosure of climate-related risks provides significant benefits for firms by reducing the risk premium associated with information asymmetry, allowing investors to make more informed evaluations of a firm's overall risk profile (Financial Stability Board, 2016). Given the severity of environmental risks, as highlighted by the World Economic Forum (2020), it is clear that failure to address climate change is among the top five risks in terms of both likelihood and impact. Hence, Palea et al. (2020) provide a comprehensive classification of carbon risk, including physical, transition, and liability risks, all of which can hinder a firm's operational capabilities. As a result, investors take into account a firm's exposure to carbon risk when analyzing its risk profile and formulating investment strategies (Matsumura et al., 2014; Bolton & Kacperczyk, 2021). Auditors also consider business risk by factoring in potential costs arising from shareholder lawsuits, reputational damage, and declining client performance (Houston et al., 2005).

The literature has highlighted the risks of GHG emissions, leading to increased evaluation by capital markets and governance monitors. In this context, scholars propose new climate disclosure standards. The SEC's proposal leverages widely-accepted market-driven solutions, including those created by the Task Force on Climate-Related Financial Disclosures (TCFD) and the (GHG) Protocol. According to Herren Lee, "environmental, social, and governance (ESG) factors are

increasingly recognized as crucial risk management strategies for portfolio construction. Various financial market participants, including investors, lenders, rating agencies, analysts, and index providers, have acknowledged the significance of sustainability factors and metrics in decision-making, capital allocation, and pricing. Auditor attestation of voluntary sustainability reporting may become part of future climate-related initiatives." (Allison Herren Lee, 2021)

Hence, firms with better ESG performance, including lower carbon emissions, tend to have higher valuations and lower costs of capital (Khan et al., 2016; Freiberg et al., 2020). Firms with higher environmental performance tend to have better financial performance and market valuation (Clark et al., 2015; Eccles et al., 2014, 2016; KPMG, 2017). Disclosing carbon emissions can result in lower capital costs and higher market valuations (Ben-Amar et al., 2017). Shareholder activism can also shape corporate governance practices related to carbon emissions (Chatterji & Toffel, 2010; Haque, 2017). In a related study by Dhaliwal et al. (2012) recognized that carbon disclosures are often reported through CDP, GRI, or self-made reporting, with CDP and GRI procedures being more restrictive and standardized compared to unregulated CSR. Firms are required to provide explicit information on their strategy, governance, emissions, and targets, which may result in a lengthy document. Thus, CDP assesses and grades the level of reporting and carbon emissions performance (Dal Maso, 2016).

### 2.2.2. Board size and carbon emissions

Board size is an important aspect of corporate governance that has been extensively studied in the literature. The size of a firm's board of directors affects decision-making processes, individual director engagement, and oversight of management (Walls, 2011). According to the agency theory (Jensen & Meckling, 1976), a larger board size can improve monitoring and reduce agency costs, leading to better corporate performance. However, board size is positively associated with environmental performance (Eugenio Zubeltzu-Jaka et al, 2020), as larger boards may lead to reduced monitoring and accountability of management, resulting in a weaker commitment to environmental performance (Singh & Davidson, 2003). In contrast, the stakeholder theory (Freeman, 1984) suggests that a board of directors has a responsibility to all stakeholders, including the environment. As such, larger boards may be more effective in addressing environmental concerns, as findings by Matsumura (2014) indicate that board size is positively associated with environmental performance as larger boards provide a more diverse set of stakeholder perspectives and increase the firm value. Finally, according to legitimacy theory (Suchman, 1995), organizations must maintain their legitimacy by conforming to social and environmental norms. Larger boards

may be better able to establish and maintain a positive association with stakeholders, including those concerned with environmental sustainability (Dhaliwal et al., 2011), as larger boards can provide greater legitimacy to firms (Patten, 2002).

Several studies have investigated the relationship between board size and environmental performance. In a related vein, Eugenio Zubeltzu-Jaka et al. (2020), Haque (2017), Cucari (2019) and De Villiers et al. (2011) indicated a positive correlation between the size of the board of directors and corporate social performance, suggesting that a larger board may lead to better environmental performance. Similarly, Matsumura (2014) indicated a positive relationship between carbon emissions and firm value, indicating that firms with higher carbon emissions may be more valuable and, therefore, may have better environmental performance. Walls et al. (2011) also observed a positive link between board size and environmental performance, arguing that larger boards are better equipped to handle complex environmental issues and ensure that firms comply with environmental regulations. However, Kassinis and Vafeas (2002) and Al-Shaer (2022) argued that larger boards are less effective in monitoring environmental performance due to coordination problems and information overload, further supporting a negative link.

Furthermore, several studies have found no significant relationship between board size and environmental performance including GHG emissions. In a related context, Coffey and Wang (1998), Depoers (2014), Webb (2004), Luoma and Goodstein (1999), Brown et al. (2006) and Ibrahim et al. (2003) Observed no significant link between board size, voluntary disclosure of GHG emissions, hence, and firm performance. Similarly, Rahman and Post (2012) highlighted that board size had no impact on environmental performance, suggesting that other factors, such as environmental regulations, firm size, and industry, may play a more significant role.

The findings from the literature suggest that the association between board size and carbon emissions may vary across different countries and regions and may depend on factors such as ownership structure, industry type, and regulatory environment. Therefore, the following hypothesis is proposed:

*H1: Board size has a negative association with carbon emissions of firms.*

A significant negative effect is expected, as larger boards may have more diverse perspectives and greater legitimacy to address environmental issues as Agency theory suggested. Larger boards may

also have more expertise and resources to deal with complex and uncertain environmental issues, such as climate change and carbon regulation (De Villiers et al., 2011).

### 2.2.3. Board gender diversity and carbon emissions

"Female on board" refers to the representation of women on the board of directors of a firm or organization. It is a concept that has gained increasing attention in recent years due to the growing recognition of the benefits of gender diversity in corporate governance (Adams & Ferreira, 2009). Despite the benefits of gender diversity on boards, progress has been slow, especially in certain sectors and regions (Carter et al., 2010). Women currently hold just 36.9% of board seats globally, and progress towards gender diversity has slowed in recent years (World Economic Forum, 2022). Hence, firms with more women on their boards outperformed those with fewer women in terms of return on equity, return on sales, and return on invested capital (Catalyst, 2023).

Agency Theory suggests that having more female directors on boards is negatively linked to carbon emissions, as women are more likely to monitor and limit management behavior, resulting in a greater emphasis on environmental sustainability (Webb, 2004). Additionally, Stakeholder theory suggests that female representation on boards is significantly associated with carbon emissions, as female directors may bring a broader range of stakeholder perspectives to board discussions, leading to greater consideration of environmental concerns (Kassinis, 2002; Curari, 2019). Finally, Legitimacy Theory suggests that female representation on boards is positively associated with carbon emissions, as firms with greater diversity on their boards, including gender diversity, may be perceived as more legitimate by stakeholders, leading to greater tolerance for environmentally harmful activities (Depoers, 2016; Martínez et al., 2022)

Literature investigating the link between board gender diversity and environmental performance have yielded mixed results. Ben-Amar et al. (2015) find that female board members enhance GHG disclosures. Similarly, some studies have noted a positive relationship between the two pillars. For example, Haque (2017) and Cucari (2019) highlighted that board gender diversity is positively related to environmental performance and argued that a more diverse board is more likely to include members with environmental expertise and, therefore, is better equipped to address environmental issues and the voluntary disclosure of greenhouse gas emissions. This is broadly in line with the arguments and evidence of related studies (Berrone & Gomez-Mejia, 2009; Webb, 2004; Post et al., 2011)

However, Nuber and Velte (2021), Al-Shaer (2022), Walls et al. (2011) and Martínez et al. (2022) observed a negative link between BGD and corporate carbon emissions. Finally, Coffey and Wang (1998) indicated no significant relationship between board diversity and environmental performance.

The correlation between board diversity and carbon emissions is complex and varies depending on the theoretical perspective. While agency theory suggests a negative association, stakeholder and legitimacy theories propose positive links. It's important also to note that the empirical evidence is mixed. Therefore, the following hypothesis is proposed:

*H2: Board gender diversity has a negative association with carbon emissions of firms.*

We expect a negative effect of board gender diversity on carbon emissions, as female directors may enhance the firm's stakeholder relations and environmental performance. According to stakeholder theory, female directors can balance the interests of various stakeholder groups, such as customers, employees, suppliers, and society, and improve the firm's social and environmental responsibility (Post et al., 2011).

#### 2.2.4. CEO compensation and carbon emissions

CEO compensation is the overall pay and benefits package received by a firm's top executive. Yermack (2006) describes CEO compensation as the total amount of pay and benefits received by the chief executive officer, which includes salary, bonus, stock options, and other benefits packages. Moreover, CEO compensation can be evaluated based on its alignment with a firm's sustainability goals and its incentivization of executives to prioritize sustainability initiatives. In addition, sustainability goals through the use of environmental, social, and governance (ESG) metrics (Cohen et al., 2022). According to a study by (EY, 2022), long-term incentives, such as performance-based equity awards, can encourage executives to prioritize sustainable long-term growth over short-term gains. Hence, strong corporate governance is critical for ensuring alignment with sustainability goals (Governance & Accountability Institute, 2022) and firms with strong sustainability performance tend to have higher CEO pay ratios, suggesting that boards of directors are willing to pay a premium for CEOs who prioritize sustainability (Institutional Shareholder Services, 2022).

Agency theory suggests that CEOs may prioritize their own interests over those of the firm, resulting in actions that benefit themselves but may harm the firm. Therefore, CEOs of firms with higher GHG emissions may receive higher compensation due to the potential short-term benefits of

such actions (Webb, 2004; McGuire et al., 2003). Stakeholder theory suggests that CEOs of firms with higher GHG emissions may receive lower compensation due to the negative impact of these emissions on the environment and other stakeholders. Conversely, CEOs of firms with lower carbon emissions may receive higher compensation as a result of their positive impact on the environment and other stakeholders (McGuire et al., 2003). Legitimacy theory proposes that CEOs of firms with higher carbon emissions may receive lower compensation due to the negative impact of these emissions on the firm's reputation and legitimacy. Conversely, CEOs of firms with lower carbon emissions may receive higher compensation due to their positive impact on the firm's reputation and legitimacy (Deegan et al., 2002).

There is a variety of empirical evidence in corporate and financial literature supporting the link between CEO compensation and environmental performance, with mixed results. Berrone and Gomez-Mejia (2009) indicated a positive association between CEO incentives and corporate social performance, suggesting that higher CEO compensation may incentivize better environmental practices. Similarly, Al-Shaer (2022) also indicated a positive correlation, suggesting that firms may be using CEO compensation as a tool to incentivize better environmental performance.

