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Three essays on ESG disclosure regulation: Implications for companies, investors and policymakers

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Abstract

The importance of environmental, social, and governance (ESG) disclosure continues to grow among companies, and an increasing interest is observable among investors and regulators. In the last decade, multiple regulatory directives were released on a European level to assure sufficient information disclosure, appropriate data standardisation and satisfactory quality. However, given the recency of these directives, no clear image of their impact was reached among researchers. This comprehensive study thus comprises insights from three distinct research essays to analyse how the designed regulations impact companies and investors in their ESG disclosure and decision-making and how future regulatory guidelines should be developed. The first essay deploys a multiple-case study approach among German family-owned companies to investigate their approach to GHG emission reporting and provides a framework of company archetypes. Moreover, customer demand, generational thinking, and an intrinsic will to contribute constitute the main motivating factors for disclosing GHG information publicly despite facing obstacles like a lack of data standardisation and a sense of urgency. Through an experimental principal-agent study with over 200 participants, the second essay reveals that mandatory disclosure regulations lead to significantly more ESG information agents share. While initial regulation boosts invested capital by principals, higher levels of regulation do not yield further disclosure increases. The third essay analyses the effects of ESG disclosure's assurance level and forward-looking information on investor decision-making. Deploying an experimental approach among non-professional investors, the results demonstrate that reasonable assurance, coupled with long-term forecasts, significantly enhances investor trust. Together, these findings contribute to the growing fields of ESG research as they underscore the benefits of ESG regulation, such as higher data standardisation, reduced information uncertainty and higher willingness to invest, while showing the limited additional value of over-regulation to companies and investors. Finally, the results guide policymakers in future directive designs to, for instance, find the right level of ESG regulation and provide precise reporting guidance on forward-looking time horizons.

Summary in German

Die Wichtigkeit der Offenlegung von Umwelt-, Sozial- und Governance-Kriterien (ESG) nimmt bei Unternehmen, Investoren und Aufsichtsbehörden weiter zu. In der letzten Dekade wurden daher auf europäischer Ebene mehrere Regulierungsrichtlinien erlassen. Da diese Richtlinien aber erst vor kurzem erlassen wurden, konnten sich Forscher noch kein eindeutiges Bild der Auswirkungen machen. Diese Studie umfasst daher Erkenntnisse aus drei verschiedenen Forschungsaufsätzen, um zu analysieren, wie sich die entworfenen Direktiven auf Unternehmen und Investoren in ihrer ESG-Offenlegung und Entscheidungsfindung auswirken und wie zukünftige regulatorische Richtlinien entwickelt werden sollten. Der erste Aufsatz untersucht anhand einer Multiple-Case Studie bei deutschen Familienunternehmen, wie diese in ihrer Berichterstattung klassifiziert werden können. Darüber hinaus zeigt der Aufsatz, dass die Kundennachfrage, das Generationsdenken und der intrinsische Beitragswille die Motivationsfaktoren für die Offenlegung der Informationen darstellen. Der zweite Aufsatz zeigt anhand einer experimentellen Prinzipal-Agenten Studie mit über 200 Teilnehmern, dass regulatorische Vorschriften zu mehr ESG-Informationspublikation bei Agenten führen. Während die anfängliche Regulierung das investierte Kapital der Prinzipale erhöht, führen höhere Regulierungsniveaus nicht zu einer weiteren Erhöhung der Informationspublikation. Der dritte Aufsatz analysiert die Auswirkungen des Auditierungslevels der ESG-Offenlegung und der enthaltenen zukunftsgerichteten Informationen auf die Entscheidungsfindung der Investoren. Die Ergebnisse des experimentellen Ansatzes mit nicht-professionellen Investoren zeigen, dass ein erhöhtes Maß an Auditierung in Verbindung mit langfristigen Zielen das Vertrauen der Anleger erheblich stärkt und die Unsicherheit verringert. Zusammengenommen unterstreichen diese Ergebnisse die Vorteile einer ESG-Regulierung und zeigen gleichzeitig, dass eine Überregulierung nur einen begrenzten zusätzlichen Nutzen für Unternehmen und Anleger hat. Darüber hinaus geben die Ergebnisse den politischen Entscheidungsträgern Hinweise für die Gestaltung künftiger Richtlinien.

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List of abbreviations

CDP	Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CEO	Chief Executive Officer
CO_2	Carbon Dioxide
CSR	Corporate Social Responsibility
CSRD	Corporate Sustainability Reporting Directive
DAX	Deutscher Aktienindex (Germany‘s largest stock market index)
ECU	Experimental Currency Unit
ESG	Environment, Social, Governance
ESRS	European Sustainability Reporting Standards
EU	European Union
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
GSSB	Global Sustainability Standards Board
IDU	Information Disclosure Unit
IFRS	International Financial Reporting Standards
IIRC	International Integrated Reporting Council
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organisation for Standardisation
ISSB	International Sustainability Standards Board
KPI	Key Performance Indicator
LSEG	London Stock Exchange Group
MDAX	Mid-Cap DAX
NFRD	Non-Financial Reporting Directive

NGO	Non-Governmental Organisation
PEF	Product Environmental Footprint
SASB	Sustainability Accounting Standards Board
SBTi	Science-based Targets Initiative
SDAX	Small-Cap DAX
SRI	Socially Responsible Investment
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VRF	Value Reporting Foundation
WBCSD	World Business Council for Sustainable Development
WEF	World Economic Forum
WRI	World Resources Institute
WWF	World Wide Fund for Nature

1 Introduction

1.1 Motivation

> *"In the face of the serious, even existential threats posed by runaway climate chaos, […] we seem powerless to act. […] Powerful tech companies are already pursuing profits with a reckless disregard for human rights, personal privacy, and social impact. […] I am outraged that so many countries and companies are pursuing their own narrow interests without any consideration for our shared future or the common good. […] So let's be clear: Rebuilding Trust is not a slogan or a PR campaign. It requires deep reforms to global governance to manage geopolitical tensions during a new era of multipolarity."*
>
> António Guterres, United Nation's Secretary-General
> (WEF, 2024a)

Since the start of the 2020s, the world has seen many global or regional crises that have significantly impacted society. Examples include the COVID-19 pandemic starting in 2020, the Russo-Ukrainian war ongoing since 2022, the Israel-Hamas war ongoing since 2023, and the ongoing climate change with its increasing temperatures, which all pose global challenges of severe magnitude. In times of such global turmoil, environmental, social, and governance (ESG) aspects are more important than ever. António Guterres stated in his 2024 World Economic Forum (WEF) speech that climate change poses an existential threat, and social inequality reaches new levels while global governance is lacking. Instead, companies and countries are putting themselves first without considering the bigger picture (WEF, 2024a). The solution proposed combines multilateralism, frameworks, and effective mechanisms to ensure global governance. Cooperation between corporations and governments is inevitable for developing clear regulatory guidelines, thus enabling working together for the same goal of

global peace and sustainability. This becomes even more evident when considering the latest Global Risk Report by the WEF (2024b). Considering the time frame of the next ten years, five of the ten most significant risks are directly related to environmental aspects, e.g., extreme weather conditions, biodiversity loss or shortages of natural resources. Three risks are technological, and transparent governance can help to overcome these risks, e.g., mis- and disinformation, as well as adverse outcomes of using artificial intelligence technologies. The remaining two risks are societal, e.g., polarisation within society. Thus, seven of the top ten global risks are directly connected to ESG. However, even more interesting is what is not among these risks: economic risks. While the WEF (2024b) lists two global risks, i.e., economic downturn and inflation, for the following years, economic risks vanish for the ten-year outlook. A similar picture can be derived from the key takeaways at the 2024 WEF, which are directly related to ESG, e.g., working on sustainability is an absolute necessity, closing the women's health gap can yield economic prosperity and increasing diversity in the workplace can significantly contribute to company performance (McKinsey & Company, 2024).

ESG is omnipresent, and its high attention in the most prominent economic forum in the world underlines its criticality. The 2024 WEF's motto was 'Rebuilding Trust'. António Guterres clarified during his Special Address that this should not be understood as a marketing campaign, but more extensive global governance changes are required (WEF, 2024a). To take on the mentioned risks of the next ten years, a combination of setting standards, providing incentives and strengthening regulations to improve ESG performance are the ways to move forward here (WEF, 2024b). Global or regional frameworks for ESG-related matters have either been developed or are currently under development. However, their impact, given their relatively recent introduction, is controversially discussed by today's researchers without reaching a clear consensus. I thus intend to contribute to the ESG regulation literature with this dissertation by finding answers to the overarching questions of whether the already designed regulatory guidelines are impactful and how future regulatory guidelines should be developed to make a change.

However, before delving into the regulations surrounding ESG, I will briefly introduce the topic and its historical development. The demand for a company's non-financial information has increased significantly over the last decades. Formerly known as corporate social responsibility (CSR), corporate sustainability or socially responsible investment (SRI) strategies (Eccles et al., 2020), stakeholders today strongly value the provision of ESG-related information (Amel-Zadeh, 2018). ESG is a phrase that bundles these three important non-

financial categories a company should consider, while the overlaps between these categories are scarce. Researchers have already struggled to define former terms, e.g., corporate sustainability. For instance, Meuer et al. (2020) identify 33 different definitions for corporate sustainability in contemporary and highly valued research journals throughout their systematic literature. The same level of intangibility applies to ESG and related metrics as no globally accepted set of key performance indicators has been defined yet to capture data in this regard in a standardised format. Multiple institutions have developed their own set of indicators, e.g., the International Sustainability Standards Board (ISSB)[1], a daughter of the International Financial Reporting Standards (IFRS) Foundation with their sustainability standard called IFRS-S, the European Union (EU) with their European Sustainability Reporting Standards (ESRS), or the Global Sustainability Standards Board (GSSB) with their Global Reporting Initiative (GRI) standard, leading researchers to question the reasonableness of ESG metrics (Chatterji et al., 2016). Nevertheless, ESG components usually contain a particular set of non-financial categories in which stakeholders are interested.

Given the various standards, it is worthwhile to understand what stands behind each of the three ESG components. One of the most prominent ESG ratings is provided by the London Stock Exchange Group (LSEG), which covers more than 90% of global market capitalisation (LSEG, 2023). Here, the environmental category is broken down into emissions, the use of resources, and innovation. Measured data thus includes, for instance, CO_2 emissions, produced waste, water and energy usage, use of sustainable packaging and production, and research and development activities focused on sustainability. The social category is broken down into community, human rights, product responsibility and the workforce. Exemplary indicators surround aspects such as adherence to human rights, product quality and data privacy, diversity throughout the workforce, career development opportunities, working conditions, and health and safety in the workplace. Lastly, the governance category splits into the sustainability strategy, the management, and shareholders. Aspects here include, for instance, the structure of the management board or their compensation, the rights provided to shareholders, and transparency in reporting (LSEG, 2023).

While ESG has seen a noteworthy increase in attention among multiple stakeholder groups over the last two decades, people have debated and acted in line with this matter for

[1] The ISSB is a combination of the former Climate Disclosure Standards Board (CDSB) and the former Value Reporting Foundation (VRF), which was again a combination of the former International Integrated Reporting Council (IIRC) and the former Sustainability Accounting Standards Board (SASB).

over a century, at least to a limited extent (Fowler & Hope, 2007). Including social or philanthropic considerations in investment processes already existed in the 19th century. One prominent example is the Quaker Friends Fiduciary Corporation, which incorporated a no-investment policy for any so-called 'sin-stocks' related to alcohol, tobacco or weaponry (Roselle, 2016). While such endeavours mainly were motivated by religious beliefs first-hand, acting socially responsible has gathered further momentum over the 20th century, with events such as the Vietnam War or civil and women's rights movements yielding a higher inclusion of such aspects in investment decision-making (Eccles et al., 2020). Thus, social responsibility matters developed into a stronger contrast between the traditional capital market-oriented view of maximising profits to benefit a company's shareholders (Friedman, 1970) and the desire to act socially responsible.

The actual term ESG was used for the first time in 2004 by the Global Compact (United Nations Global Compact, 2004), i.e., a pact between the United Nations (UN) and companies to act sustainably, socially responsibly and disclose their ESG efforts. Today, the UN Global Compact comprises over 15,000 corporations across 160 countries (United Nations Global Compact, 2021). The initial recommendations targeted a broad audience, e.g., companies, analysts, investors, accountants, consultants, and non-governmental organisations (NGOs). They included a call for incorporating and rewarding ESG industry research, implementing ESG principles, and improving its reporting and disclosure (United Nations Global Compact, 2004). The Global Compact report is seen as the foundation of the Principles for Responsible Investment, which was founded in 2006 and has grown to more than USD 120 trillion in managed assets across almost 4,000 investors who thus have committed to including ESG throughout their investment decision-making processes (Principles for Responsible Investment, 2023).

Today, an entire industry has evolved around ESG, where ESG rating agencies assess companies according to their identified performance in ESG-related topics. The number of available rankings has exceeded 500 (Mooij, 2017), while more than 170 indices on ESG exist (Lydenberg & White, 2015), besides another set of voluntary standards exceeding 120 (Bowen, 2014). The upcoming of this vast number of rankings and related indices is generally positive as it proves the interest surrounding ESG. Nevertheless, the many potential ratings to choose from also result in varying viewpoints, which are either hard to compare or incomparable. For stakeholders, it is thus even more difficult to interpret such results or even base decisions on

the reports, eventually reducing report credibility and legitimacy (Mooij, 2017; Searcy & Buslovich, 2014).

The growth of this ESG industry was only possible as it matters to many company stakeholders in today's world. ESG regulation affects companies directly and investors, as the most critical stakeholder group, indirectly. Moreover, governments constitute the core stakeholders responsible for designing such directives. Thus, I will highlight the importance of ESG for these three groups in the following paragraphs. Simultaneously, these three groups constitute the focus of this dissertation.

Regarding the company perspective first, a recent study among almost 2,700 CEOs yields multiple interesting insights (United Nations Global Compact & Accenture, 2023): First, 98% of CEOs view it as their role to increase the company's sustainability, which constitutes a 15 percentage point increase compared to the answers received ten years ago. Second, CEOs are quoted stating either that "*ESG compared to even a year ago has gone up to 3x*" (United Nations Global Compact & Accenture, 2023, p. 32) or saying that "*for the last three years, 60-70% of […] (their) conversation with shareholders pertain to ESG*" (United Nations Global Compact & Accenture, 2023, p. 36).

ESG also became a prominent topic from an investor's point of view (Eccles et al., 2011). Investors are one of the main target groups of corporate information disclosure (Serafeim, 2015). I have already mentioned that more than 4,000 investors have committed to including ESG in their investment decision-making processes (Principles for Responsible Investment, 2023). In a recent survey among more than 650 investors, more than 80% indicated the financial materiality of ESG information as their primary motivation to use ESG information in their investment decisions (Amel-Zadeh & Serafeim, 2018). In addition, the active ownership perspective becomes increasingly essential, i.e., engaging with companies can be an opportunity to improve ESG topics within them (Dimson et al., 2015). Turning towards the other side of the motivational scale, Amel-Zadeh and Serafeim (2018) found that investors have the most significant concerns with using ESG information in the investment decision process due to the lack of comparability of provided ESG information. For instance, 20% of surveyed investors do not use ESG information due to a lack of reporting reliability (Amel-Zadeh & Serafeim, 2018). Here, ESG information might benefit from a regulation which standardises and validates ESG information.

Given its importance, ESG has also become a prominent topic among governments. While they continue to issue new regulatory guidelines, as for instance the Non-Financial Reporting Directive (NFRD) or the Corporate Sustainability Reporting Directive (CSRD) (more information to follow in section 1.2), they are also perceived as highly impactful from a company perspective. Specifically, governments are seen as the second most significant influencing factor for companies after consumers and have thus surpassed investors and employees as other stakeholder groups compared to previous years (United Nations Global Compact & Accenture, 2023). The impact of governments becomes more explicit when considering specific numbers. For instance, Grewal et al. (2019) analysed the impact of introducing the EU's NFRD on companies. They found an overall adverse market reaction resulting in an average loss of ~0.8% market capitalisation post-regulation. On a more differentiated scale, however, companies with good ESG performance prior to the regulation receive a slightly positive impact due to the regulation. In contrast, low ESG performers receive a predominantly adverse market reaction.

At the same time, ESG is also controversially discussed within society. It intends to shift the focus from pure financial performance indicators to non-financial metrics. Similarly, ESG is associated with greenwashing allegations, and its lack of standardisation and differing interpretations result in complexity and losses of shareholder value within the market. One prominent example is the investment company BlackRock Inc. In 2020, they announced that they would integrate ESG into all investment processes and risk management platforms and shift to an index exposure optimised to ESG performance instead, where they formerly applied pure market capitalisation optimisation (BlackRock, 2020). However, in 2023, BlackRock's CEO Larry Fink then announced to move away from the ESG terminology given its high level of politicisation and polarisation as Republicans and Democrats in the United States have started arguing about using ESG (Binnie, 2023). Nevertheless, BlackRock will not step down from its strategy of focusing on ESG-related matters. At the same time, the ongoing backlash against ESG has caused temporary financial damage of USD 4 billion in managed assets. While this intense politicisation is generally not advantageous, the heated political debate also proves how important this topic is for all political parties. A prominent voice against ESG comes from Elon Musk, who repeatedly criticised ESG ratings and especially Tesla's bad ratings within them (Barry, 2022; Glover, 2023). Particular criticism and polarising statements such as "*ESG is the devil*" (Glover, 2023) relate to the fact that tobacco or oil and gas companies achieve much higher scores in prominent ESG ratings than Tesla.

With my dissertation, I intend to contribute to the ongoing public and academic discussions on the impact of introducing ESG-related regulations. Therefore, I tailor my research questions to determine the impact of current ESG regulations and how specific characteristics affect companies and investors. I approach my overarching research goal with three different research projects in three different essays, each with their research questions answered using two different research methods and stakeholder perspectives. While the first paper covers a company perspective using a qualitative research method, I combine the company and investor perspective in an experimental research project in essay II and apply another experimental research method solely using an investor perspective in essay III.

In my first essay, I take on a mere company perspective and focus on a specific company type strongly affected by the latest regulatory activities on a European level, i.e., family-owned companies. This company type is especially prominent in Germany, with more than 90% of German companies being family-owned and more than 60% of employees in Germany working for family-owned companies (Butzer-Strothmann & Ahlers, 2020). Family-owned companies are, on the one hand, known for causing less pollution and being more altruistic (Déniz & Suárez, 2005) as well as being more committed to preserving their socioemotional wealth through environmental management than non-family companies (Berrone et al., 2012; Cennamo et al., 2012; Déniz & Suárez, 2005). However, they are also known for their privacy and non-disclosure (Miller & Le Breton-Miller, 2021; Poza & Messer, 2001). Thus, only little is known about the environmental management approaches chosen within family-owned companies, yielding my research question in essay I: "*How and why do family-owned companies account for their GHG emissions along their value chain, and which challenges do they face during this process?*" Therefore, I test an existing environmental management framework initially developed for public corporations on family-owned companies and extend this framework into a new one specifically tailored to family-owned companies, including motivation, applied methodology and challenges faced in environmental management.

In my second essay, I shift from a mere company perspective to a combination of the company and the investor perspective. My primary motivation stems from the results achieved during the first essay, in which some companies voluntarily disclosed ESG information before any regulation. In contrast, others did not report any information and are now only pushed by external regulation to do so. Family-owned companies indicated that regulatory pressure only constitutes a minor or no motivating factor in disclosing non-financial information. Thus, this research paper aims to analyse the effects of introducing different regulatory minimum

disclosure levels on company and investor behaviour to identify which regulatory level adds value to the market. The research question of this research project is thus stated as follows: "*Does the introduction of a regulatory minimum ESG disclosure level continuously add value over a mere voluntary reporting regime?*"

In essay III, I switch to a mere investor perspective as a third possible combination of the company-investor pairing. The most recent ESG-related regulatory movement on a European level is the CSRD, which came into force in 2023 (more information to follow in chapter 1.2.1). While many aspects are defined rather clearly, others have room for improvement. This constitutes the starting point of the third research project as the exact specification of the thoroughness of a required external audit needs to be specified, and the EU demands more forward-looking information without an exact timeframe. Both aspects leave room for interpretation from a company perspective, and their effects on investor behaviour need to be identified. Given that these are two primary components within the CSRD, I use this to motivate my third essay's research question: "*Does reasonably assured and long-term, forward-looking sustainability information add value over limitedly assured and short-term, forward-looking sustainability information?*"

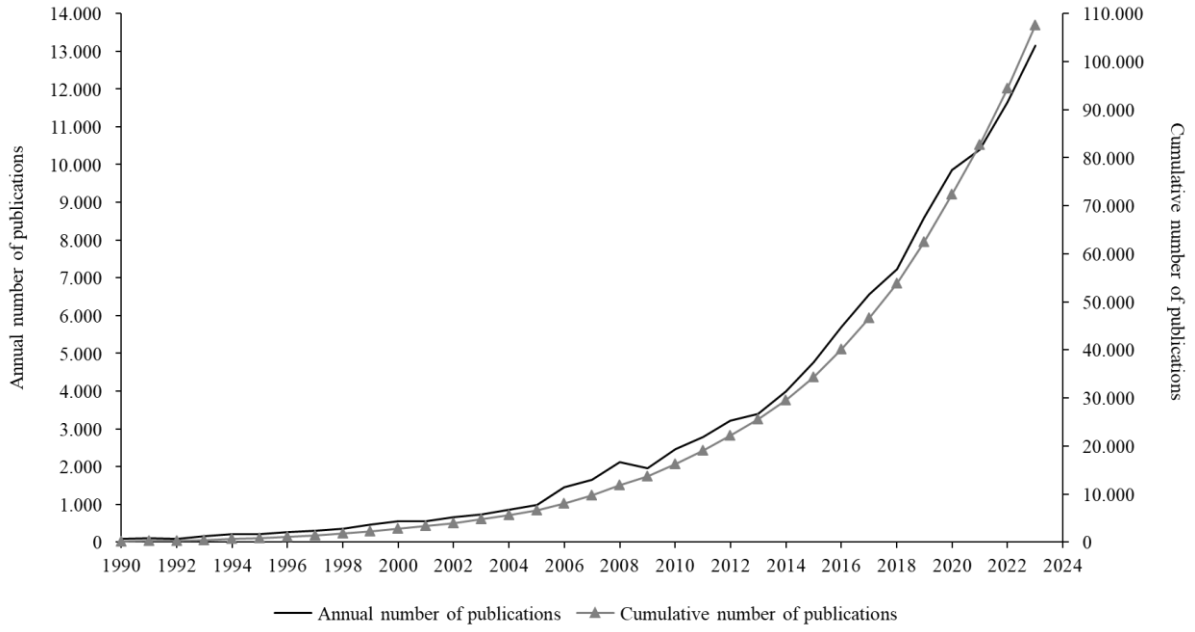
In the subsequent sections, I elaborate on recent ESG research trends focusing on both the company and the investor perspective. In addition, I provide an overview of the theories underlying my three research projects.

1.2 Research background and gap identification

Research on ESG and sustainability has been conducted for multiple decades, yet this specific area of research has accelerated, especially within the last decade (see FIGURE 1.1). Three-quarters of the publications released within the last 34 years were published within the last decade, while more than half were only published within the last five years. Besides increasing interest in society and companies, researchers have contributed enormously to this field within the past few years. The continuous strong growth of this research area constitutes one of the motivating factors of my dissertation. The three essays of this dissertation contribute to this growing field of research with a clear focus on non-financial information disclosure and regulation.

Considering traditional standard economic theory, non-financial performance and disclosure are irrelevant as a company's sole purpose is to maximise profits and, thus, shareholder value. In this regard, Friedman (1970) stated that "*there is one and only one social responsibility of business – to use it resources and engage in activities designed to increase its profits so long as it stays within the rules of the game*" (Friedman, 1970). Friedman's statements, however, created an array of discussions (e.g., Mulligan, 1986; Shaw, 1988) surrounding whether a company's only social responsibility is to increase profits. Considering today's world, his statements do not correspond to society anymore. This materialises, for instance, in the high increase of ESG-related research in recent years. Reverting to the initial quote of António Guterres at the 2024 WEF, it becomes clear that companies following their narrow interests in an egoistic fashion pose a strong challenge for today's society (WEF, 2024a). The pure shareholder orientation theory apparently cannot explain why ESG relevance has increased enormously over the last few years.

FIGURE 1.1: Annual and cumulative ESG-related publications in 1990-2023



Note: Figure represents an annual number of journal articles and conference papers published in English between 1990 and 2023. The analysis was carried out using a Scopus search in the research areas of *Business, Management & Accounting,* as well as *Economics, Econometrics and Finance,* where the keywords *ESG* or *Sustainability* are contained within the title, abstract or paper.

It is thus helpful to consider other relevant theories in the three research essays which can explain why ESG and its disclosure and regulation can be relevant from a company and an investor perspective. Hahn et al. (2015) provide a comprehensive overview of three theoretical clusters, i.e., sociopolitical, economic and institutional theories, which I will explain in the

following paragraphs. All three theoretical clusters are relevant for each essay. Thus, I briefly explain these and provide a brief overview of recent regulatory developments before delving into each research essay's specific literature.

Sociopolitical theories. This set of theories explains companies' motivation for non-financial information disclosure with pressure put on them through societal or political measures (Hahn et al., 2015). Companies face increasing pressure from society members as companies' accountability for their actions increases (Hahn, 2012). Social norms have changed in this regard, i.e., ESG has become more important for society, and companies can achieve varying reputational rewards based on their conformity with these norms (Philippe & Durand, 2011). Conforming to social norms as a company can result in reputational rewards, while non-conformity can lead to reputational losses in society. Reputational risk is among the top five risks for more than 55% of leading global companies today and 95% of companies have allocated budgets for reputational damage management (Willis Towers Watson, 2023). Within sociopolitical theories, two main sub-theories prevail, i.e., stakeholder theory (Freeman, 1984) and legitimacy theory (Suchman, 1995). Stakeholder theory argues that a company's actions should be tailored to stakeholders, not just shareholders, as Friedman (1970) stated some years before. A stakeholder can be understood as any person or entity having an interest in the activities of a specific company, e.g., customers, employees, financiers or suppliers (Freeman et al., 2010). Thus, non-financial information disclosure can be understood as a company's reply to its stakeholders' demand for ESG information, given its high relevance in society (Hahn et al., 2015; Roberts, 1992). Similar to stakeholder theory, legitimacy theory is also premised on external pressure, and as such, companies' non-financial information disclosure happens as a reaction to this pressure (Patten, 2000; Suchman, 1995). Legitimacy theory focuses on society at large, and companies use their non-financial disclosure to ensure that the implicit company-society contract of caring for topics important to society remains intact (Cotter & Najah, 2012; Deegan, 2002; Hrasky, 2011).

Economic theories. Theories based on economic principles argue that a company's voluntary disclosure of non-financial information to selected stakeholders occurs after carefully evaluating the costs and benefits associated with ESG reporting. Companies aim for economic benefits from reducing the principal-agent information asymmetry (Jensen & Meckling, 1976) as the costly increase in transparency potentially reduces their cost of capital (Frankel et al., 1995; Healy & Palepu, 2001). Moreover, increasing transparency to selected stakeholder groups can result in further economic benefits. Starting with activist groups,

voluntary information reporting in line with signalling theory can constitute a preventive measure to avoid costly attacks against the company. For this scenario, the information's trustworthiness and honesty must be guaranteed (Hahn et al., 2015), as information of little credibility can potentially work in the opposite direction. As the next stakeholder group, customers and society value sustainability information. Its disclosure can thus increase the positive perception of a company's products, eventually increasing sales. Lastly, disclosing non-financial information can help indicate that the company cares about ESG topics to thus increase a company's reputation in the eyes of regulating authorities or investors (Brouhle & Harrington, 2010).

Institutional theories. This third theoretical cluster explains a company's motivation to disclose non-financial information with the requirements set by regulatory authorities and NGOs, e.g., the Carbon Disclosure Project (CDP) (Weiss et al., 2022). Following institutional theory, companies' non-financial information disclosures should gradually align over time (Luo et al., 2012; Matisoff et al., 2013) as companies stick to the standards set out by the relevant institutions. Nevertheless, not all institutional endeavours are of added value. Kolk et al. (2008) found that, for instance, the CDP is of limited additional value as carbon disclosure only provides limited insights into a company's risks and inconsistencies prevail, which can only be solved through clear and mandatory standards set by governmental institutions.

All three mentioned theoretical clusters provide insights into companies' motivations to disclose non-financial information. While these motivations are primarily voluntary, mandatory guidelines have also come up, which will be the focus of the next chapter. Afterwards, I will elaborate on the literature relevant to each research essay and the identified research gaps.

1.2.1 Introduction to ESG regulation

Given the regulatory focus of this dissertation, I provide a brief historical overview of recent regulatory activities on a European level. Within the EU, the regulation of non-financial information began in 2014 with the introduction of European Directive 2014/95/EU, better known as NFRD, as an amendment to a European directive on annual financial (consolidated) statements[2]. It was targeted at companies of public interest with an average number of

[2] Directive 2013/34/EU on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings amending Directive 2006/43/EC of the European Parliament and of the Council and repealing Council Directives 78/660/EEC and 83/349/EEC.

employees exceeding 500 and either a balance sheet exceeding EUR 20 million or an annual turnover exceeding EUR 40 million (Grewal et al., 2019). Its main intention was to make the reporting of non-financial information mandatory to thus make information more consistent and enhance comparability. Companies were required to report on environmental, social and employee-related matters, their actions to protect human rights, the avoidance of corruption and bribery, and their policies tailored towards diversity within management and supervisory boards (European Parliament & European Council, 2014). While the NFRD intended to increase non-financial information's transparency, comparability and consistency, the desired effect was not achieved as planned. Thus, the EU announced the revision of the NFRD in line with the targets of the European Green Deal in 2019 to, amongst other aspects, achieve climate neutrality by 2050 at the latest (European Parliamentary Research Service, 2021). The aim was to react to increasing demand from investors and society to receive more information with higher consistency and comparability. Directive 2022/2464/EU was therefore developed, which became effective in January 2023 (European Parliament & European Council, 2022) and now requires all companies of public interest (except companies with fewer than ten employees) as well as non-public-interest companies with more than 250 employees to report on their ESG activities starting from the financial year 2025 according to the ESRS. This increases the number of companies from around 11,700 under the NFRD to more than 50,000 under the CSRD (EY, 2022). Besides the scope of applicable companies, the reporting scope also increases. Noteworthy are here especially the required third-party audit of the non-financial information similar to the already existing financial audit, the provision of more forward-looking information and sustainability targets, the integration of financial and non-financial information into one integrated management report as well as the requirement to report on double materiality, i.e., the impact of the reporting company on society and environment (impact materiality) as well as the environmental and social matters impacting the reporting company financially (financial materiality) (KPMG, 2023; Latham & Watkins, 2023).

1.2.2 Relevant essay literature and identified research gaps

Literature essay I. Family-owned companies are especially prominent in Germany, with more than 90% of German companies being family-owned and more than 60% of employees in Germany working for family-owned companies (Butzer-Strothmann & Ahlers, 2020). While an exact definition of the specifications of a family-owned company is lacking (De Massis et

al., 2012; O'Boyle et al., 2012), some core topics are common for all family-owned companies. Among these topics, two main aspects stand out as characteristics of family-owned companies: (1) family ownership, i.e., the company has one or very few families, and (2) family management, i.e., family members exert control via family members in the management or supervisory board with the intent of creating value for future family generations (Chua et al., 1999; Kirchdörfer, 2011). Regarding environmental management, two sides of the coin stand out. On the one hand, this particular company type is known for causing less pollution and being more altruistic (Déniz & Suárez, 2005) as well as being more committed to preserving their socioemotional wealth through environmental management than non-family companies (Berrone et al., 2012). On the other hand, they are also known for their privacy and non-disclosure (Miller & Le Breton-Miller, 2021; Poza & Messer, 2001) as well as their high level of risk aversion towards reputational losses as such a loss is directly tied to the family name (Gomez-Mejia et al., 2011). Therefore, it is reasonable to assume that family-owned companies make great environmental management efforts but only communicate little about it, providing a gap in today's research worth investigating further.

Previous researchers have developed environmental management frameworks, while these only apply to companies in general and are not family-owned company-specific (Carroll, 1979; Henriques & Sadorsky, 1999; Hunt & Auster, 1990; Wartick & Cochran, 1985). Moreover, these frameworks were developed multiple decades ago and thus do not include today's environmental management standards, e.g., the Greenhouse Gas (GHG) Protocol, the Science-based Targets Initiative (SBTi) or specific International Organisation for Standardisation (ISO) standards. Besides the applied methodology, it has become clear previously that multiple theories potentially explain the voluntary disclosure of non-financial information among companies. While authors even found it unclear why companies report beyond regulatory requirements (Delmas & Toffel, 2004), the exact motivation for disclosing non-financial information among family-owned companies has yet to be researched. In the context of the CSRD, which became effective in 2023 and applies to family-owned companies, the motivation to comply with regulatory requirements and potentially exceed the minimum requirements with additional voluntary disclosure constitutes a promising field of research.

Besides the motivation behind environmental management and the methodology applied among family-owned companies, past researchers have found multiple challenges within these processes. These challenges involve, for instance, uncertainty regarding the mathematical model (Lee et al., 2024), chosen parameters and assumptions (WBCSD & WRI, 2015),

undefined calculation standards yielding different data from different suppliers (Olson, 2010) or an increase in overall complexity resulting from international and highly flexible supply chains (Schaltegger & Csutora, 2012). Whether and how these characteristics apply also to family-owned companies has yet to be determined.

Environmental management becomes increasingly crucial while "*we still lack knowledge about the precise mechanisms through which family firms manage potential tensions between economic and non-economic goals*" (Diaz-Moriana et al., 2024, p. 70). A further investigation of the motivation behind environmental management, as well as the applied methodologies and involved challenges within family-owned companies, can thus contribute to closing this research gap. Thus, I state my central research question for this research project: "*How and why do family-owned companies account for their GHG emissions along their value chain, and which challenges do they face during this process?*"

Literature essay II. Companies today face regulatory requirements, e.g., the previously mentioned CSRD, but also choose to disclose ESG information voluntarily in addition to regulatory requirements. Such voluntary disclosure has received significant attention from researchers over many decades. For instance, researchers have identified voluntary disclosure as a method to lower uncertainty among investors, thereby reducing agency costs (Eccles et al., 2014; Jensen & Meckling, 1976), signal positive performance to external parties (Akerlof, 1970; Ramchander et al., 2012), attain broad societal legitimacy (Suchman, 1995), and effectively manage relationships with various stakeholders to sustain financial performance (Darnall et al., 2010; Freeman, 1984).

Beyond theoretical perspectives, researchers have observed that voluntary disclosure yields enhanced company valuations (Dowell et al., 2000), lowered cost of equity (Plumlee et al., 2015), improved predictability of future cash flows and profits (Clarkson et al., 2013), superior financial performance (Abdi et al., 2022), and an increased likelihood of attracting investor capital (Dhaliwal et al., 2011). Despite these potential benefits, not all companies utilise voluntary disclosure, and such voluntary disclosure differs by company, prompting regulators to establish specific rules and standards which come with their advantages and disadvantages.

On the one hand, some researchers support mandatory reporting directives as they ensure standardisation of disclosed information, enhance comprehensibility for multiple stakeholders, and overall increase transparency, potentially leading to improved ESG performance and

shareholder value (Darnall et al., 2010; Dowell et al., 2000). Conversely, critics of mandatory reporting regulations argue that they can be partly ineffective (Aragòn-Correa et al., 2020) and suggest that companies mandated to disclose information face significant cost escalations and adjustments in corporate processes to meet reporting requirements (B. Cheng et al., 2014; Ioannou & Serafeim, 2017).