On the other hand, Berrone et al. (2010) and De Villiers et al (2011) indicated a negative correlation between voluntary disclosure of GHG emissions and CEO compensation, suggesting that CEOs may prioritize short-term financial goals over long-term environmental goals. In a related study by Walls et al. (2011) pointed out a negative link, indicating that firms with better corporate governance may focus more on financial performance rather than environmental performance. Finally, Haque (2017) and McGuire et al. (2003) stated that CEO compensation is statistically insignificant with GHG emissions.

Based on the previous mixed empirical evidence, the following hypothesis is proposed:

*H3: CEO compensation has a positive association with carbon emissions of firms.*

We expect a positive effect of CEO compensation on carbon emissions management, as higher CEO pay may signal the firm's commitment to its stakeholders and the environment. According to stakeholder theory, CEO compensation can reflect the firm's responsiveness to the expectations and demands of its stakeholder groups, such as customers, employees, suppliers, and society, and enhance the firm's reputation and legitimacy (Alshaer et al., 2022).

### 2.2.5. Blockholder ownership and carbon emissions

Blockholder ownership refers to a situation where a single shareholder or group of shareholders owns a significant portion of a firm's outstanding shares (Shleifer & Vishny, 1997). Hence, the concentration of ownership has been shown to influence firm performance, governance, and investment decisions, with implications for shareholders, managers, and society at large (La Porta et al., 1999). Blockholders may have stronger incentives to monitor the firm's management and ensure that the management acts in the best interests of shareholders (Holderness, 2009). However, blockholder ownership can also pose risks to corporate governance (Masulis & Reza, 2015). Blockholders may prioritize their own interests over those of other shareholders or use their influence to push for short-term gains at the expense of long-term value creation (Shleifer & Vishny, 1997).

Agency theory suggests that blockholders may influence corporate decisions, including those related to environmental performance, and that blockholders are more likely to vote for environmental solutions (La Porta et al., 1999). Empirical evidence suggests that higher blockholder ownership may lead to a reduction in carbon emissions, as large blockholders have the power and incentive to monitor and control managerial actions related to environmental performance (Hussain et al., 2018; Masulis & Reza, 2015). According to stakeholder theory, firms with higher block vote power may prioritize the interests of powerful shareholders over other stakeholders, which can lead to less focus on sustainability and higher carbon emissions (Matsumura, 2014). However, higher blockholder ownership is associated with lower carbon emissions due to pressure from blockholders to improve environmental performance (Walls et al., 2011). Finally, Legitimacy theory posits that firms may reduce carbon emissions to maintain their legitimacy in the eyes of stakeholders, including blockholders (Ellili, 2022).

Several studies in the literature suggest a positive relationship between blockholder ownership and environmental performance. Webb's study (2004) and De Villiers et al. (2011) indicates a positive relation between independent directors, including blockholders, and better environmental performance. The findings of Post and Rahman work in line with Brown et al. (2006). Rahman and Post (2011) analyzed the environmental performance of 178 US firms and found no significant relationship between ownership concentration and the disclosure of carbon information. These scholars suggest that factors beyond blockholder ownership, such as external stakeholder pressure or regulatory requirements, may play a more significant role in corporate sustainability performance.

Blockholders can have both positive (Haque, 2017) and negative (De Villiers et al., 2011; Walls, 2011) or insignificant (Coffey and Wang, 1998; Cucari, 2019) impacts on a firm's ESG practices. Blockholders may encourage a firm to prioritize ESG factors and pursue sustainable business practices (Khan et al., 2016). On the other hand, they may pressure the firm to prioritize short-term gains over ESG considerations, leading to environmental or social controversies (Aouadi & Marsat, 2018). In contrast, a study conducted by MSCI highlighted that companies with higher levels of blockholder ownership tend to have better ESG performance and fewer controversies (MSCI, 2022).

The literature on the relationship between blockholder ownership and environmental performance is mixed. Agency theory suggests that blockholders can influence corporate decisions related to environmental performance, while stakeholder theory suggests that blockholders may prioritize their own interests over those of other stakeholders. Based on the empirical evidence, the following hypothesis is proposed:

*H4: Blockholder ownership has a negative association with carbon emissions of firms.*

We expect a negative effect of blockholder ownership on carbon emissions, as blockholders may influence the management to adopt more environmental practices and disclosures. According to legitimacy theory, blockholder ownership can reflect the firm's alignment with the social norms and values of its external environment, and increase the firm's accountability and transparency (Deegan, 2002).

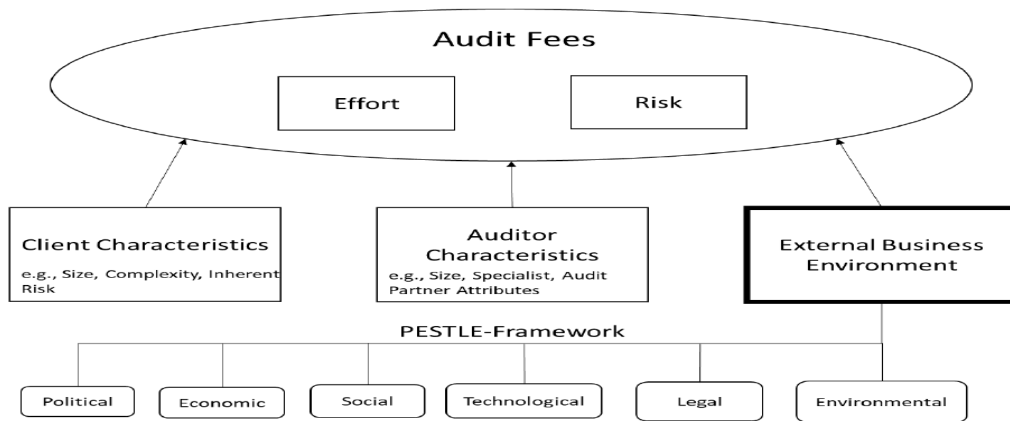
#### 2.2.6. Audit services & fees and carbon emissions

Audit services are an essential component of financial reporting, providing stakeholders with the assurance that a firm's financial statements are accurate and in compliance with relevant regulations (American Institute of Certified Public Accountants, 2017). Recently, the IAASB assembled a panel of experts to address the challenge of establishing appropriate reporting standards and guidelines for environmental and sustainability reports such as "Non-Authoritative Guidance on Applying ISAE 3000 (Revised) to Sustainability and Other Extended External Reporting (EER) Assurance Engagements", as well as to collaborate with the Global Reporting Initiative (GRI) (IAASB, 2023).

According to agency theory (Jensen & Meckling, 1976), firms face a potential conflict of interest between shareholders and managers, who may have incentives to withhold or misrepresent information to external stakeholders. Auditors play a crucial role in undertaking various activities on behalf of their clients' shareholders. The literature presents mixed empirical evidence to support this hypothesis, positive link to argue that higher audit fees may signal greater monitoring intensity and a stronger commitment to environmental performance transparency and accountability (Koh & Tong, 2013; Garcia et al., 2020; Truong & Adrian, 2020; Ashbaugh et al., 2003). According to Stakeholder theory (Freeman, 1984) firms that prioritize environmental sustainability may be more likely to incur costs related to environmental management, including external audits. Higher audit fees may signal a stronger commitment to environmental sustainability and greater responsiveness to stakeholder demands (Saeed et al., 2022). According to The legitimacy theory, external audits can signal a firm's commitment to environmental sustainability and provide assurance to stakeholders about the accuracy and completeness of its environmental performance disclosures. Higher audit fees may signal a greater investment in environmental sustainability performance and stakeholder engagement (Burke & Hoitash, 2019b).

For many years, academics have examined audit firm pricing. Audit fee studies examine a variety of issues, such as the effect of competition in the audit market on audit fees (Li et al., 2018; Kannan et al., 2021). The existing literature suggests that auditors apply a fee premium in response to higher business risk and the potential for subsequent litigation risk (Stanley, 2011). Previous research indicates that audit scope expands and audit fees increase in the presence of audit risk (Figure 1). However, auditors also face inherent risks stemming from client's GHG emissions (Truong et al., 2020). The study conducted by Kannan et al. (2021) investigates whether auditors consider their clients' direct GHG emission risk as a potential source of risk when determining their pricing decisions. The researchers find a positive and significant link between emissions and audit fees, suggesting that auditors assess and charge for business risks, including GHG emissions. The evidence of higher audit fees associated with emissions indicates that auditors perceived business risks associated with climate change decisions by managers to be more susceptible to agency costs. The pricing behavior of auditors concerning potential excess emissions aligns with the concerns of regulators, blockholders, and stakeholders (Kannan et al., 2021). Hence, (CSR) performance is another factor that impacts audit quality and fees. Firms engaged in CSR controversies are charged higher audit fees due to the higher level of assessed business risk (Koh & Tong, 2013; Kannan et al., 2014).

Figure 1. Audit fees and the PESTLE framework



Source: Truong et al. (2020)

The empirical evidence is mixed, a negative link was detected between environmental policy stringency and audit fees, as it reduces business risk. Rabarison et al. (2020) stated that higher environmental disclosure is associated with lower audit fees for clients with low media attention and in heavy pollution industries. Auditors charge higher fees to firms with greater environmental risk exposure and to clients headquartered in regions with a higher likelihood of carbon emissions (Li et al., 2018; Truong et al., 2020b). Socially responsible firms demand high-quality audits, leading to better audit quality but also higher audit fees (Saeed et al., 2022). Firms with a strong commitment to environmental responsibility and external assurance tend to have higher valuations (Sharma et al., 2018). Moreover, firms with better environmental performance tend to have higher financial reporting quality (Kinney Jr. et al., 2004). However, Brandon et al. (2004) and Chaney and Philipich (2002) indicated no significant relationship between environmental disclosures and audit fees in their research, suggesting that environmental performance may not be a key factor in determining audit fees.

In a related vein, (Koh & Tong, 2013; Garcia et al., 2020; Truog & Adrian, 2020; Ashbaugh et al., 2003) highlighted that auditors may reduce agency costs by providing credible, reliable, and independent assessments of financial and non-financial information to external stakeholders. Additionally, there is a negative link that has been detected in the literature such as (Brandon et al., 2004; Simnett et al., 2009; Chaney & Philipich, 2002). Environmental auditing is also relevant in this context, as it involves assessing a firm's environmental performance and disclosing this information to stakeholders. Environmental audits can help firms identify areas for improvement in their environmental performance and provide assurance to stakeholders that they are taking steps to address environmental issues such as carbon emissions (Sharma et al., 2018). Finally, Dhaliwal

found that firms with higher levels of CSR disclosure including the carbon emission disclosures had more accurate analyst forecasts, indicating that CSR disclosure provides useful information to analysts (Dhaliwal et al., 2012).