Besides the advantages and disadvantages of mandatory regulation requirements, past researchers analysed whether such requirements can be characterised as substitutes or complements for voluntary disclosure. Within financial reporting, past researchers mostly identified newly introduced regulatory requirements as substitutes rather than complements in the market, implying that the information disclosed does not increase post-regulation (Einhorn, 2005; Noh et al., 2019). In contrast to financial reporting, no consent among researchers was reached thus far regarding the value-relevance of voluntary disclosure in addition to mandatory disclosure requirements under the CSRD (Ioannou & Serafeim, 2017). I contribute to the existing literature by analysing German companies and investors and the effects of the recent emergence of the CSRD. I thus state the research question of essay II as follows: "*Does the introduction of a regulatory minimum ESG disclosure level continuously add value over a mere voluntary reporting regime?*"

Literature essay III. The provision of non-financial information, in contrast to financial information disclosure, is of rising interest to various stakeholder groups (Reimsbach et al., 2018). Investors, as one of the most prominent set of stakeholders, increasingly use this information for their decision-making (Bedoya-Pardo, 2023; Berthelot et al., 2012). This high interest also motivated regulators to provide clear guidelines and standards for non-financial information disclosure, e.g., the previously mentioned CSRD (European Parliament & European Council, 2022). Two aspects of the CSRD are worth mentioning as they are only vaguely described today, and today's research towards these aspects is either non-existent or inconclusive (Misiuda & Lachmann, 2022). This is the level of external assurance (limited versus reasonable) on the one side and the time horizon for forward-looking non-financial information disclosure (short-term versus long-term) on the other.

External assurance has generally been found to constitute an added value for stakeholders as it reduces information asymmetries and increases a discloser's credibility (Kolk & Perego, 2010; Sierra-García et al., 2015), leads to higher stock price estimates (Brown-Liburd & Zamora, 2015), correlates with higher perception of quality (Stuart et al., 2023), increases

information reliability as well as comparability (Cohen & Simnett, 2015) and increases willingness to invest (M. M. Cheng et al., 2015). While the general presence of assurance in contrast to its non-existence is regarded as beneficial by researchers, no consent could be reached to date regarding the right level of assurance. Multiple researchers could not identify an added value of reasonable assurance over limited assurance (Dilla et al., 2023; K. Hodge et al., 2009; Sheldon & Jenkins, 2020). In contrast, several other authors confirmed a positive effect of reasonable over limited assurance (Hoang & Trotman, 2021; Low & Boo, 2012; Rivière-Giordano et al., 2018; Vera-Muñoz et al., 2020), thus providing an exciting research field to contribute to.

Research on forward-looking non-financial information appears to be under-researched (Misiuda & Lachmann, 2022), while the EU now explicitly requires forward-looking non-financial information (European Parliament & European Council, 2022). This aspect is even more interesting when considering the reported misperceptions on time horizons between investors and company leaders (Bell, 2022) and the general lack of forward-looking disclosure (EY, 2021). Research on forward-looking information disclosure has focused solely on financial information disclosure (Mercer, 2004; Pownall et al., 1993), leaving a research gap for varying time horizons' effects on forward-looking non-financial information disclosure.

The inconclusive or non-existent research highlighted in the previous paragraphs on the right assurance level and the effects of different forward-looking time horizons in non-financial information disclosure paired with the obligatory but vague requirements stated in the CSRD constitutes an interesting field of research. I thus intend to contribute to this field of research by answering the following research question: "*Does reasonably assured and long-term, forward-looking sustainability information add value over limitedly assured and short-term, forward-looking sustainability information?*"

1.3 Methodology

Within my dissertation, I apply two approaches to best answer the stated research questions and close the research gaps identified in the previous chapter. For my first essay, I apply a qualitative, empirical research design based on a multiple-case study approach. Essays II and III follow an experimental research design in a university laboratory. As I will explain

the research methodology of each paper in detail later (cf. chapters 2, 3, and 4), I will only provide a brief summary of the applied methodologies in the following two sub-chapters.

1.3.1 Qualitative, empirical research

In essay I, I analyse the reasons for and the methodology of environmental accounting within family-owned companies to thus test an existing framework (Henriques & Sadorsky, 1999) on environmental management for this specific company type and extend it into a new framework, including methodology, motivation and challenges among family-owned companies within this process. I therefore apply a multiple-case study approach, including within- and cross-case analyses (Eisenhardt, 1989). This approach appears appropriate for answering my stated research question for three reasons: Firstly, the multiple-case study approach is especially suitable for answering research questions of 'why', 'how' and 'which'-nature (Yin, 2009). Secondly, the research method allows for results of solid reliability, accuracy and robustness (Eisenhardt & Graebner, 2007). Lastly, family-owned companies often avoid making information public (Miller & Le Breton-Miller, 2021), are characterised by non-disclosure (Poza & Messer, 2001) and preserve confidential information where possible (Miller & Le Breton-Miller, 2004).

The interviews conducted with company representatives were conducted in a semi-structured format. Thus, I had the chance to, on the one hand, collect data in a systematic format while, on the other hand, allowing sufficient room for generating new findings during the interviews, which could not have been anticipated beforehand (Yin, 2009). Only through direct interaction with interview participants is a generation of superior insights possible (Miles et al., 2018). To achieve superior quality results, a further triangulation of achieved data with secondary sources, e.g., company publications such as press releases or management reports and market report data, was conducted and used both during and after the interviews (Yin, 2009).

The interview partner sampling was conducted according to the multi-stage sampling process proposed by Glaser and Strauss (1967). Thus, I reduced my potential sample to companies with 100% family ownership to avoid outside influence on the company and excluded companies that do not meet the requirements of the CSRD in terms of number of employees, turnover, or balance sheet volume. Moreover, companies with revenue beyond EUR 5,000 million were excluded to sufficiently differentiate the sample from German DAX-

40 companies and industries known for higher carbon emissions, e.g., transportation and production, were prioritised. Cases were collected until saturation was observable (Eisenhardt, 2021). The final sample thus consisted of 13 cases. For each case, interviews were conducted with either the CEO or a person responsible for sustainability, such as the head of sustainability, a sustainability manager, or the head of quality.

The achieved interview results were then analysed following a multi-stage analysis process. Interviews were transcribed and then analysed within the case, i.e., the individual cases were analysed to derive first-order categories (Miles et al., 2018). This process step was followed by cross-case analyses between the developed cases, thus deriving commonalities and discrepancies between cases (Eisenhardt, 1989). This process step enabled a further analysis layer, i.e., the second-order category, to thus improve the overall analysis and derive the final enhanced framework (Gioia et al., 2013). The overall process was iterative, meaning that the development of second-order categories also affected first-order categories.

1.3.2 Experimental, empirical research

For essays II and III, I deploy experimental, laboratory-based approaches. Essay II combines the company and investor perspectives, while essay III focuses solely on the investor perspective as the third possible combination of the company-investor relationship.

The research project of my second essay aims to analyse how different regulatory levels affect company and investor behaviour simultaneously and whether regulatory disclosure requirements add value over voluntary disclosure. I approach this research aim with an experimental principal-agent design which allows for the isolation of the mere effects of regulation as voluntary disclosure has increased in the past, i.e., increasing information disclosure does not automatically provide evidence of an impactful regulation (Ioannou & Serafeim, 2012). Moreover, the experiment allows the direct analysis of the company's effects on investor behaviour, which helps extract important ESG issues that would be complex to analyse based on archival data (Martin & Moser, 2016). At the point of this research work, the CSRD was not effective, allowing for the prediction of potential effects of the CSRD through experimenting with university students who represent future investor behaviour. While the CSRD is effective now, reporting will only be mandatory by 2025, meaning predictions are still valuable today. The research was inspired by past researchers who identified adverse effects of control in a principal-agent relationship when the principal controls the agent instead

of trusting the agent (Falk & Kosfeld, 2006). In this case, the experiment comprises one principal, i.e., the investor, and two agents. Agents represent companies deciding how much ESG information to disclose to receive an investment from the investor represented by the principal. The experiment comprises more than 200 university students from the Technical University of Munich and Ludwig-Maximilians-University of Munich. The experimental software used was 'z-tree', which allows participants to react quickly to other participants' choices while all participants move simultaneously (Fischbacher, 2007).

Essay III focuses solely on the investor perspective to thus complete the set of possible combinations of the company-investor relationship. The research work is mainly motivated by the CSRD, which became effective in January 2023. Previous researchers have analysed regulatory effects before the CSRD became effective, such as the effects of the integration of non-financial reporting into financial reporting or the external assurance of non-financial information through an external auditor (M. M. Cheng et al., 2015; Reimsbach et al., 2018; Shen et al., 2017). However, the current version of the CSRD leaves multiple aspects with room for interpretation where the effects of distinct characteristics of these aspects have yet to be researched, i.e., differing assurance levels (limited versus reasonable) and differing forward-looking time horizons (short-term versus long-term). The primary motivation for this specific experimental setup comes from the work conducted by Reimsbach et al. (2018), who analysed the effects of external assurance (assured versus non-assured) and non-financial report integration (integrated versus separated). Like these authors, I deploy a 2 x 2 experiment with independent variables assurance level and forward-looking time horizon and analyse their effects on investor behaviour. Investor behaviour is measured based on a vastly established framework developed by Maines and McDaniel (2000), which considers an investor's information evaluation, information weighting and information-based judgement as three dependent variables in the investor's decision-making process. Over the last two decades, the framework was repeatedly used (B. Beyer et al., 2023; Cooper & Weber, 2021; Dilla et al., 2023; Landau et al., 2020; Reimsbach et al., 2018). The experiment had 163 participants, of which 108[3] participants were selected for the final sample. 55 subject responses were eliminated due to their indication of little prior experience in investing in the capital market. To collect the data, I used the vastly established web-based software Qualtrics in line with past

[3] The inspirational paper of Reimsbach et al.(2018) had 90 participants.

researchers (Brown-Liburd & Zamora, 2015; Sheldon & Jenkins, 2020; Vera-Muñoz et al., 2020).

Essay II and essay III experiments were conducted using a between-subjects design as a one-shot game. As such, I avoid unwanted effects due to learning from previous periods (Charness et al., 2012).

1.4 Results and contribution

My three essays aim to contribute to the existing ESG and regulatory literature highlighted beforehand and its identified research gaps. The dissertation aims to shed light on the overarching research question surrounding the impact of current regulatory guidelines and potential changes to future regulatory guidelines helpful to companies, investors, and policymakers. The specific research questions are specified throughout the respective chapters. The first essay focuses on a mere company perspective, the second focuses on a combination of companies and investors, and the third focuses on a mere investor perspective. I provide a concise overview of my three essays, including the specific research questions, applied methodologies, contributions to literature and managerial implications in TABLE 1.1. I will briefly summarise the results achieved within each research project in the following paragraphs.

Essay I. The objective of the first essay is twofold: (1) test an existing framework on environmental management (Henriques & Sadorsky, 1999) on family-owned companies and (2) extend this framework into a new framework including the family-owned companies' motivations, applied methodologies as well as their challenges throughout the environmental management process. Given the first objective, I can generally confirm the validity that the framework developed by Henriques and Sadorsky (1999) holds for family-owned companies, while most companies either belong to the second or third archetype, which I define as extrinsically-driven reporters and intrinsic sustainability drivers. About the second objective, I find customer demand, generational thinking, and an intrinsic will to contribute to society as the main motivating factors among family-owned companies to measure their GHG emissions. The data collected is used mainly for internal reporting or provided to stakeholders on demand, while only a few companies also report their data externally voluntarily. On the methodological side, I can confirm the GHG Protocol as the leading standard applied among family-owned

companies, while most companies focus on Scope 1 and 2 emissions. Scope 3 emission measurement is only conducted on an exploratory basis. Turning towards the challenges faced within the environmental accounting process, a lack of urgency among top-level management and general staff is perceived as highly challenging. Additionally, lacking or unstandardised data complicates the accounting process, which results in a high level of insecurity when modelling the data.

This research contributes to the growing field of research on family-owned companies (Hasso & Duncan, 2013) in general and contributes to ongoing research about family-owned companies' ESG activities and their willingness to preserve their socioemotional wealth in particular (Berrone et al., 2010; Cennamo et al., 2012; Gómez-Mejía et al., 2007). Besides contributing to the existing literature on family-owned companies, two important managerial implications can be drawn from these results. First, increasing awareness throughout the entire company is pivotal to succeeding in environmental management, as proper accounting is only possible based on the delivery of data from many sources throughout the organisation. This creation of awareness is required from family-owned companies' owners and managers to motivate their staff, as well as from family associations, in case the family-owned companies' owners are not yet fully aware of their environmental management processes. Second, a lack of data standardisation was criticised in many cases. Creating an elevated level of standardisation beyond the current level communicated within the CSRD can save a considerable amount of time that is used today to create individualised reports for every customer, regulator, or other stakeholder.

Essay II. The second essay combines the company and investor perspectives in an experimental setup to identify whether introducing a regulatory minimum ESG disclosure level adds value over the absence of regulatory requirements, i.e., voluntary non-financial information disclosure. Based on this experimental setup, I can derive three key results: Within the boundaries of the experimental setup, I find that disclosed information among companies and capital invested among investors increases with higher regulatory minimum disclosure levels, i.e., the higher the regulatory requirements for minimum information disclosure, the higher both disclosed amount and capital invested. Second, subjects representing companies within the experiment are already voluntarily disclosing comparably high amounts of information in the no-regulation case. In contrast, subjects representing investors invest significantly more capital in the low-regulation treatment than in the no-regulation case, while only little additional capital is invested when switching from the low- to the medium- and high-

regulation treatments. Third, I analyse the profits of both companies and investors within the experiment. Combined profits are highest within my experiment when a low regulation is applied for a minimum disclosure level. Additionally, I framed the experiment purposefully within an ESG context, which appeared to matter to experimental subjects as more than 60% of subjects indicated that ESG was a high priority, influencing their decisions during the experiment. Lastly, investors did not appear to be motivated by the effects of reciprocity, i.e., they did neither punish companies for not exceeding the minimum disclosure level nor reward companies for going far beyond the required minimum disclosure level.

With my experiment, I contribute to the existing literature on ESG regulation (Aragòn-Correa et al., 2020; B. Cheng et al., 2014; Darnall et al., 2010; Dowell et al., 2000; Ioannou & Serafeim, 2017). I achieve this by deploying an experimental approach and thus isolating the mere effects of ESG disclosure regulation on company and investor behaviour. In this way, I avoid additional effects such as an increase in voluntary disclosure in the market occurring in the past years. Moreover, I provide potential scenarios for the future impact of the CSRD.

While the generalisability of a laboratory experiment among university students to the global economy is complex, specific implications for companies and regulators could be considered for future decision-making. Overall, finding the right balance is most important. A specific regulation which entails standard setting reduces friction and principal-agent information asymmetries in the market and can thus be meaningful (Jensen & Meckling, 1976). Excessive regulation, however, might result in a cost burden for companies that exceed the benefits, which has been confirmed by previous researchers (Ioannou & Serafeim, 2017).

Essay III. The third essay presents insights into two main aspects of the newly introduced CSRD, its characteristics, i.e., degree of external assurance (limited versus reasonable) and time horizon of forward-looking information disclosure (short-term versus long-term), and its impact on the investor's decision-making process along the investor's decision-making categories introduced by Maines and McDaniel (2000). This study highlights the critical role of higher assurance levels and long-term, forward-looking perspectives in influencing an investor's decision-making process. A higher level of assurance significantly influences how investors evaluate and prioritise non-financial information instead of financial information. This influence becomes even more pronounced when investors receive long-term, forward-looking information. The general uncertainty associated with long-term forecasts tends to decrease with more assertive assurance, thus positively influencing the investor. However,

when considering long-term, forward-looking information, the investor's investment judgement significantly improves, whereas the level of assurance has a marginal effect on their decisions. This discrepancy in information evaluation, weighting, and judgement is potentially linked to a bias towards socially desirable outcomes (Podsakoff et al., 2003). Subjects asked directly about their evaluation and weighting of non-financial information sought highly assured information, signalling that the non-financial information is essential to them. In a concrete investment decision, however, where both financial and non-financial information come into play, reasonable assurance of non-financial information is of less importance vis-à-vis the overall long-term orientation of a company.

I furthermore regarded both CSRD components individually. When subjects were presented with both assurance options and asked for their preference, a strict and statistically significant choice of reasonable over limited assurance was observable. However, no significant difference could be observed when subjects were asked about their preference between short-term and long-term, forward-looking time horizons. For the former effect observed, the positive framing of reasonable assurance, in contrast to the negative framing of limited assurance, is assumed to have a substantial influence in line with findings from previous authors (Vera-Muñoz et al., 2020). For the latter effect, it appears that subjects are less clear on their preference as a trade-off between both options is more complex than for the assurance level, where one option is better.

With these findings, I contribute to the existing literature (Cort & Esty, 2020; Heichl & Hirsch, 2023; Kolk & Perego, 2010; Reimsbach et al., 2018; Stuart et al., 2023) on non-financial disclosure by highlighting the additional value of reasonable in contrast to limited assurance in information evaluation and weighting, which previous authors have confirmed and rejected. Moreover, I also find that long-term, forward-looking time horizons positively affect investors' willingness to invest in an ESG context. Previous authors only touched upon this aspect to a limited extent. In summary, these results contribute to ongoing discussions about the exact specifications of the CSRD regarding the mandatory assurance level and the forward-looking time horizons.

1.5 Structure of this dissertation

This dissertation is structured into three essays, all responding to research questions related to the impact and specific characteristics of ESG reporting regulation. Each essay covers a company, or an investor perspective, or a combination of both and is related to one research project, which has been conducted independently of the others. Thus, each essay's sections can overlap, enabling readers to understand each essay fully without reading the others.

The remainder of this dissertation thus follows the following structure. The second chapter comprises essay I, titled "*Measurement and accounting of greenhouse gas emissions in German family-owned companies*". As part of this research project, I test and extend an existing general framework on environmental management in companies for the specific company type of family-owned companies. Through my research I refine the existing framework into a new framework and identify challenges specific to family-owned companies when measuring and accounting for GHG emissions. The third chapter follows with the second research project, i.e., essay II, titled "*The effects of mandatory ESG disclosure regulation on company and investor behaviour: An experimental approach*". Motivated by many family-owned company managers complaining about regulatory oversight, I experimentally test whether introducing a minimum regulatory ESG disclosure level adds value over a no-regulation scenario. Essay III, titled "*Effects of assurance levels and forward-looking time horizons in non-financial reporting: An experimental approach*", is presented in this dissertation's fourth chapter. Here, I experimentally test specific regulatory characteristics, i.e., assurance level and forward-looking time horizon, which are currently under discussion on a European level. I conclude my dissertation in the fifth and last chapter with a summary of the key findings, its scientific contributions and managerial implications, and its limitations and opportunities for future research. The appendix then covers additional material supplementing the described essays, e.g., the interview questionnaire used in essay I or the experimental instructions used in essays II and III. An overview of this dissertation is presented in TABLE 1.1.

TABLE 1.1: Overview of three essays within this dissertation

Essay characteristics	**Essay I (cf. Chapter 2)**	**Essay II (cf. Chapter 3)**	**Essay III (cf. Chapter 4)**
Research question	How and why do family-owned companies account for their GHG emissions along their value chain, and which challenges do they face during this process?	Does the introduction of a regulatory minimum ESG disclosure level continuously add value over a mere voluntary reporting regime?	Does reasonably assured and long-term, forward-looking sustainability information add value over limitedly assured and short-term, forward-looking sustainability information?
Research approach	Qualitative	Experimental	Experimental
Methodology	Multiple-case study	Laboratory experiment	Laboratory experiment
Unit of analysis	13 German family-owned companies	207 laboratory participants simulating corporate decision makers and investors	108 frequent and capital-market interested non-professional investors
Stakeholder perspective	Company perspective	Company and investor perspective	Investor perspective
Contributions	Test and extension of existing conceptual framework on environmental management approaches for family-owned companies and identification of motivation for and challenges in environmental management	Experimental test of multiple regulatory minimum disclosure levels and effects on companies and investors; significant impact of regulation versus no regulation while higher regulatory levels with little additional value	Experimental test of regulatory characteristics currently under discussion on a European level; clear view on positive effects of reasonable assurance and provision of long-term forward-looking information
Managerial implications	Overview and guidance for family-owned companies for their environmental management; sense of urgency and standardisation of data formats identified as key for future environmental success	Guidance for companies, investors and regulating authorities for how other stakeholder groups react to certain minimum levels of disclosure requirements	Guidance for regulatory authorities on how to design specific characteristics of ESG regulation of non-financial information disclosure

2 Essay I – Measurement and accounting of greenhouse gas emissions in German family-owned companies

Abstract

This paper explores the unique intersection of family-owned companies and their approach to environmental management in times of a growing need to fight climate change. Among various initiatives to reduce GHG emissions, the EU has been exceptionally proactive, mandating large companies to report on environmental and non-financial matters. Within Europe, this study focuses on Germany, where family-owned companies play a dominant role, comprising a significant portion of the private sector and emissions. Recognising the distinct characteristics of these companies, such as a long-term mindset and sustainable management combined with their tendencies towards secrecy, this research aims to (1) examine whether existing conceptual frameworks on environmental management methodologies apply to family-owned firms and (2) delve into why these companies report on environmental activities beyond regulatory requirements and the challenges they face in this journey. Utilising a qualitative approach, including semi-structured interviews and case studies, the study confirms the relevance of certain archetypes to family-owned companies while extending existing frameworks to include motivations, methodologies, and challenges specific to this company type. The findings highlight the importance of customer demand, generational thinking, and an intrinsic desire to mitigate GHG emissions as motivators, with the GHG Protocol emerging as the prevalent standard. Challenges such as a lack of urgency and standardised data complicate environmental reporting. This paper contributes to the literature by offering insights into the environmental management practices of a sector known for its privacy and suggesting tailored approaches for future GHG reduction efforts.

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Status: Working Paper[4]

[4] This essay was presented at the 3rd European Institute for Advanced Studies in Management (EIASM) Conference on Management Accounting and Control in SMEs in Assisi, Italy, in April 2023 and accepted at the 23rd European Academy of Management (EURAM) Annual Conference in Dublin, Ireland, in June 2023.

2.1 Introduction

The world in the 2020s faces global challenges such as the COVID-19 pandemic or the Russo-Ukrainian war, which pose significant threats to today's society. However, climate change is "*the biggest threat to security that modern humans have ever faced*" (United Nations, 2021), as David Attenborough stated at the 2021 UN Security Council. Over the last four decades, global temperatures have been rising constantly, with each decade warmer than the previous decade. For instance, in the second decade of the 21st century, temperatures have been ~1.1° Celsius higher than pre-industrial temperatures (IPCC, 2021), driven to the most considerable extent by GHG emissions.[5] Now, more than ever, it is essential to reduce GHG emissions as much as possible and as soon as possible to reduce climate change risks (UNFCCC, 2015). Many initiatives have been started over the last three decades, such as, for instance, the Kyoto Protocol (signed in 1997), the Paris Agreement to limit the temperature increase to a maximum of two degrees Celsius (signed in 2016), the European Green Deal to become carbon neutral by 2050 (approved in 2020) or the European "*Fit for 55*" initiative to reduce GHG emissions by 55% until 2030. Globally, the industry is responsible for 30-40% of GHG emissions (Ritchie et al., 2023), making it evident that this constitutes one of the main levers for managing and optimising the world's GHG emission household.

The EU is mainly active in enforcing these initiatives with the design and implementation of regulatory guidelines, thus urging companies to report on and manage their environmental emissions. In 2014, the EU approved the NFRD (European Parliament & European Council, 2014). Later on, the CSRD (European Parliament & European Council, 2022) required companies to report on environmental performance, social and employee matters, human rights performance, corruption and anti-bribery matters (CSR Europe & GRI, 2017; European Parliament & European Council, 2022). Within the EU, Germany constitutes the largest emitter of GHG, with a share of 25% of European GHG emissions (European Environment Agency, 2023). Different to other European countries, family-owned companies constitute the predominant company type, with more than 90% of private companies being family-controlled, comprising ~57% of employees within the private sector and ~55% of total German company revenue (Stiftung Familienunternehmen, 2023). Family-owned companies differ substantially from public corporations given their long-term mindset, their sustainable management, the will

[5] As defined by the Kyoto Protocol, GHG emissions include the following six gases in particular: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HCFs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) (UNFCCC, 2008).

to assure the persistence of the company and a desire to hand over the company to the next generation, yet also their tendency towards privacy and secrecy (so-called hidden champions) (Stiftung Familienunternehmen, 2023). As carbon accounting becomes increasingly important and the required processes within family-owned companies have only received limited attention to date (Salvato & Moores, 2010), I contribute to the growing field of research on family-owned companies (Hasso & Duncan, 2013) by answering the following overarching research question with my research essay: "*How and why do family-owned companies account for their GHG emissions along their value chain, and which challenges do they face during this process?*"

To approach this research question, I come up with two core objectives: (1) test whether conceptual frameworks for environmental management developed by past researchers for firms in general also hold for family-owned companies as particular company type and (2) extend this previous research into a new framework by gathering information on the applied methodologies for environmental management, i.e., how do family-owned companies perform their environmental management, identify why family-owned companies account and report carbon emissions besides regulatory guidance as well as identify which challenges family-owned companies face throughout their carbon accounting process. Given that these aspects cover several topics of the environmental management approach, I will divide the overarching research question into multiple research sub-questions later. This analysis has not been performed before for the interface of family-owned companies and their approach to environmental management.

Related to the first objective, various researchers in the past have classified companies into environmental management archetypes based on their level of top-level management involvement, degree of reporting and employee training, as well as the overall importance of environmental matters to management and employees (Carroll, 1979; Henriques & Sadorsky, 1999; Hunt & Auster, 1990; Roome, 1992; Wartick & Cochran, 1985). I, thus, use their developed frameworks as a starting point to test whether the mentioned aspects and categories hold for family-owned companies. A family-owned company can differ from general company archetypes as family-owned companies have been found to be more altruistic than non-family companies (Déniz & Suárez, 2005), cause less pollution (Cennamo et al., 2012) and typically commit to preserving their socioemotional wealth through environmental management (Berrone et al., 2012).

These aspects also influence the second research objective, i.e., applied methodology for environmental management and its motivation to do so as well as the faced challenges during this process. Various methodological approaches exist within environmental management. The most prominent standard used among public corporations is the so-called GHG Protocol, applied by more than 92% of Fortune 500 companies as the accounting standard (WBCSD & WRI, 2023). Other initiatives are, for instance, the SBTi, aiming at enabling companies to set relevant climate targets and provide guidance on how to achieve these targets (Science Based Targets, 2022) or the ISO 14064 standard, which serves as a complement to the GHG Protocol to design, develop, manage, report, and verify a company's GHG inventory (Wintergreen & Delaney, 2007). Furthermore, on behalf of over 680 institutional investors, the CDP collects survey-based data regarding carbon emissions and water consumption from companies, cities, regions, and public authorities in a standardised format (Weiss et al., 2022). To what extent family-owned companies apply each standard has not been discussed in the existing literature, and neither were related factors such as involved resources, calculation methods, or involved software.

The motivation to report such information to outside stakeholders can be manifold and is part of the second research objective. One explanation can be found in a desire to please demands from various stakeholders (Freeman, 1984), while a second explanation can be found in a desire to achieve broad legitimacy in society as their company name and their family name are tied together closely (Cotter & Najah, 2012). The aspects that motivate family-owned companies to account for and report their GHG emissions will thus be analysed as part of this research essay.

Besides the motivation behind performing carbon accounting, the literature identifies various general challenges in the carbon accounting process. To name a few, examples involve overall insecurity in reported values (Rypdal & Winiwarter, 2001), uncertainty regarding the mathematical model and chosen parameters (WBCSD & WRI, 2015), as well as undefined calculation standards yielding different data from different suppliers (Olson, 2010). The literature has yet to thoroughly discuss whether these challenges apply to family-owned companies.

Turning towards the research methodology applied for this research essay, it is crucial to understand that family-owned companies are known for their privacy (Miller & Le Breton-Miller, 2021), non-disclosure (Poza & Messer, 2001) and preservation of confidential

information (Miller & Le Breton-Miller, 2004). As such, public information on family-owned companies is only available to a limited extent. I, therefore, chose a qualitative approach and used a multiple-case study approach (Eisenhardt, 1989). I conducted semi-structured interviews among 13 German family-owned companies, which I further triangulated with external sources to the extent available (Yin, 2009). Cases were carefully selected via a detailed sampling approach (Glaser & Strauss, 1967). Only companies with 100% family ownership, appropriate size in terms of employees and revenue such that the CSRD applies, and companies from industries known for comparably high GHG emissions were chosen. The chosen approach reflects the best opportunity to gather the relevant data, mainly because carbon accounting has yet to become a fully established approach but constitutes an exploratory effort for most companies today. I eventually evaluate the data by precisely transcribing all interviews to then code (Miles et al., 2018) and analyse the generated data within- and cross-case.

Turning to my results, I generally confirm that the classification applied by Henriques and Sadorsky (1999) is also valid for family-owned companies, while most companies either belong to the second or third archetype, which I define as extrinsically-driven reporters and intrinsic sustainability drivers. Additionally, I extend the framework regarding methodology, motivation, and challenges. On the methodological side, I generally confirm the GHG Protocol as the leading standard among family-owned companies. In contrast, most companies have focused on Scopes 1 and 2, and only some have collected Scope 3 GHG data in an exploratory manner. The data collected is used mainly for internal reporting or provided to stakeholders on demand, while only a few companies also report their data externally voluntarily. Customer demand, generational thinking, and an intrinsic will to contribute were identified as the primary motivators for family-owned companies to account for their GHG emissions. Among the main challenges, a need for more sense of urgency among either top-level management or general staff was identified as highly challenging. Additionally, lacking or unstandardised data complicates the accounting process, resulting in high levels of insecurity when modelling the data.

With the achieved results, I contribute to the growing literature related to family-owned companies (Hasso & Duncan, 2013) known for privacy and reservedness (Miller & Le Breton-Miller, 2021; Stiftung Familienunternehmen, 2023) by applying an interview-based approach. In contributing to this scientific area, I present a novel and comprehensive scientific framework designed to enhance the understanding of the current state and future potential of carbon accounting within family-owned businesses. This framework will equip researchers and

practitioners with the necessary insights to address and improve carbon accounting practices. It is essential to tackle the challenges identified in this context. Consequently, the analysis yields two critical managerial implications: Firstly, the need to raise awareness and address the relatively low sense of urgency regarding carbon accounting among top management and staff across various companies, and secondly, the importance of developing standards for data exchange, both internally within companies and externally between different entities, to mitigate the issues related to carbon emission data accessibility.

After this introduction, I structure this paper as follows: In the next section, I will cover the theoretical foundations surrounding environmental management frameworks, family-owned companies, environmental regulatory guidelines, carbon accounting methodologies, and theoretical motivations. The third section presents the qualitative multiple-case study methodology applied in this research essay. Section four then presents the results of this scientific work, including the developed company archetypes. Section five summarises the findings, provides managerial implications, and gives an outlook on potential future research.

2.2 Theoretical background and literature review

As part of the theoretical literature review, I will provide an overview of the literature on environmental management frameworks for companies and discuss past literature on environmental management methodologies, motivations, and challenges. To answer the overarching research question mentioned in the previous chapter, I thus break down my research question into four sub-research questions I will derive in the following four sub-chapters.

2.2.1 General environmental management frameworks

As mentioned, family-owned companies constitute the primary company type in Germany, with over 90% of German companies owned by one or multiple families (Stiftung Familienunternehmen, 2023). Besides the considerable importance for the German economy, this company type also differs from other corporations in various ways, which I will discuss in the following chapter.

Multiple definitions for family-owned companies have been developed over time. De Massis et al. (2012) have therefore analysed definitions of family-owned companies for 15

years and identified across 215 studies the most relevant factors for differentiating family from non-family companies. 79% of definitions include family ownership, and 53% include family management as definition criteria. In contrast, only 15% use self-identification and 9% use multiple generations as criteria to define a family business (De Massis et al., 2012). Considering Germany, the German foundation for family-owned companies follows the definition provided by Kirchdörfer (2011), who acknowledges that varying definitions exist, primarily related to equity share and share of control of the family owning the company. He defines a family-owned company as a company of an arbitrary size and legal form where one or multiple families own most of the company. In the case of multiple families owning the company, they must either be directly related to each other or connected via a history within their families of jointly owning the company. Additionally, the families must influence the company sustainably, either via direct exertion of influence within the board of advisors or management or indirect exertion of influence via selected representatives of the families (Kirchdörfer, 2011). The German foundation for family-owned companies further adds to this definition by stating that even public companies listed on a stock exchange can be defined as family-owned companies in case one or multiple families who have founded the company, acquired it, or inherited it, own at least 25% of decision rights (Stiftung Familienunternehmen, 2022).

Family-owned companies are an interesting phenomenon as they differ significantly from public companies (Berrone et al., 2012). In other words, "*family firms are typically motivated by, and committed to, the preservation of the socioemotional wealth, referring to non-financial aspects or 'affective endowments' of family owners*" (Berrone et al., 2012, p. 259). Such non-financial aspects include, for instance, the family's reputation, which is inseparably tied to the family-owned company's actions and sustainable, cross-generational thinking, including the will to hand over the company to future generations. Family-owned companies are more risk-averse than non-family companies (Gomez-Mejia et al., 2011) and are more risk-averse towards socioemotional aspects of their financial performance (Berrone et al., 2012). This trend can also be identified in the literature when looking at ESG-related activities. For instance, family-owned companies have been found to cause less pollution, have built unique stakeholder relationships, and are more altruistic than non-family companies (Berrone et al., 2010; Cennamo et al., 2012). All these activities primarily explain a great risk aversion towards reputational losses. Moreover, family-owned companies are often situated in rural areas and

are economic drivers in their operating region. Thus, they receive special attention from the local population regarding their actions (Déniz & Suárez, 2005).

Whether and how these characteristics influence a family-owned company's environmental management has yet to be determined. To better understand how companies in general can be classified according to their environmental management, various researchers have made schematic definitions of company archetypes (see TABLE 2.1) to easily understand environmental management efforts (Carroll, 1979; Henriques & Sadorsky, 1999; Hunt & Auster, 1990; Roome, 1992; Wartick & Cochran, 1985). Both Roome (1992) and Hunt and Auster (1990) have clustered companies on a 5-point scale. Roome (1992) starts with the non-compliance level, i.e., companies belonging to this archetype do not adhere to regulatory standards, neither proactively nor cost-driven. Compliant companies, i.e., the second archetype, adhere to regulatory standards while not exceeding them. The third archetype, compliance plus, describes companies that already use environmental information and reporting to their advantage, e.g., by positioning positive aspects in front of customers. The fourth and fifth archetypes describe companies that excel at environmental management and do more than regulators, customers, or society require. While Hunt and Auster (1990) use different wording for these archetypes, i.e., ranging from beginner to proactivist, associated characteristics on every level are similar to those described. Henriques and Sadorsky (1999) linked these two frameworks to a more general framework, i.e., a classification into four archetypes, i.e., reactive, defensive, accommodative and proactive, as more general categories.

Given the individual characteristics of family-owned companies described before on the one hand and the different environmental management classifications applying in general to all companies on the other hand, I make an essential contribution to the existing literature by testing the described framework for family-owned companies. While family-owned companies are known for their risk aversion on one side (e.g., Gómez-Mejía et al., 2007), implying that family-owned companies are hypothetically no frontrunners in environmental management, their high interest in acting sustainably (e.g., Berrone et al., 2010) could imply that no activity at all is also relatively improbable. As explained before, I will use research sub-questions to contribute to the overarching research question stated earlier and, therefore, state this first research sub-question as follows:

Do traditional environmental management frameworks for companies in general apply to family-owned companies?