From an ESG standpoint, auditors can ensure that ESG information is accurate and reliable, which in turn can help firms improve their ESG performance and contribute to sustainable development (Del Maso et al., 2020). Audit services also play a crucial role in ensuring that companies are transparent and accountable in their reporting of sustainability-related information (De Villiers et al., 2020). One of the key contributions of CSR assurance is to provide assurance on ESG information, which is crucial for ensuring that companies identify areas for improvement in environmental compliance and corporate governance to serve as an effective monitoring mechanism for clients (Watts & Zimmerman, 1986). According to KPMG (2022) and PwC (2022), several studies have found that audit services can enhance the credibility of ESG information and increase stakeholder trust.

Overall, the empirical research suggests a positive relationship between carbon emissions and audit fees (Cho et al., 2014), with firms that have higher carbon emissions tending to pay higher audit fees. This can be attributed to the additional audit work required to verify the accuracy and completeness of the sustainability reporting. Therefore, the following hypothesis is proposed:

*H5: Carbon emissions have a positive association with the audit fees charged to the firms.*

We expect a positive association between carbon emissions and audit fees, as higher carbon emissions imply higher audit risk and complexity. Auditors may charge higher fees to compensate for the increased effort and potential liability associated with auditing firms with high carbon emissions (Simnett et al., 2009; Cho et al., 2014).

#### 2.2.7. Non-audit services & fees and carbon emissions

Non-audit fees are fees charged by an audit firm for services other than the audit of a firm's financial statements, such as tax consulting, advisory services, or other consulting services (Winterich, 2022). In the United States, the Sarbanes-Oxley Act of 2002 was passed in response to several high-profile corporate accounting scandals. Section 202 of the Act requires public companies to disclose all fees paid to their external auditors for audit and non-audit services in their annual reports to (SEC), increasing transparency and providing shareholders with information about

the services provided and fees paid (SEC, 2003). Therefore, the prohibition of non-audit services has had a negative impact on audit quality and has increased audit fees (Eierle et al., 2022).

Agency Theory suggests that the link between NAS and carbon emissions is mixed. Higher non-audit fees can lead to lower carbon emissions if firms hire external consultants to identify and implement more efficient practices (Ashbaugh et al., 2003). Stakeholder theory suggests that higher NAS can be used to invest in sustainability initiatives to meet stakeholder demands. For example, Aouadi & Marsat (2018), found that firms with higher NAS were more likely to disclose their carbon emissions and engage in sustainability reporting. Legitimacy Theory suggests that firms may engage in sustainable practices, including carbon emission reduction, to maintain their legitimacy and reputation in the eyes of stakeholders. Higher NAS may indicate a greater commitment to transparency and accountability, which can help firms maintain their legitimacy (Cho & Patten, 2010).

There is a growing body of literature exploring the role of Non-audit services, such as sustainability assurance, can help improve the quality and credibility of sustainability reports. Some studies have examined the role of internal audit in GHG emissions and energy reporting (Trotman & Trotman, 2015), the role of external auditors in managing ESG reputation risk (Asante-Appiah & Lambert, 2022) and ensuring accurate and reliable reporting of environmental performance (Winterich, 2022). Moreover, some researchers have suggested that auditors offering both CSR assurance and financial auditing are the best option for firms in relation to environmental performance (Del Maso et al., 2019). These scholars suggest that auditors have a key role to play in helping companies accurately report their environmental performance, and in turn, helping investors make informed decisions.

Furthermore, recent developments in international reporting standards, such as the (IFRS S2 Climate-related Disclosures, 2022), highlight the importance of accurate environmental reporting for investors and other stakeholders. In addition, accounting firms such as EY and PwC are taking a leading role in helping companies report on their environmental performance and risks, through their climate change and sustainability activities. Additionally, the role of non-audit services in CSR has been examined, with SMEs using non-audit services to improve their CSR practices (Ganesan et al., 2019).

NAS may have mixed effects on carbon emissions. Agency theory suggests that higher fees can lead to lower emissions if firms hire external consultants for more efficient practices. Stakeholder theory suggests that higher fees can be used for sustainability initiatives to meet stakeholder demands. Legitimacy theory suggests that higher fees indicate a greater commitment to transparency and accountability around environmental practices, helping firms maintain legitimacy. Studies show mixed results, with some finding a positive relationship between NAS and carbon emissions, while others find no significant relationship.

Therefore, the following hypothesis is proposed:

*H6: Carbon emissions have a negative association with the non-audit fees charged to the firms.*

We expect a negative association between carbon emissions and non-audit fees, as higher carbon emissions may indicate lower demand for non-audit services. Firms with high carbon emissions may face more regulatory scrutiny and stakeholder pressure, which may limit their opportunities for growth and diversification. As a result, they may require less non-audit services from their auditors, such as consulting, tax, or advisory (Gul et al., 2009; Choi et al., 2010).

### 2.3. Limitations of the selected theory

There is a lack of existing recent literature on the agency theory, stakeholder theory and legitimacy theory related to corporate governance and carbon emissions in academic books and journals but the traditional theories can be seen as timeless. The theoretical framework of this research incorporates literature spanning from 1976 to 2023. Within this broad time frame, only a handful of recent scholarly journals were identified as relevant, particularly when it comes to the topic of non-audit fees and their correlation with greenhouse gas emissions. It was observed that there is a lack of comprehensive scholarly research addressing the phenomenon of GHG emissions and its impact on changes in non-audit fees charged to firms. There are six potential determinants of corporate governance factors that are unable to obscure all the features of corporate governance. Nevertheless, these six acknowledged features are important to be investigated for this thesis to answer the research question.

## Chapter 3. Research Methodology

This chapter explains the research methodology that has been adopted in this thesis to test the hypothesis to be able to answer the main research question in chapter 4. This part covers the research design, the data collection methods for primary and secondary research, selected theory, type of research, data collection method, and source for each chapter.

### 3.1 Research Design

This study adopts an exploratory research approach, which is appropriate when the situation is unclear or the information is insufficient to develop a sound theoretical framework (Sekaran & Bougie, 2016). Exploratory research helps to gain more insights and understanding of the problem or research issue by examining existing or new data sources. This study employs a mixed method approach that combines primary and secondary research to answer the research question.

### 3.2 Primary research

Primary research methods involve the collection of original data that the researcher obtains directly from the variable of interest for the specific purpose of the study. Primary research methods include interviews, observations, questionnaires, and experiments (Sekaran & Bougie, 2016). For this research study, primary data was collected from the Nordic Compass database, which provides ESG-data from public Swedish firms from 2014 to 2021. Appendix 3 summarizes the articles used for this research.

#### 3.2.1. The sample

The sample initially included large-cap and mid-cap plus small-cap companies (EUR 150 million to EUR 1 billion) on NASDAQ-OMX Nordic and Oslo Bors. The data consists of 80 variables that cover ESG topics (Swedish House of Finance, 2022). Nordic Compass, the Swedish House of Finance's ESG Database, is a (ESG) database on publicly traded Nordic firms since 2014. The purpose of the Nordic Compass is to collect, maintain, and distribute detailed, firm-level ESG data to be made available for researchers all over Sweden. Table 3.1 describes the data retrieved from Nordic Compass. The researchers started with an initial sample of 1455 observations (2014-2021) and applied two criteria to select their sample: the firm must be based in Sweden and report both GHG emissions and corporate governance factors. This excluded 605 firms with no GHG data and 150 firms with no corporate governance data, resulting in a final sample of 700 observations. Table 3.2 shows that the data is divided into different panels. The first panel represents the whole period from 2014 to 2021,

while the second panel presenting pre regulations took place 2014–2016, post regulations 2017–2019 and the pandemic effect 2020-2021 to investigate the research question over time.

*Table 3.1 Sample size*

Year	Pre regulations			Post regulations			Pandemic effect		Total observation
	2014	2015	2016	2017	2018	2019	2020	2021	
Initial sample (N_Firms)	100	150	164	202	213	209	206	211	1455
Blanks or 0 GHG	42	73	88	122	123	12	86	59	605
Blanks or 0 CG	5	8	34	24	20	10	25	24	150
Final sample	53	69	42	56	70	187	95	128	700

To ensure consistency and comparability across the sample, it was necessary to select a mutual currency for the research. The initial dataset from Nordic Compass included firms listed in various currencies such as USD, Euro, and Swedish Krona. Given the focus of our research on the Swedish context, the Swedish Corona was adopted as the mutual currency. Because of this decision, the researchers were able to analyze and compare the ESG data of Swedish firms accurately. By standardizing the currency, the ESG trends and developments were examined effectively over time within the Swedish market, providing valuable insights for this research.

*Table 3.2. Variables capturing regulations and pandemic effects*

Panel 1	Whole period	Takes sample for the year 2014 - 2021 and zero otherwise
Penel 2	Pre regulations	Takes sample for the year 2014 - 2016 and zero otherwise
	Post regulations	Takes sample for the year 2017 - 2019 and zero otherwise
	Pandemic effect	Takes sample for the year 2020 - 2021 and zero otherwise

### 3.2.2. Dependent variable

The dependent variable in this study is greenhouse gas emissions, which serves as a proxy for measuring a firm's environmental performance. GHG emissions are considered a critical aspect of corporate sustainability and are commonly used as an indicator to assess a firm's environmental

impact (Dal Maso, 2016; Khan et al., 2016). In this research, GHG emissions are measured in terms of carbon dioxide equivalents (CO<sub>2</sub>) in tons and are obtained from The Nordic Compass database. By focusing on GHG emissions as the independent variable, this study aims to understand the relationship between corporate governance factors and environmental performance. Appendix 2 summarizes the measurement of variables, as well as supporting literature and data sources.

### 3.2.3. Independent variable

The study uses several independent variables that are related to corporate governance and sustainability performance, based on the literature. These variables are board size, board gender diversity, CEO compensation, blockholder ownership, and audit and non-audit fees. They may affect how a firm reduces its GHG emissions. The study focuses on firms listed on NasdaqOMX Stockholm and headquartered in Sweden, which vary in size and in the values of the independent variables. For instance, large firms tend to have higher CEO compensation, audit fees and non-audit fees than small firms. Board size is the number of directors on the board, while board gender diversity is the proportion of women on the board (Adams & Ferreira, 2009). CEO compensation is the financial rewards given to executives, which can influence their choices about sustainable practices (De Villiers et al., 2011). Blockholder ownership is the presence of large shareholders who can shape corporate governance practices (Singh & Davidson, 2003). Finally, audit and non-audit fees are the amount of external oversight and auditing activities (Ashbaugh & LaFond, 2003; Kannan et al., 2021). Look at appendix 2 for the variables measurement and supporting literature.