TABLE 2.1: Schematic environmental management company archetypes[6]

Roome (1992)	Non-compliance	Compliance	Compliance Plus	Environmental excellence	Leading edge
Hunt and Auster (1990)	Beginner	Firefighter	Concerned citizen	Pragmatist	Proactivist
Henriques and Sadorsky (1999) **Wartick and Cochran (1985)** **Carroll (1979)**	Reactive	Defensive	Accommodative	Proactive	
Overall importance of environmental management	None	Critical issues only	Regarded as relevant function	Top priority function	
Top-level management involvement	None	Partially	From time to time	Full support	
Reporting mode	None	Regulatory minimum	Good internally, Little externally	Fully internal and external	
Employee involvement	None	Little	Some	Strongly preferred	

2.2.2 Methodological approach to environmental management

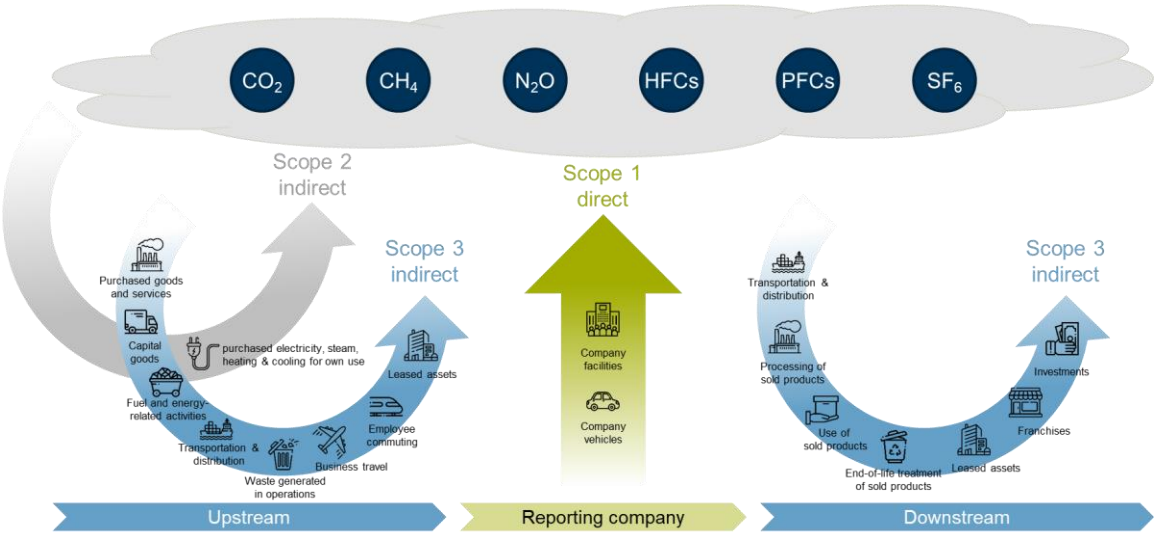
Besides testing the framework, I also aim to extend the framework in terms of the chosen methodological approach. Only limited information exists on family-owned companies today regarding operationalising the environmental accounting process, its associated accounting methods and involved resources. When discussing the carbon accounting process, it is helpful to understand what it involves. I, therefore, follow the definition provided by Stechemesser and Guenther (2012): "*Carbon accounting comprises the recognition, the non-monetary and monetary evaluation and the monitoring of GHG emissions on all levels of the value chain and the recognition, evaluation and monitoring of the effects of these emissions on the carbon cycle of ecosystems*" (Stechemesser & Guenther, 2012, p. 35).

Several standards have been established and widely adopted in the industry to perform carbon accounting in companies. First, the so-called GHG Protocol constitutes one of the most widely used standards for carbon accounting, with more than 92% of Fortune 500 companies using it as their accounting standard (WBCSD & WRI, 2023). The GHG Protocol was first

[6] Adapted from Henriques and Sadorsky (1999).

established by two NGOs in 2001. It aims to provide a common standard for companies to enable an accurate and fair accounting of GHG emissions. Following the typical financial accounting principles[7], the GHG Protocol has developed five fundamental principles: Relevance, completeness, consistency, transparency, and accuracy (WBCSD & WRI, 2015). Carbon accounting today is, however, still very much unregulated in comparison to financial accounting (Ioannou & Serafeim, 2017). The GHG Protocol clusters GHG emissions into direct and indirect GHG emissions and classifies these into three different Scopes of GHG emissions: Scope 1, Scope 2, and Scope 3 emissions (see FIGURE 2.1). Scope 1 emissions are direct GHG emissions from a company's sources. Examples here are the operation of a power plant, including its fossil and liquid fuel or company vehicles consuming fuel. Scope 2 emissions are indirect GHG emissions resulting from generating electricity for the company, i.e., the GHG is physically emitted at the electricity power plant instead of the company. Scope 3 emissions are all other indirect GHG emissions from activities outside a company's direct control or ownership. Therefore, a thorough analysis of the company's value chain is required. The GHG Protocol provides separate guidance for Scope 3 emission calculations, breaking Scope 3 emissions into 15 categories categorised into upstream or downstream activities (WBCSD & WRI, 2013).

FIGURE 2.1: Overview of three GHG Protocol Scopes along the value chain[8]



[7] Relevance, faithful representation, comparability, verifiability, timeliness, understandability (International Accounting Standards Board, 2018).
[8] Adapted from (WBCSD and WRI, 2015).

Besides the GHG Protocol, one noteworthy carbon accounting standard is standard 14064, published by the ISO. Introduced in 2006, ISO 14064 provides specific minimum standards for how to comply with the defined best practices. As such, the GHG Protocol defines the content to be accounted for, and ISO 14064 defines how to operationalise the process. In this way, both standards complement each other (Wintergreen & Delaney, 2007). Thus, ISO 14064 helps an organisation design, develop, manage, report, and verify a company's GHG inventory.

The third standard mentioned here is the SBTi created by the CDP, the UN Global Compact, the WRI and the World Wide Fund for Nature (WWF) (Science Based Targets, 2022). This initiative aims to enable companies to set relevant climate targets and provide guidance on achieving these targets. Therefore, the SBTi establishes a target validation process along a particular set of criteria to assess and validate a company's climate targets individually and independently. Today, over 2,200 companies covering more than a third of global market capitalisation adhere to the SBTi.

Typically, companies would use their annual reporting and integrate their emissions into the annual report (Depoers et al., 2016). Nevertheless, the structure of these company reports differs in terms of reported data and format, which is why another initiative has been launched to overcome this issue, i.e., the previously mentioned CDP. The CDP is an international non-profit charity organisation across multiple countries (e.g., Germany, United States of America, United Kingdom, Japan, and China) founded in 2000. On behalf of over 680 institutional investors with over USD 130 trillion in managed assets, the CDP collects survey-based data from companies, cities, regions and public authorities regarding carbon emissions and water consumption. In 2021, over 13,000 companies reported their data voluntarily via the CDP, including 2,400 companies within Europe, equal to 74% of the total market value (Weiss et al., 2022).

In summary, various accounting methods exist for a company's GHG emissions. Nevertheless, it is a question of which standard to use and how to operationalise it throughout the company. The operationalisation includes, for instance, the resources involved in the accounting process, the broadness (e.g., all versus limited GHG Protocol Scopes), and diligence (e.g., estimation versus accurate calculation) of GHG emissions. Family-owned companies are often less innovative, and resource availability is limited (Nieto et al., 2015), which can thus result in a leaner accounting process. As financial accounting processes within family-owned

companies have to date received only limited attention and carbon accounting processes thus even less (Salvato & Moores, 2010), I contribute to the growing field of research on family-owned companies (Hasso & Duncan, 2013) by answering my second research sub-question:

How do family-owned companies operationalise their GHG emissions accounting along their value chain?

2.2.3 Motivations to perform environmental management

Besides testing and extending an existing environmental management framework, I aim to contribute to the previously mentioned family-owned company literature on environmental reporting by identifying why family-owned companies collect and report environmental information. Various motivational theories for collecting and disclosing environmental information can be identified. Hahn et al. (2015) cluster such theories into three groups: (1) socio-political theories, (2) economic theories and (3) institutional theories.

First, socio-political theories can be broken down into stakeholder and legitimacy theories. Stakeholder theory was initially introduced by Freeman (1984), who argues that a company's success depends on accounting for the interests of all stakeholders a company has, internally and externally, and not only targeted at the company's shareholders. Gray and Bebbington (2000) argue here, however, that voluntary environmental disclosure results in only sharing information the management is willing to release. As such, the disclosed information only fulfils legitimation purposes, yet there is no accountability for the information shared by the company. Disclosed information can even be used to justify certain decisions, and therefore, companies may use the disclosed information for this purpose while leaving other information aside, thus making it invisible (Broadbent et al., 1994). Another aspect to consider as part of stakeholder theory is the reasoning behind sharing information. Stakeholder theory argues that management will disclose environmental information due to pressure from their stakeholders (Roberts, 1992), yet disclosed information has no completeness guarantee of any kind (Depoers et al., 2016).

In contrast, disclosed information can enhance a company's reputation among stakeholders and increase the perception of the company's brand overall, resulting in a significant impact on employee hiring and retention, creating new business opportunities and assuring better access to external financing (Ioannou & Serafeim, 2017). Another benefit of participating in environmental activities and disclosing environmental information to

stakeholders is stakeholder goodwill, almost comparable to insurance preserving corporate financial performance in critical situations (Godfrey et al., 2009). Albertini (2013), for instance, confirms a positive correlation between environmental and financial performance after conducting a meta-analysis across more than 50 studies, underlining that environmental disclosure can safeguard stakeholders as they associate good financial performance with environmental performance.

Legitimacy theory, compared to stakeholder theory, argues that disclosure of information is targeted at an even broader audience and thus aims at society in its entirety. According to this theory, a company's interests are to gain broad acceptance throughout society and, as such, achieve buy-in for its actions and generate a credible image among a broad audience (Cotter & Najah, 2012). Legitimacy theory furthermore argues for environmental disclosure because of pressure from external stakeholders. However, the disclosure does not aim to harm the social contract between the company and the broader society (Deegan, 2002). For climate-related topics, this social contract is firm. Whenever society perceives a company breaches this implicit social contract, society will start to revoke the company's contract by stopping the demand for the product or making public statements against the company. For instance, Aerts and Cormier (2009) found a positive correlation between a company's environmental legitimacy and the quality of disclosed environmental information. Terlaak et al. (2018) argue that companies with a more significant extent of family ownership benefit more from environmental information disclosure as they are perceived to disclose less information than companies with little family ownership.

Economic theories argue that disclosure is merely based on a trade-off between the benefits of disclosing information and the costs of disclosing this information (Clarkson et al., 2008). Shareholders are the focal point here, for which the disclosed information has the potential to reduce the problem of information asymmetries between them and the management, as explained in the principal-agent theory by Jensen and Meckling (1976). This phenomenon is also explained by the signalling theory, where one party communicates with another, and the sending party chooses the content and method of communication. In contrast, the receiving party then chooses how to interpret the received information (Connelly et al., 2011). Thus, the sender can pre-empt scrutiny from stakeholder groups such as political groups. Especially in the case of voluntary disclosures, signalling theory argues that strong emphasis is put on conveying good environmental performance and presenting the company in the best

way possible. Nevertheless, the information must be perceived as trustworthy to ensure the integrity of the reporting company.

Lastly, institutional theory constitutes the third cluster of motivation for carbon disclosure presented by Hahn et al. (2015). This theoretical field argues that organisations are driven, similar to economic theory, by profit maximisation, yet also by demands from different kinds of (governmental) institutions.

At this point, a quick regulatory digression is helpful to understand the regulatory network family-owned companies operate in today. Most important to mention here is the previously mentioned NFRD, regarded as one of the most impactful directives the EU has enacted to achieve climate targets (Cosma et al., 2022). It limits the company scope to companies with more than 500 employees, net turnover exceeding EUR 40 million or balance sheet volume exceeding EUR 20 million and generally companies of public interest, i.e., credit and insurance institutions and capital market-oriented companies. Within the EU, approximately 11,700 companies fall under the criteria set out in the NFRD (European Parliament & European Council, 2022). Companies to which these criteria apply must report on environmental performance, social and employee matters, human rights performance, corruption and anti-bribery matters in either the management report or a separate non-financial report (CSR Europe & GRI, 2017). Considering the criteria under which companies must comply with the NFRD, it becomes evident that family-owned companies without capital market orientation are outside the scope and, thus, are not obliged to report under the guidelines of the NFRD. To further contribute to the European Green Deal and, as such, achieve the net-zero GHG emission target by 2050, the European Commission has deemed it necessary to further enhance today's reporting guidelines for non-financial matters and, therefore, propose the previously mentioned CSRD (European Parliament & European Council, 2022). Compared to the NFRD, the CSRD will extend the NFRD majorly in terms of company type, reporting scope and reporting format, extending the regulatory scope to more than 50,000 companies (EY, 2022). As such, family-owned companies will, going forward, be regulated under the CSRD and face regulatory pressure to report on environmental information.

Empirically, smaller companies feel regulatory or institutional pressure more strongly, while larger companies are influenced rather by other stakeholder groups (Henriques & Sadorsky, 1999). Larger family-owned companies, especially, will investigate formalised reporting approaches to comply with the needs of their stakeholders (Shields et al., 2018).

Smaller family-owned companies are often overwhelmed with the required workload and need more financial or human resources to compile sophisticated carbon accounting and reporting. Nevertheless, institutional pressure is comparably low. Previous authors stated that "*despite burgeoning research on companies' environmental strategies and environmental management practices, it remains unclear why some firms adopt environmental management practices beyond regulatory compliance*" (Delmas & Toffel, 2004, p. 209).

Moreover, regulatory measures also come with certain drawbacks given the required reporting effort and a need for changing corporate processes. Furthermore, this act of bureaucratisation yields a convergence in the disclosure behaviour of companies. DiMaggio and Powell (1983) argued that companies are becoming more similar, yet not driven by the need for efficiency but by the need to comply with specific guidelines set by institutions. Thus, companies are becoming more homogenous, which makes them less efficient. Additionally, disclosing environmental information can furthermore be penalised on financial markets or used against the company's interest by competitors (Cormier & Magnan, 1999). Greater exposure to NGOs or other activist groups can lead to negative consequences when the disclosed information is used to attack the company or accuse the company of conducting greenwashing (Lyon & Maxwell, 2008). Lastly, Y. Li et al. (1997) argue that disclosed information could be used as preliminary information for investigators and, as such, increase compliance-related costs.

In summary, various theoretical motivations explain why family-owned companies disclose environmental information voluntarily. Apart from the mentioned motivating factors, which I consider extrinsic, other intrinsic influencing factors, such as the company's values, might exist. Moreover, even if private family-owned companies do not report their GHG emissions externally, an internal accounting might make sense to manage GHG-related risks and identify mitigation and reduction strategies (WBCSD & WRI, 2015). In any case, today, many family-owned companies are at least internally accounting for their GHG emission information and partly already disclose this information externally without being regulated to do so.

I, therefore, motivate the following research question by the broad set of potential motivating factors to disclose environmental information and aim to identify what motivates family-owned companies to do so. I find further support from various authors as research on family-owned companies is regarded as an emerging field of research in the literature (Carrera,

2017), where the amount of research is behind other academic fields today (Prencipe et al., 2014). I therefore state the third research sub-question as follows:

Why do family-owned companies account for their GHG emissions along their value chain?

2.2.4 Challenges in environmental management

Many of the required processes in carbon accounting constitute new territory for family-owned companies due to the recency of its introduction. In line with establishing such new processes comes measurable uncertainty. The uncertainty in today's carbon accounting can range between five and twenty percent of the reported GHG emission value (Rypdal & Winiwarter, 2001). This uncertainty can result from several sources, such as uncertainty regarding the mathematical model (Lee et al., 2024), chosen parameters and assumptions (WBCSD & WRI, 2015), as well as undefined calculation standards yielding different data from different suppliers (Olson, 2010). Moreover, the increasing complexity resulting from international and highly flexible supply chains complicates data gathering within a company (Schaltegger & Csutora, 2012). Of course, the previously mentioned limited availability of resources and reluctance to adopt new processes quickly among family-owned companies (Nieto et al., 2015) can also complicate the establishment of new accounting processes. Digital transformation can, in addition, support a smooth carbon accounting process. However, the digitalisation of processes depends on the abilities of the family-owned company. Furthermore, the overall transformation effort depends on the individual willingness to transform among the owning family (Heider et al., 2022).

Whether the challenges described above also apply to family-owned companies and to what extent family-owned companies are willing to digitally transform in the carbon accounting space has yet to be discussed thoroughly in the existing literature on family-owned companies. Thus, to better understand which exact challenges family-owned companies face in this regard, the fourth research sub-question of this research essay shall answer the following question:

Which challenges do family-owned companies encounter when measuring and accounting for GHG emissions along the value chain?

2.3 Qualitative methodology

2.3.1 Multiple-case study approach

Environmental management is a topic of broad societal interest today, and many companies are willing to speak openly about their approach to measuring and reducing GHG emissions. Nevertheless, family-owned companies often avoid making information public (Miller & Le Breton-Miller, 2021), are characterised by non-disclosure (Poza & Messer, 2001) and preserve confidential information where possible (Miller & Le Breton-Miller, 2004). Thus, collecting public information on family-owned companies is challenging as it is at least complicated to gather or unavailable. Qualitative data collection is thus most appropriate in this case to collect sufficient data on the one hand and better understand where family-owned companies stand today in their carbon accounting processes on the other hand. In addition, I aim to not only test an existing framework but also extend this into a new framework. Therefore, I deploy a multiple-case study approach to test the existing framework and extend it into a new theoretical foundation following the approach introduced by Eisenhardt (1989). Initially, research questions were defined based on a thorough literature review where I identified today's research gaps. Given the high relevance of carbon accounting and the high complexity involved, case study research is a well-suited method to reflect real-world phenomena (Eisenhardt & Graebner, 2007). As case study research is characterised by using multiple data sources (Yin, 2009), I also triangulate the empirical results where possible.

Conducting research based on a single, extensive case-study research constitutes an exciting approach, yet based on findings in previous literature (Eisenhardt & Graebner, 2007; Yin, 2009), I decided that a multiple-case study approach allows for a more thorough analysis representing the real world more realistically. In addition, this approach allows for a cross-case analysis and thus allows the comparison of different family-owned companies in their approaches instead of a mere within-case analysis (Eisenhardt, 1989). Moreover, I follow Eisenhardt's (1989) replicational logic, i.e., I regard every case as a discrete unit of investigation and thus extend the empirical results with each additional case to eventually develop a new theory.

While the framework testing and extension is focused on a sample of German family-owned companies across multiple industries, generalisability to other family-owned companies in European countries is applicable as other European companies face similar upcoming

regulations on a European level. The details of the applied data sampling approach are described in the next chapter.

2.3.2 Data sampling and used sources

Within the focus of this research essay are German family-owned companies. Germany is Europe's largest economy, and ~90% of German companies are family-controlled, resulting in a highly relevant group of companies (Stiftung Familienunternehmen, 2023). According to Glaser and Strauss (1967), I conducted the sampling to ensure a high-quality sample to select the best cases. I started sampling with German companies with family ownership. To ensure that the results are tied to family ownership, I only focused on companies owned 100% by one or multiple families related to each other. I thus avoid the influence of other shareholders as many examples within Germany exist with partial family and partial public ownership (e.g., Volkswagen AG, Wacker Chemie AG). Furthermore, many private companies today are not regulated by the NFRD. However, they might fall under the CSRD regulations when relevant criteria are met. To ensure that regulatory aspects also influence company decisions, I reduced the sample to companies exceeding two of the following three criteria, thus falling under the regulation of the CSRD: (1) More than 250 employees, (2) more than EUR 40 million net turnover or (3) more than EUR 20 million balance sheet. Such companies face reporting requirements as part of the new CSRD and are thus assumed to have already considered carbon accounting to some extent. Family-owned companies in scope were limited to, at most, a net turnover of EUR 5,000 million to differentiate the sample sufficiently from large public corporations. These sampling boundaries, on the one hand, helped to interview companies which are sufficiently large and, therefore, are assumed to have proper carbon accounting in place and, on the other hand, differentiate themselves sufficiently from DAX-40 companies where ~80% of companies exceed the upper net turnover level. The industry focus was set on companies belonging to the industrial and consumer goods sectors and the transportation industry due to their comparably high GHG emissions across all three Scope levels as defined in the GHG Protocol. Due to the comparably high GHG emission levels, companies are likely to have considered carbon accounting more thoroughly. Lastly, I only considered companies with public communication regarding their activities towards fighting the climate crisis for this sample as I assumed a genuine interest in this topic among those companies and presumably employees responsible for carbon accounting. Based on this multi-step sampling process, I was able to identify a set of 13 cases (TABLE 2.2) which I reached through either one of the

following methods: (1) reach-out via e-mail or social media, (2) personal network or (3) introduction via the interviewed family-owned company. I contacted 29 companies, resulting in a 45% response rate. I mainly conducted the interviews with one interview partner per company, i.e., the CEO, the head of sustainability or the sustainability manager. In two cases, I spoke to multiple interview partners in multiple interviews to generate a further in-depth understanding. In all other cases, the relevant information was sufficiently captured in one interview. All interviews were conducted in May, June, and July 2022 and lasted between 43 and 78 minutes, using virtual telecommunication methods involving cameras. Towards the last interviews, I identified a convergence of interview results, assuring that further interviews would yield only a little insight. Thus, the interview procedure was stopped after the described cases (Eisenhardt, 1989).

TABLE 2.2: Overview of interviewed companies

Company	**Industry**	**Revenue [EUR M]**	**Employees**	**Interview partner(s)**
Alpha	Healthcare	1,800	8,000	Sustainability Manager
Beta	Industrial Goods	3,400	13,000	Head of Sustainability & Sustainability Manager
Gamma	Industrial Goods	2,100	15,000	Group Director Quality & Environment, Sustainability Manager and Team Manager Environmental Protection
Delta	Agriculture	200	500	CEO
Epsilon	Paper	1,000	2,500	Sustainability Manager
Zeta	Industrial Goods	600	1,500	Sustainability Manager
Eta	Industrial Goods	200	1,500	CEO
Theta	Logistics	4,000	12,000	Senior Project Manager Sustainability
Iota	Construction	125	650	Sustainability Manager
Kappa	Industrial Goods	250	2,000	CEO
Lambda	Industrial Goods	250	1,500	CEO & Head of Sustainability
Mu	Industrial Goods	300	4,000	Member of the Executive Board
Nu	Industrial Goods	250	1,000	Quality Manager

For the previously mentioned data triangulation (Yin, 2009), I extended the empirical interview-based results with publicly provided company information in press releases and company websites. In addition to the described cases, three expert interviews were conducted with a senior manager from a leading consulting company, the CEO and founder of a start-up focusing on carbon emission accounting, and the sustainability manager from an international family-owned company located outside Germany to further triangulate the findings. To ensure a high level of validity, I assured the interview partners of the complete anonymity of the collected data before the interview. Furthermore, the interviews were semi-structured, i.e., a deviation from the interview guideline was possible. The interview guide involved multiple open questions to avoid suggestive questions (see appendix, FIGURE 6.2) and it was designed per the guidance Yin (2009) provided.

2.3.3 Data analysis

According to the approach described by Eisenhardt (1989), I initially developed each case individually and conducted the within-case analysis. I then compared the results across cases to test the existing framework (Henriques & Sadorsky, 1999) and extend it. Initially, all interviews were precisely transcribed. Transcripts were then coded and analysed using the MAXQDA[9] tool. The coding was inspired by the approach Miles et al. (2018) described, and I, therefore, diligently assigned individual codes to each transcript passage. In total, a set of 708 individual written codes were coded. I grouped the developed codes into first-order categories in a second coding round. Afterwards, I was able to divide these categories into higher-level categories in a third round to thus derive the second-order categories resulting in a three-level coding approach. The overall approach was conducted iteratively, and thus second-order categories also influenced first-order categories during the coding process. With the generated evidence, initial hypotheses were revised and shaped further to create additional internal validity. I could thus identify specific patterns as part of the cross-case analyses to derive categories with generalisability beyond the discussed cases. Finally, additional validity was built by comparing the results with conflicting and similar literature and further triangulation with company-provided public information and expert interview input to eventually reach closure in a tested and extended framework.

[9] Software program developed by German software company usually deployed for mixed methods and qualitative data analysis. Supports researchers in coding and visualising text-based data input.

2.4 Results and discussion

The empirical analysis of the qualitative data allows me to find answers to the defined research objectives and questions. I can test whether the previously developed frameworks (Carroll, 1979; Henriques & Sadorsky, 1999; Hunt & Auster, 1990; Roome, 1992; Wartick & Cochran, 1985) apply to family-owned companies and extend their conceptual frameworks into a new framework in terms of methodological approach towards carbon accounting, motivation to perform carbon accounting and reporting beyond regulatory guidance as well as challenges family-owned companies face throughout their reporting journey. I aggregated the data to a meaningful level for all research questions to contribute to current research with meaningful result clusters. While writing this paper, I was challenged whether a difference between family-owned companies and large public corporations (e.g., DAX-40) exists several times. Therefore, I will also answer this question in the results section. Lastly, I critically discuss the results in a broader economic context.

2.4.1 Carbon accounting: Company archetypes

As described in the methodology, I have performed within-case and cross-case analyses. The cross-case analyses and the derived framework are the most considerable contributions to the literature on carbon accounting and family-owned companies. Therefore, I focus the results on the findings from the cross-case analysis, allowing me to answer my defined research questions holistically. Where applicable, I additionally provide information from the within-case analyses.

Based on my analyses, I derive an extended framework for carbon accounting among family-owned companies. While some aspects of previous frameworks still apply (Henriques & Sadorsky, 1999), I extend the framework into a new one (see TABLE 2.3). I, therefore, cluster the interviewed companies into archetypes and present the results for each along five relevant categories concerning carbon accounting: (1) overall importance, (2) motivation, (3) methodology, (4) challenges and (5) company size. As such, categories two, four and five are entirely new, while the third category not only comprises top-level management involvement, reporting mode and employee involvement (as used by previous authors, e.g., Carroll, 1979; Henriques & Sadorsky, 1999; Wartick & Cochran, 1985) but is furthermore extended to also comprise the applied carbon accounting standards (e.g., GHG Protocol), used software, calculation method and measurement years. Four archetypes are sufficient to describe the

different family-owned company types. I, thus, generally stick with the categorisation used by previous authors (Carroll, 1979; Henriques & Sadorsky, 1999; Wartick & Cochran, 1985) while renaming them into the, from my point of view, more specific archetypes: (1) Sustainability laggards, (2) extrinsically-driven reporters, (3) intrinsically-driven realists, and (4) sustainability frontrunners which I briefly describe in the following:

I specify the first identified archetype as sustainability laggards. Companies of this archetype need to show more urgency in working on carbon accounting. Moreover, the motivation to measure GHG emissions is generally low and will eventually only result from regulatory pressure. Shifting towards the applied methodology, standards such as the GHG Protocol still need to be discovered. Thus, no internal reporting nor external collection or reporting of data is taking place, and no employees are assigned to accounting tasks related to GHG emissions. In selected cases, external support is requested to collect the first set of GHG emission data. However, calculations are equal to a back-of-the-envelope calculation instead of a profound analysis. Most challenging for this archetype is the shallow sense of urgency and the general missing mindset towards reducing carbon emissions. Family-owned companies of this archetype are comparably small, thus ranging below EUR 250M in revenue.

Second, I identified extrinsically-driven reports as an archetype for family-owned companies regarding carbon accounting. They differentiate themselves substantially from the previous archetype in various categories. First, they show at least low urgency when measuring GHG emissions among top-level management. Motivation results mostly from external pressure, i.e., customer demand, regulatory pressure, and sometimes pressure from financial institutions. As such, this company archetype measures Scope 1 and 2 GHG emissions according to the GHG Protocol to adhere to the accepted minimum amount of data, while Scope 3 data is not measured. Data reporting only occurs on demand, i.e., no regular reporting mechanisms are established, and top-level management needs to request the data regularly. In line with the reduced reporting efforts, a limited number of employees is involved. On average, less than two employees are involved in carbon accounting, mainly not located in a separate sustainability department but within another department, e.g., the quality management department. Using e-mail and spreadsheet software (e.g., Microsoft Excel), a rather unestablished process is applied to collect the data. Data is mainly calculated backwards, i.e., derived from financial data instead of actual emission measurement, and to date, only one full year has been calculated. The most challenging aspects for this company type are limited personnel on the one hand and unestablished processes on the other. Interview results showed

that larger family-owned companies with revenue beyond EUR 1,000M belong to this archetype.

Third, I identified the intrinsically-driven realists as an archetype describing family-owned companies in their carbon accounting behaviour. The sense of urgency is higher among top-level management yet still close to a low to medium level compared to the fourth archetype. The general staff's sense of urgency is still relatively low throughout the organisation, while top-level management perceives higher importance in reducing carbon emissions. Intrinsic factors now constitute the main motivating factors paired with generational thinking and a strong will to contribute to society. Some extrinsic motivating factors are also coming into play, e.g., customer demand, creating a competitive advantage or being attractive to future employees, yet intrinsic motivating factors are predominant. Regarding carbon accounting standards, Scopes 1 and 2 are measured with confidence following the GHG Protocol, yet Scope 3 data is collected using an exploratory approach with limited data confidence. In line with this confidence, external reporting does not occur, while internal reporting is regularly performed and sometimes discussed in management meetings. On average, around two to five full-time employees oversee carbon accounting and reporting, mostly still integrated into an existing department, e.g., quality management. The software used is comparable to the second archetype, while data is calculated based on financial backward calculation and some actual GHG data measurement. Companies of this archetype have established relevant processes within the last three years.

Thus, processes are no longer a real challenge, but limited data availability from internal and external sources still yields high uncertainty regarding the accuracy of achieved calculation results. In terms of revenue, no tendency can be observed, i.e., revenue does not indicate whether a company is intrinsically motivated to account for its GHG emissions. Again, a sense of urgency among top-level management is the main driver for this archetype. Nevertheless, carbon accounting and reduction are not top priorities, resulting in reduced speed of setting up holistic carbon accounting processes.

TABLE 2.3: Four archetypes of carbon accounting among family-owned companies

Archetypes / Categories		Sustainability laggards	Extrinsically-driven reporters	Intrinsically-driven realist	Sustainability frontrunners
Overall importance & sense of urgency		None	None to low	Low to medium	High
Motivation		Fully driven by upcoming regulatory changes	Regulatory and customer pressure as main drivers	Motivated to act sustainably & generational thinking	Feel obligated to contribute to society
Methodology	Standard & Scopes	No use of standards	GHG Protocol Scope 1-2	GHG Protocol Scope 1-2, Scope 3 exploratory	GHG Protocol Scope 1-3 and additional method (e.g., SBTi)
	Reporting mode	No internal or external reporting	Internal reporting on demand	Regular internal reporting	Full external and internal reporting
	Management involvement	No interest among top management	Sporadic interest among top-level management	Interest in some management meetings	High and regular agenda item
	Employee involvement	No dedicated sustainability employees	< 2 employees integrated into other department (e.g., Quality Management)	2-5 employees integrated into other department (e.g., Quality Management)	> 5 employees in dedicated sustainability department
	Software	No software used	E-mail and regular spreadsheet software (e.g., Microsoft Excel)	E-mail and regular spreadsheet software (e.g., Microsoft Excel)	E-Mail, spreadsheet software and dedicated GHG measurement software
	Calculation method	Back-of-the-envelope calculations, if at all	Mere backward calculation via financial information	Mix of GHG and financial data backward calculation	Actual measurement of GHG data wherever possible
	Years measured	Exploratory only, no full measurement of any kind	One-time effort only	1-3 years in annual effort	> 3 years in annual effort
Challenges		Low sense of urgency and missing mindset among management and owners	Limited personnel and unestablished data reporting processes and interfaces	Insecurity regarding internal and external data accuracy	Limited data availability from external suppliers
Company size [M EUR]		< 250	> 1,000	All	>250

Lastly, I determine sustainability frontrunners as a company archetype where a high sense of urgency among top-level management and general staff driving the sustainability efforts is the case. As such, measuring and reducing carbon emissions is essential and is perceived as a task for everyone. A lack of urgency constituted an overarching challenge among previous archetypes, yet not among this company archetype anymore. The motivation to measure and reduce GHG emissions is highly intrinsic, i.e., family-owned companies belonging to this archetype are driven by their will to contribute to society and their generational thinking and show a strong will to improve themselves constantly through benchmarking against other companies. This company archetype is far advanced in standards, applies the GHG Protocol across all three Scopes, and further enhances the achieved results with additional standards, e.g., SBTi. Data is calculated with high confidence and reported externally and internally regularly. Reporting data in such a diligent way requires substantial resources. Family-owned companies in this archetype have at least five full-time employees working on carbon accounting and reporting, supported mainly by further part-time employees. A dedicated sustainability department, including defined processes, is set up. While e-mails and spreadsheet software are still used regularly for data collection and calculation, dedicated GHG emission measurement software is also used where applicable. Processes were set up several years ago, and wherever possible, actual GHG emission data is measured instead of using a financial backward calculation. Data availability among external suppliers is the most challenging aspect for this company type. International suppliers apply different standards, especially in a globalised world, making calculations difficult. Although substantial resources are required, it cannot be generalised that only companies of significant size in terms of revenue belong to this archetype. Instead, companies with revenue above EUR 250M already belong to this archetype. In conclusion, the main driving force behind belonging to the sustainability frontrunners can be identified in a high sense of urgency among the top-level management and the family owners.

In summary, I identify four different archetypes. Although no significant number of companies were interviewed to generalise from this population to all family-owned companies, I see that most companies either belong to the second or third archetype with a slight tendency towards the third archetype (see appendix, FIGURE 6.1, for an allocation of interviewed companies to archetypes). Companies falling under archetypes one or four are only observed rarely. In the next three sub-chapters, I elaborate on the exact methodology, motivation, and

challenges faced when performing carbon accounting to answer research sub-questions two, three, and four.

The How – Methodology and processes of carbon accounting

Measuring and accounting for GHG emissions is not trivial and constitutes a new approach for most family-owned companies. Much of the required data points have never been collected before, and processes for collecting such data still need to be implemented. Nevertheless, family-owned companies have found different approaches to collecting and synthesising the data meaningfully. I will highlight which standards are used by family-owned companies, to which degree these standards are already implemented today and how family-owned companies calculate the GHG emission data. Moreover, I will shed light on the experience in this field regarding how many years companies have already measured such data, how many resources they invest, and which software companies use to support their calculations. I will then conclude by shedding light on the used reporting methods.

Starting with the applied standards, I introduced the GHG Protocol as the leading standard for carbon accounting among companies in general, which also applies to family-owned companies. While it is not mandatory to use this standard, it is the most holistic and, at the same time, most detailed approach for measuring GHG emissions. Moreover, companies stated that a set standard is helpful to avoid further discussions, e.g., "*Ultimately, it is about comparability, and it is about the fact that we are always in competition and have to make sure that we are also comparable and everything that offers a definition in the market and thus actually one where we do not have to discuss with the people, is of course simply taken with the palm of our hand*" (Gamma, Pos. 26). All but one company reported an accounting approach based on this standard. Besides the GHG Protocol, only one company has applied the SBTi, and no companies have reported participating in the CDP. Furthermore, family-owned companies do also not adopt the ISO 14064 standard. However, some mentioned using other ISO standards, such as ISO 50001, i.e., a norm for an energy management system related to carbon accounting. As part of the carbon accounting, most companies reported focusing on all six GHGs instead of CO_2 only and thus report so-called CO_2-equivalents where all GHGs are converted into CO_2. As mentioned earlier, the GHG Protocol splits GHG emissions into Scopes 1,2 and 3. However, most family-owned companies only focus on Scopes 1 and 2, which are far more trivial to measure and calculate than Scope 3. Only two interviewed companies fully report on their Scope 3 emissions with confidence. Companies who have already performed

their first calculations on Scope 3 still hesitate to publish these figures to avoid justifying significant changes in reported numbers in the following years due to potential changes in the calculation method.

Zooming in on the calculation method, various approaches can be applied, varying from a mere spend-based approach, e.g., deriving transportation-related GHG emissions from total logistics costs, to a direct measurement of consumed energy. The chosen approach again varies across Scopes. While Scopes 1 and 2 are comparably easy to calculate, e.g., by collecting data from the electricity meter and multiplying it with a specific CO_2 factor, Scope 3 is far more complex to calculate and frequently only possible via a spend-based approach. Another way to facilitate such calculations is via databases, which allow family-owned companies to multiply their input materials with certain CO_2 factors. One example mentioned during the interviews was the so-called Product Environmental Footprint (PEF) database, which allows companies from the agricultural sector to find the right CO_2 factors for their input materials.

Nevertheless, specific GHG emissions must be calculated via a spend-based approach, reducing data correctness as more assumptions are involved. The calculation process in most family-owned companies interviewed was reported to be highly manual and based on data collection via e-mail and aggregation via Excel. Beta stated, "*I am not giving away any secrets here, but currently, our climate management is an Excel hell, but we have currently mapped that via Excel because we simply cannot collect the data in any other way yet because it is simply not available in this granularity from the production control systems*" (Beta, Pos. 16). Specific software tools to collect, aggregate, and report the data is not used by any of the interviewed companies. Nevertheless, it is essential to highlight that the main issue for companies today is not internal data collection itself. Instead, the issue lies with collecting data from suppliers, as this kind of data was never requested from suppliers before or captured otherwise.

In terms of effort and resources involved, family-owned companies reported an average number of employees involved of two to four full-time equivalents. Half of the interviewed companies had already set up a specific sustainability department, and the other half had integrated these employees into their quality management departments. Data collection started for most companies in 2019 or 2020, while only two companies reported a data collection start for Scopes 1 and 2 before 2019 in an annual format. Lastly, family-owned companies reported using annual data analyses primarily for internal top-level management reporting. Very few

companies publish public sustainability reports and only provide data to external parties when specifically asked for, e.g., by customers. As most data analyses still contain a relatively high degree of uncertainty due to missing data points and data calculated based on a broad set of assumptions, reluctance to share data with the public prevails.

In summary, the methodology of measuring and accounting for GHG emissions in family-owned companies is dominated by the GHG Protocol as an overarching framework. Nevertheless, most companies focus on Scopes 1 and 2 in a manual instead of a software-driven approach and need more insight into their Scope 3 emissions. Nevertheless, Scope 3 typically accounts for most of the total emissions. For instance, considering the sustainability report published by Wacker Chemie AG, a German company majorly (~70%) yet not fully family-owned, >80% of GHG emissions pertain to Scope 3 emissions (Wacker Chemie AG, 2020). I will elaborate on the challenges associated with Scope 3 emission accounting later in this chapter.

The Why – Motivation for carbon accounting

I aim to extend previous frameworks on carbon accounting and thus deliberately asked for the motivation behind carbon accounting among family-owned companies. This question originates from the fact that family-owned companies in Germany, when conducting the interviews, were not required to disclose environmental information and, as such, did not face regulatory pressure (European Parliament & European Council, 2022). Nevertheless, it can still make sense for family-owned companies to account for their GHG emissions, e.g., to improve the management of GHG-related risks and develop strategies to mitigate such risks. At the same time, a higher degree of bureaucracy and more personnel and financial resources correlate with the measurement and accounting of GHG emissions.

Based on the performed analyses, the motivating factors to measure and account for GHG emissions can be clustered into four intrinsic and six extrinsic categories. The intrinsic motivating factors are generational thinking, the will to contribute, benchmarking, and employee demand. The extrinsic motivating factors are customer demand, competitive advantage, attractiveness for future employees, regulatory pressure, pressure from financial institutions and access to financing, and social pressure. Both intrinsic and extrinsic motivating factors are ordered by the degree to which the factors motivate family-owned companies from high to low.

The first and highest intrinsic motivating factor is generational thinking. As seen earlier, family-owned companies are characterised by general long-term thinking and a strong will to ensure the company's persistence over decades. These characteristics are underlined by the results achieved in the interviews. For example, Lambda highlights that "*we are now more than 100 years old as a company. As a family business, we think not only of quarters but also of decades and generations. Moreover, if this is to continue for another 100 years, let us say. There must also be a planet that is still supposed to exist*" (Lambda, Pos. 18). This is consistent with statements from other companies such as Iota: "*Especially when you see the third generation already growing up in the family business, which is a completely different motivation (for carbon accounting)*" (Iota, Pos. 101). Across all cases, this factor was most significant among most companies.

The second intrinsic motivating factor points in the same direction as the first motivating factor, i.e., the will to contribute to society. Family-owned companies feel a special responsibility to contribute to society. For example, Delta raises the following statement: "*Because we are also a family business, decisions are made at the lunch table, and our children are increasingly involved here. Nevertheless, not only because of the children, we say, we companies must optimise, reduce, or avoid resources, and then compensate*" (Delta, Pos. 34). A particularity for family-owned companies here is that their will to contribute is frequently paired with a strong regional focus. Again, Delta frames this precisely stating that "*we do not want to stand in a corner and say, well, now we have compensated, and 100,000 trees will be planted. We want projects we can touch and follow*" (Delta, Pos. 90).

Benchmarking constitutes the third most important intrinsic motivating factor mentioned during the interviews. Alpha stated, "*You cannot control what you cannot measure, i.e., we cannot say we want to get better somehow if we do not know where to start*" (Alpha, Pos. 44). It becomes evident that data transparency is an essential basis to reducing GHG emissions going forwards. Nevertheless, only around half of the family-owned companies interviewed are already setting targets, stating, for instance, that "*we have targets for all three Scopes. We have set specific targets for 2045 and 2050, and they are in place*" (Epsilon, Pos. 83). In contrast, other companies state that target setting will be "*the cherry on top, i.e., we set the targets afterwards and then expand our system*" (Theta, Pos. 45). As only half of the companies are already setting targets, it becomes clear that benchmarking constitutes a motivating factor of medium importance.

Lastly, demand from currently active employees has been mentioned as a motivating factor for family-owned companies. In this regard, Alpha stated that "*the recording of our GHG emissions has arisen bottom up. Out of our team, that we must do it in any case*" (Alpha, Pos. 42). Yet only one company stated that carbon accounting is driven bottom-up rather than top-down. Thus, this motivating factor is of relatively low intrinsic importance.

Extrinsic motivating factors constitute the other large category of motivating elements for family-owned companies to measure and account for their GHG emissions. Customer demand has been mentioned the most and thus constitutes the highest motivating extrinsic factor for family-owned companies as their customers increasingly request information on GHG emissions of the entire company or specific products. Most interviewed companies supply to their customers in a business-to-business relationship. Often, their customers are large corporations mandated to account for their GHG emissions. Thus, they also request the information from the family-owned companies. High pressure was especially mentioned in the automotive industry as this industry receives much attention and pressure from many angles to reduce GHG emissions. While many customers directly request GHG emission information, such requests are also included in requests from organisations such as EcoVadis. This French organisation, for instance, supports companies in managing a company's business relationships, upstream and downstream, by requesting and managing sustainability information. For instance, Mu states, "*For some time now, we have also been experiencing increased interest from suppliers in the form of questionnaires sent to us*" (Mu, Pos. 69).

The second extrinsic motivating factor comes from the will to gain a competitive advantage in the market. As seen before, customers demand environmental information from their suppliers, i.e., family-owned companies. This information is then used to make supplier decisions. Family-owned companies state that disclosing GHG emission information, ideally presenting low GHG emissions, can yield more signed contracts. Gamma stated that "*the further up the value chain I am, the more I can differentiate myself with these topics, even to an end customer*" (Gamma, Pos. 68). Other companies even stated that they are already aware of their advantage in terms of low GHG emissions over their competitors. Nevertheless, correctly measuring and accounting for their GHG emissions underlines this advantage with precise data. Epsilon states, "*We know we are better than the competition with our energy supply. Moreover, we can score points with that […]. Moreover, here we need concrete tools that we can use to demonstrate that we can help our customers reduce their footprint and that we can do this as a very, very effective tool*" (Epsilon, Pos. 75).

Attractiveness for future employees was the third most important extrinsic motivating factor. The younger generation, especially those who are now finishing their educational journey and entering the job market, show an increased interest in sustainability. Looking at movements such as Fridays for Future, where many young students fight to prevent climate change, it becomes clear that environmental aspects are at the top of many young people's minds when entering the job market. Family-owned companies often have disadvantages in the job market as they are perceived as more conservative, change-resistant, and inflexible, resulting in a reduced attractiveness in the eyes of young talent entering the job market (Duran et al., 2016; Hauswald et al., 2016). Thus, family-owned companies must increase attractiveness through several factors, including a strong sustainability mindset. Measuring and accounting for GHG emissions and using this to reduce GHG emissions actively can be a differentiating factor in the job market. Nu described this in their interview: "*It is becoming increasingly common for applicants to ask: What is your company's position on sustainability? What do you do? Furthermore, of course, you want to attract applicants, but you also want to retain employees. So, these are the crucial areas for us, so we also address sustainability issues and account for GHG emissions*" (Nu, Pos. 36).

As mentioned, family-owned companies are not obliged to disclose their environmental information under the NFRD, as this regulation only applies to capital market-oriented corporations and credit and insurance institutions. Nevertheless, the upcoming CSRD pressures family-owned companies, so I identified this as the fourth most important extrinsic motivating factor. Family-owned companies will need to report their GHG emissions based on the CSRD starting in 2026, but the pressure is still perceived as low. However, a genuine will to prepare for the reporting and thus perform several trial runs before the first official reporting is desirable to pre-empt reporting issues. Nu stated, "*It is also the case that legal requirements will, of course, have to be met. It is not urgent for us now per se, but we want to prepare ourselves for everything coming. Be it the CSRD revision, i.e., reporting requirements that we must fulfil by 2026 at the latest for the financial year 2025. […] So, all these legal requirements are coming our way. We want to prepare ourselves and do our work so that we do not have to create something just before the deadline that can no longer be achieved*" (Nu, Pos. 36). Yet customers of family-owned companies are partly already under pressure from the NFRD which explains why regulatory pressure exerts lower pressure and yields lower motivation than customer demand and the ability to achieve a competitive advantage.

Closely related to regulatory pressure is the access to financing and the pressure exerted via financial institutions as a motivating factor. When performing their credit assessment, credit institutions increasingly consider the environmental information of their debtors. Looking at this from the perspective of a credit institution, it makes sense to associate higher environmental performance with a higher probability of a company's successful future, resulting in lower risk and, thus, lower interest rates for companies (Healy & Palepu, 2001; Plumlee et al., 2015). To disclose this information to credit institutions, family-owned companies must measure and account for their GHG emissions, thus complying with their requirements. Lambda states that "*purely from a financial point of view, based on the rating, I either get the better or worse interest rate. If I am sustainable, I get a better one; if not, I get the worse one. This, too, is now common practice*" (Lambda, Pos. 72). Nevertheless, this appears to be a smaller motivating factor. In turn, companies started with carbon accounting driven by other motivating factors such as customer demand or generational thinking. They only afterwards used the generated data to access green financing.

Lastly, pressure from society strongly related to legitimacy theory (Suchman, 1995) introduced earlier builds an extrinsic motivating factor for family-owned companies. The German society has shifted increasingly towards a more sustainable way of thinking and expects sustainable acting from German companies (O'Riordan & Hampden-Turner, 2021). Here, measuring and accounting for GHG emissions can be used to showcase in a data-based approach how a company actively manages and reduces GHG emissions. For instance, Beta reported that they were accused of product greenwashing and are even facing a lawsuit from an NGO due to their carbon offsetting projects. However, only one family-owned company throughout the research project reported societal pressure, presumably driven by their business-to-consumer focus. In contrast, most other companies are business-to-business companies and appear less in public, resulting in less societal attention and attacks. Thus, this constitutes the most negligible extrinsic motivating factor in this research. When focusing on pure business-to-consumer companies, the research might yield different results.

In summary, I identified intrinsic and extrinsic motivating factors for family-owned companies to measure and account for their GHG emissions. While some factors result in a low motivation for family-owned companies, generational thinking and the will to contribute to society as intrinsic motivation and customer demand as extrinsic motivation are the factors especially driving the need for measuring and accounting for GHG emissions. After analysing

why family-owned companies account for their GHG emissions without regulatory obligations, I now shift to their challenges when performing their carbon accounting.

The Which – Challenges German family-owned companies are facing

Measuring and accounting for GHG emissions is a comparably new field for family-owned companies. As with establishing all new processes, many are performed for the first time, resulting in company challenges. Thus, I have targeted the challenges of measuring and accounting for GHG emissions as the fourth and last research sub-question. I identified five challenge areas: two constitute overarching challenges, and three are processual challenges. The two overarching challenges are a lack of urgency and limited personnel availability. In comparison, the three processual challenges range from data collection and aggregation over data modelling to reporting and controlling.

Starting with the first overarching challenge, i.e., needing more sense of urgency, almost all companies report needing more sustainability awareness among employees and partly among top-level management. Eventually, GHG emissions and sustainability affect all employees' ways of working. Nevertheless, not all employees are aware or want to be aware of the upcoming challenges and the need to reduce GHG emissions as a company. While this is a general challenge, especially for the older generation of employees, it needs a sense of urgency towards carbon accounting. For instance, Lambda states, "*It is an issue just to get that into the understanding of older colleagues. The generation coming in now has a lot more focus on these issues. It is a holistic issue. It does not just affect the quality or the sustainability department; it affects every single area of our company, e.g., how do I plan an air travel, how do I get to work, how do I drive home from work*" (Lambda, Pos. 60). This is also represented in statements from other companies, e.g., Alpha who reported that "*there are some people in the company who have completely understood the topic and have a complete grasp of it and are also intrinsically motivated to tackle the issue. However, there is also a completely different side that can hardly grasp the topic. Moreover, in my opinion, it is a generational issue*" (Alpha, Pos. 82). Reducing GHG emissions and acting sustainably is a topic every employee needs to contribute to. Thus, creating an overall sense of urgency among employees is crucial and needs to be overcome by family-owned companies to achieve GHG emission targets. This image also needs to be portrayed by the top-level management. Around half of the interviewed companies reported a high sense of urgency among top-level management, while the other half lacked top-level management buy-in and support. For instance, Alpha accounts for Scopes 1 and 2 carbon

emissions in line with the GHG Protocol. Nevertheless, data has not been reported to the top-level management as this group has no interest. Without sufficient top-level management interest, measuring and reducing GHG emissions throughout the company will be impossible.

The second overarching challenge consists of limited personnel availability. Carbon accounting involves many manual process steps for data collection, modelling, and reporting, especially as it is a comparably unestablished field. Family-owned companies are typically smaller in terms of number of employees. Thus, they can shift resources slower than large public corporations or even free up the budget for hiring additional resources. Around half of the interviewed companies thus have integrated carbon accounting into their quality management departments, where resources work only part-time on carbon accounting. Nevertheless, additional resources will be required with an increased workload in the future, especially when companies start focusing on Scope 3 GHG emissions as well. The other half of the companies have already set up dedicated sustainability departments. However, hiring the right people is more challenging than initially anticipated for various companies. For instance, Gamma reported to "*have advertised two positions for more than a quarter of a year, and we cannot fill them*" (Gamma, Pos. 2). At the same time, Beta says, "*In general, finding good people in the field is very difficult, especially with the upcoming changes*" (Alpha, Pos. 32). Family-owned companies are frequently located in rural areas which makes it even more complicated to hire young talent in this area of expertise. Some companies have, therefore, established offices in attractive locations to attract young talent, yet finding the right employees is still challenging. Nevertheless, this challenge was expected to eventually be solved by interviewed companies through more talent entering the job market and a comparably low number of employees needed. Leading companies have reported that around five to six full-time employees can collect, aggregate, and report GHG emission data across all three Scopes of the GHG Protocol.

Besides the fundamental challenges described, processual challenges range across the entire carbon accounting process, from data collection and aggregation over data modelling to reporting and controlling. Starting with the first step in this process, i.e., data collection and aggregation, I further break down this process step into data collection and aggregation from external and internal sources. External data collection means receiving data from suppliers providing the family-owned company with specific parts or materials with a particular carbon footprint. The family-owned company purchasing the good then accounts for the supplied product's carbon footprint within the Scope 3 upstream GHG emissions typically in the

purchased goods and services category. However, receiving the correct data in a suitable format from the suppliers is a significant challenge for family-owned companies. Mu, for instance, states that they "*see fewer challenges in the calculation than in the data provision from suppliers and its quality*" (Mu, Pos. 100). Other family-owned companies reported that working with international suppliers is even more challenging in this regard due to different data formats or a different understanding of the product carbon footprint calculation. While this might not be too challenging for one supplier, it becomes a considerable challenge when hundreds or thousands of goods are supplied for a manufactured product. Ultimately, a supplier providing such data has an additional effort for which additional financial resources are required. This additional investment must be charged again to the family-owned company and their customers. Nevertheless, customers expect data transparency at no additional costs. Lambda reflects this: "*For the data transparency, you pay the surcharge. Moreover, there, of course, we are also dependent on our customers, because many do not yet want to pay these surcharges, especially not in current times as they already have surcharges in current times*" (Lambda, Pos. 42).

The second step after receiving the correct data in the suitable format from the suppliers is to collect the data internally within the family-owned company. Interviewed family-owned companies frequently have global and decentralised setups. Collecting the data from all subsidies and geographical locations is, on the one hand, very time-consuming and, on the other hand, very challenging without clear and strict data standardisation. Iota summarised this as "*our problem is actually that the data is available, but somehow rather organised in a decentral way or often also available but in the wrong unit*" (Iota, Pos. 83). A clear definition of relevant key performance indicators (KPIs) and how to calculate these is frequently missing resulting in different calculation methods and thus differing results. Also, many of the interviewed family-owned companies have grown fast via acquisitions. Many of these acquisitions have never been properly integrated, which is also reflected in unstructured IT systems, making data aggregation even more challenging. Gamma states, "*This is also important, i.e., uniform IT structures. I would say that groups of a certain size have this and can aggregate in this way. However, I would say that we have grown structures through smaller acquisitions, which we have had, and they are not fully integrated. That is exactly what we are seeing now in aggregation, where problems keep coming up*" (Gamma, Pos. 27). Lastly, not only the internal IT structures need to be coherent, but also the internal structures among departments. Central data aggregation departments, e.g., the sustainability department, do not yet have interfaces

established into all relevant departments for holistic data collection, making the data aggregation process more difficult. Zeta, for instance, stated that "*there are so many contact persons for the individual topics, for the individual Scopes as well. That is somewhat difficult in this corporate structure*" (Zeta, Pos. 31). Ultimately, this again results in a time-consuming effort which is challenging to manage without automation.

The second processual challenge is situated in data modelling. Data modelling depends on data collection and aggregation as higher quality data inputs make data modelling much more manageable. Nevertheless, data collection and aggregation are challenging, resulting in comparably poor data inputs for data modelling, which is the second big processual challenge. The three main drivers of data modelling challenges are (1) poor data quality, (2) high data granularity and (3) difficulties in making the correct assumptions. Poor data quality makes data modelling incredibly challenging, as confidence in calculated results still needs to be higher for most companies. For instance, Mu stated this as their biggest challenge: "*The currently biggest challenge is the data quality. Data is not available in the desired quality yet, so in some cases, we must use the worst-case scenario as a basis, which means that the calculation of the emissions is slightly more negative for us*" (Mu, Pos. 91). Thus, poor data quality leads to companies applying a conservative calculation method yielding potentially worse results than required. Other companies reported data quality issues, especially among Scope 3 emissions, which are far more complex to collect than Scope 1 & 2 data. This aspect is also closely connected to the second challenge of data modelling, i.e., high data granularity. Scope 3 emissions come from many data sources, making the data very granular. These many data sources and input formats make the modelling exercise incredibly challenging. Iota framed this as "*so, if you want to calculate Scope 3 in a manufacturing company and all the materials used, including these upstream chains, it is a huge amount of work*" (Iota, Pos. 81). Lastly, making the correct assumptions is challenging when it comes to data modelling. These challenges are, on the one hand, the result of poor data quality, which requires making assumptions, but on the other hand, emission factors are required for specific data inputs where assumptions are required. Considering power consumption, not all electricity is the same, i.e., it can be generated from various sources, and thus, GHG emissions are different. Iota reflects this in another example: "*Not all concrete is the same. Depending on its strength class, for example, whether it contains more or less cement. So C2025 concrete naturally has a completely different carbon footprint than a C5060 or even a stronger concrete*" (Iota, Pos. 55). Eventually, this leads to uncertainty when calculating GHG emissions and results in a trade-off between

investing the correct number of resources performing the calculations sufficiently granular on the one hand and on the other hand pragmatically calculating GHG emissions without being too conservative or opening the door for being accused of greenwashing.

Lastly, reporting and controlling constitute the third big processual challenge in the carbon accounting process. The data collected, aggregated, and modelled in the previous process steps are only a means to an end. Eventually, family-owned companies aim to measure and reduce their GHG emissions. Reducing GHG emissions, however, requires changes in current processes for which data-based prioritisation and steering is needed. Thus, controlling processes must steer each company's GHG emission reduction efforts. Nevertheless, family-owned companies just started collecting data and still need to establish transparent reporting or controlling processes, making it especially challenging now.

Looking first at the reporting, transparent reporting formats need to be improved, and as most family-owned companies only started with Scopes 1 and 2 measurements, reporting is still evolving. Moreover, the uncertainty in the modelled results creates reluctance among companies to report their data publicly. Nu summarised this: "*No uniform granular standard exists in the industry yet. That is the reason why we do not publish it. Because once a number is fixed, then you are measured by it without having this explanation behind it*" (Nu, Pos. 34).

Besides the mere reporting of data, controlling is even more challenging as companies are facing a plethora of data points when accounting for Scopes 1, 2 & 3 across various locations and departments. Thus, prioritising the GHG emission reduction efforts where the impact is significant and the effort is low is not as trivial as it might seem. Zeta described this challenge: "*What I still see as a challenge is actually: What do we do with the data? How do I get a roadmap from it now? Reporting is one thing, but as I said, I also want to do something with the figures. I do not yet have a clear picture of how we will approach this*" (Zeta, Pos. 69). In financial controlling, detailed steering concepts have been developed over decades, which are now also required for GHG emission controlling. Such concepts were also referenced in an interview with Beta, who is comparably far advanced in carbon accounting, yet still stating that for "*a real carbon footprint that I can then control, similar to what I do in cost controlling where I can control my supply chain costs, is still a long way off, and it is tough at this moment*" (Beta, Pos. 26).

In summary, two fundamental challenges, a lack of urgency and personnel availability, and three processual challenges along the carbon accounting process were identified. While the

fundamental challenges are expected to resolve comparably fast, clear data standards for data collection, which enable proper data modelling and clear controlling concepts building upon the data, will take more work. This results from many interlinks within and across companies, often even cross-border, which must be overcome in the long term.

2.4.2 Carbon accounting distinctions to large public corporations

GHG emissions generally do not differ by company type, i.e., a family-owned company might have similar GHG emissions compared to a large, public corporation, and thus, it also measures those similarly. During the interviews, however, I explicitly focused on this difference with a specific set of questions. Results are highly valid as several sustainability managers had work experience in large public corporations and thus could provide valid comparisons. With this approach, two main differences have been identified from the perspective of family-owned companies: resource scarcity and long-term thinking.

Resource scarcity refers to financial resource scarcity, which results in personnel resource scarcity. Lambda states, "*A DAX company has more resources to deal with these issues than we do. We must find smart solutions because setting up large departments would not be supported by the cost structure and the structure of the company*" (Lambda, Pos. 64). Especially in these relatively early days of carbon accounting, transparent processes have not yet been established resulting in a low degree of automation and as such a high amount of manual process steps for which personnel resources are required. Family-owned companies' sustainability managers reported that from their point of view, large public corporations can shift resources more short-term and flexibly due to higher resource availability. Alpha stated in this regard that it is more complicated for them to receive the budget for personnel resources as "*every decision still goes more or less through the board of directors*" (Alpha, Pos. 100). However, other companies also reported the reduced bureaucracy and accelerated release of budget for personnel resources in case something matters to the family owner. Gamma reported even a challenge with finding the right resources, stating, "*The market has been grazed for two years. Everyone dealing with the subject of sustainability, the big players have hired all those resources, and now it is even harder for us*" (Gamma, Pos. 4). However, this statement also does not hold for all companies as some family-owned companies are trying to circumvent this issue through office locations in larger cities attracting young talent. In summary, resource scarcity is a more significant challenge for family-owned companies than large public corporations, reducing access to currently required talent.

Long-term thinking is the other factor identified as the main difference between family-owned and large public corporations. Family-owned companies, for instance, are not obliged to report every quarter to their shareholders. This is underlined by Epsilon stating that this "*is, of course, a great advantage that we have, because the family can, of course, plan a bit longer term than if they were to move from one quarterly report to the next*" (Epsilon, Pos. 27). This also means that family-owned companies are not pressured right now to deliver GHG emission figures but rather still have time to assure that numbers are as correct as possible once they are published for the first time. This long-term thinking also stems from a long-term responsibility towards the company's future and future generations. Lambda's CEO summarises this as "*I then have to justify myself to my children in several decades, in doubt as to why I did or did not do certain things*" (Lambda, Pos. 66). This, of course, is a different incentive for these family-owned company managers than mere financial long-term incentives a board member of a large, public corporation would have. These fundamentals may influence the approach to carbon accounting and the actions taken resulting from the captured data.

2.4.3 Discussion

This research essay investigates the measurement and accounting of GHG emissions in German family-owned companies. Therefore, I tested an existing framework on environmental management in companies for family-owned companies and extended it in terms of motivation, methodology and challenges related to carbon accounting.

First, I can generally confirm that the previously developed 4-level framework also applies to family-owned companies (Carroll, 1979; Henriques & Sadorsky, 1999; Wartick & Cochran, 1985). The overall importance of environmental management to family-owned companies, top-level management involvement, reporting mode, and employee involvement is similar for general and family-owned companies. As I extended the applied methodology to family-owned companies, I saw that the GHG Protocol constitutes the predominant standard for carbon accounting, similar to Fortune 500 companies where adoption is above 90% (WBCSD & WRI, 2023). Regarding the motivation for carbon accounting, previous authors found that family-owned companies are risk-averse (Gomez-Mejia et al., 2011), want to preserve socioemotional wealth (Berrone et al., 2012) and are more altruistic than non-family companies (Berrone et al., 2010; Cennamo et al., 2012). These aspects also translate into carbon accounting, as most family-owned companies are motivated intrinsically to measure and reduce carbon emissions rather than extrinsically. Still, extrinsic motivation is essential for less active

companies, i.e., extrinsically-driven reporters and sustainability laggards. Their motivation can be found in socio-political theories such as stakeholder theory (Freeman, 1984), where companies disclose environmental information due to stakeholder pressure (Roberts, 1992). Previous researchers found that disclosed information has no guarantee for completeness (Depoers et al., 2016), which I also saw during the interviews: most family-owned companies only partly apply the GHG Protocol. In addition, carbon accounting is used for legitimation purposes. Family-owned companies also seek buy-in for their actions from society and aim to generate a credible image among a broad audience (Cotter & Najah, 2012).

Regarding the challenges in carbon accounting, I have seen previously that actual carbon emission data can range between five and twenty percent from the reported GHG emission values (Rypdal & Winiwarter, 2001). Due to unestablished and new processes, the perceived uncertainty among family-owned companies appears even more extensive. Of course, mathematical models still need to be established (Lee et al., 2024), and accurately choosing parameters and assumptions is challenging (WBCSD & WRI, 2015). On top of this, receiving different data from different suppliers and collecting accurate data internally is incredibly challenging for family-owned companies today (Olson, 2010). In addition, limited personnel availability makes carbon accounting furthermore challenging (Nieto et al., 2015). The need for standardisation of carbon emission data across companies makes it especially hard to translate data from one company to another. Going forward, clear guidelines would facilitate the carbon accounting process paired with overcoming today's challenges of resource scarcity and unestablished processes.

2.5 Conclusion

This paper investigates the measurement and accounting of GHG emissions in German family-owned companies. The world is facing increasing energy prices, and companies and governments are struggling to meet the goals agreed upon in the Paris Agreement to limit the global temperature increase to 1.5° Celsius above pre-industrial levels. Achieving these targets was once more doubted at the UN climate conference, COP27, in Egypt in November 2022 (Ward, 2022). Reducing GHG emissions, however, will only be possible based on a solid data basis for which carbon accounting is essential. Within Germany, the largest economy in Europe, family-owned companies account for 90% of all German companies and constitute the backbone of the German industry, the fourth largest economy in the world in 2020

(International Monetary Fund, 2021). Considering the importance of reducing GHG emissions, paired with the relevance of German family-owned companies for Germany and the world while also keeping the lack of regulations in mind, I felt the need to investigate this research area further.

I have therefore tested and extended previous frameworks on environmental management for German family-owned companies and identified four archetypes. Carbon accounting among family-owned companies is in a solid state as most companies fall under the second or third archetype with a tendency towards the third archetype, i.e., intrinsically-driven realists. I have identified generational thinking and the will to contribute to society as the main intrinsic motivating factors pushing carbon accounting forward. Customer demand, in addition, is the primary extrinsic motivating factor. Although family-owned companies face upcoming regulations for measuring and accounting for GHG emissions, I could not identify regulatory factors as a primary motivating factor. Family-owned companies stick to globally agreed standards, i.e., the GHG Protocol, yet most companies have only implemented Scopes 1 and 2 measurements. Scope 3, however, constitutes the most complicated measurement category and accounts for most GHG emissions.

Nevertheless, more than intrinsic motivation alone will be required. A higher sense of urgency among company leaders is required, proper processes must be set up, investment in personnel is needed, and better data integration across companies is incredibly challenging. Thus, further work will be required to measure carbon emissions thoroughly and eventually reduce carbon emissions. Given their relevance, family-owned companies can be a significant driver in Germany.

2.5.1 Contribution and managerial implications

Carbon accounting has, to date, only received limited attention (Salvato & Moores, 2010). Furthermore, the research on family-owned companies is regarded as a growing field in the existing literature (Hasso & Duncan, 2013). Thus, I contribute to this strand of literature through the new and extended scientific framework, which shall help researchers and practitioners better understand where family-owned companies stand today in carbon accounting and what could be done to improve and facilitate carbon accounting processes going forward. It will be essential to, therefore, overcome the identified challenges. Thus, two managerial implications are most important as a result of the analyses: (1) increasing awareness

to overcome the still comparably low sense of urgency among top-level management in some companies and general staff overall in most companies, as well as (2) creating standards for data exchange both within and across companies to overcome the data availability challenges.

Increasing awareness is vital among top-level management and employees. The awareness among top-level management is the first step towards reducing GHG emissions throughout the company. Reducing GHG emissions requires top-level management support. If top-level management acknowledges carbon accounting and reduction as top priorities, it can become a central part of the company's strategic goals. A few interviewed companies even reported that although carbon accounting is already taking place, the aggregated data is of no interest among the top-level management. As such, no regular reporting is taking place. However, increasing the awareness among this target group can mostly be achieved externally, e.g., via even more regulatory or customer pressure. One alternative way to achieve this could be to exert pressure via educational events of family organisations such as the Stiftung Familienunternehmen. The second step is then to increase awareness among general staff. As mentioned earlier, employees partly do not consider GHG emission reduction or sustainability in general as a top priority. Alpha, for instance, quoted from a training session where an employee stated, "*We need to be careful not to focus too much on the sustainability trend*" (Alpha, Pos. 86). Thus, increasing awareness even more among employees from all functions and age groups is essential for a successful GHG emission reduction journey. A mix of top-level management communication and educational events is required to create a mindset towards GHG emission reduction. A lasting impact will only be possible if all employees live and communicate this mindset throughout the company. Beta summarises this: "*It (GHG emission reduction) is not the function of a staff unit. It is not the function of a compliance team, but it is the function of everyone in the company to think about this in their respective area of expertise*" (Beta, Pos. 34). As such, it needs to become part of a company's culture and DNA.

The other managerial implication is creating standards for data exchange within and across companies. A company must collect GHG emission information from suppliers regarding the materials they purchase to calculate their GHG emissions. Today, information is transmitted in multiple ways, in multiple data formats and includes different information. For instance, sometimes a supplier would provide Scope 1, 2 and 3 GHG emission information at the company level while another supplier provides Scope 1 & 2 data at the product level. For each family-owned company receiving the data, finding a common denominator when dealing

with hundreds or thousands of suppliers becomes overly complicated. The global setup of many companies makes this even more challenging. A typical data standard is an indispensable basis for correct carbon accounting, as upstream calculation errors or missing data will follow through to customer reports. Moreover, calculations based on such inconsistent data will be inaccurate and can eventually lead to wrong decisions. Thus, onboarding all companies to a common ground where data is shared in the same data formats will rigorously facilitate data collection and calculation processes while at the same time making the results more accurate and reliable.

2.5.2 Limitations and areas for further research

Within this paper, I have asked why and how family-owned companies measure and account for their GHG emissions and which challenges they face when accounting for their GHG emissions. I answered all research questions via a multiple-case study approach, including within and cross-case analyses among 13 family-owned companies. These cases were selected via a detailed sampling approach to only include companies with 100% family ownership, appropriate size in terms of employees and revenue such that the CSRD applies and industries known for comparably high GHG emissions. With this approach, relevant results could be achieved, and interview results started to show substantial overlap after the first few interviews, justifying the termination of interviews after the identified set had been interviewed. Nevertheless, the results are subject to certain limitations addressed in the following.

First, the chosen data set is still comparably small and thus does not allow for statistically significant statements. Nevertheless, interview results were triangulated with external experts, e.g., from a leading consulting company and a start-up building software for carbon accounting, mainly confirming the results. Second, only family-owned companies from comparably CO_2-heavy industries were considered. Moreover, I focused on companies communicating certain sustainability activities in either sustainability reports or their website, leading to a bias towards companies where GHG emissions play, by nature, already a specific role within the company. Nevertheless, it is impossible to conclude to what extent family-owned companies generally care about carbon accounting, as family-owned companies not accounting for their GHG emissions were omitted in this case study setup. Third, I compared the carbon accounting approach of family-owned companies with that of large public corporations. The results achieved here, however, are solely based on perspectives from employees in family-owned

companies reported during the interviews. I did not collect a direct view from employees in large public corporations. Nevertheless, statements from employees in family-owned companies were based on work experiences in large, public corporations. Results were further enhanced with a literature review, which added validity to the generated results.

As an avenue for future research, I suggest a cross-sectional survey design with a much higher number of participating family-owned companies. Thus, verifying or falsifying the identified company archetypes would be possible. On top of that, I suggest focusing on all family-owned companies of appropriate size without focusing on CO_2-heavy industries only, thus generating a more holistic view of the actual status of carbon accounting among German family-owned companies.

Alternative research for future researchers could stem from investigating how the current approach among German family-owned companies compares to other nationalities. Identifying whether specific findings are solely a German phenomenon or whether these findings also hold for other nationalities can enhance the findings and increase their external validity and generalisability.

3 Essay II – The effects of mandatory ESG disclosure regulation on company and investor behaviour: An experimental approach

Abstract

Over the past two decades, the focus of company's information disclosure has expanded from primarily financial performance indicators to include non-financial topics, notably ESG aspects. This shift is due to a growing interest from a broader stakeholder audience in ESG information, leading companies to voluntarily include such details in their reports. This trend, in turn, has prompted governmental bodies to establish mandatory ESG disclosure regulations, such as the EU's NFRD and CSRD, to standardise disclosures and enhance transparency. This study investigates the value enhancement of mandatory ESG disclosure regulations over voluntary regimes, considering the equilibrium proposed by conventional accounting theory where the costs of disclosure match its benefits. It explores the perspectives of both companies and shareholders regarding voluntary and mandatory disclosures' effectiveness in reducing uncertainty, influencing company valuation and investment attraction. Drawing from experimental research, I find regulation to increase information disclosure and invested capital. Moreover, principals invest significantly more when low regulation is in place opposed to no regulation. Higher regulation, however, yields no further increase in invested capital implying that low regulation finds the right balance between reporting effort and respective added value. The findings contribute to discussions on the costs and benefits of ESG disclosure regulations, offering insights for policymakers and corporate decision-makers on optimal disclosure strategies.