### 3.2.4. Control Variable

In this study, two control variables were incorporated that are carefully accounted for. Previous research has indicated that the size of firms has a significant influence on both GHG emissions disclosures and the independent variables (Berrone & Gomez Mejia, 2009). To capture the firm's size, the researchers utilize total sales as a proxy to capture the firm size "FirmSizeDummies. Firm size is a widely recognized measure in the literature, as a proxy (Poursoleyman et al., 2023). By employing this established metric, referred to as FirmSize, it effectively accounts for the impact of firm size on the variables under investigation.

In addition to controlling for firm size, the firm's industry is also considered as another important control variable in robust tests. Previous studies have consistently demonstrated that the industry in which a firm operates has a substantial influence on the level of GHG emissions it produces (De

Villiers et al., 2011). The nature of different industries, their operational processes, and resource utilization can significantly impact environmental sustainability practices, IndustryDummies is a multi-level categorical variable represented by (Global Industry Classification Standard) GICS codes obtained from MSCI for the given year 2023. These codes categorize the firms into specific industry groups, providing a standardized classification system for analyzing and comparing firms within their respective sectors. By including the firm's industry as a control variable in this study, the researchers effectively account for and mitigate any potential confounding effects arising from variations in emission levels across industries following previous studies such as Ashbaugh & LaFond (2003). This enables the researchers to isolate the specific relationships and effects that are aimed to examine between the independent variables and GHG emissions disclosures accurately.

### 3.2.5. Omitted variables

This study does not include the environmental regulation variable in the research model, This variable may affect both the independent and dependent variables regarding the environmental obligations that companies have to comply with. The environmental regulation variable may reflect different levels of regulatory pressure and incentives for different companies, which are beyond the scope of this study. Therefore, the environmental regulation variable is excluded from the model and analysis. The last variable that is omitted from this research is firm culture. This variable may influence both the independent and dependent variables by shaping the corporate governance decision-making of the companies. The firm culture variable may represent different values and norms that guide the companies' actions and behaviors, which are not the main interest of this study. Therefore, the firm culture variable is excluded from the model and analysis.

## 3.3. Secondary research

Secondary research methods involve the collection of data from existing sources that the researcher uses to examine the variable of interest for the specific purpose of the study. Secondary research methods include firm documents, annual reports of firms, government publications, and scientific articles (Sekaran & Bougie, 2016).

### 3.3.1. Desk research

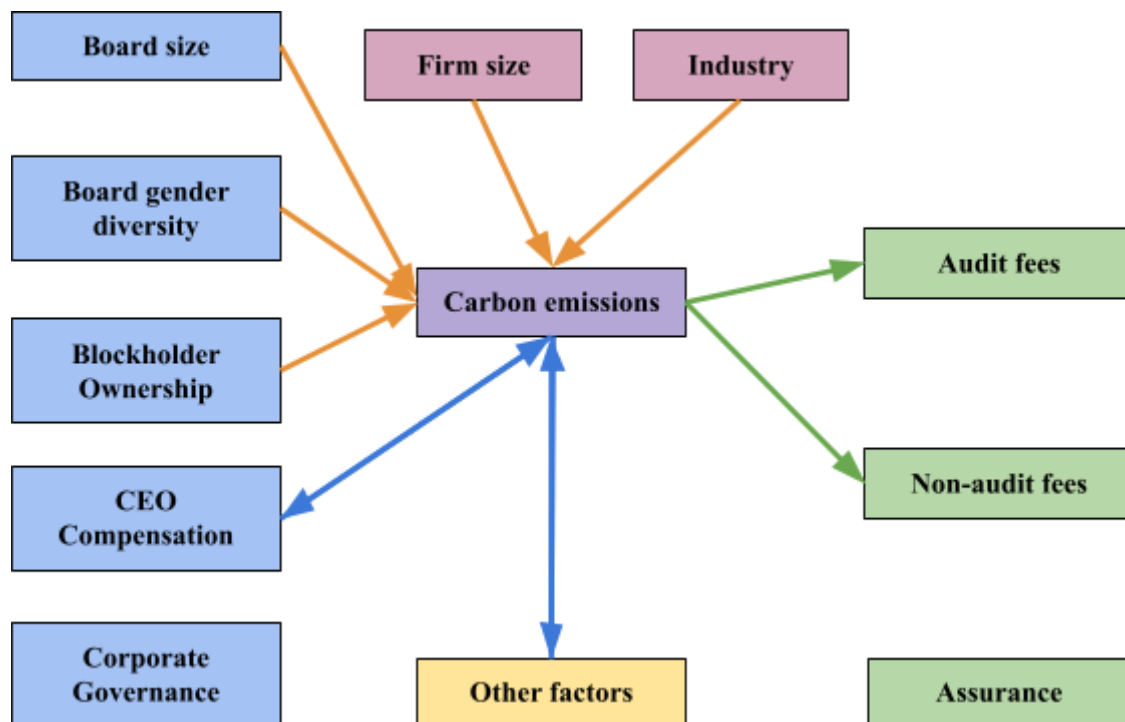
The information collected on the six variables that are expected to influence environmental performance will be used to answer the research question “What is the impact of corporate governance factors on greenhouse gas emissions disclosure in Swedish publicly listed firms?”. The

six variables are board size, board gender diversity, CEO compensation, blockholder ownership, and audit and non-audit fees.

### 3.4. Research model

Model 3.1. demonstrates the interconnections between carbon emissions disclosure and various factors derived from the theoretical framework outlined in the previous paragraph. The factors categorized under corporate governance are depicted as blue boxes, namely board size, board gender diversity, blockholder ownership, and CEO compensation. These factors are expected to influence the level and quality of carbon emissions disclosure by a corporation, hence they are indicated by orange arrows. Additionally, the assurance category encompasses audit fees and non-audit fees, which are expected to be determined by the level and quality of carbon emissions disclosure by a corporation. They are depicted as green boxes in the model, and green arrows are used to illustrate that assurance fees depend on the extent and reliability of carbon emissions disclosure. The other factors that may have a relationship with carbon emissions disclosure, including the control variable such as firm size and industry, in addition to other factors that are not included in our study due to data limitations or other reasons.

*Model 3.1. Research model*



Model 3.1, Own construction

To examine the relationship between corporate governance characteristics and GHG emissions disclosures, This study proposed the following regression model that was employed to test the hypothesis.

$$CD = \beta_0 + \beta_1 BSIZE + \beta_2 BGD + \beta_3 CEOCOMP + \beta_4 BLOCKO + \beta_5 AUDITF + \beta_6 NONAUDITF + \beta_7 FirmSize + \beta_8 Industry + \epsilon$$

The coefficients of these variables, represented by  $\beta_1$  to  $\beta_8$ , measure the association between each variable and carbon emission level while  $\beta_0$  represents the intercept. The error term is represented by  $\epsilon$ .

*Table 3.3 Variables definitions*

Variable	Description
<u>Dependent variable</u>	
- CD	- Carbon emissions disclosures
<u>Independent variable</u>	
- Board size (BSIZE)	- Total number of directors on the board
- Board gender diversity (BGD)	- Total number of female on the board
- CEO compensation (CEOCOMP)	- Total compensation paid to the CEO
- Blockholder ownership (BLOCKO)	- Total Block shareholders voting power
- Audit fees (AUDITF)	- Total reported amount paid in audit fees
- Non- audit fees (NONAUDITF)	- Total reported amount paid in non- audit fees
<u>Control Variable</u>	
- Firm size (FirmSize)	- Total sales disclosed by firms
- Industry (Industry)	- GICS codes by MSCI

Based on our theoretical framework, we expect the following signs for the coefficients:

- $\beta_1$ : Negative, as larger boards may have more diverse perspectives and greater legitimacy to address environmental issues.
- $\beta_2$ : Negative, as female directors may bring more stakeholder awareness and environmental expertise to board discussions.
- $\beta_3$ : Positive or negative, depending on whether CEO compensation is aligned with environmental goals or financial goals.
- $\beta_4$ : Negative, as blockholders may pressure the management to prioritize long-term environmental goals over short-term financial goals.
- $\beta_5$ : Positive, as higher audit fees may reflect higher audit quality and credibility of carbon emissions.
- $\beta_6$ : Negative, as higher non-audit fees may indicate lower auditor independence and lower quality of carbon emissions.

### 3.5. Limitation of the selected analysis model

One of the limitations of this study is that the regression models do not imply causal relationships between the corporate governance factors and carbon emissions disclosure, but rather associations or correlations. Therefore, the results should be interpreted with caution and do not necessarily reflect the true effects of the independent variables on the dependent variable. Establishing causality in this research context is challenging for several reasons. First, there may be endogeneity issues, meaning that some of the independent variables may be correlated with the error term, leading to biased and inconsistent estimates. For example, audit fees may be endogenous if it is determined by other factors that also affect carbon emissions disclosure, such as firm size, risks or industry type. Second, there may be reverse causality issues, meaning that the direction of causation may run from the dependent variable to the independent variable, rather than the other way around. For example, carbon emissions disclosure may affect board gender diversity if firms with higher disclosure attract more female directors or if female directors leave firms with lower disclosure.

### 3.6. Casuality

To address these challenges and establish causality in future research, some methods or techniques could be employed. One possible method is to conduct experiments, such as randomized controlled trials or natural experiments, where the independent variables are randomly assigned or exogenously changed by an external factor, such as a policy change or a natural disaster (Sekaran & Bougie, 2016). This would allow for isolating the causal effects of the independent variables on the dependent variable by eliminating confounding factors and reverse causality. Another possible method is to use instrumental variables, which are variables that are correlated with the independent variables but not with the error term or the dependent variable. Instrumental variables can help overcome endogeneity issues by providing a source of exogenous variation for the independent variables. For example, an instrumental variable for board size could be the average board size of other firms in the same industry or country. A third possible method is to use panel data analysis, which involves using data from multiple firms over specific industries. Panel data analysis can help control for omitted variable bias by accounting for unobserved heterogeneity across firms and specific industries. For example, fixed effects models can control for firm-specific and industry-specific factors that may affect both corporate governance factors and carbon emissions.

### 3.7. Reliability and validity

Reliability and validity of the research depend on the quality of information that the researcher has gathered throughout the research. The conclusions that are drawn from qualitative and quantitative

data have to be reliable (Sekaran & Bougie, 2016). Selection bias occurs when individuals or groups in a research study differ systematically from the population of interest, leading to a systematic error in the outcomes. Selection bias can threaten the validity of the findings in the selection of participants (Sekaran & Bougie, 2016). To avoid selection bias, the data collected from Nordic Compass is randomized by using information from firms with different size, industry, and place of residence in Sweden. The reliability and validity of outcomes are established by excluding the data from countries outside the target country Sweden.

### 3.8. Research ethics

Ethics in research refers to the code of conduct or expected societal norms of behavior while conducting research (Sekaran & Bougie, 2016). To ensure the confidentiality of the Swedish firms, the data is collected manually by a group of research analysts each year. They download the annual reports for the preceding year of firms in the sample and organize them by around 80 variables that cover the Environmental, Social, and Governance (ESG) topics. The ethical issues regarding the critical literature review are misrepresenting the work of other authors and plagiarism. Both are considered frauds. To eliminate this issue, the work of other authors used in this thesis is cited properly and the plagiarism guidelines of the university are followed.

## Chapter 4. Empirical results

This chapter presents the empirical results of the study, focusing on descriptive statistics, the Pearson correlation matrix, collinearity test, and multivariate tests. These analyses provide valuable insights into the relationships and interactions among the variables under investigation, shedding light on the dynamics of the research topic. The chapter begins with descriptive statistics, which offer a summary of the key variables, including measures of central tendency, dispersion, and distribution characteristics. This information provides a foundation for understanding the data and its variability. Subsequently, the Pearson correlation matrix examines the associations between the variables, allowing for an assessment of the strength and direction of these relationships. Moreover, the collinearity test explores the presence of multicollinearity, which is essential to ensure the validity and reliability of the regression models. Lastly, the multivariate tests provide a comprehensive analysis of the relationships between the dependent and independent variables, accounting for the influence of other control variables. Together, these empirical analyses contribute to a robust understanding of the research topic and provide valuable insights for drawing meaningful conclusions.

### 4.1.1. Descriptive statistics

In order to analyze the empirical impact of corporate governance characteristics on GHG emissions disclosures, regression analysis in SPSS was employed. Multivariate regression analysis is a statistical method that studies how a dependent variable relates to multiple independent variables at the same time. This method helps us understand how different independent variables affect the dependent variable together or separately. The main goal of multivariate regression analysis is to estimate the regression coefficients for each independent variable, measure their individual effects while controlling for other variables, and evaluate how well the model fits the data. This technique allows us to examine complex relationships and discover how multiple factors explain the variation in the dependent variable. The researchers follow previous studies (Kannan et al., 2021) and check the validity of our regression analyses by testing if the assumptions required for multivariate regression, such as normality, no evidence of multicollinearity are issued.

Table 4.1 presents the descriptive statistics for the variables in this study. The variables included in the table are explained in table 3.3.

*Table 4.1 Descriptive statistics of the variables 2014-2021*

Variable	Mean	Median	Minimum	Maximum	Std.Dev.
CD	6.66T	6.65T	0,13T	36,77T	5,45T
BSIZE	2.14	2.12	0	17	0,30
BGD	0.97	0.89	0	10	0,42
CEOCOMP	10.18	9.13	0	38,44	0.72
BLOCKO	2.26%	2.44%	0%	6.79%	2.57%
AUDITF	10,47	10,30	0	38,76	13.37
NONAUDITF	2,00	1.89	0	38.51	1,54
FirmSize	6.84	6.87	2.74	10.62	1.54
Industry	34,94	35	10	60	12,90

\*Dependent Variable: CD, "T" values in trillion and N = 700 firm-years observations

Carbon emission disclosures (CD) have a mean of 6.66T ton and a median of 6.65T ton, with a range from 0.13T to 36.77T ton and a standard deviation of 5.45T ton. This suggests a relatively symmetrical distribution with equal observations above and below the mean, aligning with the variable measurement section. Board size (BSIZE) has a mean of 2.14 executives and a median of 2.12 executives, indicating consistent board size. The range spans from 0 to 17 executives, with a standard deviation of 0.30. Board gender diversity (BGD) has a mean of 0.97 and a median of 0.89 females, ranging from 0 to 10 females, displaying a wide distribution. The standard deviation for BGD is 0.42. CEO compensation (CEOCOMP) has a mean of 10.18 trillion SEK and a median of 9.13 trillion SEK, with a range from 0 to 38.44 trillion SEK and a standard deviation of 0.72 trillion SEK. Blockholder ownership (BLOCKO) has a mean of 2.26% vote and a median of 2.44% vote, ranging from 0% to 6.79% vote, with a standard deviation of 2.57%. Audit fees (AUDITF) have a mean of 10.47 trillion SEK and a median of 10.30 trillion SEK, ranging from 0 to 38.76 trillion SEK, with a standard deviation of 13.37 trillion SEK. Non-audit fees (NONAUDITF) have a mean of 2.00 trillion SEK and a lower median of 1.89 trillion SEK, ranging from 0 to 38.51 trillion SEK, with a standard deviation of 1.54 trillion SEK. Control variables include Firm Size, with an average of approximately 6.84 trillion SEK, indicating moderate variability in firm sizes. Industry classification averages at 34.94, reflecting a range of industries, with the minimum value of 10 and the maximum value of 60. The standard deviation of 12.90 indicates significant variability in industry classifications, representing diversity across sectors.

The descriptive statistics reveal notable variations in the key variables. Carbon emission disclosures (CD) and independent variables exhibit substantial variability. These findings highlight the diverse nature of the variables among the observed Swedish publicly listed firms. However, further analysis is needed to test hypotheses and answer the research question. The subsequent chapters will present regression analysis results and discuss the findings in detail.

#### 4.1.2. Pearson Correlation Matrix

Table 4.2. shows the Pearson correlation matrix for the variables. The highest correlations among corporate governance variables are observed between the following pairs: AUDITF and NONAUDITF (0.58), BGD and BSIZE (0.39), and AUDITF and CEOCOMP (0.57). The correlation analysis provides a preliminary insight into the relationships between the variables. However, to test the hypotheses and examine the impact of corporate governance factors on GHG emissions, a multivariate regression analysis is conducted in the next section.

Table 4.2. Pearson correlation matrix (panel 1- 2014/2021)

	Variable	1	2	3	4	5	6	7	8	9
1	CD	1								
2	BSIZE	0.02 (0,38)	1							
3	BGD	-0.04** (2,23)	0,39*** (7,09)	1						
4	CEOCOMP	0,15** (0,003)	0,28*** (1,09)	0,28*** (1,30)	1					
5	BLOCKO	0,06 (0,13)	-0,06 (0,13)	-0,09* (0,06)	0,19*** (0,00)	1				
6	AUDITF	0,20*** (0,00)	0,25*** (1,88)	0,19*** (0,00)	0,57*** (3,16)	0,13* (0,01)	1			
7	NONAUDITF	0,11* (0,03)	0,22*** (0,00)	0,15** (0,00)	0,34*** (2,54)	0,04 (0,25)	0,58*** (1,72)	1		
8	FirmSize	-0,07 (0,09)	0,03 (0,29)	0,11* (0,02)	0,04 (0,22)	0,04 (0,23)	0,03 (0,29)	-0,05 (0,18)	1	
9	Industry	0.08 (0,07)	-0,06 (0,14)	0,01 (0,40)	0,01 (0,43)	-0,04 (0,25)	0,03 (0,32)	0,04 (0,23)	0,02 (0,35)	1

Notes: Sig. (2-tailed) are reported in parentheses, \*p < 10%; \*\*p < 5% and \*\*\*p < 1%

### 4.1.3. Collinearity test

The researchers centered the variables of environmental governance and environmental performance to avoid collinearity issues (Aiken and West, 1991). The table 4.3. shows that all variables have tolerances above 0.1 and VIF values below 5, indicating no significant multicollinearity among the independent variables in the all regression models. This means that the variables are independent and the regression results are reliable.

*Table 4.3. Collinearity test*

Variable	Tolerance	VIF
CD		
BSIZE	0,78	1,27
BGD	0,79	1,26
CEOCOMP	0,62	1,62
BLOCKO	0,93	1,08
AUDITF	0,51	1,98
NONAUDITF	0,65	1,53
FirmSize	0,97	1,02
Industry	0,98	1,01

### 4.2. Multivariate test

This section presents the results of the multivariate test that examines the impact of corporate governance factors (board size, board gender diversity, CEO compensation, blockholder ownership, and audit and non-audit fees) on GHG emissions disclosure by Swedish listed firms.

Table 4.4 presents the regression results for the main model (Model 7) in Panel 1, covering the period from 2014 to 2021, in our study. This model includes all the independent variables along with the control variables. In contrast, the univariate analysis (Model 8) examines the relationship between each individual independent variable and the dependent variable without considering the control variables. Furthermore, Models 1 to 6 represent simple linear regression models between each independent variable and the dependent variable for the same range of years, incorporating the control variables. These models allow us to analyze the isolated impact of each independent variable on the dependent variable while controlling for other factors.

Table 4.4. Regression models

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
BSIZE	0.01 (0.18)	-	-	-	-	-	-0,01 (-0,09)	-0.03 (-0.72)
BGD	-	-0.03 (-0.50)	-	-	-	-	-0,08* (-1,34)	-0.10** (-2.07)
CEOCOMP	-	-	0.17*** (3.49)	-	-	-	0,07** (2,06)	0.14** (2.62)
BLOCKO	-	-	-	0.09* (1.78)	-	-	0,02 (0,41)	0.02 (0.43)
AUDITF	-	-	-	-	0.21*** (4.29)	-	0,19** (2,41)	0.15** (2.42)
NONAUDITF	-	-	-	-	-	-0.12** (-2.13)	-0,02** (-2,28)	-0.01 (-0.17)
Constant	CD	CD	CD	CD	CD	CD	CD	CD
FirmSize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
R squared	0.12	0.14	0.43	0.12	0.56	0.13	0.36	0.46
Adjusted R	0.11	0.12	0.36	0.11	0.49	0.10	0.34	0.45
Durbin Watson	1.63	1.64	1.64	1.68	1.63	1.78	1,79	1.68
Sig.	***	***	***	***	***	***	***	***
N	700	700	700	700	700	700	700	700

Notes: t-statistics are reported in parentheses, \*p < 10%; \*\*p < 5% and \*\*\*p < 1%

Table 4.5 introduces regression models for Panel 2, focusing on different time periods: pre-regulation (2014-2016), post-regulation (2017-2019), and pandemic effects (2020-2021). Model 9 represents the regression analysis for the pre-regulation period, Model 10 for the post-regulation period, and Model 11 for the pandemic effects period. In Model 9, we examine the relationships between the independent variables and the dependent variable specifically for the years 2014 to 2016, while considering the control variables. Similarly, Model 10 focuses on the post-regulation period, spanning from 2017 to 2019. It enables us to investigate the relationship between the independent variables and the dependent variable in the context of the regulatory changes, while accounting for the control variables. This analysis helps us understand how the relationships may

have evolved after the implementation of the regulations. Lastly, Model 11 explores the effects of the COVID-19 pandemic on the relationships between the independent variables and the dependent variable for the years 2020 and 2021. By examining this specific time period, we can capture the potential disruptions or changes in the relationships due to the unprecedented circumstances brought about by the pandemic. The control variables are also included in this model to account for their potential influence. By analyzing these regression models for different time periods, we gain insights into the variations and dynamics of the relationships between the independent variables and the dependent variable over time. This temporal analysis provides a comprehensive understanding of how the relationships may have been influenced by regulatory changes and external shocks.