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3.1 Introduction

Traditionally, shareholders have evaluated companies based on their financial performance. As such, company reporting was focused on this audience and included primarily economic key performance indicators. In the last two decades, however, a broader audience of stakeholders has become interested in companies' information disclosure, focusing on non-financial topics, i.e., ESG aspects (Deegan, 2017; Garcia-Sanchez et al., 2014; Verbeeten et al., 2016). Companies thus started to disclose ESG information of interest to stakeholders voluntarily as part of their annual reports or in separate sustainability reports to satisfy stakeholders' demands (Helfaya et al., 2019; Ioannou & Serafeim, 2012; Kolk, 2003). These developments have also motivated governmental institutions to introduce mandatory ESG disclosure regulations and set specific standards (Costa & Agostini, 2016). For instance, in the EU, the NFRD was introduced in 2014 and tailored to large companies of public interest, requiring these companies to disclose environmental and social information such as GHG emissions or compliance with human rights (European Parliament & European Council, 2014)[11]. The NFRD was followed by the CSRD in 2023, thus increasing requirements further (European Parliament & European Council, 2022)[12]. Whether or not those recently introduced regulatory measures to disclose non-financial information are value-enhancing for stakeholders or just an additional bureaucratic effort for companies has yet to be agreed upon in the literature (Bernardi & Stark, 2018; Stubbs & Higgins, 2014). Motivated by these recent regulatory changes, this research aims to identify whether additional regulatory requirements enhance the value of the market. Thus, I state my research question: "*Does the introduction of a regulatory minimum ESG disclosure level continuously add value over a mere voluntary reporting regime?*"

In a pure voluntary disclosure regime, conventional accounting theory proposes a disclosure level equilibrium where the additional costs of disclosure match its incremental benefits (Verrecchia, 2001). As previously mentioned, companies are disclosing ESG information voluntarily today. Such voluntary disclosure has been of interest to researchers for many decades who have found voluntary disclosure as means to reduce uncertainty among

[11] When the number of employees exceeds 500 and either balance sheet volume exceeds EUR 20 million or annual turnover exceeds EUR 40 million; around 11,700 companies in scope (EY, 2022).
[12] Includes also non-public companies and applies when the number of employees exceeds 250 and either balance sheet volume exceeds EUR 20 million or annual turnover exceeds EUR 40 million; around 50,000 companies in scope (EY, 2022).

investors and thus reduce agency costs (Eccles et al., 2014; Jensen & Meckling, 1976), signal good performance to outsiders (Akerlof, 1970; Ramchander et al., 2012), achieve broad legitimacy in society (Suchman, 1995) or manage relationships with various stakeholders properly to maintain good financial performance (Darnall et al., 2010; Freeman, 1984). Besides the theoretical points of view, researchers found voluntary disclosure to result in higher company valuations (Dowell et al., 2000), reduced cost of equity (Plumlee et al., 2015), better predictability of future cash flows and profit (Clarkson et al., 2013), higher financial performance (Abdi et al., 2022), and an increased likelihood of receiving capital from investors (Dhaliwal et al., 2011). While voluntary disclosure can result in the mentioned benefits, not all companies use this mechanism, and many companies report in different formats, resulting in regulators setting specific rules.

Considering the value relevance of mandatory reporting regimes, past researchers, on the one hand, found mandatory regulations to be helpful as they assure standardisation of disclosed information, make reports more understandable for multiple stakeholders and increase transparency overall, which eventually can result in better ESG performance and thus also increase shareholder value (Darnall et al., 2010; Dowell et al., 2000). On the other hand, mandatory reporting regulations' critics describe mandatory regulations as partly ineffective (Aragòn-Correa et al., 2020) and even argue that companies forced to disclose information face significant cost increases as well as changes in corporate processes to provide such reporting (B. Cheng et al., 2014; Ioannou & Serafeim, 2017).

In contrast to financial reporting, no consent among researchers was reached thus far regarding the quantitative value-relevance of mandatory disclosure requirements in addition to voluntary disclosure in non-financial reporting. While some researchers have proven an increase in companies' disclosed informational levels through a disclosure regulation (Albertini, 2014; Ioannou & Serafeim, 2017; Ottenstein et al., 2022), other authors have reached the opposite conclusion, i.e., no impact of mandatory reporting regulations on amounts of disclosed ESG information (Bebbington et al., 2012; Chauvey et al., 2015; Larrinaga et al., 2018). In financial reporting, for instance, newly introduced regulatory requirements were primarily identified as substitutes rather than complements, implying that the information disclosed does not increase post-regulation (Einhorn, 2005; Noh et al., 2019).

Turning from the company to the shareholder view, the views of past researchers also differ regarding the added value of mandatory reporting regulations (Bernardi & Stark, 2018;

Stubbs & Higgins, 2014). On the one hand, economic theories suggest that disclosure regulations can be costly for firms, leading to adverse market reactions to ESG regulations (Birkey et al., 2018; Chen et al., 2018; Haji et al., 2023; Manchiraju & Rajgopal, 2017). On the other hand, following agency theory, increased transparency reduces investment risk, encouraging higher investments as it enables better evaluation of future cash flows and risks, thus potentially increasing share prices (Barth et al., 2017; A. Beyer et al., 2010; Clarkson et al., 2013; Healy & Palepu, 2001).

Given the differing opinions on ESG regulation of the mentioned researchers, I contribute to the highlighted discussions on the effects of disclosure regulations on companies' disclosed information quantity and shareholders' invested capital with this research paper. Moreover, I respond to calls for research for an increase in experimental studies as they "*are likely to help address some of the inconclusive findings from archival research and be informative to existing and potential policy issues*" (Haji et al., 2023, p. 195). In addition, other authors called for further experimental research and highlighted the added value of different research approaches in this regard (e.g., Bloomfield et al., 2016; Humphreys & Trotman, 2022). Thus, I address my research question with an experimental approach.

The inspiration stems from two experimental and influential research works, i.e., Falk and Kosfeld (2006) and De Villiers et al. (2021). Falk and Kosfeld (2006) examined the impact of control on motivation within an experimental principal-agent game and identified adverse effects of control in this relationship, i.e., motivation is lower when the principal controls the agent instead of trusting the agent. Moreover, they deployed an external regulatory scenario in which certain minimum control levels were exogenously defined. At the same time, they did not frame their experiment in a sustainability, ESG or non-financial context. De Villiers et al. (2021) analysed whether shareholders are willing to pay for financial and non-financial disclosure in a choice-based experiment and identified that shareholders are willing to pay for financial and environmental data while not for social information. As their paper only considered the shareholder view, my research intends to develop their approach further and factor in the company perspective, as well as varying minimum disclosure levels. My experiment is designed as a multi-agent reverse gift-exchange game in which two agents each disclose a specific amount of ESG information to achieve an investment from one principal. Based on the provided information, I test whether the agents provide more than the minimum required level of non-financial disclosure and which agent the principal chooses to invest in. In total, I deploy four different treatments with different minimum regulatory requirements.

The experimental approach allows for the isolation of the mere effects of regulation as voluntary disclosure has increased in the past years. As such, increasing information does not automatically provide evidence of an impactful regulation when conducting archival studies (Ioannou & Serafeim, 2012).

Based on this experimental study among more than 200 students from the two leading Munich universities, I derive three key results: First, I find that regulation increases disclosed information among agents and capital invested among principals, i.e., the higher the regulatory requirements for minimum information disclosure, the higher both disclosed amount and capital invested. Second, agents are already voluntarily disclosing comparably high amounts of information in the no-regulation case, thus seeking an investment. In contrast, principals invest significantly more capital in the low-regulation treatment than in the no-regulation case. At the same time, no further increase is observable for the medium- and high-regulation treatments. Third, I analyse the profits of both principals and agents, supporting the point of low regulation vis-à-vis higher regulation, as combined profits are highest in the low-regulation treatment.

With this research, I make at least four contributions: First, I respond to the call for research for more experimental research in the field of non-financial information disclosure (Bloomfield et al., 2016; Humphreys & Trotman, 2022), which allows me to uniquely focus on the direct impacts of regulatory measures amidst the rising trend of voluntary disclosures, following insights from Ioannou and Serafeim (2012). Second, I contribute to the existing non-financial information literature, which is currently divided between the effects of regulation on non-financial information disclosure. Higher cost burdens contradict more regulation on the one hand while higher transparency and standardisation speak for more regulation on the other (Haji et al., 2023). Third, this study extends the analysis of mandatory reporting regulations to various regulatory levels, inspired by the methodology of Falk and Kosfeld (2006). By applying their model to an ESG context, I explore stakeholders' responses to different levels of non-financial information disclosure. Lastly, given that the CSRD was only implemented in 2023, with its effects expected to be delayed until after the 2025 financial year, this research facilitates early predictions about its future impacts. While these experimental findings have limited external validity, the results can still help regulators identify the right level of non-financial information disclosure to be mandated. I moreover stress the positive effects of regulation, i.e., experimental principals invested significantly more post-regulation. For corporate decision-makers, I find that agents disclosing beyond the minimum regulatory level were only rewarded

for this additional effort in the low regulation scenario, which can potentially guide companies in deciding how much information to disclose.

The remainder of this essay is structured as follows: Section 2 reviews the literature regarding voluntary and mandatory information disclosure, including theoretical background, impact, advantages, and disadvantages to thus derive the hypotheses. Section 3 describes the experimental methodology, inspirational work, and procedural details. Section 4 presents the results. I conclude with a final summary, practical implications, and avenues for future research in section 5.

3.2 Literature review and hypotheses development

In this essay, I analyse the effects of moving from voluntary to mandatory ESG reporting on principal and agent behaviour, representing shareholders and companies in the experimental setting. I begin by outlining companies' motivations to disclose ESG-related information voluntarily from a theoretical standpoint and provide empirical insights from previous research on voluntary disclosure's impact on company performance and value. I then shift to mandatory reporting and highlight the associated (dis-)advantages. The review then provides empirical evidence on its impact on companies and shareholders found by previous researchers and highlights the current conflict among researchers in this regard. Eventually, I develop the research hypotheses in the last section of the theory chapter.

3.2.1 Voluntary disclosure

Many companies are already motivated to report non-financial information voluntarily without regulatory guidelines (e.g., Rossmann, 2023; Viessmann Group, 2023). From a theoretical standpoint, two main theoretical lines of thought can be used to explain this behaviour, i.e., economic and socio-political theories (Hahn et al., 2015).

Considering economic theories first, in every market situation, information asymmetries between shareholders and managers exist as managers are assumed to have superior knowledge about the company's future performance (Healy & Palepu, 2001). This information gap can be overcome by voluntarily disclosing information to shareholders, thus reducing uncertainty about the company's future performance and reducing agency costs (Jensen & Meckling, 1976). Additional information is valuable to outside shareholders as it allows them to assess a

company's future better and thus better determine the fair price to pay for the company (Eccles et al., 2014). Graham et al. (2005) surveyed more than 400 company leaders regarding the reasoning behind information disclosure. They identified the reduction of information risks and a desire to be perceived as a transparent company as the primary motivators. Besides the reduction of information risks, companies can use voluntary non-financial disclosure to signal their good non-financial performance to shareholders (Akerlof, 1970) and make them aware of their ESG-related actions (Cordazzo et al., 2020; Lourenço et al., 2014). By voluntarily disclosing such information, a company's reputation increases and uncertainty among investors decreases, resulting in a higher willingness to invest more and pay higher prices (Ramchander et al., 2012).

Economic theories put the shareholder at the centre of attention. Nevertheless, disclosing information voluntarily can also be focused on a broader audience of stakeholders, which is the target of socio-political theories. Within this theoretical space, non-financial disclosure is regarded as an effort made by companies to address social and political demands placed upon them by a range of stakeholders. This set of theories is split into two sub-categories, i.e., stakeholder and legitimacy theory. Stakeholder theory refers to a company's relationship management with its various stakeholders, not just shareholders, e.g., suppliers, customers, or employees. Initially introduced by Freeman (1984), it refers to a correlation between a company's ability to perform well financially and the degree of stakeholder relationship management. Especially in light of increasing ESG pressure, managing the various relationships acceptably can create a competitive advantage for a company and increase overall performance (Darnall et al., 2010; Donaldson & Preston, 1995). Legitimacy theory explains the motivation for non-financial disclosure as a reaction to external pressure by society (Patten, 2000). Non-financial disclosure helps to uphold the social contract between companies and society, which was implicitly agreed upon and, if broken, can cause companies to face intensified examinations and criticism from the public and stakeholders (Deegan, 2002; Hrasky, 2011). Suchman defines legitimacy as "*a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions*" (Suchman, 1995, p. 574). Especially in today's world, a broad legitimacy in society is relevant for a company's success as various stakeholder groups increasingly observe companies' ESG-related performance.

The two mentioned theoretical strands provide insights into the motivations for companies to disclose non-financial information voluntarily. Apart from these theoretical

considerations, several authors have shown empirically that voluntary information disclosure can enhance company value in different ways. In total, I will provide empirical results from previous researchers along the following categories: (1) company valuation, (2) cost of equity, (3) predictability of future cash flows, (4) financial performance and (5) investment likelihood.

Regarding company valuations, Dowell et al. (2000) found that companies adhering to an agreed-upon global standard, e.g., the GHG Protocol for environmental information disclosure (WBCSD & WRI, 2015), achieve higher market valuations measured by Tobin's Q, i.e., company's market value divided by reproduction costs of tangible assets. Darnall et al. (2010) found this effect stronger among larger companies. This finding is backed by Veltri et al. (2020), who found a positive correlation between non-financial risk information disclosure and the market value of the related company. Verbeeten et al. (2016) analysed the value of voluntary ESG reporting among DAX, MDAX and SDAX companies. They found that issuing an ESG report positively relates to company value, yet this correlation is relatively marginal. Moreover, they showed that disclosure of social aspects adds company value. In contrast, environmental disclosure does not create company value, explained by the high public scrutiny and even litigation risks when disclosing ecological information in Germany.

Considering the cost of equity as the second pillar of influence of voluntary non-financial information disclosure, Plumlee et al. (2015) analysed the amount of environmental disclosure and its quality. They found that voluntarily disclosing environmental information correlates with the cost of equity, i.e., higher disclosure yields lower cost of equity. Voluntary environmental disclosure impacts the cost of equity, concluding that voluntarily disclosing impacts the numerator more than the denominator in company valuation (Clarkson et al., 2013). Dhaliwal et al. (2011) found a positive correlation between voluntary ESG disclosure and company value driven by lowered cost of equity through provided ESG information. Additionally, they indicated that companies are filing ESG reports intending to achieve a lower cost of equity.

Considering the predictability of future cash flows, Clarkson et al. (2013) investigated five industries in the United States characterised as high-polluting. The authors analysed the effects of voluntary environmental disclosure on company valuation, future cash flows, profitability, and company risks. Their findings indicate that voluntarily disclosing environmental information is incrementally informative for investors. They announced that such information results in better predictability of future cash flows and profitability.

Turning towards the impact of non-financial information disclosure on financial performance, Reverte (2016) found a link between reporting ESG-related information and financial performance. He found that incorporating non-financial information into conventional financial investment analyses offers a deeper insight into the long-term performance of companies. The findings indicate that non-financial reporting could connect non-financial figures with future financial success, holding significance for investor decision-making processes. This finding aligns with Abdi et al. (2022), who discovered that a firm's engagement in non-financial initiatives is positively and significantly correlated with increased financial performance.

Lastly, considering the investment likelihood, companies issuing ESG reports receive special attention from market analysts and show an increased likelihood of receiving investments when disclosing non-financial information. Among the companies that receive equity capital, those that disclose non-financial information successfully raise a substantially more significant sum (Dhaliwal et al., 2011).

Summarising the above, voluntary non-financial information disclosure is advantageous from theoretical and empirical standpoints to close informational gaps, signal good performance to outsiders and achieve higher investments. While some companies use the mechanism of voluntary disclosure, other companies avoid it, which causes regulators to design mandatory reporting regimes with specific advantages and disadvantages. These will be highlighted in the subsequent chapter.

3.2.2 Mandatory disclosure

In this chapter, I will discuss the benefits and drawbacks of mandatory disclosure regimes. Then, I will discuss previous literature regarding the impact of existing mandatory disclosure regimes on the amount of non-financial information disclosed in the past.

Starting with the benefits of mandatory disclosure, regulation is especially justified in case private contracts for disclosure between companies and stakeholders are inefficient (Leuz, 2010). Throughout the literature, four primary reasons exist regularly justifying information disclosure regulation, i.e., positive externalities, cost savings throughout the market, unsatisfactory sanctions in the private market, and cost savings through preventing fraud and reducing agency costs (Leuz & Wysocki, 2008). Positive externalities may arise when the disclosure of a company benefits other companies or institutions that do not compete with the

company that is facing the mandatory disclosure. For instance, in the example of environmental information disclosure, companies providing software for GHG emission accounting can benefit from the environmental information disclosed as they can improve their software using public data. In this regard, Porter and van der Linde (1995) found that regulatory measures can foster innovation exceeding the cost required to comply with the set standards. Moreover, they found that regulation can be valuable as it points towards resource inefficiencies, puts pressure on companies to innovate and makes companies feel more secure about investing in specific technologies, allowing them to comply with the regulation (Porter & van der Linde, 1995). In line with Porter's and van der Linde's work, a more recent study conducted in an experimental approach by Chakraborty and Chatterjee (2017) revealed increasing expenditures on research and development of 11% to 61% caused by foreign regulations showing that regulatory measures can foster innovation.

Cost savings throughout the market are the second main reason in favour of regulatory measures driven by the standardisation of reporting formats, i.e., information processing constitutes less effort. It is less time-consuming for stakeholders when all companies apply the same standard. Moreover, disclosing companies are no longer required to negotiate disclosure agreements with various stakeholders, saving company costs. As such, regulation can benefit companies and their stakeholders by providing a standard at lower costs if adequately designed (Berthelot et al., 2012; Christensen et al., 2021; Mahoney, 1995). These regulatory benefits, however, are not entirely backed by the literature, as some authors argue that mandatory reporting regulation impacts the quantity of disclosed information, yet not necessarily the quality (Bebbington et al., 2012; Veltri et al., 2020).

The third primary reason in the literature relates to unsatisfactory sanctions in the private market. Leuz and Wysocki (2008) bring up the example of a family-owned company with a non-family member as a manager. Monetary punishments for the manager can be insufficient in achieving the disclosure amount requested by the owner of the family company. The sanctions are limited to monetary punishments in private contracts, whereas a governmental regulator can further impose criminal penalties beyond financial punishment. In the example of ESG-related regulation, it can be furthermore challenging for a purchasing company to sanction a supplier unless the exact scope of information disclosure is defined diligently, which, however, can be challenging given the broad spectrum of possible information provision.

As a last reason for mandatory regulation regimes, regulation can prevent company insiders from generating private advantages to the disadvantage of outside investors. Thus, regulation can serve as a fraud-preventing measure when, for instance, company insiders are hesitant to disclose information that would make their private actions obvious (Shleifer & Wolfenzon, 2002).

While the previously mentioned advantages point out the potential of mandatory disclosure regulation, introducing such regulatory measures also has drawbacks for regulators and companies. From a regulatory perspective, developing and designing a mandatory reporting structure is costly for the regulator and society as it requires resources to develop the regulatory framework and to enforce compliance with this set of rules or punishment otherwise (Leuz & Wysocki, 2008). Additionally, regulators often are less familiar with the information required for disclosure compared to companies that produce or consume such data making this task more challenging for them. Moreover, political developments can be subject to inefficient decision-making (Peltzman et al., 1989). Overall, the regulator should ideally create a regulation that is either less costly or performs better than a solution created within the market (Leuz & Wysocki, 2008).

From a company perspective, regulatory measures increase effort and risks. In 1995, costs for complying with environmental regulations in the United States already exceeded USD 125 billion, a number expected today beyond USD 200 billion and roughly one per cent of gross domestic product (Jaffe et al., 1995). While these regulations aim to prevent even more extensive financial damage, the financial burden for companies to comply with regulations is substantial. Moreover, regulation increases efforts among companies with high and low disclosure efforts before the regulation. For companies performing superiorly before the regulation, it becomes harder to differentiate themselves from other companies as all companies at least meet a certain minimum standard of disclosure. For companies performing inferiorly before the regulation, additional effort is required to meet at least the minimum standard required (Ioannou & Serafeim, 2017). Ioannou and Serafeim (2017) thus assume that the value of ESG-related information disclosure vanishes, and mandatory reporting regimes destroy shareholder value. Additionally, companies might end up disclosing information they would usually not want to become public. The fact that various stakeholders such as competitors, suppliers or customers now know about such confidential information imposes a risk on the disclosing company, potentially resulting in proprietary costs (Graham et al., 2005; Wagenhofer, 1990). Disclosing more information also results in a higher degree of public

scrutiny, time-consuming requests from society members and even the risk of facing litigations from private people or organisations (Arora & Cason, 1995; Christensen et al., 2021; Graham et al., 2005). Additionally, regulations which leave companies with room for interpretation might even discourage companies from investing in certain areas and instead cause them to wait for more detailed regulatory information (Kemna, 2015).

3.2.3 Hypotheses development

As seen in the last chapter, regulating companies to disclose specific ESG-related information can be justifiable and, in an ideal case, creates a positive upward spiral where more information increases transparency in the market, thus increasing internal governance structures and standards, which then affect internal systems and eventually increase not only ESG information disclosure but also ESG performance (B. Cheng et al., 2014). Nevertheless, drawbacks such as increased costs for companies and regulators and higher risks for companies speak against mandatory regulation. Given these opposing arguments, considering the empirically discovered effects of mandatory reporting regimes is worthwhile. Today's researchers are divided between mandatory regulations having a positive and a negative effect on ESG disclosure. This provides an exciting opportunity to contribute to this literature strand meaningfully, as my research can facilitate dissolving the current conflict. In the following section, I will present the empirical results of both observed effects to derive my research hypotheses.

Considering researchers who identified a significant impact of mandatory reporting regulations for non-financial information, Ioannou and Serafeim (2017), for instance, identified an explicit increase in reported ESG information based on introduced ESG regulations in European, Asian and African countries, both on companies disclosing much information and little information before the regulation. They thus identified mandatory ESG reporting regulations as cause for a so-called "*race to the top*" (Ioannou & Serafeim, 2017, p. 15) and determined the positive effect of introducing ESG disclosure regulation regimes. Ottenstein et al. (2022) analysed European firms subject to the NFRD. They found the directive to affect both the quantity and quality of sustainability reporting, i.e., firms subject to the directive offer about four percentage points more information on sustainability than similar firms not subject to the directive, as determined by propensity score matching. Mio et al. (2020) achieved similar findings when analysing the effects of the NFRD on information disclosure. They found companies to significantly increase their ESG information disclosure after the regulation

became effective. Criado-Jiménez et al. (2008) investigated a directive mandating Spanish firms to disclose environmental information in their financial reports. They found the regulation to boost both the amount and quality of non-financial information disclosure, particularly regarding unfavourable information. However, their research also points out that firms tend to use non-financial reporting to shape the public perception of their environmental actions, favouring the dissemination of positive news over negative. Hummel and Rötzel (2019) analysed the 2013 Regulations Amendment to the British Companies Act 2006 on various ESG topics (e.g., GHG emissions, gender quotas or issues related to human rights) and also identified an increase in disclosure post-regulation.

Additionally, a regulation does not only have an impact on the amount of information but also ESG-related performance (Aragòn-Correa et al., 2020; Christmann, 2004). Companies disclosing information particularly well prior to the regulation might even be motivated to disclose more information than required to put pressure on regulatory authorities. Thus, they increase the minimum regulatory disclosure level through their over-compliance and restrict their competitors (Arora & Cason, 1995). Multiple other authors found similar effects for various international legislations (for a thorough overview, see Haji et al. (2023)).

In contrast, multiple authors found no or negative effects of mandatory reporting regulations on ESG information disclosure. For instance, Bebbington et al. (2012) found that an environmental reporting system in Spain did not evolve to fully capture the enacted law mandates, indicating that formal legislation might not be enough to establish a standard. The regulations did not fit within a cohesive normative structure, and the way the standard was designed did not guarantee its interpretation and application. In a French study on the effects of an ESG regulation released in 2001, Chauvey et al. (2015) found that the quality of the information disclosed could be better, and the number of companies incorporating negative ESG information in their reports decreased. Larrinaga et al. (2018) analysed the 2011 Spanish legislation requiring public sector organisations to adopt sustainability accounting practices. Their findings indicate that, even after introducing this new legislation, the volume and quality of ESG accounting practices continue to be limited. Cordazzo et al. (2020) did not find companies to disclose more ESG-related information once an ESG regulation has come to power. Instead, they identified companies shifting to pragmatic legitimacy (Suchman, 1995). In an Italian context, Costa and Agostini examined the effects of an Italian legislation on reporting environmental and employee issues. They found that although there has been an increase in the amount of text dedicated to environmental and employee topics, the richness of

the information provided has not seen a significant enhancement. Again, further authors have made similar observations (for a thorough overview, see Haji et al. (2023)).

Researchers have thus found both positive and negative effects of mandatory reporting regulations on non-financial information disclosure. In line with previous analyses (Haji et al., 2023), I, however, hypothesise that a mandatory reporting regime for non-financial information will have a positive effect on non-financial information disclosure. Thus, I state my first research hypothesis as follows:

H1: The amount of information agents disclose increases with increasing the regulatory minimum disclosure level for ESG-related information.[13]

While I hypothesise that the ESG information disclosure will increase in line with the minimum ESG information disclosure level, it is interesting to understand how agents' choices shift. Ioannou and Serafeim (2017) identified a race to the top due to regulatory disclosure levels. However, De Villiers et al. (2021) found that shareholders are unwilling to pay for above-average information disclosure. If the regulatory minimum disclosure level exceeds the expected average information in a voluntary reporting setting, companies will thus only disclose up to the minimum level. In this regard, Cormier et al. (2005) found that information disclosure converged over time due to imitating other companies' behaviours and routines. I, thus, anticipate the average disclosure level to converge against the minimum regulatory disclosure level with increasing minimum levels and state my second research hypothesis as follows:

H2: The amount of information agents disclose converges towards the minimum regulatory information disclosure level with increasing regulatory minimum levels.

Shifting towards the shareholder perspective, a growing disparity exists between theoretical and practical considerations concerning the extent to which shareholders appreciate non-financial disclosure (Bernardi & Stark, 2018; Stubbs & Higgins, 2014). Two different theoretical lenses should be regarded here. On the one hand, according to economic disclosure theories, regulations mandating disclosure incur costs for firms, e.g., proprietary and litigation expenses (Haji et al., 2023). Following this logic, capital markets are expected to respond

[13] Given the experimental principal-agent setting of this research project, I deploy the terminology of principals and agents instead of shareholders and companies. I use this to better represent the individual decision-making occurring during the experiment vis-à-vis decision-making processes in larger corporations with many individuals involved.

negatively to implementing ESG regulations, which multiple researchers have proved in the past (Birkey et al., 2018; Chen et al., 2018; Manchiraju & Rajgopal, 2017). On the other hand, agency theory posits that information disclosure reduces risks as insufficient information availability poses a risk (A. Beyer et al., 2010; Clarkson et al., 2013), which causes shareholders to lower their investments or only accept similar investments at higher returns (Barth et al., 2017; Healy & Palepu, 2001). This suggests that investors are willing to pay higher prices for shares of companies that provide disclosure above the average level, as this enables them to more accurately evaluate future cash flows and the associated risks (De Villiers et al., 2021). This is in line with the statement made under H1. I thus hypothesise that invested capital also increases due to the increasing regulatory minimum disclosure levels and therefore state my third research hypothesis as follows:

H3: The amount of capital principals invest increases with increasing the regulatory minimum disclosure level for ESG-related information.

3.3 Experimental methodology

3.3.1 Experimental setting & selected treatments

This research project was initially inspired by the experiment conducted by Falk and Kosfeld (2006), i.e., an experimental principal-agent game in which the principal could regulate the agent's actions by setting a minimum performance threshold that had to be met before the agent selected a task to engage in productively. The agent could conduct an activity x equal or higher to the set minimum performance threshold at the cost c(x) (see I). The principal received a payout p(x) (see II).

$$c(x) = x \text{ where } x \in \{0, 1, \ldots, 120\} \quad \text{(I)}$$

$$p(x) = 2x \text{ where } p(x) \in \{0, 1, \ldots, 240\} \quad \text{(II)}$$

Their experiment thus constitutes an adaptation of a classical gift-exchange game (Akerlof, 1982; Akerlof & Yellen, 1990). The authors introduced three main treatments in which the principal could choose not to set any minimum activity level of x or a minimum activity level of 5, 10 or 20. Because x incurs a cost to the agent, conventional economic theory anticipates that the agent would select the smallest possible value of x, i.e., zero when the principal did not limit the agent's choices and more than zero when limitations were imposed.

The principal's benefits increased with higher values of x, implying that exerting control over the agent's decisions is more advantageous than not constraining the agent's options. Nonetheless, if agents are intrinsically motivated to act in the principal's best interest, exercising control could reduce their performance. The experiment revealed agents implementing a higher activity level when the principal did not set a minimum activity level. As such, they concluded that hidden costs of control arise as the agent's activity decreased when being controlled for a certain level. Falk and Kosfeld (2006) introduced multiple control treatments, where one was used to implement an exogenous minimum activity level of 10, similar to an external regulation. Agents received the explicit information that this level was set exogenously rather than by the principal itself. When they controlled for the minimum level being set exogenously, agents showed ~50% higher activity levels than in the treatment where the principal directly set the same minimum activity level. However, the differences between an exogenous minimum activity level and the treatment in which the agent could choose an activity level freely were insignificant, constituting the starting point of this research project.

In my experiment, subjects participate as principals or agents, whereas principals represent investors and agents represent companies. I pair one principal with two agents and thus adapt the inspirational paper into a multi-agent game. Moreover, the agents in this experiment move first translating this experiment into a reverse gift-exchange game similar to other authors (Abeler et al., 2010; Kleine & Kube, 2015). Agents are explicitly required to disclose a certain level of ESG information, and the principal then responds to the disclosed amounts with an investment decision. Previous authors have been motivated to increase the classical gift-exchange game, i.e., one principal and one agent, to a multi-agent setting to thus better mimic real-world patterns, increase external validity and mimic real-world organisational structures more accurately (Gächter et al., 2012; Maximiano et al., 2007). Thus, I employ this 1:2 principal-agent relationship to mirror real-world organisational and contractual relationships, generate more complex data, increase external validity, and capture the dynamics of competition among agents as they reach for an investment from the principal.

Both agents receive an initial endowment of 100, similar to the approach chosen by Kleine and Kube (2015) and decide how much ESG information x they want to disclose where $x \in \{0, 1, \ldots, 10\}$, i.e., an eleven-point Likert scale similar to previous authors (Cianci & Kaplan, 2008; Reimsbach et al., 2018). Other than Falk and Kosfeld (2006), associated costs are not linear. Instead, I choose, similar to other experimental researchers (Bartling & Siemens, 2011; van den Akker et al., 2020), a convex cost function c(x), which strictly increases in the

disclosed ESG information for every agent. I approximate the cost development using a quadratic cost function as follows:

$$c(x) = x^2 \text{ where } x \in \{0, 1, 4, ..., 100\} \quad \text{(III)}$$

This quadratic cost development is mainly assumed due to three factors. First, recent regulatory changes in the United States have led to a quadruplication of costs associated with compliance with ESG-related regulations (Spiess, 2022). Second, additional information disclosure results in proprietary costs resulting from legal authorities and competitors knowing more about internal company data and processes (Wagenhofer, 1990). Lastly, my previous research shows that providing more detailed information becomes increasingly difficult (cf. Chapter 2). For instance, reported GHG emissions are typically clustered into three Scopes according to the GHG Protocol: Scope 1, 2 and 3 (WBCSD & WRI, 2015). While providing data for Scope 1 and 2 emissions is reasonably straightforward, providing detailed information on Scope 3 emissions is complicated and a task many companies are still avoiding due to the high complexity of calculating emission data along the entire value chain. Given the above arguments, the applied cost function constitutes a valid approximation of ESG cost development while an overestimation of cost development might be possible.

The second player group in this experiment are principals, endowed with an initial amount of 110. Principals decide whether to invest an amount y where $y \in \{0, 1, \ldots, 110\}$ either into the first or the second agent, creating a competitive environment between both agents as only one can receive an investment. Each agent's payout p_c is thus described as follows:

$$p_c = 100 - x^2 + y \quad \text{(IV)}$$

The principal's payout p_i follows a risk-return pattern dependent on the amount of information disclosed by the agent they invested in. I choose this approach to accurately reflect the fundamental economic principle that higher returns are associated with higher risks. Higher ESG disclosure typically reduces risks and thus also returns (Naseer et al., 2023; Reber et al., 2022). In this way, I encourage agents to strategically decide how much information to share and principals to decide how much capital to invest, simulating real-world strategic decisions companies and individuals make regarding transparency and information management. Moreover, I simulate decision-making processes under conditions of uncertainty, a common challenge in business and economics. This risk-return pattern was based on a two percentage point increment per additional information unit provided by the agent, similar to the approach chosen by De Villiers et al. (2021). To then adjust for the risk spread between entirely

uninformed (no ESG information) and fully informed principals, the percentage point increment per informational unit was increased to two and a half percentage points in line with previous authors (Bloomfield et al., 1999; Easley & O'Hara, 2004; Jiang et al., 2005). As the presence of complete ESG information is the state of least risk, yet not risk-free, I set the maximum investment success rate to 90% in the case of complete information disclosure by the agent and consequently the minimum level is set to 65%. The success probability p_x can thus be described as $p_x \in \{0.65, 0.675, \ldots, 0.90\}$. Moreover, this assumption relates to the reduced principal uncertainty coming with higher knowledge about ESG information (Ramchander et al., 2012).

The invested amount y is doubled and then divided by the success probability p_x. As such, principals achieve higher returns when investing in agents with little ESG information disclosure. However, there is also a higher probability that a principal's investment will fail, resulting in a total loss of the amount invested. I model this using a dummy variable s representing the investment success where $s \in \{0, 1\}$. A random number r is generated for each investment where $r \in \{0, \ldots, 1\}$. The dummy variable $s = 1$, if $p_x \geq r$ and $s = 0$ otherwise. The principal's return thus results as follows:

$$p_i = 110 - y + \frac{2*y}{p_x} * s \qquad \text{(V)}$$

As stated earlier, the idea is to study the effects on principal and agent behaviour when introducing a regulatory minimum ESG disclosure level $\underline{x}$. For the first group, i.e., the control or no-regulation group (C0), no regulatory minimum ESG disclosure level $\underline{x}$ is set. As such, $x \in \{0, 1, \ldots, 10\}$ for each agent in the no-regulation group, i.e., agents choose the disclosure level freely. Additionally, three treatments are introduced, and the regulatory minimum ESG disclosure level $\underline{x}$ differs for each treatment. In the first treatment group, the minimum level is set as $\underline{x} \geq 3$ (T3). For the second treatment group, I set $\underline{x} \geq 5$ (T5), and the third and last treatment group requires $\underline{x} \geq 7$ (T7). The disclosure amount thus follows as $x \in \{\underline{x}, \underline{x} + 1, \ldots, 10\}$ for each treatment group.

3.3.2 Experimental procedure

Across all treatments, subjects play the principal-agent game as a one-shot game similar to the approach chosen by Falk and Kosfeld (2006). As such, I avoid unwanted effects due to learning from previous periods and increase internal validity (Charness et al., 2012). I randomly assigned principal and agent roles to subjects at the beginning of the experiment. The subjects

were students from Technical University of Munich and Ludwig-Maximilians-University of Munich. All experiments were conducted at experimenTUM, a computer lab at Technical University of Munich, which allowed me to create an environment of minimal distraction where subjects could focus on the required task. I formulated all experiment instructions neutrally. For the experimental design, I used the 'z-tree' software (Fischbacher, 2007). In the no-regulation group, 54 subjects participated, and for each treatment group (T3, T5, T7), 51 subjects participated, resulting in 18 (C0) and 17 (T3, T5, T7) observations, respectively, for the four groups. In total, 207 subjects participated, 69 representing principals and 138 representing agents, for 69 observations across all treatments. An overview of the experimental procedure is provided in the appendix (see FIGURE 6.3). The experiments lasted, on average, 42 minutes, and subjects earned, on average, EUR 12.42. I ran 15 sessions in April and May 2023, where each subject participated only once. 41% of subjects identified as female, while 56% identified as male[14], 54% were below 25, 38% were between 25 and 30, and 8% were above 30 years. The experiment was conducted in German, and the full pre-experiment text provided to subjects can be found in the appendix in a translated version (see FIGURE 6.4).

3.3.3 Predictions of subject behaviour

The subject behaviour predictions depend on each subject's risk attitude. In the following, I present two scenarios of subjects' risk propensity, i.e., (1) I anticipate subjects as being risk-neutral, and (2) I present a scenario in which subjects are expected to reflect risk aversion in their utility function.

Starting with the more trivial yet less realistic scenario of risk neutrality among subjects, I apply a backward approach as I start with principals' reactions to agents' disclosure. Implementing the parameters into the utility function (VI) results in a formula in which the first term represents the investment failure and the second represents the investment success case. The principal's utility function, in case the principal is risk-neutral, at first appears to be dependent on the disclosed amount x. Nevertheless, the formula can be simplified as stated under (VII), yielding that the utility of a risk-neutral principal does not depend on the disclosed amount.

[14] 3% of subjects did not identify as female or male (2%) or decided not to disclose their gender (1%).

$$U(I) = (0.35 - 0.025 * x) * (110 - y) + (0.65 + 0.025 * x) * (110 - y + \frac{2y}{0.65+0.025*x}) \quad \text{(VI)}$$

$$U(I) = 110 + y \quad \text{(VII)}$$

Thus, the principal maximises personal utility according to the presented utility function by investing the entire capital available into any agent, regardless of the disclosure amount provided by any agent. In other terms, the principal chooses one agent randomly. With this in mind, I turn to the agents' choices. When agents anticipate the principal's risk-neutral behaviour in which one agent is chosen randomly, the optimum choice of information to be disclosed is the minimum, as the agent's utility function follows the formula under (VIII). The agent should expect to receive an investment of the total possible amount at an expected probability of 50% (see IX).

$$U(C) = 100 - x^2 + y \quad \text{(VIII)}$$

$$U(C) = 100 - 0 + 110 * 0.5 \quad \text{(IX)}$$

As briefly mentioned earlier, the case of risk-neutral principals and agents within the market appears to not be the case in most scenarios (e.g., Arrow, 1965; Kahneman & Tversky, 1979; Pratt, 1964). I, therefore, also consider a predictive scenario in which subjects are risk averse. Starting again with anticipated principal behaviour, I now shift from a linear utility function used in the risk-neutral scenario to a generally accepted risk-averse utility function, i.e., $U(C) = \sqrt{x}$ (e.g., Atamtürk & Gómez, 2017; Markowitz, 2014; McCardle & Winkler, 1992).[15] Thus, the principal's utility function is dependent on x and y, i.e., the principal's choice of capital invested depends on the amount of information disclosed by the agents (see formula X). Notable here are two things: (1) the principal's utility increases in the agent's disclosed amount x, i.e., the higher the amount disclosed by the agent, the higher the principal's utility, and (2) the higher the amount disclosed, the higher the optimum investment amount which lies strictly below the maximum of 110. I present an overview of optimum investment amounts by information disclosure amount in the appendix (see TABLE 6.1). For instance, should both agents disclose an amount of zero information disclosure units (IDUs), the optimum strategy for the principal would be to invest ~90 experimental currency units (ECUs) into one of the two agents. In contrast, if one agent discloses the maximum amount of 10, the principal would

[15] The applied utility function is used as an illustrative example where other utility functions, e.g., constant absolute risk aversion (CARA) or constant relative risk aversion (CRRA), could have been used (e.g., see Wilcox, 2011). However, these utility functions would not change the fact that a risk-averse principal's utility increases with increasing agent disclosure, yet incrementally slower.

maximise personal utility by investing ~108 ECUs into the respective agent. Stated differently, the risk-averse principal will always choose the maximum possible disclosure amount to invest in and then chooses the respective amount presented in the appendix (see TABLE 6.1) to maximise personal utility.

$$U(I) = (0.35 - 0.025 * x) * \sqrt{(110 - y)} + (0.65 + 0.025 * x) * \sqrt{(110 - y + \frac{2y}{0.65 + 0.025 * x})} \quad (X)$$

Assuming that agents anticipate this specific principal behaviour, I now identify the optimum strategy for each agent. If both agents disclose the same amount of information, the principal randomly chooses one of them to invest in. However, if one agent discloses more than the other, I showed previously that the principal favours the agent who disclosed more information. From an agent's perspective, disclosing more information is thus beneficial as it increases the chances of securing an investment. Nevertheless, when disclosures are equal, each agent has only a 50% chance of receiving an investment.

Shifting to the exact optimum agent strategy, I must split these by treatments. In the high-regulation treatment, the most effective strategy for both agents is to disclose the maximum amount driven by the high costs when choosing the minimum disclosure level possible. Agents thus optimise their utility by disclosing the maximum amount and hoping for the investment even if the other agent also discloses the maximum amount.

However, in the treatments of no, low and medium regulation, a definitive optimum strategy for agents cannot be determined. Instead, local optima can be achieved when an agent discloses just one more unit of information than the other, maximising personal benefit. However, this approach leads to a strategic loop: if one agent discloses the maximum possible amount, the best counterstrategy for the other is to disclose nothing, complicating determining an optimal strategy. Given this repetitive cycle where no ultimate optimal strategy emerges, an agent might assume the other choose their disclosure amount randomly, with each amount having equal probability. Consequently, the optimal strategy varies by regulation level: without regulation, an agent maximises personal gain by disclosing an average of five IDUs. In stricter regulatory scenarios, the optimal disclosure amount linearly increases from this base, progressing to seven IDUs in T3 and nine IDUs in T5.

Reverting to the previously stated hypotheses, I expect support for H1 and H3, i.e., disclosed amount and invested capital increase post-regulation. In contrast, I do not expect to

find evidence for H2. A convergence towards the minimum disclosure level post-regulation does not resonate with the predictions, as principals are assumed to always choose the higher disclosing agent as an investment target.

3.3.4 Subject questionnaire

Besides the experimental study, I conducted a short post-experimental questionnaire among experiment participants to elaborate on each subject's main characteristics and perception of ESG importance. To test the subject's perceived importance of ESG during the experiment, I asked subjects how relevant the fact was that they were dealing with ESG rather than financial information. I applied a 5-point Likert scale with levels of not relevant, somewhat irrelevant, neutral, somewhat relevant, and very relevant. I chose the 5-point Likert scale to assure sufficient reliability and validity while at the same time avoiding overcomplicating the questionnaire with a more detailed scale (Dawes, 2008; Malhotra & Peterson, 2006). While I only conducted a one-shot experiment, I aimed to understand better how learning would affect subjects' behaviour in a subsequent round. I, therefore, asked subjects representing investors whether they would invest more, less or the same amount of capital in a subsequent round and agents whether they would disclose more, less or the same amount of information in a subsequent round. I deliberately decided to use a 3-point Likert scale for these questions to avoid differentiation between, e.g., the terms "*much more capital / information*" and "*slightly more capital / information*" as such qualitative assessment did not seem appropriate for precisely quantifiable amounts. Lastly, I sought further information regarding the principal's risk propensity and thus asked only principals whether they would always invest in the agent disclosing the highest amount of ESG information available. Subjects could only choose between yes and no. I deliberately deviated from the Likert scale here to force subjects into making a decision while not necessarily reducing validity or reliability (Dolnicar et al., 2011). The complete set of questions is provided in the appendix (see FIGURE 6.5).

3.4 Results and discussion

In this chapter, I present the results of this experimental study. I first present results related to the agents and then shift to the principal perspective and their behaviour across treatments. I added the results from the post-experimental questionnaire for both sections to

further enhance the findings. Lastly, I turn to the combined results to discuss the findings and interpret these in the broader context of ESG-related information disclosure.

3.4.1 Agent behaviour

Starting with the agents' behaviour and reactions to the introduction of minimum regulatory disclosure levels, I stated in my first hypothesis that the amount of information an agent discloses increases with increasing the regulatory minimum disclosure level for ESG-related information.

TABLE 3.1: Agent information disclosure behaviour by regulatory treatment

		C0	**T3**	**T5**	**T7**
Disclosed amount [IDUs]	Average	4.64	5.50	6.44	7.56
	Median	5.00	5.50	6.00	7.00
Wilcoxon rank-sum test results	C0	-	0.1583	0.0000***	0.0000***
	T3	-	-	0.0099**	0.0000***
	T5	-	-	-	0.0000***

Note - number of agents: 36 (C0), 34 (T3, T5, T7)

General support for the first hypothesis comes from the results stated in TABLE 3.1. The table presents the disclosed amounts across the no-regulation case and the three treatment groups. First, a close to a linear increase of one additional IDU per treatment is observable, e.g., increasing the disclosure level from T3 to T5 increases the average disclosure from 5.5 to 6.4 IDUs. To further test this, I deploy the Wilcoxon rank-sum test for unmatched data sets (Mann & Whitney, 1947; Wilcoxon, 1945). According to the test, T3 does not differ significantly from the no-regulation group, i.e., the null hypothesis that T3 differs significantly from C0 cannot be rejected. Average disclosure values for C0 and T3 differ by a disclosure level of 0.85 IDUs, and median disclosure levels differ slightly less at 0.50 IDUs. T5 differs significantly from the no-regulation group (p-value <0.0001) and the treatment T3. Moreover, T7 differs significantly from the no-regulation and other treatment groups (p-value <0.0001).

I, thus, confirm hypothesis H1 only partly for the T5 and T7 treatments, yet not for the T3 treatment, confirming that more regulation also leads to more agent information disclosure. Nevertheless, in the case of no regulation, the agent discloses almost half the possible disclosure amount already. While this result might be influenced by an agent's central tendency bias under uncertainty (Douven, 2018; Stevens, 1971), I also identified more than 55% of agents to state that dealing with ESG information, in this case, was (very) relevant to them while less than 15% identified dealing with ESG information as somewhat irrelevant and less

than 10% defined it as not relevant (n = 138). I, thus, interpret this finding as a willingness to disclose information beyond an economically reasonable level because this information is ESG-related. In this case, a different approach to explaining this economically irrational behaviour is a general will to receive an investment instead of not receiving an investment, similar to preferring winning over losing. In the second agent-focused question, subjects were asked how they would disclose in a subsequent round. When agents received an investment from the principal, 48% of agents would disclose an equal amount, while 28% would disclose less and 25% would disclose more. However, when not receiving an investment, 48% of agents would disclose more to ensure an investment in a subsequent round. In comparison, 29% would disclose even less and 23% would disclose a similar amount.

Turning to the second hypothesis, I stated that the amount of information agents disclose converges towards the minimum level set by the regulatory authority. The analysis of this possible effect is presented in TABLE 3.2.

TABLE 3.2: Convergence of agent disclosure against the regulatory minimum

		C0	**T3**	**T5**	**T7**
Delta disclosed amount versus required minimum [IDUs]	Average	4.64	2.50	1.44	0.56
	Median	5.00	2.50	1.00	0.00
Share of subjects choosing reg. minimum		11%	15%	24%	59%
Shapiro-Wilk test results		0.1566	0.3881	0.1089	0.0003***

Note - number of agents: 36 (C0), 34 (T3, T5, T7)

First, I examine the delta between average (median) disclosure values and the possible regulatory minimum. For the no-regulation case, the difference between the average (median) disclosure level chosen and the absolute minimum of zero IDUs is most pronounced, i.e., the average (median) lies 4.64 (5.00) IDUs above the absolute minimum. For the first treatment with a regulatory minimum of three IDUs, a delta of almost half of the no-regulation case to 2.50 (2.50) IDUs on average (median) can be observed. This trend continues again for treatment T5 and T7, where the delta lies at 1.44 (1.00) IDUs on average (median) for T5 and 0.56 (0.00) IDUs for T7 above the regulatory minimum. Furthermore, it is interesting to analyse the share of agents who chose the exact regulatory minimum. While in the no-regulation case, only 11% of agents chose the regulatory minimum of zero IDUs, 15% already chose the regulatory minimum of three IDUs in treatment T3. For T5, almost one-quarter of subjects

chose the minimum of five IDUs. Lastly, for treatment T7, 59% chose the regulatory minimum of seven IDUs.

A general tendency for disclosure levels to converge against the regulatory minimum is observable. However, the significance of this observation is yet to be tested. I, therefore, deploy the Shapiro-Wilk test (Royston, 1982; Shapiro & Wilk, 1965) to test each sample for normality. Based on the performed analysis, it becomes clear that only for treatment T7 can the null hypothesis that the disclosure amounts are normally distributed be rejected at the 0.1% significance level. For all other treatments, including the no-regulation case, I cannot reject the null hypothesis that these treatments are normally distributed. As disclosure costs rise significantly between disclosure levels seven, eight and nine, the added value of disclosure vis-à-vis the incremental cost seems to motivate subjects to stick with the regulatory minimum instead. For all other cases, the added value of an incremental IDU vis-à-vis the incremental cost seems appropriate, thus resulting in a broader distribution of disclosure levels. I, therefore, reject my second hypothesis as I cannot identify an apparent convergence towards the minimum set by the regulator, at least in the low and medium regulation scenarios. Considering once again the predictions I previously made, I predicted that agent disclosure would not converge towards the minimum or maximum; instead, agents' disclosure amounts are close to the mean of available options. Multiple effects could be the cause for this, e.g., (1) agents anticipate that principals will not value higher disclosure indefinitely, i.e., at a certain point, the principal's appetite for a secure investment could be satisfied, or (2) agents are too risk-averse to invest high amounts in information disclosure and instead keep the initial endowment.

In addition to the results related to the agent hypotheses stated earlier, I also analyse the average (median) profits agents achieve to better understand how profitable agents can be in each treatment. The results for agent profits are supported by TABLE 3.3, which presents agent profits and Wilcoxon rank-sum test results, where average agent profits by treatment are compared. Looking at average agent profits, agents in the low-regulation treatment (T3) show the highest profits with 100.44 ECUs earned, followed by the no-regulation case (C0) with 93.08 average ECUs. The medium-regulation treatment (T5) shows similar results to the no-regulation case, with 91.56 ECUs earned on average.

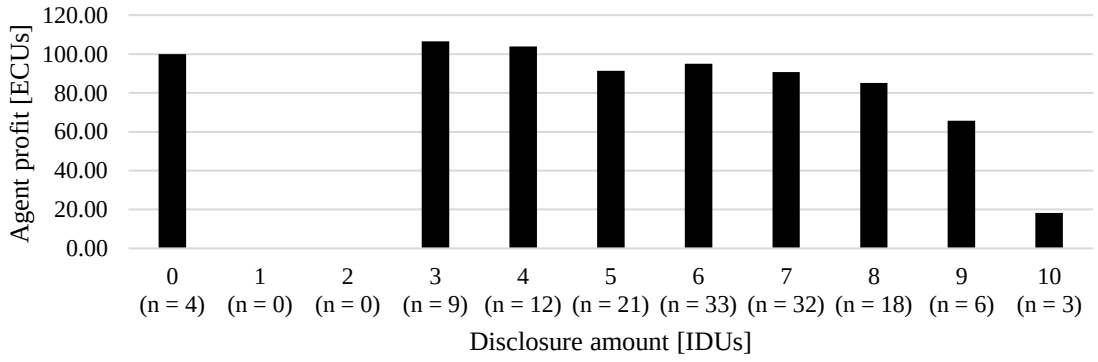
TABLE 3.3: Agent profits by regulatory treatment

		C0	T3	T5	T7
Agent profits [ECUs]	Average	93.08	100.44	91.56	78.29
	Median	91.00	90.00	75.00	53.50
Wilcoxon rank-sum test results	C0	-	0.3064	0.8257	0.0142*
	T3	-	-	0.1730	0.0001***
	T5	-	-	-	0.0052**

Note - number of agents: 36 (C0), 34 (T3, T5, T7)

The high-regulation treatment ranks lowest with 78.29 ECUs earned. Turning to medians, a similar yet slightly different picture can be observed. The case without regulatory influence (C0) ranks highest for median agent profits, closely followed by the low-regulation treatment (T3), with 91.00 and 90.00 ECUs earned. The medium-regulation treatment is further away from the first two treatments with 75.00 ECUs earned, and T7 ranks again lowest with 53.50 ECUs earned. As case C0 and treatments T3 and T5 are all comparably close to each other, I performed a Wilcoxon rank-sum test to determine differences in profit distributions. As presented in TABLE 3.3, the differences between C0, T3 and T5 are insignificant, yet all three treatments differ significantly at either the 5% or 1% level from the high-regulation treatment. Based on these results, high regulation appears unattractive from an agent's perspective as profits are the lowest. Looking at the highest average profits, agents are between the no-regulation case and the low-regulation treatment, with a tendency towards the low-regulation treatment based on a combination of average and median profits. This becomes clearer when the Wilcoxon rank-sum test results are factored in, which are insignificant yet provide a direction as T3 and T5 differ at the 17% level. At the same time, C0 and T5 appear very similar according to the test results. To elaborate further on this topic, I analyse average profits by disclosed amount irrespective of treatment (see FIGURE 3.1). In this case, only four agents disclosed zero IDUs, and no agent chose a level of one or two IDUs.

FIGURE 3.1: Agent profits [ECUs] by disclosure amount choice [IDUs]



Profits are highest for a disclosure level of three IDUs (106.44 ECUs) and second highest for four IDUs (103.83 ECUs). These two levels are the only two that exceed the zero-disclosure decision, where agent profit equals 100.00 ECUs. Agents disclosing amounts between five and seven IDUs reached similar profits between 90.69 and 94.94 ECUs. Agents disclosing beyond this level saw an explicit decrease in profits from 85.17 ECUs at a disclosure level of eight IDUs to 65.67 ECUs at a disclosure level of nine IDUs and 18.33 ECUs at a disclosure level of ten IDUs. While the number of agents disclosing an amount of ten (n=3) was comparably small, it is still interesting to see that not even the highest possible disclosure amount made principals either invest in them (only one of the three agents received an investment) or invest high amounts, i.e., the one agent receiving an investment received an investment amount of 55 ECUs. This finding is interestingly contradictory to the previously assumed utility function for principals, where I assumed that principals always prefer a higher disclosure over a lower disclosure. Instead, principals require a certain level of investment security, yet this need is at one point fulfilled, resulting in an investment shift towards the riskier investment. I will now shift to the principal analyses to better understand how the initial decisions made by agents affect principal behaviour to conclude in a broader economic context.

3.4.2 Principal behaviour

The third hypothesis states that the amount of capital principals invest increases with increasing the regulatory minimum disclosure level for ESG-related information. Support for this hypothesis comes from TABLE 3.4. I present average and median investment amounts and the differences between investment distributions by treatment according to the previously described Wilcoxon rank-sum test. Looking first at the average (median) invested amounts, an investment amount of 38.56 (30.00) ECUs in the no-regulation case is observable. For all three other treatments, invested amounts are almost twice as high (or more than twice as high when considering medians), with 67.29 (60.00), 68.82 (65.00) and 72.06 (70.00) ECUs for the treatments T3, T5 and T7. Two aspects are important to highlight here: (1) the steep increase in invested amounts between the case of no regulation vis-à-vis any treatment of regulation and the subtle differences between any regulatory treatment scenario.

TABLE 3.4: Principal behaviour by regulatory treatment

		C0	T3	T5	T7
Investment amount [ECUs]	Average	38.56	67.29	68.82	72.06
	Median	30.00	60.00	65.00	70.00
Wilcoxon rank-sum test results	C0	-	0.0057**	0.0048**	0.0023**
	T3	-	-	0.8578	0.3948
	T5	-	-	-	0.6506

Note - number of principals: 18 (C0), 17 (T3, T5, T7)

The Wilcoxon rank-sum test is applied to further elaborate on these findings and find further support for the hypothesis. The investment distribution of the no-regulation case differs significantly from all regulatory treatments (p-value < 0.01 for all three treatments). However, no significant differences can be observed when comparing treatments T3, T5 and T7 regarding invested amounts. These findings confirm H3 partly as a significant increase in invested amounts is observable. However, the difference results from the existence of the regulation, irrespective of its magnitude. Whether the regulatory minimum is at a higher or a lower level appears not to impact principal behaviour any further. Again, a low to moderate regulatory level seems reasonable as invested amounts are already reasonably high in the T3 treatment. Considering the questionnaire results, interestingly, principals reported that dealing with ESG information is especially relevant to them. More than 75% of principals reported that ESG information is either relevant or very relevant to them (55% among agents), while only 11% reported ESG information as somewhat or not relevant.

Nevertheless, principals were mostly not willing to invest their entire capital. The investment amounts are generally lower than previously predicted. One explanation for this could be a higher level of risk aversion than previously anticipated. Another explanation could stem from principals' negative reciprocity, i.e., principals generally invest less to punish agents for disclosing too little. I, therefore, performed another analysis on investment amounts by IDU and treatment. The results are, however, mixed and thus only provide limited support for the phenomenon of negative reciprocity. While in treatments T3 and T5, principals invest (significantly) more capital when an agent slightly exceeds the minimum disclosure level, this trend does not continue in T7. Moreover, comparing investment amounts across treatments, principals, for instance, invest more capital into an agent providing a disclosure level of five IDUs in T3, i.e., more than the agent should, as in T5, i.e., the minimum the agent must disclose.

Conversely, I find the opposite effect when comparing T3 and T7. Here, principals invest more in the T7 treatment, although this is what agents at least must disclose, and agents in T3

exceed the minimum level strongly. Instead, principals are generally not willing to invest their entire capital. At the same time, some regulation already safeguards them to invest a substantial amount, which does not further increase with higher disclosure levels.

From a principal's decision regarding the amount of invested capital, I now shift to the principal's decision dependent on the amounts disclosed by both agents.

TABLE 3.5: Principal investment decision by regulatory treatment

		C0	T3	T5	T7
Relative share of investment decisions based on agent disclosure	Higher disclosure	61.1%	70.6%	64.7%	41.2%
	Lower disclosure	5.6%	17.6%	35.3%	23.5%
	Equal disclosure	33.3%	11.8%	0.0%	35.3%

Note - number of principals: 18 (C0), 17 (T3, T5, T7)

Starting with the no-regulation case, 61.1% of principals invested in the agent with the higher disclosure amount, while 5.6% invested in the agent with lower disclosure than the other disclosing agent. This finding is also statistically significant (binomial test, $p < 0.01$)[16]. Turning to the regulatory treatments, I still find that most principals invest in the agent with higher disclosure in the low-regulation treatment. 70.6% of principals invest in the agent with higher disclosure, while 17.6% invest in the agent with lower disclosure. These results indicate statistically significant that principals still invest in the agent disclosing at a higher level (binomial test, $p < 0.05$). For the medium-regulation treatment (T5), 64.7% of principals invest in the higher-disclosing agent, while 35.3% invest in the lower-disclosing agent. In the high-regulation treatment (T7), 41.2% invest in the high-disclosure agent, while 23.5% invest in the low-disclosure agent. For both treatments, findings are insignificant, i.e., I cannot reject the null hypothesis that the actual probability is above 50% or vice versa. Overall, most principals in all treatments invest in the higher disclosing agent, which is significant in the no-regulation and low-regulation treatments. This generally aligns with the assumption that principals prefer a higher information disclosure. Nevertheless, the desire for higher disclosure slightly vanishes once information disclosure is higher among both agents the principal can invest in.

When asked about their risk propensity, 59% of principals said to invest in an agent with higher disclosure at any given level. In comparison, only 41% of principals would not choose

[16] One-sided binomial test at 50% probability, observations where companies had same disclosure were omitted for the binomial test.

this at any level. A tendency towards fewer principals investing in the higher disclosure option is observable, e.g., principals are four times more likely to invest in the higher disclosure agent in the low-regulation treatment (T3). This likelihood decreases to less than two times in the high-regulation treatment (T7), and the overall risk aversion overweighs. This finding is backed by the third questionnaire question in which principals were asked about their investment strategy for a potential next round. While 39% answered they would be willing to invest more in a subsequent round, more than 50% of principals would stick to their investment strategy and reinvest the same amount.

Nevertheless, only 6% of principals would even invest less. Another interesting fact was found in the principals' decision when confronted with two agents disclosing the same amount of information. Overall, this occurred in 20% of the cases. In 93% of these cases, the principal decided to invest in the first agent, while only in one case the principal decided to invest in the second agent. While the overall relevance for regulators might not be too relevant, it is still interesting to see how subjects are biased to choose the first option in case of a decision with an equal outcome, e.g., being positioned first in a list can help secure investments.

Similar to the analysis in the previous chapter, I also analyse the profits achieved by principals during the experiment. The results are presented in TABLE 3.6.

TABLE 3.6: Principal profits by regulatory treatment

		C0	**T3**	**T5**	**T7**
Principal profits [ECUs]	Average	153.61	183.09	187.34	201.01
	Median	150.09	195.45	204.84	204.71
Wilcoxon rank-sum test results	C0	-	0.0492*	0.0457*	0.0077**
	T3	-	-	0.8851	0.4688
	T5	-	-	-	0.7402

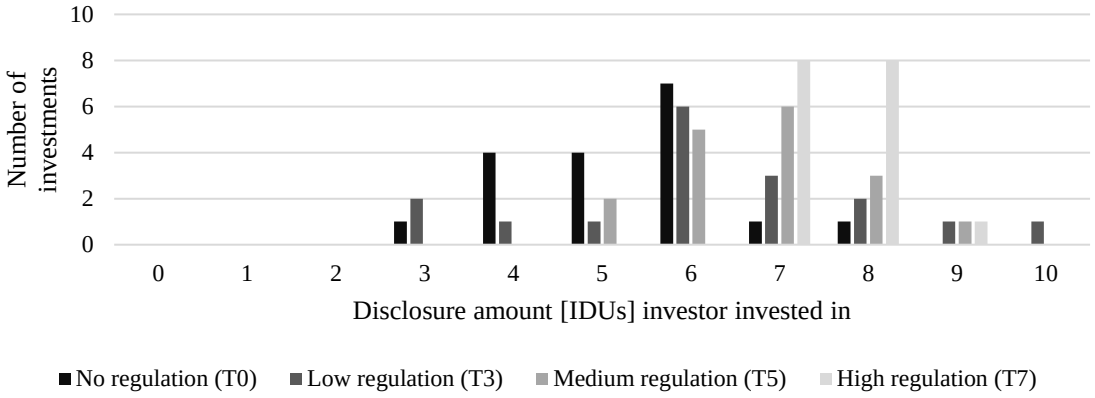
Note - number of principals: 18 (C0), 17 (T3, T5, T7)

Considering average (median) profits first, a continuous increase in principal profits can be observed from 153.61 (150.09) ECUs in the no-regulation case to 183.09 (195.45) ECUs in the low-regulation treatment across the medium-regulation treatment with an average (median) principal profit of 187.34 (204.84) ECUs to a profit of 201.01 (204.71) ECUs in the high-regulation treatment. These results align with the higher invested amounts presented in TABLE 3.4. I test these results again with the Wilcoxon rank-sum test and find significant differences between the no-regulation case and all other three treatments ($p < 0.05$ (C0, T3) and $p<0.01$ (T7)). Nevertheless, only insignificant differences can be found when comparing the treatments (T3, T5, T7) against each other. Based on these results, I interpret the introduction of a

regulatory minimum as value-enhancing in this experiment. In contrast, the magnitude of the regulatory minimum appears almost irrelevant to the principal's decision and the achieved profits.

Lastly, I want to highlight which disclosure amount generated the most investments overall. Therefore, the number of investments is split by treatment and disclosure amount chosen for the investment by the principal (see FIGURE 3.2). First, no investments were taken below the low-regulation level of a disclosure amount of three. A disclosure level of six IDUs was chosen most often for the no-regulation and the low-regulation treatments.

FIGURE 3.2: Number of investments by disclosure amount invested in



A disclosure level of seven IDUs was primarily chosen for investment for the medium-regulation treatment. Seven and eight IDUs were chosen equally often for the high-regulation treatment. Principals generally acknowledged the extra effort of going beyond the minimum level required by the regulatory institution while investing lower than initially predicted to signal their expectation of higher disclosure amounts. On the other side, principals tended not to value this effort indefinitely but rather showed an interest in investing slightly above the required level. This tendency decreased with higher minimum regulatory levels.

3.4.3 Combined behaviour

Lastly, I examine the combined results of agents' behaviours and the principal's responses. Therefore, the profits of agents and principals per regulatory treatment are combined. The results are presented in TABLE 3.7.

TABLE 3.7: Combined profits across principals and agents by regulatory treatment

		C0	T3	T5	T7
Combined agent and principal profits [ECUs]	Average	339.77	383.98	370.46	357.60
	Median	317.48	390.45	398.24	361.71
Wilcoxon rank-sum test results	C0	-	0.1458	0.3304	0.3305
	T3	-	-	0.7789	0.2415
	T5	-	-	-	0.4691

Overall, profits are lowest for the no-regulation case, with an average combined profit of 339.77 ECUs and highest in the low-regulation treatment (T3), with 383.98 ECUs. The second highest profits are achieved in the medium-regulation treatment (T5), and the third highest in the high-regulation treatment (T7) with 357.60 ECUs. A shift between the low- and medium-regulation treatments is observable in medians, as the median for T5 is slightly higher. Performing the Wilcoxon rank-sum test, insignificant differences between all profit distributions can be seen. In contrast, the differences between the no-regulation case and the low-regulation treatment are closest to statistical significance, with a p-value < 0.15. Although insignificant, a low to moderate regulation makes sense vis-à-vis a no-regulation scenario. This aligns with what was seen in the analyses in the previous chapters.

3.4.4 Discussion

The results of this experiment with university students regarding ESG information disclosure and related investment decisions align with the previously mentioned authors. At the same time, new, exciting aspects are essential to highlight, which I will discuss in the following.

Agents in this experiment disclosed more information with increasing the regulatory minimum disclosure levels, supporting previous authors who found an increase in companies' information disclosure based on mandatory reporting regimes (Hummel & Rötzel, 2019; Mio et al., 2020; Ottenstein et al., 2022). Other than the finding in the inspiring paper (Falk & Kosfeld, 2006), I find a significant difference between disclosed amounts in a voluntary and mandatory reporting regime. Ioannou and Serafeim (2017) argued that mandatory reporting regimes result in a race to the top. Throughout the experiment, I find limited support for this. While in the low- and medium-regulation treatment agents still exceed the required regulatory minimum, they converge towards the minimum in high-regulation scenarios. Agents thus showed that in the lower regulation scenarios, it is still assumed to be worthwhile to exceed the

minimum as a competitive advantage. At the same time, this becomes more difficult in the high-regulation scenario. Translating this to a real-world scenario, regulators should bear in mind that setting the regulatory minimum too high potentially results in the disappearance of using non-financial information disclosure as a competitive advantage. Regulators should thus ask themselves whether this is the desired effect or whether they want companies to enhance their reporting and thus provide superior information to the market.

Turning to the principal behaviour, principals invest significantly more capital in the low than the no regulation treatment, while no further increase in invested capital with higher regulation was observed. These findings align with the findings achieved by De Villiers et al. (2021), who found that investors are willing to invest significantly more for average and above-average information compared to below-average information. When investors can, however, choose between average and above-average information, no significant difference is observed. Stated differently, investors are willing to pay for some informational security, yet not indefinitely. I discovered a similar effect throughout my experiment, raising whether a high regulation makes sense given the limited willingness to pay for this extra information.

Considering overall average (median) profits, these are achieved in the low (medium) regulation scenario. Agents are already disclosing relatively high amounts of information in the low-regulation treatment, and principals are investing significantly more capital in the low-regulation treatment vis-à-vis the no-regulation case. In line with the previously discussed literature, which overall argues more for than against mandatory regulation (Haji et al., 2023), I thus argue that, within the boundaries of this experimental setting, a low to moderate regulation helps to safeguard investors at a reasonable cost for companies. Regulating too strictly results in an excessive cost burden for companies with limited additional value for shareholders. At the same time, no regulation yields investors investing too little due to insecurity, resulting in losses for the overall economy.

3.5 Conclusion

This experimental research project analyses, motivated by recent regulatory activity on a European level (CSRD), the effects of different minimum regulatory levels for ESG information disclosure on company and investor behaviour represented by principals and agents in a laboratory experiment. The previously stated research question ("*Does the*

introduction of a regulatory minimum ESG disclosure level continuously add value over a mere voluntary reporting regime?") was targeted by an experiment among more than 200 students from Technical University of Munich and Ludwig-Maximilians-University of Munich which were split into four treatment groups of varying regulatory minimum disclosure levels (voluntary, low, medium, and high regulation). Subjects had to decide how much ESG information to disclose when representing a company as an agent or how much capital to invest into one of the two agents when representing an investor as a principal.

Three main observations can be taken away from this experimental research project: First, I find statistically significant evidence that higher regulation leads to more information disclosure by agents. Nevertheless, subjects disclosed substantial amounts of ESG information during the voluntary disclosure treatment. I attribute this to the high importance of ESG topics to subjects, as more than 60% of subjects indicated ESG as a high priority influencing their decisions during the experiment. In comparison, less than 20% of subjects indicated ESG as irrelevant to their decisions. Second, principals appeared to value a certain minimum level of regulated information disclosure, motivating them to invest most of their capital. Here, I find a significant increase of invested capital from the voluntary disclosure to the low regulation disclosure treatment. Nevertheless, the investment amount increases not further when disclosed amounts increase due to stronger regulation. Principals do not appear to be motivated by the effects of reciprocity, i.e., either punish agents for not exceeding the minimum disclosure level or reward agents for going far beyond the required minimum disclosure level. Third, principals generally invested in the agent with more disclosed information, which I attribute to the high-risk aversion among experiment subjects. In summary, a low to medium regulation scenario creates the highest value for all market participants, given that principals invest significantly more when safeguarded by regulatory guidelines while costs for agents are justifiable.

3.5.1 Contribution and managerial implications

With this experimental research project, I contribute to the existing literature on mandatory reporting regulations (Haji et al., 2023). Specifically, this research essay provides three contributions to the existing literature. First, I respond to the call for research for more experimental studies as most research thus far is focused on archival studies (Bloomfield et al., 2016; Humphreys & Trotman, 2022). This experimental approach allows me to isolate the mere effects of regulation as voluntary disclosure has increased in the past years (Ioannou & Serafeim, 2012). Second, the CSRD only became effective in 2023, and thus, its impact will

not be observable for another few years as the reporting mandate only starts from the financial year 2025 onwards. The experimental approach thus allows for a first prediction of future effects. Moreover, present researchers are divided between the positive (Berthelot et al., 2012; Ottenstein et al., 2022; Porter & van der Linde, 1995) and negative (Bebbington et al., 2012; Ioannou & Serafeim, 2017; Leuz & Wysocki, 2008) effects of mandatory reporting regulations to which I can contribute with my research. Lastly, I analyse the effects of mandatory reporting regulations across various levels similar to the approach chosen by Falk and Kosfeld (2006). By adapting their approach to an ESG setting, I can test these varying levels for subjects' reactions to non-financial information disclosure.

From a managerial perspective, the research project provides potential insights for companies and regulatory decision-makers while carefully considering the limited external validity of this laboratory experiment. It can be interesting for companies to understand that investors value disclosure beyond the required minimum due to the associated risk reduction, which is rewarded with invested capital. This aligns with agency theory (Healy & Palepu, 2001; Jensen & Meckling, 1976). For regulatory authorities it can be relevant to understand how market participants react to ESG information disclosure regulation in a theoretical setting. According to this research project, assuming the regulator's highest interest is to create the highest welfare among all market participants, a low to moderate regulation appears to be the best way to reconcile all stakeholders' interests. Setting specific regulatory minimum disclosure boundaries safeguards investors, reduces uncertainty and thus increases invested capital. Nevertheless, further incremental information is only of limited added value in safeguarding investors in their decision-making process. Regulatory authorities should thus carefully consider the amount of information mandated as a minimum reporting requirement from companies to find the right balance between disclosed information and the required reporting effort.