*Table 4.5. Regression models*

Variable	Model 9	Model 10	Model 11
BSIZE	0.23** (2.84)	-0.63 (-0.72)	0.08 (0.88)
BGD	0.00 (0.004)	-0.17* (-2.03)	-0.16* (-1.80)
CEOCOMP	0.22** (2.51)	0.07 (0.70)	0.01 (0.07)
BLOCKO	-0.22 (-0.30)	0.03 (0.46)	0.05 (0.62)
AUDITF	0.003 (0.03)	0.34** (3.01)	0.002 (0.02)
NONAUDITF	0.17 (1.38)	-0.06** (-1.57)	0.06 (0.71)
Constant	CD	CD	CD
FirmSize	Yes	Yes	Yes
R squared	0.23	0.11	0.29
Adjusted R	0.19	0.09	0.28
Sig.	***	***	***
Durbin Watson	1.37	1.85	1.78
N	164	313	223

Notes: t-statistics are reported in parentheses, \*p < 10%; \*\*p < 5% and \*\*\*p < 1%

#### 4.2.1. Board size and carbon emissions

The correlation between board size and carbon emissions indicates a weak positive correlation coefficient of (0.02) is reported for the association between BSIZE and CD. However, this correlation coefficient is not statistically significant ( $p > 0.10$ ), suggesting that there is no robust evidence of a significant relationship between board size and carbon emissions. This finding implies that variations in board size are not strongly related to differences in carbon emissions among the sampled firms. The lack of a significant relationship between board size and carbon emissions can be interpreted in different ways (Rahman and Post, 2012). One possible explanation is that other factors, such as industry characteristics or firm-specific strategies, may have a stronger influence on carbon emissions than board size alone. It is also important to consider that board size is just one aspect of board composition and governance, and other dimensions such as board diversity or expertise may have a more substantial impact on environmental performance (Walls, Phan, and Berrone, 2011).

BSIZE (board size) has been examined across multiple regression models (Models 1, 8, 9, 10, and 11) to understand its relationship with carbon emissions (CD). Analyzing the regression models, we observe the coefficients and associated t-statistics for BSIZE. In model 1, BSIZE had a positive but not significant effect on CD (0.01), which means that after controlling for other variables, an increase in board size does not lead to an increase in corporate disclosure. The coefficient of BSIZE was not significant in any of the other models either, except for model 9, which captured the pre regulations period (2014-2016). In model 9, BSIZE had a positive and significant effect on CD at the 5% level (0.23), which means that after controlling for other variables, an increase in board size leads to an increase in corporate disclosure in the first period. Taken together, the findings indicate that the relationship between board size (BSIZE) and carbon emissions (CD) is not consistently significant across different periods or models. While there is some evidence of a positive association in the pre-regulation period, this relationship weakens or becomes statistically insignificant in the post-regulation and pandemic periods. Therefore, the influence of board size on carbon emissions may be context-specific or influenced by other factors not captured in the models.

This evidence is in line with a growing body of related studies (Depoers, 2014; Webb, 2004; Brown et al., 2006). This means that the researchers can be more sure that board size doesn't influence carbon emissions. Therefore, H1 is rejected.

#### 4.2.2. Board gender diversity and carbon emissions

The correlation between Board Gender Diversity and Carbon Emissions (-0,04) indicates negative and significant correlation at 5% level, this result extends the findings of Martínez et al. (2022) and Walls et al. (2011). The negative correlation suggests that as board gender diversity increases, carbon emissions tend to decrease (Al-Shaer, 2022). This implies that firms with more women on their boards may be more likely to adopt environmentally friendly practices or policies, leading to lower carbon emissions. This is because female executives tend to pay more attention to ethical problems, including environmental issues, and actively take solutions. Additionally, women directors tend to be more conservative in strategy making and tend to abide by environmental regulations to avoid potential policy and market risks.

Examining the regression models, In models 2, 7 and 8, BGD had a negative and significant effect on CD at the 10%, 5% and 5% levels, respectively, which means that after controlling for other variables, an increase in board gender diversity leads to a decrease in corporate disclosure. The coefficient of BGD ranged from -0.03 to -0.10, depending on the model specification. However, in models 9, 10 and 11, which captured the time differences by dividing the sample into three periods (2014-2016, 2017-2019 and 2020-2021), BGD was not significant in any of the models, which means that the effect of board gender diversity on corporate disclosure varies over time and is not consistent across different periods. The results of this analysis suggest that board gender diversity has a negative impact on corporate disclosure in general, but this impact is not stable over time and may depend on other factors. The coefficient for board gender diversity shows how board gender diversity affects carbon emissions (Nuber & Velte, 2021). These findings suggest that higher board gender diversity is associated with lower carbon emissions, indicating a potential link between gender diversity and environmentally sustainable practices within firms and confirm H2. Our findings support previous research on the negative relationship of board gender diversity and corporate carbon emissions (Nuber & Velte, 2021; Martínez et al., 2022).

#### 4.2.3. CEO compensation and carbon emissions

The correlation between CEO compensation and carbon emissions (0.15,  $p < 0.01$ ) indicates a strong positive significant correlation at the 1% significance level (Table 4.3). This implies that as CEO compensation increases, carbon emissions tend to increase as well. One possible explanation for this positive association is that higher CEO compensation may incentivize executives to pursue growth strategies that prioritize financial performance over environmental sustainability. CEOs may

focus on maximizing short-term profits, which can result in higher carbon emissions through increased production or resource consumption. This aligns with the agency theory perspective, which suggests that executives driven by financial incentives may prioritize shareholder value maximization at the expense of environmental concerns ( Jensen & Meckling, 1976). However, further research is needed to explore the underlying mechanisms and potential contextual factors that contribute to the observed relationship between CEO compensation and carbon emissions.

Look at tables 4.4 and 4.5. In model 3, CEOCOMP had a positive and significant effect on CD at the 1% level (0.17), which means that after controlling for other variables, an increase in CEO compensation leads to an increase in corporate disclosure. The coefficient of CEOCOMP was also significant in models 7 and 8 at the 5% levels, with values ranging from 0.07 to 0.17, depending on the model specification. However, in models 9, 10 and 11, which captured the time differences by dividing the sample into three periods (2014-2016, 2017-2019 and 2020-2021), CEOCOMP was not significant in any of the models, which means that the effect of CEO compensation on corporate disclosure varies over time and is not consistent across different periods. The results of this analysis suggest that CEO compensation has a positive impact on corporate disclosure in general, but this impact is not stable over time and may depend on other factors. This means that CEO compensation influences carbon emissions disclosures and H3 accepted. This evidence is in line with a growing body of related studies (Berrone and Gomez-Mejia, 2009; Al-Shaer, 2022).

#### 4.2.4. Blockholder ownership and carbon emissions

The correlation between blockholder ownership and Carbon emissions (0.06) indicates a positive but not significant association with Carbon emissions. The positive correlation suggests that blockholders, who are large shareholders with more than 5% of the shares, do not have a strong incentive or influence to reduce the carbon emissions of firms, or that their impact is offset by other factors. This result may contradict the expectation that blockholders can enhance the environmental performance or disclosure of firms by providing effective monitoring and governance mechanisms (Kassinis and Vafeas, 2006; Berrone and Gomez-Mejia, 2009; Walls et al., 2012).

In model 4, BLOCKO had a positive and significant effect on CD at the 10% level (0.09), which means that after controlling for other variables, an increase in block ownership leads to an increase in corporate disclosure. The coefficient of BLOCKO was positive and not significant in all other models, except for model 9, BLOCKO had a negative but not significant effect on CD (-0.22), which means that after controlling for other variables, an increase in block ownership leads to a

decrease in corporate disclosure in the pre regulation period. The results of this analysis suggest that block ownership has no significant impact on corporate disclosure in general, but this impact may vary over time and depend on other factors. It is essential to further investigate the factors and contextual dynamics that contributed to this divergence in order to gain a comprehensive understanding of the relationship between blockholder ownership and carbon emissions. This evidence corroborates the work of (Rahman and Post, 2011; Cucari, 2019). This means that blockholder ownership doesn't influence carbon emissions disclosures and H4 is rejected.

#### 4.2.5. Audit services & fees and carbon emissions

The correlation between audit fees and Carbon emissions (0.20) indicates a positive significant correlation at the 1% significance level. The positive correlation indicates that as audit fees increase, carbon emissions tend to increase. Higher audit fees might incentivize firms to adopt more robust reporting and monitoring systems, including environmental impact assessments (Rabarison et al., 2020). Auditors charge higher fees to firms with greater environmental risk exposure and to clients headquartered in regions with a higher likelihood of carbon emissions (Li & Simunic, 2018; Truong et al., 2020b).