3.5.2 Limitations and areas for further research

While I have conducted this experimental research diligently and thoroughly, various limitations were still faced based on the chosen experimental setup. First, this is related to the subjects participating in the experimental sessions. All subjects were either Technical University of Munich or Ludwig-Maximilians-University of Munich students, with slightly more than half being younger than 25 years and roughly 38% between 25 and 30, while only about ten percent of subjects were older than 30 years. On the one hand, these subjects thus

have the potential to represent future decision-maker behaviour. On the other hand, most subjects still need to become decision-makers in their personal development, either in a disclosing or an investment company. Thus, the generalisability of the results is considered limited, whereas an experiment among actual decision-makers could have a higher degree of generalisability. Nevertheless, the practicability of such an endeavour is much more challenging.

Second, I have focused the experiment on the amount of ESG disclosure. Nevertheless, not only the amount of information disclosed to principals matters when making investment decisions, but also the quality. However, I deliberately excluded the qualitative aspects in this experimental study to avoid over-complication, similar to the approach chosen by De Villiers et al. (2021). Nevertheless, I cannot say with certainty that subjects might have associated a higher level of disclosure with a higher quality of information. Like the approach chosen by Perera et al. (2019), I assume the information disclosure variable in this experiment to be perceived as a combination of qualitative and quantitative information by experimental subjects. Moreover, I did not distinguish between environmental, social, and governance aspects. Instead, I grouped these under the term ESG. While it is a term used broadly, the individual aspects have little in common besides non-financial characteristics. I found that ESG mattered to subjects, yet I cannot say which specific aspects mattered most to subjects.

Third, specific experimental choices were made for this experiment, e.g., quadratic disclosure cost. Of course, the experimental parameters could have been chosen differently, which could affect the overall outcome. At this point, it is impossible to say how this would shape the experimental results. In addition, I paid a high degree of attention to assuring a proper and randomised experiment to achieve high internal validity. While experimental studies generally allow for high control over potential confounding factors (Eden, 2017), unobserved confounders might still influence subject behaviour.

Fourth and last, investment decision processes are complex and usually involve various legal, technological, financial, and non-financial aspects. While I focus specifically on non-financial aspects, all other investment decision aspects are omitted in this experiment, drawing a black-and-white picture in a world which is most likely much greyer than applied here. In addition, I only focused on company shareholders making decisions. In the real world, company behaviour is influenced by various stakeholders (Darnall et al., 2010; Freeman, 1984) besides investors, such as customers, employees, or NGOs, especially in today's world.

Leaving these factors and other stakeholders apart allows for controlling the principal-agent relationship and facilitates a real-world scenario, but potentially reducing real-world generalisability.

Based on the described limitations, three future research areas would be worth investigating in subsequent work. First, factoring in disclosure quality as a second differentiating parameter besides the disclosure amount could influence principals' decisions. It would be interesting to understand how principals would substitute quality for quantity and which aspects are more relevant to principals. With future regulations, certain minimum levels of quantity and quality must be met. Understanding how principals value agents' efforts to exceed these thresholds could provide valuable insights into company behaviour.

Second, I mentioned the undifferentiated combination of environmental, social and governance aspects. Dividing these aspects in a subsequent experiment could provide further insights into which aspects matter most to principals. It is possible to break down E, S, and G further into the most relevant aspects in each cluster to understand better where principals' interests lie.

Lastly, I suggest extending the scope of focusing on the narrow principal-agent, i.e., investor-company, relationship to a broader audience of stakeholders. It can be interesting to see how agents react to comply with various stakeholder interests and better understand where agents want to keep good, neutral, or bad relationships. On top of that, generating a better understanding of how various stakeholder groups react to ESG-related information disclosure amounts and the quality of disclosed information can be beneficial to designing optimal disclosure reports. As such, tailoring regulatory guidelines to the requirements of the broad set of stakeholders might have value-enhancing potential.

4 Essay III – Effects of assurance levels and forward-looking time horizons in non-financial reporting: An experimental approach

Abstract

In exploring the impact of non-financial disclosure on investor decision-making, this study focuses on the assurance level (limited versus reasonable) and forward-looking time horizon (short-term versus long-term) in disclosures. Utilising a framework that splits the decision-making process into evaluation, weighting, and judgment phases, the research finds that assurance level and forward-looking information significantly influence investor decisions. Specifically, reasonable assurance improves the evaluation and weighting of non-financial information, especially when paired with long-term forecasts, reducing uncertainty associated with future projections. However, the impact of assurance level on information-based judgment is negligible, suggesting a divergence in how assurance and time horizon affect different decision-making stages. This finding implies a social desirability bias in investor behaviour. The study contributes to the existing research on non-financial disclosure by showing how reasonable assurance significantly enhances investor trust. It also offers initial results on how long-term forward-looking disclosures positively influence an investor's decision-making processes.

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4.1 Introduction

The provision of companies' non-financial information has increased significantly within the last years, and the respective non-financial performance has been of rising importance to various stakeholders compared to the traditionally high importance of financial performance indicators (Reimsbach et al., 2018). Investors, as stakeholder group of high criticality from a company perspective, are increasingly using non-financial information as a basis for their decision-making to anticipate future performance (Bedoya-Pardo, 2023; Berthelot et al., 2012) and have started to prioritise long-term performance over short-term profitability (Chalmers et al., 2021). Especially over the last decade, non-financial disclosure reporting has, thus, also gained substantial traction among researchers (Heichl & Hirsch, 2023) and the specific aspects influencing investors when non-financial disclosure is provided (Mercer, 2004). Given the importance of this kind of information, regulators also began to detail more guidelines to safeguard stakeholders as the credibility of non-financial information is often challenged, and quality and reliability are not at the desired levels (Cort & Esty, 2020). One noteworthy directive in this regard is the CSRD, which became effective in January 2023, increasing non-financial reporting requirements for companies within the EU (European Parliament & European Council, 2022). In this regard, two aspects are worth mentioning as they are only vaguely described by the EU within the CSRD (European Parliament & European Council, 2022), and current research on these aspects is either non-existent or inconclusive (Misiuda & Lachmann, 2022). On the one hand, this is the level of external assurance (limited versus reasonable) and, on the other hand, the time horizon for forward-looking non-financial information disclosure (short-term versus long-term). Motivated by the regulatory importance and the current research gap, I examine how these aspects influence non-professional investor behaviour to determine their informational value.

Starting with external assurance, researchers have generally agreed that it is of added value as it reduces information asymmetries and increases a discloser's credibility (Kolk & Perego, 2010; Sierra-García et al., 2015). Moreover, external assurance leads to higher stock price estimates (Brown-Liburd & Zamora, 2015), correlates with a higher perception of quality (Stuart et al., 2023) and increases information reliability and comparability (Cohen & Simnett, 2015). Assurance also increases willingness to invest (M. M. Cheng et al., 2015) and is positively associated with non-financial performance (Shen et al., 2017). Thus, the effects of assurance are sufficiently proven. Nevertheless, no exact specification of the right assurance

level could be reached, leading researchers to call for further research on the impact of varying assurance levels (Cohen & Simnett, 2015). Motivated by this, researchers have started investigating assurance levels without reaching a clear target picture. On the one side, multiple researchers did not find an added value of reasonable assurance over limited assurance (Dilla et al., 2023; K. Hodge et al., 2009; Sheldon & Jenkins, 2020), while other authors confirmed a positive effect of reasonable over limited assurance (Hoang & Trotman, 2021; Low & Boo, 2012; Rivière-Giordano et al., 2018; Vera-Muñoz et al., 2020). Therefore, one of the objectives of this research work is to shed more light on the effects of limited and reasonable assurance, considering the currently ongoing controversial discussion and inconsistent effects observed.

Research on forward-looking non-financial information disclosure has only received limited attention to date (Misiuda & Lachmann, 2022), although companies have been disclosing such information for multiple years now (e.g., Allianz SE, 2020; Merck KGaA, 2020), and the EU is now explicitly demanding such information (European Parliament & European Council, 2022). In traditional financial accounting, researchers found investors to put higher weight on forward-looking financial information, if available (Flöstrand & Ström, 2006), found that forward-looking disclosures are used to disguise bad past performance (Athanasakou & Hussainey, 2014) and overall to have a significant impact on stock market performance due to information asymmetry reduction (Bravo, 2016). While most researchers have not focused on the differentiation between different lengths of forward-looking time horizons, few found short-term time horizons in financial disclosure to substantially impact stock market performance (Mercer, 2004; Pownall et al., 1993). To my knowledge, such analyses have not been performed for non-financial disclosure. This aspect is even more surprising as professionals report a misperception between investors and financial company leaders about investment horizons (Bell, 2022). Moreover, investors increasingly criticise a lack of forward-looking disclosure (EY, 2021). Given the scarce literature on non-financial forward-looking information disclosure on the one hand and the interest among investors and regulators to increase such information on the other hand, this work can contribute to the current literature. Considering the shortcomings, I thus state the main research question: "*Does reasonably assured and long-term, forward-looking sustainability information add value over limitedly assured and short-term, forward-looking sustainability information?*"

I conducted this research by deploying a 2 x 2 experiment in a between-subjects design. The approach was based on a framework developed by Maines and McDaniel (2000), which was successfully applied in the past for similar research endeavours (B. Beyer et al., 2023;

Cooper & Weber, 2021; Dilla et al., 2023; Landau et al., 2020; Reimsbach et al., 2018). I thus designed the research along the described investor decision-making process and analysed investors' information evaluation, information weighting, and information-based judgement. Therefore, I manipulated the independent variables of assurance level (limited versus reasonable) and forward-looking time horizon (short-term versus long-term) in non-financial disclosure. Moreover, previous research has shown that contrasting statements help non-professional investors differentiate better between the possible options (Low & Boo, 2012). Contrasting statements for assurance levels were only analysed once and never for differing time horizons which motivated me to conduct further research in this area.

My research confirms the significance of higher assurance levels and long-term, forward-looking perspectives and their interplay with different aspects of the decision-making process. Reasonable assurance significantly impacts how investors evaluate and weigh non-financial information. This influence is even more pronounced when long-term, forward-looking information is provided. I attribute this to the general insecurity of long-term forecasts, mitigated by reasonable assurance. Conversely, the investor’s information-based judgement significantly increases for long-term, forward-looking time horizons, while the assurance level does not significantly alter the outcome. I link this discrepancy between information evaluation, weighting, and judgement to a social desirability bias (Podsakoff et al., 2003). Subjects asked directly about their evaluation and weighting of non-financial information sought highly assured information. In a concrete investment decision, however, where both financial and non-financial information come into play, assurance of non-financial information is of less importance vis-à-vis the long-term orientation of a company. When subjects were presented with both options and asked for their preference, I saw a strict and statistically significant choice of reasonable over limited assurance. However, no significant difference could be observed when participants were asked about their preference between short-term and long-term, forward-looking time horizons. For the former effect observed, the positive framing of reasonable assurance, in contrast to the negative framing of limited assurance, has a substantial influence (Vera-Muñoz et al., 2020). For the latter effect, it appears that subjects are less clear on their preference as a trade-off between both options is more complex than for the assurance level, where one option is clearly better.

With these findings, I enhance today’s knowledge on non-financial disclosure by highlighting the superior value of reasonable over limited assurance in information evaluation and weighting, which previous authors have confirmed and rejected. I also find that long-term,

forward-looking time horizons positively affect investors' willingness to invest. In addition, I provide initial insights into the effects of forward-looking non-financial disclosure on investors' decision-making, which has only received limited attention in today's literature. Moreover, these results can contribute to ongoing discussions about the exact specification of the CSRD regarding mandatory assurance levels and forward-looking time horizons.

I structure the remainder of this paper in the following sections. First, I provide an overview of past literature on external assurance levels and forward-looking time horizons in non-financial reporting. I then present the theory behind the chosen research framework and derive hypotheses about non-professional investors' decision-making. Afterwards, I explain the applied methodology, including experimental participants, design, and task. I then continue with the presentation and discussion of the experimental findings. Eventually, I summarise the contribution, highlight the limitations of this research approach and provide opportunities for future research.

4.2 Literature review and hypotheses development

4.2.1 Levels of assurance of non-financial information

Researching the effects of external assurance on non-financial information disclosure is generally a well-known field of research. There is general consent among researchers that external assurance positively impacts the perceived credibility of provided non-financial information (e.g., Kolk & Perego, 2010; Sierra-García et al., 2015). Brown-Liburd and Zamora (2015) found higher stock price estimates when non-financial information is assured. Moreover, they found that assurance increases the credibility of non-financial information independent of the assurer (professional accountant versus sustainability consultant) from the point of view of Australian or British investors. In contrast, United States investors strictly prefer professional accountants to ensure non-financial information. As part of their systematic literature review, Stuart et al. (2023) found that external assurance of non-financial information directly correlates with a higher perceived quality of disclosed information. Moreover, it makes the disclosed information more reliable, credible, and comparable (Cohen & Simnett, 2015; Simnett et al., 2009). M. M. Cheng et al. (2015) found similar results and indicated a higher willingness to invest when non-financial information is assured. Past research has evolved from researching the mere effects of external assurance to the combined effects of external assurance

with another variable. For instance, assurance has been found to have a stronger impact when financial and non-financial reports are separated than when they are integrated (Reimsbach et al., 2018), when non-financial performance is more robust (Shen et al., 2017) and when non-financial aspects are of high importance to a company's strategy (M. M. Cheng et al., 2015). Moreover, its impact differs by industry. Assurance has a stronger impact in industries known typically for lower non-financial performance and importance to the company strategy (Pflugrath et al., 2011).

While the mentioned researchers have only focused on assurance as a binary variable (assurance versus no assurance), an increasing interest surrounds the topic of the right level of assurance and thus, researchers have called for further research on the optimal level of assurance and the effects of differences in assurance quality (Cohen & Simnett, 2015). This call for further research aligns with recent regulatory developments mandating assurance for certain companies. The CSRD requires European companies of relevant size regarding revenue and employees to conduct a mandatory audit with a certified accountant (European Parliament & European Council, 2022).

In line with standard practice in external assurance, the EU differentiates between limited and reasonable external assurance in this regard. Limited assurance typically uses a negating approach, i.e., the auditor certifies that "*no matter has been identified by the practitioner to conclude that the subject matter is materially misstated*" (European Parliament & European Council, 2022, p. 34). In contrast, the reasonable assurance approach is more extensive and conducted in a "*positive form of expression and results in providing an opinion on the measurement of the subject matter against previously defined criteria*" (European Parliament & European Council, 2022, p. 34). A limited assurance audit is less comprehensive than a reasonable assurance audit. Primarily, this involves analytical procedures rather than detailed tests of records or invoices. The reasonable assurance audit, in contrast, involves detailed procedures, including verifying transactions by examining invoices or contracts and testing internal controls. Overall, the limited assurance approach is less holistic than the reasonable assurance approach as fewer examinations are conducted and less time is invested in the audit. Thus, reasonable assurance constitutes a more in-depth examination and provides a higher confidence level for stakeholders.

Previous authors have, at least in financial assurance, found that such positive connotations result in more investors believing that the information audit was performed

diligently. At the same time, there was only a limited perception of differing data accuracy between positive and negative phrasing (Schelluch & Gay, 2006). Moreover, report users have shown higher confidence levels when assurance statements were framed positively instead of negatively and when framed as reasonable instead of limited (Vera-Muñoz et al., 2020). The EU recognises that the standards for assuring sustainability reporting are not developed far enough, especially in light of qualitative and forward-looking information, resulting in companies understanding reasonable assurance differently (European Parliament & European Council, 2022). Thus, the EU's current way forward is to introduce limited assurance as part of the CSRD with a plan to shift to reasonable assurance. However, this will not occur before the financial year 2028.

Nevertheless, current auditors can provide feedback on what a reasonable assurance standard should entail. In addition, the CSRD currently states that "*undertakings subject to sustainability reporting requirements should be able to decide to have an assurance opinion on their sustainability reporting based on a reasonable assurance engagement if they so wish*" (European Parliament & European Council, 2022, p. 35). Motivated by the duty to have an external assurance while having the freedom to choose between two different auditing standards, researchers have begun to analyse the effects of limited and reasonable assurance of sustainability information. The findings thus far are inconsistent, providing a research gap worth investigating further.

For instance, K. Hodge et al. (2009) found general evidence for a positive effect of assurance on information reliability. No significant differences were found for varying assurance levels or auditor types. However, when combining the effects of reasonable assurance with top-level auditing, increased information reliability was observed in contrast to a sustainability consultant auditing the information. Low and Boo (2012) analysed the differences in assurance levels for two groups of users (more and less informed) in combination with contrasting statements. These statements help the user better assess the relative level of assurance provided and thus make users aware of how high the level of assurance is compared to the other possible levels. They found that uninformed users cannot differentiate between limited and reasonable assurance when contrasting statements are omitted. However, both user groups can better differentiate between limited and reasonable assurance when providing contrasting statements. Nevertheless, including contrasting statements mainly helps less-informed users make decisions, as more-informed users can differentiate better without contrasting statements. Rivière-Giordano et al. (2018) chose a similar approach and

differentiated between three assurance levels in their experimental study: no, limited and moderate assurance. Their findings indicate that report users are indifferent between no assurance and moderate assurance. Moreover, they found that users even prefer no assurance over limited assurance. Their findings thus suggest that companies, when provided with the option to choose different levels of voluntary assurance, should avoid choosing the lowest level, as this can result in adverse investor reactions. Sheldon and Jenkins (2020) found well-performing sustainability reports with a limited assurance level more credible than reports lacking assurance statements. Nevertheless, this finding could not be confirmed for the more robust reasonable assurance. As this finding is somewhat counterintuitive, other authors found limited and reasonable assurance to increase credibility vis-à-vis no assurance. At the same time, only reasonable assurance also yields higher investor valuations (Hoang & Trotman, 2021). Dilla et al. (2023) further developed the experimental approach of Reimsbach et al. (2018) and manipulated report integration (integrated versus separated) and assurance (limited versus reasonable). They found that the assurance level only impacts investors' decisions when reports are presented separately. Surprisingly, investors are more willing to invest and deem reported information as more credible only in the limited assurance, yet not the reasonable assurance scenario, indicating once more that investors might not be able to correctly differentiate between a higher and a lower assurance level. In summary, results regarding the effects of limited and reasonable assurance are inconsistent (Misiuda & Lachmann, 2022), which I interpret as motivation to analyse this research area further.

4.2.2 Forward-looking time horizons in non-financial disclosure

The other factor of interest mentioned earlier, i.e., the time horizon of forward-looking disclosure, has received only limited attention from previous researchers. In their literature review of an initial 1,045 articles, which were later reduced to 27 highly relevant papers, Misiuda and Lachmann (2022) did not identify any authors researching the impact of time horizons for forward-looking non-financial disclosure, while researchers recently reported a generally increasing interest in forward-looking sustainability reporting (Heichl & Hirsch, 2023). Still, the limited amount of research in this field is surprising due to two aspects: (1) companies have already been disclosing forward-looking non-financial information for multiple years now (e.g., Allianz SE, 2020; Merck KGaA, 2020), and (2) the EU, in contrast to previous European directives, now requires companies as part of the CSRD to provide forward-looking sustainability information stating that there "*is currently a lack of forward-looking*

disclosures, which users of sustainability information especially value" (European Parliament & European Council, 2022, p. 25). As part of the CSRD, future reports must include both backward- and forward-looking sustainability information in a qualitative and quantitative format. A specific time horizon, however, was not specified by the EU, leaving companies with room for interpretation and freedom regarding the exact timelines they want to report for future goals.

As financial accounting is far older than non-financial accounting, research on the impact of forward-looking financial information disclosure has been conducted thoroughly. Nevertheless, research has faced challenges as firms traditionally still only disclose little forward-looking financial information. If they do so, the provided information contains quantitative aspects only to a limited extent (Menicucci, 2018). From an investor perspective, previous authors found a high degree of relevance when considering financial information forecasts, e.g., higher emphasis is put on forward-looking financial information, if available, in investment decisions (Flöstrand & Ström, 2006). Furthermore, company size and profitability significantly affect the reporting of forward-looking information according to Menicucci (2018).

Moreover, when companies provide forward-looking financial disclosure information, no significant investor reaction is observed when a company of high performance discloses such information. At the same time, a low-performing company benefits from forward-looking disclosure only if external assurance is provided by an internationally accepted and sufficiently large auditing company (Hassanein et al., 2019). Other authors found forward-looking disclosure to disguise bad past performance and attract investors via positive future outlooks (Athanasakou & Hussainey, 2014; Hassanein & Hussainey, 2015). Bravo (2016) found forward-looking financial information to have a significant impact on the stock market as this kind of information reduces stock return volatility due to reduced information asymmetry. In addition, the author found the impact on stock return volatility moderated by forward-looking information disclosure in combination with company reputation, i.e., high-reputation companies benefit more from reporting forward-looking financial information. Another moderating factor of forward-looking information disclosure is uncertainty. While an uncertain environment can generally make companies refrain from predicting the future to avoid being liable for these statements later on (Papaj-Wlisłocka & Strojek-Filus, 2019), Bozanic et al. (2018) found companies to issue more quantitative, earnings-like statements when uncertainty is low. The opposite effect occurs when uncertainty is high, i.e., more qualitative predictions

about future company performance are issued in uncertain times. When categorising forward-looking statements using a Naïve Bayesian machine learning approach, F. Li (2010) found that the tone of forward-looking financial disclosure correlates with future company performance. However, the informativeness of forward-looking information disclosure has not increased over time, although regulatory authorities have issued multiple directives in the past to improve forward-looking disclosure (F. Li, 2010).

The correlations described by the authors in the last paragraph only consider forward-looking information as a binary variable or analyse merely the amount of disclosed information as part of a content analysis (Bravo, 2016). As such, the mentioned authors omitted a differentiation between specific time horizons reported by a company. Considering the differences in the length of forward-looking time horizons, Mercer (2004) argues that shorter time horizons result in higher perceived credibility in financial reporting. In contrast, long-term planning and communicated goals are subject to investors' perception of less credibility. In this regard, Pownall et al. (1993) found a more robust reaction in the stock market when companies issue interim forecasts (e.g., quarterly earnings forecast) than announcements made in annual company reports.

As mentioned previously, research in the area of forward-looking information disclosure is scarce when this information is of a non-financial nature. Rezaee and Tuo (2017) found a link between companies with forward-looking non-financial disclosure and their sustainability performance of the following year. In contrast, higher sustainability performance in a specific year correlates with higher non-financial information disclosure for past years. While the authors differentiated between various elements of non-financial information, e.g., environmental information, they also specified, for instance, the company’s competitive environment as non-financial information and did not differentiate between the possible forward-looking time horizons in terms of specific years similar to Bravo (2016). Moreover, they tied non-financial information disclosure to sustainability performance instead of investor behaviour. Other authors have analysed the effects of non-financial information disclosure on forecast accuracy. Nevertheless, these predictions were only based on historical non-financial information instead of forward-looking non-financial information disclosure (Muslu et al., 2019; Rossi & Candio, 2023). The authors stated that integrated and separated sustainability reports increase forecast accuracy by decreasing information asymmetries.

Many researchers have covered financial forward-looking information disclosure. Nevertheless, non-financial forward-looking information has received only limited attention. In addition, no authors have considered the specific impact of short-term vis-à-vis long-term non-financial forward-looking information similar to past approaches for financial reporting (e.g., Mercer, 2004; Pownall et al., 1993) and its impact on investor behaviour. More research work covering this research gap can help both companies and regulators, given the current vagueness of forward-looking disclosure requirements in the CSRD. Contributing to this research field can thus help to better decide which specific time horizons will be helpful to investors for making informed decisions based on provided non-financial forward-looking information.

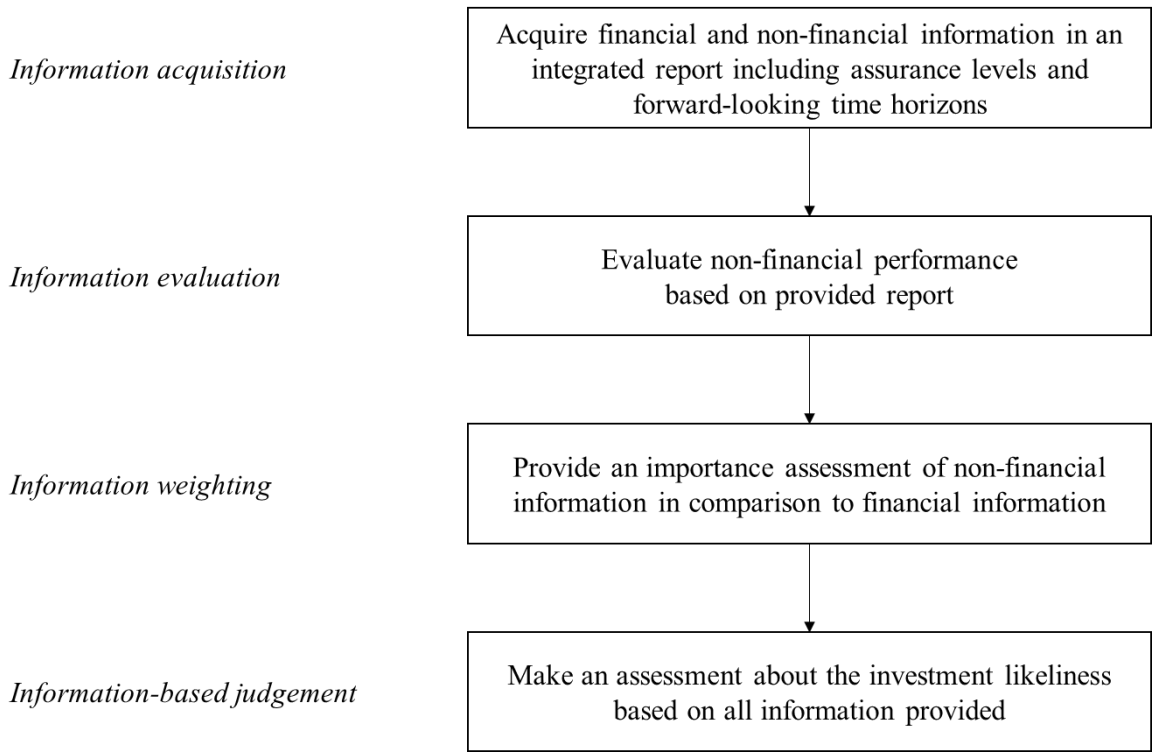
4.2.3 Information processing framework and hypotheses

An influential framework for researching investor behaviour was provided by Maines and McDaniel (2000). The framework focuses on assessing company performance based on company reports from an investor perspective. This framework is appropriate for multiple reasons: First, it has significantly influenced recent experimental research in the accounting space (Dunbar & Weber, 2014). Second, it was explicitly designed for non-professional investors, the leading target group of this experiment. Moreover, they constitute the leading target group of the regulator. For instance, the EU states within the CSRD that if "*undertakings carried out better sustainability reporting, the ultimate beneficiaries would be individual citizens and savers*" (European Parliament & European Council, 2022, p. 18). Third, many researchers have applied this framework since its introduction until very recently (B. Beyer et al., 2023; Cooper & Weber, 2021; Dilla et al., 2023; Landau et al., 2020; Reimsbach et al., 2018). As part of this research, I will use the Maines and McDaniel (2000) framework to analyse the effects of limited and reasonable assurance combined with short-term and long-term, forward-looking time horizons in non-financial reporting.

The Maines and McDaniel (2000) framework breaks down a non-professional investor's decision-making process into four phases: (1) the information acquisition phase, (2) the information evaluation phase, (3) the information weighting phase and (4) the information-based judgement phase. Within the acquisition phase, the investor scans the provided data and understands it. For non-professional investors, this typically occurs in a sequential format (Bouwman, 1984). Previous authors have investigated the effects of integrated and non-integrated financial and sustainability reports on the information acquisition phase (Dilla et al.,

2023; Reimsbach et al., 2018). In the integrated versus non-integrated scenario, the so-called display proximity plays an important role, assuming that informational pieces presented closer to each other enhance information acquisition (F. D. Hodge et al., 2010). Like Reimsbach et al. (2018), I hypothesise that assurance and forward-looking time horizons do not change the cognitive cost of acquiring the presented information. In addition, this aspect was researched thoroughly by the mentioned authors, and the CSRD now requires an integrated report mandatorily. As such, a further investigation of this aspect and the information acquisition phase appears redundant. I, therefore, focus the research on the subsequent phases. During the second (information evaluation) phase, many aspects influence the investor according to information processing theory, such as information placement and provided categories or labels (Libby et al., 2002).

FIGURE 4.1: Information acquisition, evaluation, weighting and judgement framework[18]



An investor, influenced by the mentioned aspects, then decides how well the company is performing in a particular area, which, in this case, refers to the evaluation of non-financial performance both for the past and the future. In the third phase (information weighting), the investor then places a specific weight on each informational piece received and evaluated in the previous steps. This weight is strongly influenced by the perceived reliability of that

[18] Adapted from Maines and McDaniel (2000).

specific information (Gödker & Mertins, 2018), implying that reasonable assurance potentially yields higher weights on the provided non-financial information due to its higher reliability. While it is almost impossible for investors to entirely disconnect financial and non-financial information when presented in an integrated report (Orlitzky, 2013), the information weighting approach has proven to be successful in the past (Cooper & Weber, 2021; Reimsbach et al., 2018) and furthermore is closer to a real-world scenario. In the fourth and last (information-based judgment) phase, the investor then decides about the willingness to invest in the company of interest based on all informational pieces provided. Investors use financial and non-financial information confirmed in past decision-making experiments (Ghosh & Wu, 2012). The judgment depends on all previous phases of the decision-making process, which is eventually the essential part of this research work as the investor's reaction regarding an investment decision is also directly observable in the market.

Regarding the hypotheses, Misiuda and Lachmann (2022) found mixed results among researchers for limited and reasonable assurance effects. On the one hand, several authors found investors indifferent between limited and reasonable assurance (Dilla et al., 2023; K. Hodge et al., 2009; Sheldon & Jenkins, 2020). Dilla et al. (2023) state that "*labelling and isolation information presentation dimensions of combined assurance reports suggest that it will be more difficult for non-professional investors to distinguish between limited and reasonable assurance of sustainability information*" (Dilla et al., 2023, p. 1216). On the other hand, several authors found positive investor reactions to reasonable assurance (Hoang & Trotman, 2021; Low & Boo, 2012) or at least found investors to punish limited assurance (Rivière-Giordano et al., 2018). Moreover, the positive framing in the reasonable assurance case was superior to the negative framing in the limited assurance case (Vera-Muñoz et al., 2020). In line with Reimsbach et al. (2018), voluntarily conducting reasonable assurance and thus exceeding the required level of limited assurance is regarded as a positive signal by investors as the company is making an additional and costly effort. This increases informational credibility (Mercer, 2004), resulting in a higher perception of sustainability performance and relative weighting. Following the Maines and McDaniel (2000) framework, this should also increase the investor's judgement. The current effect of the interaction between assurance and forward-looking time horizons is an unanswered question. The interest in research on forward-looking sustainability information is, however, increasing (Heichl & Hirsch, 2023), and researchers have shown a significant impact of forward-looking sustainability information on investor decision-making (Bravo, 2016; Flöstrand & Ström, 2006) without differentiating

between short-term and long-term time horizons. In traditional financial accounting, short-term, forward-looking information is historically more powerful and yields stronger stock market reactions (Mercer, 2004; Pownall et al., 1993). In contrast to the financial accounting world, however, the non-financial world is characterised by a more long-term-oriented mindset. While the effort required to develop a company into a state of non-financial assurance readiness is significant, great potential exists to create long-term value and thus increase credibility (KPMG, 2023).

Investors tend to discount cash flows from companies with substantial long-term investments less than for companies with only small long-term investments (Henisz et al., 2019). Moreover, non-financial information is increasingly used to assess a company's long-term performance (Bedoya-Pardo, 2023), and more than three-quarters of investors prioritise long-term non-financial performance over short-term profitability, according to a recent study (Chalmers et al., 2021). According to Bell (2022), there is even a current misperception between investors and financial company leaders, as investors value long-term investments and sustainable developments much stronger than financial leaders currently anticipate. Moreover, the lack of forward-looking disclosure is increasingly reported as an issue when analysing company reports. In contrast, almost all report users, i.e., investors, deem external assurance of non-financial information necessary (EY, 2021). Based on the previously provided arguments, I hypothesise that investors value forward-looking long-term disclosure more strongly, yet only if this information is entirely believable, which is the case when reasonable assurance is provided. I therefore hypothesise the following:

H1a: The reasonable assurance effect on a non-professional investor's information evaluation is stronger when a long-term forward-looking time horizon is provided

H1b: The reasonable assurance effect on a non-professional investor's information weighting is stronger when a long-term forward-looking time horizon is provided

H1c: The reasonable assurance effect on a non-professional investor's information-based judgement is stronger when a long-term forward-looking time horizon is provided

As previously mentioned, research on limited and reasonable assurance effects has shown mixed results. One of the reasons brought forward by researchers was a potential misunderstanding or at least limited knowledge about the exact specification of limited and reasonable assurance (Simnett et al., 2009; Stuart et al., 2023). One way to overcome such communication issues is by providing more explanations about the information provided. In this regard, Low and Boo (2012) investigated the impact of providing contrasting statements for assurance levels, i.e., they provided subjects with information about both possible assurance

levels and the one they received. Inspired by their approach, I thus also test the effect of contrasting statements on assurance levels, as they appear to be the only authors to have investigated such an effect, and additionally test contrasting statements for forward-looking time horizons for the first time. In line with the results achieved by Low and Boo (2012) and the fact that positive framing positively influences individuals (Vera-Muñoz et al., 2020), contrasting statements are likely to positively influence non-professional investor behaviour when reasonable assurance is provided. For the forward-looking time horizon perspective I have previously seen a shift from short-term to long-term orientation for the forward-looking time horizon perspective as investors increasingly criticise the lack of long-term perspectives in forward-looking disclosures (EY, 2021). In line with the provided arguments, I hypothesise the following for non-professional investors who are provided with contrasting statements and have the chance to choose between the limited or reasonable assurance and the short-term or long-term, forward-looking time horizon options:

H2a: Non-professional investors prefer reasonable over limited assurance in non-financial reporting when they have the opportunity to choose

H2b: Non-professional investors prefer long-term over short-term forward-looking time horizons in non-financial reporting when they have the opportunity to choose

To the best of my knowledge, the effects of external assurance and its combination with short-term and long-term, forward-looking sustainability disclosure have yet to be researched. As the perceived credibility of certain information depends on the individual investor, a behavioural experiment is appropriate and helpful for analysing potential investor behaviour (Dietrich et al., 1997). I contribute to the existing literature on non-financial reporting by, on the one hand, extending prior research on the effects of external assurance levels on investor behaviour and, on the other hand, analysing the effects of external assurance levels in combination with differing time horizons of forward-looking non-financial reporting. As research on time horizons in sustainability reporting has only been touched to a limited extent by previous researchers, I can contribute to the non-financial reporting literature with this work.

4.3 Experimental methodology

4.3.1 Experimental participants & validation

At the centre of this research is non-professional investor behaviour. Thus, I conducted this experiment with the university's computer research lab participants. The computer lab allows me to create an environment of minimal distraction where subjects can focus on the required task without any other influence. In total, the pool of potential candidates comprises around 2,000 individuals. As potential participants come from various educational backgrounds, I specifically highlighted a need for participants with interest and experience in the capital market. I received 211 registrations throughout 16 individual sessions, yielding an initial response rate of 10.6%, similar to previous researchers', which I thus deem acceptable (Reimsbach et al., 2018; Rombach, 2022). Of the initially registered 211 students, 163 participants showed up (66.3%) and participated in the experiment. While I already requested capital market interest in the experiment invitation, I also controlled for investment experience. I thus reduced the final sample to 108 participants[19], as 55 subjects indicated no prior investing experience in the capital market. As described in TABLE 4.1, more than 90% of participants were 30 years of age and below and 34% of participants identified as female, which is very similar to the distribution other researchers have worked with (Dilla et al., 2023). The sample is well-balanced between backgrounds in business sciences and natural and other sciences. Moreover, capital market interest among the participants was mostly rather or very high (80%), sustainability was of (rather) high importance (72%), and investment frequency was at least once a year, with 66% of respondents even investing (in)frequently multiple times per year.