A series of regression models were estimated to test the effect of AUDITF on CD while controlling for other variables. The dependent variable was CD and the independent variables were AUDITF and other control variables. Eight models were estimated with different combinations of variables and specifications. In model 5, AUDITF had a positive and significant effect on CD at the 1% level (0.21), which means that after controlling for other variables, an increase in audit fees leads to an increase in corporate disclosure. The coefficient of AUDITF was also significant in models 7 and 8 at the 5% level, with values ranging from 0.15 to 0.19, depending on the model specification. However, in models 9, 10 and 11, which captured the time differences by dividing the sample into three periods (2014-2016, 2017-2019 and 2020-2021), AUDITF was not significant in any of the models, which means that the effect of audit fees on corporate disclosure varies over time and is not consistent across different periods. The results of this analysis suggest that audit fees have a positive impact on corporate disclosure in general, but this impact is not stable over time and may depend on other factors. The significance levels show how confident the relationship is and not due to chance. Our results contradict the findings of Kannan et al., (2021) as articulated the audit fees and its association with GHG emissions and declared "a negative and significant link between fees and regulated industries, suggesting "that auditors assess a lower CO<sub>2</sub> emission business risk in the presence of regulations, constraints, potentially stronger monitoring, and control mechanisms in

regulated industries." This means that carbon emissions influence audit fees, as was expected, H5 was consistent. This evidence is in line with a growing body of related studies (Kaplan & Ramanna, 2021; Chang et al., 2021).

#### 4.2.6. Non-audit services & fees and carbon emissions

The correlation between non-Audit Fees and Carbon Emissions (0.11) indicates a positive and not significant correlation with Carbon Emissions. This result may suggest that non-audit fees are not related to the environmental performance or disclosure of firms, or that other factors may moderate or mediate this relationship (Trotman & Trotman 2015).

A series of regression models were estimated to test the effect of NONAUDITF on CD while controlling for other variables. The dependent variable was CD and the independent variables were NONAUDITF and other control variables. six models were estimated with different combinations of variables and specifications. In model 6, NONAUDITF had a negative and significant effect on CD at the 5% level (-0.12), which means that after controlling for other variables, an increase in non-audit fees leads to a decrease in corporate disclosure. The coefficient of NONAUDITF was also significant in model 7 at the 5% level (-0.02), but with a smaller value, depending on the model specification. However, in models 9, 10 and 11, which captured the time differences by dividing the sample into three periods, NONAUDITF was not significant in any of the models, which means that the effect of non-audit fees on corporate disclosure varies over time and is not consistent across different periods. The evidence is in line with work of (Kaplan & Ramanna, 2021; Chang et al., 2021). This means that carbon emissions influence non-audit fees and the evidence gathered in this research strongly supports the accepted H6.

#### 4.3. Robustness tests

This section aims to explore the relationships between the independent variables in the study and provide empirical evidence of their associations and their interrelationships. Understanding these relationships is crucial for gaining insights into corporate governance mechanisms and their implications for firms. In the analysis, correlation coefficients are utilized to examine the pairwise associations between the variables. The significance levels of these correlations provide insights into the strength and statistical significance of the relationships. Additionally, relevant studies are referenced to support and contextualize the findings.

#### 4.3.1. CEO Compensation and Board size

The correlation between CEO Compensation and board size (0.28) indicates a positive significant correlation at the 1% significance level. The positive correlation indicates that CEO compensation increases in larger boards. This suggests that larger firms may have the resources to offer higher CEO compensation, and as a result, they may have larger boards to accommodate their organizational structure and decision-making processes. This finding is broadly in line with the arguments and evidence of related studies (Al-Shaer, 2022; De Villiers et al., 2011).

#### 4.3.2. CEO Compensation and Board gender diversity

The correlation between CEO compensation and board gender diversity (0.28) indicates a strong positive significant correlation at the 1%. This could imply that more diverse boards are more likely to monitor and restrain the CEO's pay, and to align the CEO's interests with those of the stakeholders. This evidence corroborates the work of (Al-Shaer, 2022; Webb, 2004)

#### 4.3.3. CEO compensation and blockholder ownership

The correlation between CEO compensation and blockholder ownership (0.19) at the 1% significance level indicates a positive and strong relationship. This could imply that blockholders, who are large shareholders with more than 5% of the shares, have a positive influence on CEO pay by aligning the interests of managers and shareholders and providing effective monitoring and governance mechanisms. (Shleifer & Vishny, 1986).

#### 4.3.4. CEO Compensation and Audit fees

The correlation between audit fees and CEO compensation (0.57) indicates a strong positive significant correlation at the 1% significance level. This result may suggest the existence of agency problems and conflicts of interest between managers and auditors, as higher audit fees may indicate higher audit risk and complexity associated with firms with high levels of managerial pay, which may create incentives for earnings management and manipulation (Gul et al., 2009).

#### 4.3.5. CEO Compensation and Non audit fees

The correlation between non-audit fees and CEO compensation (0.34) indicates a strong positive significant correlation at the 1% significance level. This result may reflect the demand for non-audit services by firms with complex and risky operations that require high levels of managerial skills and incentives. Alternatively, this result may suggest the existence of agency problems and conflicts of interest between managers and auditors, as higher non-audit fees may impair auditor independence and reduce the quality of financial reporting and monitoring (Ashbaugh et al., 2003).

#### 4.3.6. Board gender diversity and Board size

The correlation between board gender diversity and board size (0,39) at the 1% significance level, indicates a positive and strong significance level, indicating that firms with larger boards tend to have more female directors. This result is consistent with previous studies that suggest that board size is a determinant of board gender diversity (Adams and Ferreira, 2009).

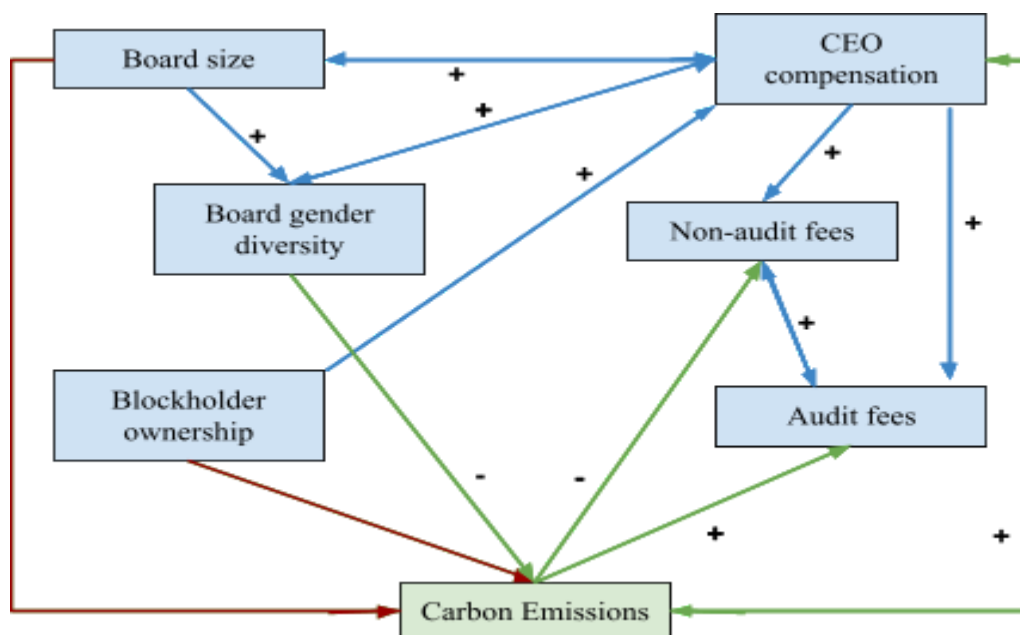
#### 4.4. The research Variables Interactions

The research variables interaction model explores the link between carbon emissions (green arrows for significant relation and red for insignificant relation) and all six independent variables (blue arrows). The research indicates that not all independent variables have a direct influence on carbon emissions, and there are additional interaction effects among the variables (Model 4.1.):

1. The CEO compensation exhibits relationships with board size, board gender diversity, blockholder ownership, audit fees, and non-audit fees.
2. Board size is linked to board gender diversity.
3. Audit fees and non-audit fees are not only influenced by carbon emissions but also exhibit interaction relations with each other.

By considering these interactions, the research aims to provide a comprehensive understanding of the complex interplay among the variables and their collective impact on carbon emissions.

*Model 4.1. The research Variables Interactions*



## Chapter 5. Conclusion

## 5.1. The Impact of Corporate Governance Factors on GHG Emissions: Insights and Implications for Sustainable Development

By shedding light on the importance of corporate governance factors in tackling climate change and promoting sustainable development, this study contributes to the broader literature on corporate governance and sustainability. This study contributes to the understanding of the relation between corporate governance factors and greenhouse gas emissions in Swedish listed companies. Recalling the research question "What is the impact of corporate governance factors on greenhouse gas emissions in Swedish publicly listed firms?" Thus, the research findings successfully indicate that across all examined corporate governance factors - Board size, CEO compensation, board gender diversity, blockholder ownership, audit fees and audit fees - there is a consistent significant association with GHG emissions. These findings- Table 5.1. - not only support the theories of agency, stakeholder, and legitimacy, but also emphasize the importance of integrating sustainable practices into corporate governance frameworks. By adopting measures that align the interests of management with shareholders, promote board diversity, and invest in external oversight, companies can effectively mitigate their environmental impact and contribute to sustainable development.

*Table 5.1. Summary of the findings*

	<b>Hypothesis</b>	<b>Findings</b>	<b>Supported studies</b>
H1	Board size has a negative association with carbon emissions of firms.	Insignificant Rejected	- Depoers (2014) - Webb (2004)
H2	Board gender diversity has a negative association with carbon emissions of firms.	Negative Accepted	- Nuber & Velte (2021) - Martínez et al. (2022)
H3	CEO compensation has a positive association with carbon emissions of firms.	Positive Accepted	- Berrone & Gomez (2009) - Al-Shaer (2022)
H4	Blockholder ownership has a negative association with carbon emissions of firms.	Insignificant Rejected	- Rahman & Post (2011) - Cucari (2019)
H5	Carbon emissions have a positive association with the audit fees charged to the firms.	Positive Accepted	- Kaplan & Ramanna (2021) - Chang et al. (2021)
H6	Carbon emissions have a negative association with the non-audit fees charged to the firms.	Negative Accepted	- Trotman & Trotman (2015) - Chang et al. (2021)

CEOs with higher compensation prioritize long-term value creation and sustainable practices, aligning with financial performance and shareholder value, which reduces agency costs. They are motivated to enhance the firm's reputation, minimize regulatory risks, and meet stakeholder

demands for environmental responsibility. Higher CEO compensation attracts top talent with expertise in sustainability, enabling the development of initiatives that reduce GHG emissions, improve resource efficiency, and drive sustainable operations.

More women on the board is associated significantly with carbon emissions, indicating that increased gender diversity leads to better consideration of stakeholder interests and improved environmental performance. Diverse perspectives and experiences among board members foster thorough evaluations of environmental risks, innovative thinking, and the adoption of sustainable practices to mitigate carbon emissions. Hence, firms with higher blockholder ownership exhibit better environmental performance and lower greenhouse gas (GHG) emissions. Blockholders, as influential shareholders, act as effective monitors of management, ensuring environmental performance aligns with shareholders' interests. They have the power to influence corporate strategies, policies, and resource allocation, encouraging environmentally responsible practices and GHG emission mitigation. This finding aligns with stakeholder theory, emphasizing the importance of engaging and satisfying diverse stakeholder interests.

Stakeholders may expect firms to invest in external auditing to ensure credibility and accountability in assessing their GHG emissions. The negative association between non-audit fees and GHG emissions suggests that firms consider the balance between internal mechanisms and external verification to signal their commitment to transparency, and maintain their environmental legitimacy.

## 5.2. Limitation of the presented research and suggestions for future investigations

The study's implications are significant for regulators, investors, and firms. Regulators can utilize these findings to design and implement effective governance regulations that encourage sustainability practices and reduce greenhouse gas emissions. Investors can consider these factors when making investment decisions, identifying companies with strong governance practices that align with their sustainability goals. For firms, the study suggests that implementing appropriate compensation structures, promoting board diversity, and investing in external oversight and auditing can lead to improved environmental performance and align with societal expectations.

While this study has provided valuable insights, there are opportunities for future research. Further investigations can explore the relationship between corporate governance factors and greenhouse gas emissions. Hence, considering additional contextual factors, diverse contexts and industries,

future research can enhance the effectiveness of corporate governance practices in reducing GHG emissions and promoting sustainability would be beneficial. Future research may also consider the influence of regulatory environments and stakeholder pressure on corporate governance practices and sustainability performance.

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## Appendices

### Appendix 1: Abbreviations

<b>GHG</b>	Greenhouse Gas
<b>CSR</b>	Corporate social responsibility
<b>ESG</b>	Environmental, social and governance
<b>SDG</b>	Sustainable Development Goals
<b>NAS</b>	Non-audit fees
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>OECD</b>	Organization for Economic Cooperation and Development
<b>CDP</b>	Carbon Disclosure Project
<b>GRI</b>	Global Reporting Initiative
<b>MSCI</b>	Morgan Stanley Capital International
<b>IAASB</b>	International Auditing and Assurance Standards Board
<b>IFRS</b>	International Financial Reporting Standards
<b>ISAE</b>	International Standard on Assurance Engagements
<b>SEC</b>	Securities and Exchange Commission
<b>SME</b>	Small and Medium-sized Enterprises.
<b>ICB</b>	Industry that best corresponds with their business
<b>SEK</b>	Swedish Krona
<b>VIF</b>	Variance Inflation Factor
<b>GICS</b>	Global Industry Classification Standard

### Appendix 2: Measurement of variables

This table includes the measurement of variables, as well as supporting literature and data sources.

Variables	Measurement/Supporting literature	Data sources
Carbon emissions	The natural logarithm of carbon emissions in metric tonnes is used to measure the rate of Scope 1 and Scope 2 emissions (Ben Amar et al., 2017; Haque, 2017)	Nordic compass
Board size	Board Size including employee representatives (Yermack, 1996)	Nordic compass
Board Gender Diversity	The total number of female directors on the board in a given year (Adams & Ferreira, 2009)	Nordic compass
CEO compensation	CEO compensation as total pay, excluding severance payments and pension (Singh and Davidson, 2003)	Nordic compass
Blockholder ownership	Blockholder ownership as a percentage of total shares outstanding (Shleifer & Vishny, 1997; Masulis & Reza, 2015)	Nordic compass
Audit fees	Total amount that has been paid in audit fees (in millions of SEK) during the last fiscal year. (Truong et al., 2020; Maso et al., 2020)	Nordic compass
Non audit fees	Total amount that has been paid in non-audit fees (in millions of SEK) to auditors during the last fiscal year, including consulting fees.(DeFond & Zhang, 2014)	Nordic compass
Firm size	Total sales as a proxy to capture the firm size (Berrone and Gomez Mejia, 2009)	Nordic compass
Industry	A four-tiered, hierarchical industry classification system. (Ashbaugh & LaFond, 2003)	MCSI

### Appendix 3: Overview of Corporate Governance literature

Level	Study	Theory	Sample	Independent variables	Dependent variable	Relation
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CSR	Dhaliwal et al. (2012)	Stakeholder theory	113,345 international firm between 1994–2007	CSR disclosure	Analyst forecast accuracy	+
Materiality	Khan & Serafeim (2016)	Stakeholder theory & Agency theory	2,307 international firm between 1992-2012	Firm size, leverage, industry, and profitability	(ROA) (ROE), and Tobin's Q.	+
Ownership Management	Masulis & Reza (2015)	Agency theory	2,421 firm in the Fortune 500 universe, between 1996-2006	CEO power, board independence, and institutional ownership.	Level of corporate philanthropy	-/+
ESG	Aouadi & Marsat (2018)	Stakeholder theory	4000 firms from 58 countries during 2002–2011	ESG controversies	firm value	-/+0
Audit	Koh & Tong (2013)	Agency theory	1,281 firm in S&P 500 between 1978 - 1980	CSR controversies	Audit fees	-/+
Audit	Saeed & Gull (2022)	Agency theory & Stakeholder theory	42,231 international firm between 2002–2016	CSR performance	Audit fees	-0/+
Audit	Maso et al. (2020)	Stakeholder theory	28,661 french firm between 2002-2017	CSR assurance & financial audit	Auditors' assessment of going-concern risk	-/+
CSR	Dal Maso (2016)	PSM approach	2,725 firm 2003-2009	GHG Disclosure	forecast error	+/-
Board	Zubeltzu-Jaka et al. (2020)	Stakeholder theory	80,000 international firm between 1997 - 2018	-Board size -board independence -Firm size	Corporate social performance	-/+

Board	Kassinis (2002)	Stakeholder theory	362 US firm between 1991 - 1995	Board independence Board size Board compensation	Environmental litigation	+/-
CSR	Depoers (2014)	Stakeholder theory	350 French firm in SBF 120 index between 2007- 2009.	Corporate reports (CR) Carbon. Disclosure Project (CDP).	(GHG) disclosure	+
Board, Management	Coffey & Wang (1998)	Stakeholder theory	98 U.S firm, Fortune 500 between 1991- 1993.	Board diversity, Board compensation & CEO duality	Corporate social performance (CSP)	+/-0
Board, Management	Webb (2004)	Agency theory	394 U.S firm between 1999 - 2001	Board size Board independence CEO duality Environmental committee Board members	The level of firm's CSR	+
Board	Ibrahim et al. (2003)	Stakeholder theory	307 directors from S&P's Register of Corporations, Directors between 1999 - 2000	Dimensions of CSR	Board independence	+/-0
Board, Management	Rahman & Post (2011)	Agency theory	89 US firms between 2006-2007	Board independence Board size CEO duality Ownership concentration	Level of ECSR performance	-/-0/+
Board, Management	Hussain (2018)	Stakeholder theory & Agency theory	100 US firm between 2007 - 2011.	CEO incentives Board size Board independence	CSR performance	+

Managem ent	McGuire et al. (2003)	Stakeholde r theory	374 U.S. firms between 1991 - 1994	CEO incentives & CEO ownership & CEO compensation	CSR performance	- \0
Audit	Kinney (2004)	Agency theory	979 firms from NYSE, AMEX, or NASDAQ between 1995 - 2000	Auditor independence & Provision of non-audit services & non-audit fees	Financial restatements	+
Board	Brown, Helland, and Smith (2006)	Stakeholde r theory Agency theory	207 firms from the Fortune 500 list between 1998-1999.	Firm size, profitability, Board size, composition & Ownership concentration	Corporate philanthropic practices	+ \0
Board, managem ent	Berrone & Gomez- Mejia (2009)	integrated Agency- Institutiona l perspective	469 Fortune 500 firms between 1997-2003	Executive compensation & board diversity,	Environmental performance	+ \0
Managem ent	Luo ( 2012)	Agency theory & Legitimacy theory	CDP 500 global firms in FTSE year 2009	Corporate Incentives	level of (GHG) disclosure.	+
Board, Managem ent	Matsumura (2014)	Agency theory & Natural resource based view	1,015 firms from CDP by S&P 500 between 2006 - 2008	Carbon Emissions Carbon Disclosures	Firm Value	-
Board	Luoma & Goodstein (1999)	Institutiona l & Stakeholde r theory	224 largest U.S. firms by revenue in 1994	Stakeholder pressure Institutional context	Board composition, Board structure & firm size	+ \0
Board, Managem ent	Walls, Phan & Berrone (2011)	‘just-the facts’ approach	313 US firm from the S&P 500	Environmental strategy, Ownership,	Stakeholder pressure &	+ \- \0

			between 1997–2005	BOD, CEO and management characteristics	environmental disclosure & ROA	
Board, Management	Walls (2012)	Natural resource–based view	83 U.S. firms 1991 - 2005	board independence, CEO duality & board size.	Environmental performance	+
ESG	Chatterji (2010)	Align with Legitimacy theory	598 firms with criteria (S&P SmallCap 600 or S&P MidCap 400 Index) between 1999-2000	ESG issues	ESG ratings	+
Board	Adams & Ferreira (2009)	Agency theory	1,939 EU firms between 2003-2005	Women on boards	Corporate governance factors & firm performance	-
Audit	Ashbaugh & LaFond (2003)	Resource dependence theory & Agency theory	3,170 firm from the Compustat database between 2001	Provision of non-audit services	Quality of financial reporting & auditor independence	+\\0\\-
Audit	Ashbaugh & Warfield (2003)	Agency theory	German firms listed on the frankfurt stock exchange between 1995-1998	Auditing	Corporate governance	+\\-
Board	Carter et al., (2010)	Agency theory	2,300 firms in the S&P 500 1998-2002	Board Gender diversity	Firm financial performance	0
Board	Yermack (2006)	Agency theory	179 CEO exiting Fortune 500 CEOs 1992 -2003	CEO compensation	Firm financial performance	-\\+

Audit	Asante-Appiah & Lambert (2022)	Enterprise risk management (ERM)	6,565 international firm	Tainted reputation	Nonaudit services	+
Board, Management	Alshaer et al., (2022)	Stakeholder theory	All listed firms FTSE between 2011–2019	CSR-linked compensation and CEO power	Environmental performance	-/+
Board	Ben Amar et al., (2015)	Resources dependence theory	541 firm listed in Toronto Stock Exchange (TSX) 2008–2014	Board Gender Diversity	GHG emissions	+
Board	De Villiers et al., (2011)	Agency theory;	1,216 U.S. public firms between 2003- 2004	Board governance variables	Environmental performance	-/+