[19] The inspirational paper of Reimsbach et al. (2018) had 90 participants.

TABLE 4.1: Descriptive statistical overview of experimental sample

Age	**#**	**Gender**	**#**	**Study background**	**#**
<=25	71	Female	37	Business sciences	51
26-30	22	Male	71	Natural sciences	35
31-35	7			Other	22
>35	8				
Total	**108**	**Total**	**108**	**Total**	**108**

Capital market interest	**#**	**Sustainability importance**	**#**	**Investment frequency**	**#**
Very high	30	Very high	24	Once a year	37
Rather high	56	Rather high	54	Multiple times per year but infrequently	43
Neutral	15	Neutral	20		
Rather low	7	Rather low	9	Multiple times per year and frequently	28
Very low	0	Very low	1		
Total	**108**	**Total**	**108**	**Total**	**108**

4.3.2 Experimental design

The experiment was conducted as a 2 x 2 experiment in which I manipulated the independent variables assurance level (limited versus reasonable) and length of forward-looking time horizon (short-term versus long-term) for non-financial information reporting. Across all treatments, this experiment was conducted as a one-shot game in a between-subjects setup similar to the inspiring approach deployed by Reimsbach et al. (2018). As such, I avoided unwanted effects due to learning from previous periods (Charness et al., 2012). All experimental subjects were randomly assigned to one of the four treatments (see FIGURE 4.2) as the applied software randomly provided treatments to computers, and participants were free to choose their computer in the laboratory. Moreover, all experiment instructions were formulated neutrally. Subjects did not know about different treatments or that other participants might have received other information documents similar to the approach of Rikhardsson and Holm (2008). All experimental subjects had access to the same informational documents with minor manipulations on assurance level and time horizon. I provided in total three parts: (1) general company information, (2) financial information (profit & loss statement, balance sheet, cash flow statement, historical stock performance) and (3) non-financial information (ESG) in one integrated annual report in PDF format. Similar to other researchers, I provided experimental subjects with a shortened annual report as these are known for being typical

investor sources and correlate with other external communications on company performance (Lang & Lundholm, 1993). Moreover, various past researchers have applied this approach (Bravo, 2016; Dilla et al., 2023; Reimsbach et al., 2018).

The information belonged to a fictitious German company called ‘Sigma AG’, whereas the provided information followed an actual German role-model company. This company was chosen based on its clear reporting format and the provision of both short-term and long-term sustainability goals I could use to manipulate the time horizon variable. In addition, the inspiring company was a large corporation that appeared reasonable as forward-looking disclosure and firm size have a positive association (Kılıç & Kuzey, 2018). The identity of the chosen company was sufficiently disguised to avoid unwanted effects from subjects knowing the actual company and thus being potentially biased towards the company's future performance (similar to Reimsbach et al., 2018; Rikhardsson & Holm, 2008). To collect the data throughout the experiment, I used the vastly established web-based software Qualtrics in line with past researchers (Brown-Liburd & Zamora, 2015; Sheldon & Jenkins, 2020; Vera-Muñoz et al., 2020).

As shown in FIGURE 4.2, four treatments were developed, of which precisely one was assigned randomly to each experimental subject. In line with the framing outlined in the CSRD (European Parliament & European Council, 2022), subjects who received an annual report of reasonable assurance found a positively connotated statement at the beginning of the non-financial information. This stated that the non-financial information of Sigma AG was audited as part of a reasonable audit by an international auditing company, i.e., the audit firm conducted an in-depth audit including an examination of the company's internal controls.

FIGURE 4.2: Experimental treatment groups

		Time horizon of forward-looking non-financial information	
		Short-term (1 year – 2023)	**Long-term (8 years – 2030)**
Level of external audit & certification of correctness of ESG information	**Reasonable**	Short-term, forward-looking ESG information with reasonable assurance certificate by external auditor	Long-term, forward-looking ESG information with reasonable assurance certificate by external auditor
	Limited	Short-term, forward-looking ESG information with limited assurance certificate by external auditor	Long-term, forward-looking ESG information with limited assurance certificate by external auditor

Subjects who received an annual report in which the non-financial information was of limited assurance were provided with a negatively connotated statement. This stated that an international auditing company audited the non-financial information of Sigma AG as part of a limited audit, i.e., the audit firm was unable to identify any material misstatements by Sigma AG throughout the audit (European Parliament & European Council, 2022). For the financial information, subjects received the same auditing statement similar to standard practice in annual reports of large corporations, e.g., German DAX companies, where statements such as "*this Non-Financial Statement is an integral part of the management report and is subject to the statutory audit of […]*" (Allianz SE, 2022, p. 57) are commonly used. I did not provide contrasting statements right from the start of the experiment but asked specifically for this aspect later. Previous authors raised whether report users can differentiate sufficiently between the two assurance concepts (Simnett & Huggins, 2015; Stuart et al., 2023). Thus, I clearly stated the assurance level at the beginning of the fictitious company report to avoid sender-receiver issues as much as possible.

Subjects, moreover, received non-financial information on the time horizon variable, including a forecast of future sustainability performance over a short-term (one year, i.e., 2023) or a long-term (eight years, i.e., 2030) perspective. These time horizons align with the suggested European Sustainability Reporting Standards (European Financial Reporting Advisory Group, 2022) and are also common in annual reports (e.g., Allianz SE, 2022; Merck KGaA, 2022). While a company can generally provide short- and long-term goals in one report, most companies offer one or the other, which encouraged me to perform this research work.

4.3.3 Experimental task

I defined multiple dependent variables to test subjects' reactions to manipulated independent variables. As I dealt with non-professional investors in this experiment, I deployed the previously mentioned framework for the effects of reporting aspects on non-professional investors' company performance assessment developed by Maines and McDaniel (2000). According to the authors, investor behaviour follows a three-step process, which is divided into (1) information evaluation, (2) information weighting and (3) information-based judgment (Maines & McDaniel, 2000). For each of the three categories, subjects had to make one or multiple decisions about the first three hypotheses (H1a, H1b, H1c) during the experiment as follows: First, subjects were asked to evaluate the provided non-financial information in terms of its strength and the level of confidence related to the provided non-financial information.

Similar to previous researchers (e.g., Lachmann et al., 2015; Reimsbach et al., 2018), I asked subjects to rank Sigma AG's non-financial performance on a scale from zero (very low) to ten (very high) and thus deployed an eleven-point Likert scale. I deployed the same scaling for the second step, i.e., information weighting, where subjects were asked to rank both financial and non-financial information on an eleven-point range (no importance to very high importance) with regards to how relevant each the financial and the non-financial information is for their decision-making process of evaluating the investment attractiveness of the company. Lastly, I asked subjects about their investment judgement and thus, subjects had to indicate how likely it is that they would invest in Sigma AG on an eleven-point scale ranging from zero (very unlikely to invest) to ten (very likely to invest) comparable to previous authors (Cianci & Kaplan, 2008; Reimsbach et al., 2018). Regarding the fourth and fifth hypotheses (H2a and H2b), I asked specifically for the subject's willingness to change their investment strategy when provided with the alternative option, i.e., reasonable assurance instead of limited assurance and short-term instead of long-term information.

Overall, each subject's task was thus clustered into three steps after receiving the initial instructions to access the experiment (see appendix, FIGURE 6.7). First, subjects received a brief introduction to the experimental company Sigma AG and received general experimental instructions. Afterwards, subjects received access to the company report in PDF format inspired by a company report from a German DAX company, which was facilitated to make the information digestible within the timeframe of the experiment. Subjects received qualitative information on the company's past performance and overall strategy and quantitative information on financial and non-financial performance over the past five years, i.e., 2018 through 2022. The assurance level and time horizon were manipulated, as explained previously. After reviewing Sigma AG's facilitated company report, the subjects answered questions regarding information evaluation, weighting, and judgement. Afterwards, they answered questions about their willingness to change their investment strategy (see FIGURE 6.8). Lastly, I asked subjects about personal information, e.g., age, gender, educational background, prior investment experience and stock market interest, to screen for sufficiently experienced non-professional investors (see appendix, FIGURE 6.9).

Like Reimsbach et al. (2018), I conducted a pretest before the experiment. Therefore, I ran a test with nine students several weeks before the experiment. Students were not informed that they were participating in a test to create reliable results. Participating students had the chance to provide feedback on wording and understandability, which allowed me to increase

experimental validity and plausibility. All participating subjects were compensated equally with EUR 12.00, which was not communicated to participants beforehand. Each subject received a fair compensation with an average working time of 19 minutes. An overview of the experimental procedure is provided in the appendix (see FIGURE 6.6).

4.4 Results and discussion

4.4.1 Hypothesis testing

In this experiment, I manipulated two independent variables, i.e., external assurance (reasonable versus limited) and forward-looking time horizon (short-term versus long-term), to analyse their effects on three dependent variables representing the steps in an investor's decision-making process according to Maines and McDaniel (2000), i.e., information evaluation, information weighting and information-based judgement. For these three elements, I stated three hypotheses, predicting that the effect of reasonable assurance is stronger in the long-term, forward-looking disclosure scenario for information evaluation (H1a), information weighting (H1b) and information-based judgement (H1c).

FIGURE 4.3: Graphical representation of performed analyses

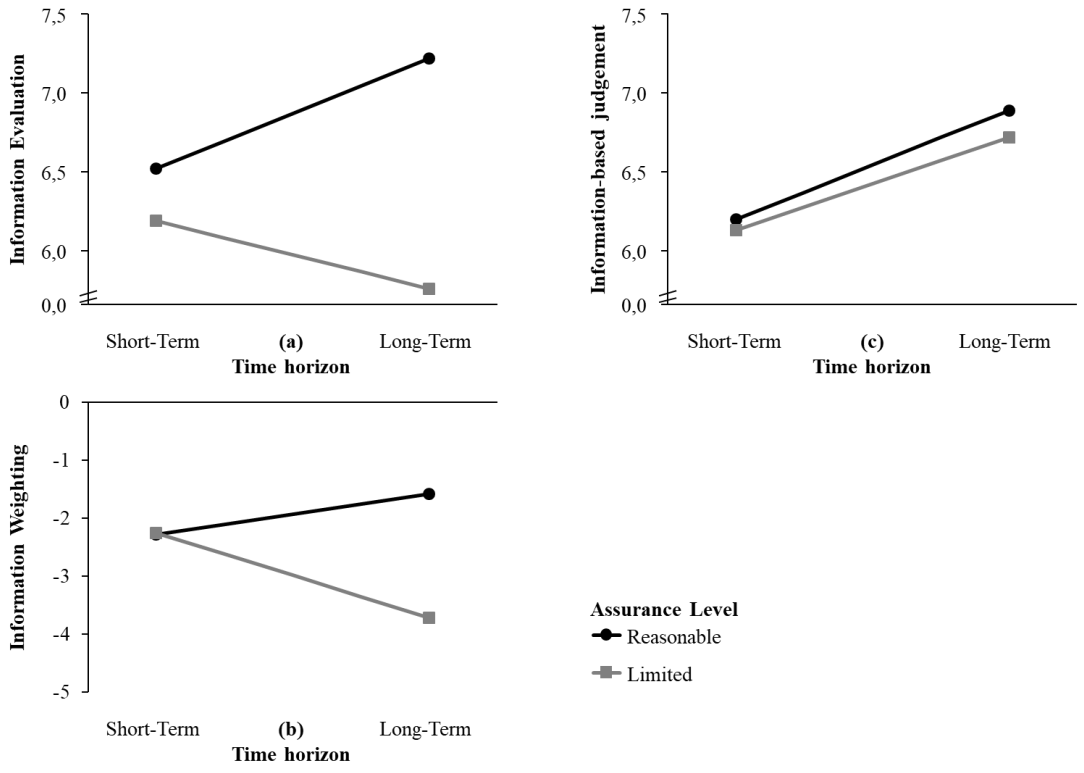


TABLE 4.2: Non-financial information evaluation statistics and results

Panel A: Descriptive statistics (non-financial information evaluation) (mean [SD])						
	n	Short-Term Forward-Looking	n	Long-Term Forward-Looking	n	Total
Reasonable Assurance	25	6.52 [1.56]	27	7.22 [1.53]	52	6.89 [1.57]
Limited Assurance	31	6.19 [1.87]	25	5.76 [1.48]	56	6.00 [1.71]
Total	56	6.34 [1.73]	52	6.52 [1.66]	108	6.43 [1.69]
Panel B: Two-way ANOVA test results (evaluation)						
	df	**Sum of squares**	**Mean square**	**F**	**p(F)**	**Partial**
Corrected model	3	30.10	10.03	3.78	.0128**	X
Assurance	1	21.43	21.43	8.07	.0054***	X
Time-Horizon	1	0.48	0.48	0.18	.6705	X
Assurance x Time-Horizon	1	8.64	8.64	3.25	.0742*	X
Error	104	276.31	2.66			

The results are presented respectively in TABLES 4.2, 4.3, and 4.4, and a graphical representation of all three steps of the decision-making process can be found in FIGURE 4.3. For H1a, I find general support for the hypothesis as the assurance level significantly affects an investor's information evaluation ($F_{1,107}$ = 8.07; $p < 0.01$), and I observe a significant interaction between assurance level and forward-looking time horizon ($F_{1,107}$ = 3.25; $p = 0.07$). As hypothesised, in the short-term, forward-looking scenario, evaluation values for reasonable and limited assurance are closer to each other (mean evaluation 6.52 versus 6.19) than in the long-term, forward-looking scenario (mean evaluation 7.22 versus 5.76), highlighting the importance of reasonable assurance for investors in case long-term goals are projected. For H1b, I collected information on how relevant the provided financial and non-financial information is for the experimental subject in two separate questions. Then, I subtracted the value provided for the weight put on the financial information from the weight provided for the non-financial information. As financial information is regarded as critical for making an investment decision and thus higher, values are negative here (TABLE 4.3).

TABLE 4.3: Non-financial information weighting statistics and results

Panel A: Descriptive statistics (non-financial information weighting) (mean [SD])						
	n	Short-Term Forward-Looking	n	Long-Term Forward-Looking	N	Total
Reasonable Assurance	25	-2.28 [1.65]	27	-1.59 [1.99]	52	-1.92[1.84]
Limited Assurance	31	-2.26 [2.41]	25	-3.72 [2.26]	56	-2.91[2.44]
Total	56	-2.27 [2.08]	52	-2.62 [2.36]	108	-2.44[2.22]
Panel B: Two-way ANOVA test results (weighting)						
	df	**Sum of squares**	**Mean square**	**F**	**p(F)**	**Partial**
Corrected model	3	62.01	20.67	4.63	.0044***	X
Assurance	1	29.70	29.70	6.65	.0113**	X
Time-Horizon	1	4.02	4.02	0.90	.3451	X
Assurance x Time-Horizon	1	30.94	30.94	6.93	.0098***	X
Error	104	464.53	4.47			

I derive a similar conclusion as for the information evaluation from the results achieved. For the weighting of non-financial information, assurance again has a significant effect ($F_{1,107} = 6.65$; $p = 0.01$) and the interaction between forward-looking time horizon and assurance level shows significant results as well ($F_{1,107} = 6.93$; $p < 0.01$). For reasonable assurance, the weighting of the non-financial information is only 1.92, on average, lower than the financial information. In contrast, in the limited assurance scenario, the weight for non-financial information is 2.91 lower. For forward-looking time horizons, values are closer to each other, with a delta of 2.27 for short-term, forward-looking disclosure and 2.62 for long-term, forward-looking disclosure, resulting in insignificant findings regarding the isolated time-horizon variable ($F_{1,107} = 0.90$; $p = 0.35$). I, again, observe a spread for the long-term, forward-looking time horizon disclosure showing an increased weight put on long-term, forward-looking disclosure when it is reasonably assured, yet not when it is assured to a limited extent.

TABLE 4.4: Non-financial information-based judgement statistics and results

Panel A: Descriptive statistics (non-financial information-based judgement) (mean [SD])						
	n	Short-Term Forward-Looking	n	Long-Term Forward-Looking	n	Total
Reasonable Assurance	25	6.20 [1.76]	27	6.89 [1.89]	52	6.56 [1.84]
Limited Assurance	31	6.13 [1.50]	25	6.72 [2.01]	56	6.39 [1.75]
Total	56	6.16 [1.60]	52	6.81 [1.93]	108	6.47 [1.79]
Panel B: Two-way ANOVA test results (information-based judgement)						
	df	**Sum of squares**	**Mean square**	**F**	**p(F)**	**Partial**
Corrected model	3	11.73	3.91	1.23	.3036	X
Assurance	1	0.39	0.39	0.12	.7286	X
Time-Horizon	1	10.97	10.97	3.45	.0663*	X
Assurance x Time-Horizon	1	0.06	0.06	0.02	.8873	X
Error	104	331.19	3.19			

While I observe similar effects for the non-financial information evaluation and weighting categories, the observed effects for the information-based judgement differ and contradict the initial hypothesis that reasonable assurance has a stronger impact in the long-term, forward-looking disclosure scenario (TABLE 4.4). Here, I observe a significant effect of the time horizon variable ($_{F1,107}$ = 3.45; p = 0.07) and see that long-term, forward-looking information yields a higher investment likeliness with an average value reported of 6.81, whereas short-term, forward-looking information only yields an average value of 6.16. While the reported values for reasonable assurance are slightly higher in both time horizon scenarios (6.20 versus 6.13 and 6.89 versus 6.72), the reasonable assurance effect is insignificant. I will discuss the diverging results for H1a/H1b and H1c and the respective interpretations in the discussion section. For the hypothesis regarding contrasting statements, I stated that non-professional investors prefer reasonable over limited assurance (H2a) and that non-professional investors prefer long-term over short-term, forward-looking time horizons when they can choose (H2b).

TABLE 4.5: Willingness to change investment strategy

Panel A: Two-sample t-test (Willingness to change investment strategy – Assurance)						
Group	**n**	**Mean**	**SD**	**[95% Conf. Interval]**		**p-value RA != LA**
Reasonable Assurance	52	2.67	1.06	2.38	2.97	0.0001***
Limited Assurance	56	3.48	0.79	3.27	3.69	
Combined	108	3.09	1.01	2.90	3.29	
Difference		-0.81		-1.16	-0.45	
Panel B: Two-sample t-test (Willingness to change investment strategy – Time Horizon)						
Group	**n**	**Mean**	**SD**	**[95% Conf. Interval]**		**p-value LT != ST**
Long-Term Forward-Looking	52	3.48	1.04	3.19	3.77	0.9939
Short-Term Forward-Looking	56	3.49	0.83	3.26	3.70	
Combined	108	3.48	0.93	3.30	3.66	
Difference		-0.01		-0.36	0.36	

Previous authors have found contrasting statements to influence uninformed report users and improve their decision-making as users are otherwise unable to differentiate between limited and reasonable assurance (Low & Boo, 2012). I, therefore, asked subjects about their likeliness to change their willingness to invest when confronted with the oppositive independent variable, i.e., reasonable instead of limited assurance and short-term instead of long-term, forward-looking time horizons and vice versa. Thus, I performed a two-sample t-test and displayed the results in TABLE 4.5. For the assurance level variable, I observe a significant increase in willingness to invest when subjects who received a limited assurance report were offered a reasonable assurance report (mean = 3.48) compared to subjects who received a reasonable assurance report right away ($p < 0.01$). Subjects who received a reasonable assurance report and were offered a limited assurance report were willing to invest similarly or less. Thus, I confirm hypothesis H2a and show that reasonable assurance significantly impacts investment likeliness. For H2b, subjects' responses did not differ significantly. They appeared indifferent between receiving long-term instead of short-term (and

vice versa) reports. Both groups would increase their willingness to invest. Thus, I reject the fifth hypothesis, H2b, and cannot observe a significant effect of time horizon on investment behaviour. The results of H2a and H2b align with the results achieved for hypotheses H1a and H1b, yet I also acknowledge that they contrast with the results achieved in H1c. I will delve into possible explanations for these divergent effects in the discussion section of the results chapter.

4.4.2 Robustness checks

I conducted multiple robustness checks to assess the validity of the generated data, i.e., a response time check, a sustainability bias check, and an applied reporting information check. Turning first to the response time check, a short response time can indicate a phenomenon commonly known as insufficient effort responding (Huang, Bowling, et al., 2015; Huang, Liu, & Bowling, 2015). To eliminate careless respondents, I thus eliminated outliers of the lower end, similar to the approach chosen by Meade and Craig (2012), while not removing upper-bound outliers, as taking more time to analyse the company information is not necessarily a sign of carelessness. The first decile of respondents showed a response time of slightly less than six minutes. Less than six minutes is insufficient to read the reduced company report. Thus, eleven participants were eliminated. Performing the ANOVA and two sample t-tests with the remaining subset of responses, I find similar results, implying that the results achieved are robust to response times.

Furthermore, I collected general information on the importance of sustainability to respondents. As experimental subjects were primarily young people, with 86% of respondents below 30 years of age, a sustainability bias could be the case. Therefore, I performed a Shapiro-Wilk test for non-normality (Royston, 1982; Shapiro & Wilk, 1965). While the test reveals a rejection of non-normality, social desirability potentially comes into play here as society expects people to deem sustainability a vital issue (Podsakoff et al., 2003). Thus, I also checked how the achieved values compare to other statistical papers. For instance, a recent study conducted by Piscitelli and D'Uggento (2022) measured sustainability on a 5-point Likert scale similar to this work and found an average importance of sustainability of 3.76, equal to the mean of 3.79 in the case of this research. Thus, the population is not biased more significantly than that of other researchers. Lastly, I provided non-professional investors with a company report as the basis for their investment decision-making. Therefore, I asked participants which method of information they choose when evaluating a company for a potential investment. 41%

of respondents replied that company reports would be their primary source of information. Another 37% listed it as their secondary source, just behind sources solely based on company information, i.e., newspapers and broker reports. Based on these results, offering non-professional investors company reports as an information basis is a valid method to analyse investment choices.

4.4.3 Discussion

The results of this experiment reveal that both the assurance level and the forward-looking time horizon have a significant impact on investment decisions, yet on different parts of the decision-making process. Starting with the first two hypotheses (H1a and H1b), I was able to confirm these and saw a significant effect of reasonable assurance on information evaluation and relative weighting of sustainability information similar to previous authors (Hoang & Trotman, 2021; Low & Boo, 2012; Rivière-Giordano et al., 2018; Vera-Muñoz et al., 2020). Investors value the positive framing in the reasonable assurance case over the negative framing in the limited assurance case. Although the experiment was conducted with non-professional investors only, who are said to be unable to distinguish between various levels of assurance (Dilla et al., 2023), I showed the contrary in this experiment. I thus highlighted the importance of high assurance levels for non-professional investors. Non-financial information is assessed better and receives more attention in an investor's decision-making process when assured to a reasonable level. This factor becomes especially relevant when long-term goals are provided, as non-professional investors consider them significantly more credible when strong assurance is present.

Turning to the third hypothesis regarding investors' information-based judgement (H1c), I then find results that, at first sight, seem to contradict the findings from before. I find that the forward-looking time horizon significantly affects investor's information-based judgement. In contrast, the assurance level does not affect the willingness to invest, contrary to what I found for information evaluation and weighting. Investors prefer the long-term, forward-looking scenario for both the limited and reasonable assurance scenarios. Various factors come into play that might influence the experimental subjects in this case. First, a primary difference between the questions asked under hypotheses H1a and H1b versus H1c is that subjects were explicitly asked about their view on the non-financial information in the first two. In H1c, subjects had to regard financial and non-financial information for one investment decision. Hence, one explanation can come from the previously mentioned social desirability bias

(Podsakoff et al., 2003). While respondents under H1b answered that they would provide significantly higher weight to reasonably assured non-financial information as it is socially accepted, the actual investment decision is mainly based on financial performance, which is always reasonably assured. Whether the non-financial information is reasonably assured has thus no significant effect. It is still interesting to see that the long-term scenario results in a significantly higher investment likeliness, which contradicts findings that short-term goals are more potent than long-term goals (Mercer, 2004; Pownall et al., 1993). However, the mentioned findings lie substantially in the past and are based on professional investors and solely financial disclosure. While, on the one hand, a general change among investors to account for a higher value of long-term information is observable (Bell, 2022; EY, 2021), non-professional investors appear to value this long-term information strongly. Other explanations could stem from learning effects during the experiment, which, however, I tried to reduce to a minimum by using a between-subjects design (Charness et al., 2012) and keeping the overall experiment sufficiently short without adding complexity over time. In summary, I see positive effects of long-term over short-term goals across all decision-making steps in the reasonable assurance scenario. The investor's evaluation and relative weighting are weaker in the limited assurance scenario. At the same time, this has no significant effect on the investor's likeliness to invest, implying that the investment decision is much more strongly focused on the financial information than what investors mention when explicitly asked (Podsakoff et al., 2003).

Given the fourth and fifth hypotheses (H2a and H2b), I found results in line with hypotheses H1a and H1b, i.e., assurance significantly impacts investor behaviour. In contrast, a forward-looking time horizon does not have an impact. Nevertheless, these results contradict the results I achieved concerning H1c. This divergence occurs for three reasons: First, for the question on H1c, experimental subjects were influenced by assurance level and time horizon simultaneously, while in H2a and H2b, subjects had to decide directly between both options. Thus, when both assurance options are directly in front of each other, it makes sense to always choose the higher option when available. This finding is in line with Low and Boo (2012) and underlines the importance of contrasting statements. If companies invest in the higher assurance level, it makes sense to differentiate it from limited assurance as a positive framing positively influences report users (Vera-Muñoz et al., 2020). While this point refers to the results of H2a, the second and third explanations refer to H2b. As I asked questions regarding H2b at the end of the experiment, the common phenomenon of experimental fatigue could be the case (Lavrakas, 2008). While turning around the order of questions would have been one

option to investigate this issue further, this could have possibly been inferred by questions related to H1a, H1b and H1c, and thus did not investigate this further. Lastly, a potential misunderstanding of the question related to H2b could be the case. While under H2a, a participant must decide between one of the two options, for H2b, it is possible to have long-term, forward-looking information on top of short-term, forward-looking information. Since subjects answered similarly under H2b and said they would invest slightly more when offered the other option, a misunderstanding is likely.

4.5 Conclusion

This study approaches differences in non-financial reporting with a focus on two specific variables, i.e., assurance level and forward-looking time horizon, in an experimental approach motivated by recent regulatory developments on a European level (see CSRD, European Parliament & European Council, 2022), a call for further research on non-financial reporting (Cohen & Simnett, 2015) as well as inconclusive research results achieved thus far for the variables under investigation (Misiuda & Lachmann, 2022). Therefore, I raised whether reasonably assured and long-term, forward-looking sustainability information adds value over limitedly assured and short-term, forward-looking sustainability information. Following the established framework developed by Maines and McDaniel (2000), I analysed the effects of assurance level and time-horizon of non-financial information on investors' information evaluation and weighting and their information-based judgement. I find reasonable assurance and a long-term, forward-looking time horizon to significantly impact information evaluation and weighting, i.e., the effect of reasonable assurance is stronger in the long-term, forward-looking time horizon scenario. When analysing the willingness to invest, investors significantly increased their investment probability when long-term, forward-looking information was provided, while differing assurance levels had no impact. When explicitly asked and provided with contrasting statements (Low & Boo, 2012), investors prefer reasonable over limited assurance, while time horizons are not mentioned as an influencing factor. I conclude that reasonable assurance and long-term time horizons positively influence an investor's decision-making process.

4.5.1 Contribution and managerial implications

With my research, I contribute to the increasing research field on non-financial disclosure (Heichl & Hirsch, 2023) and respond to the call for more research on varying assurance levels (Cohen & Simnett, 2015). Moreover, a clear opinion has yet to be developed on some aspects influencing investors' decision-making (Mercer, 2004). Overall, the contribution is split into two parts in light of the recently released, yet not fully defined, CSRD (European Parliament & European Council, 2022). First, I add to the existing literature on external assurance levels. On the one hand, multiple researchers did not find reasonable assurance to add value over limited assurance (Dilla et al., 2023; K. Hodge et al., 2009; Sheldon & Jenkins, 2020). Contrary to these researchers, others found reasonable assurance to be of added value (Hoang & Trotman, 2021; Low & Boo, 2012; Rivière-Giordano et al., 2018). Given that researchers found support for both sides of the coin, I contribute by supporting authors stating that reasonable assurance is of added value. However, whether this added value is proportional to the added cost of this extra effort was no subject of investigation here. Second, I contribute to the literature by shedding light on the variable of forward-looking time horizons, which previous authors have not investigated in non-financial research (Misiuda & Lachmann, 2022). Showing the importance of long-term over short-term, forward-looking time horizons is thus the second contribution of this research.

Two stakeholder groups potentially benefit the most from these findings: companies and regulatory authorities. Companies should thus consider investing additional resources in reasonable assurance as it increases their credibility and trustworthiness in the eyes of an investor. Providing long-term targets can also help. Nevertheless, a company should always consider disclosing targets considering their current non-financial performance. Regulatory authorities can also use these results in their ongoing development of regulatory directives, e.g., the CSRD, and adjust their current wording concerning limited and reasonable assurance. Moreover, regulatory authorities might use the results to adjust their rather vague phrasings concerning forward-looking time horizons. Eventually, aligning financial and non-financial assurance levels to a reasonable standard on the regulatory level thus makes sense according to the analyses.

4.5.2 Limitations and areas for further research

Besides a design based on an established and commonly used framework (Maines & McDaniel, 2000), this study contains three main limitations along the previously introduced methodological categories: experimental participants, design, and task. First, I experimented with the established laboratory setup within the university. While there was no outside influence of any kind, the population of experimental subjects is biased toward German male students of a comparably young age, i.e., most participants were 30 years of age or below and identified as male. This limits the experiment's external validity to some extent, as not all non-professional investors are students or comparably young. Nevertheless, male students with higher education make up the largest share of non-professional investors in Germany, allowing for the conclusion that the sample is close to reality (Deutsches Aktieninstitut, 2022). Second, I could only analyse two specific components, i.e., assurance level and time horizon, while many other factors influence an investor's decision-making (Mercer, 2004). I chose a company from the automotive industry with comparably strong financial and non-financial performance in the past. Thus, the subjects' responses might have been different if I had chosen a different role-model company from another industry or with different performance, as previous researchers have found different results for assurance effects when such aspects are different (Pflugrath et al., 2011; Shen et al., 2017). Third, subjects were only given a simplified annual report from one specific year. Like previous researchers (Dilla et al., 2023; Reimsbach et al., 2018), I chose this particular design to limit the duration of the experiment to an acceptable amount of time and minimise experiment fatigue (Lavrakas, 2008). Still, an actual report is much more complex. In a real-world investment scenario, most investors might base their investment decisions on more than one annual report or consult other sources of information.

Based on the mentioned limitations, I can derive propositions for future research. Extending this research to other population groups, e.g., older populations outside Germany or of different educational backgrounds, could be value-enhancing. Comparing these results to the results of this research work could provide exciting insights into the external validity of this experiment. Moreover, future researchers could choose a more complex information design, including multiple informational sources or years. Using eye-tracking devices, experimenters could identify the importance of various informational sources to investors and detect how vital financial and non-financial information is for their decision-making.

5 Conclusion

5.1 Recapitulation of research findings

The significance of ESG considerations has considerably increased over the last decades. ESG is omnipresent in company publications and investor discussions and is highly interesting to many members of society and, of course, scientific researchers. The importance of ESG and the high interest among many stakeholder groups have also led policymakers to design global and regional frameworks and directives to standardise reported ESG information and eventually achieve higher comparability and understandability. However, researchers are still determining whether the increasing number of regulatory directives is efficacious in improving ESG information quantity and quality and ESG performance. This dissertation thus contributes to the ongoing discussions related to ESG regulation by answering research questions on the impact of already designed regulatory guidelines and the potential design of future regulatory guidelines to make a change. I address these overarching research questions with three research essays deploying two distinct research methods: one qualitative multiple-case study and two experimental laboratory designs. I focus my research on the core stakeholders of ESG information, i.e., companies and investors, analyse every perspective separately (Essays I and III), and combine their perspectives in one research essay (Essay II).

Within this dissertation, I find that ESG is highly important to companies and investors. At the same time, regulation exerts only limited pressure on companies to disclose information compared to other stakeholders, safeguards investors to thus increase their willingness to invest, yet only to a limited extent, and higher external assurance and long-term, forward-looking information disclosure yield higher investment attractiveness in the eyes of an investor. Thus, this dissertation contributes to the ESG literature by providing an enhanced comprehension of the impact of ESG regulation on company and investor behaviour and facilitates the future development of ESG regulations for policymakers.

Within the second chapter, I respond to the research question surrounding the characteristics of the approach to environmental management among family-owned companies in Germany. Germany constitutes the largest economy within the EU, and within Germany, more than 90% of companies are family-owned, proving the relevance of this company type on a European level. As this company type is known for its little transparency and secrecy, I approach the research question using a multiple-case study approach, including qualitative interviews with sustainability managers and CEOs in 13 family-owned companies. To answer the research question, I first test and extend previous frameworks on environmental management for German family-owned companies and define four environmental management archetypes, i.e., sustainability laggards, extrinsically-driven reporters, intrinsically-driven realists, and sustainability frontrunners. Overall, carbon accounting among family-owned companies is decent, as most companies fall under the second and third archetypes. From a methodological standpoint, family-owned companies adhere to globally accepted standards like the GHG Protocol, but most have only implemented measurements for Scopes 1 and 2. Scope 3, accounting for most GHG emissions typically, remains the most complex category to measure and is thus underrepresented today. From a motivational perspective, I identify generational thinking and the will to contribute to society as primary internal motivators propelling carbon accounting. Additionally, customer demand serves as a significant external motivator. Despite upcoming regulations on measuring and reporting GHG emissions, regulatory factors still need to emerge as a primary motivator among family-owned companies. However, intrinsic motivation alone is insufficient. Setting up appropriate processes, investing in personnel, and enhancing data integration across companies present substantial challenges. Therefore, more effort is needed to comprehensively measure and reduce carbon emissions. Given their significant impact, family-owned companies in Germany have the chance to play a crucial role in this initiative.

The achieved results are subject to multiple limitations. First, the dataset used in this study is relatively small, limiting the ability to make statistically significant claims. However, interviews were verified by external experts from a leading consulting firm and a carbon accounting software start-up. Second, my research was focused exclusively on family-owned companies in CO_2-intensive industries, introducing a potential bias as it only included companies that already prioritise sustainability to some extent. Moreover, the perspectives on carbon accounting were primarily sourced from employees within family-owned companies,

some of whom had experience in large public corporations, without directly gathering views from employees at larger public firms.

The motivation for my second essay in chapter 3 stems from the low pressure exerted via regulatory measures on companies analysed in my first research essay. Thus, I aimed to analyse the right regulation level and find out with my research whether introducing a regulatory minimum ESG disclosure level continuously adds value over a mere voluntary reporting regime. I approached this research question using a laboratory experiment among more than 200 experimental subjects divided across four different treatment groups. Throughout the experiment, I analysed how different minimum regulatory disclosure levels affect principal and agent behaviour, imitating investor and company behaviour within the boundaries of laboratory research. My research provides three key findings: First, I find significant evidence that higher regulation leads to increased ESG information disclosure by agents. Second, although subjects already disclosed substantial ESG information voluntarily, principal investments increased significantly with just a minimum level of regulated disclosure, without further increases under stricter regulations. This suggests that principals value a baseline of disclosure but do not significantly reward additional transparency beyond this. Third, principals tend to invest more in agents who disclose more information, likely due to their risk aversion. My findings suggest a low to medium regulation scenario to provide the optimum balance between increased investment due to regulatory safeguards for principals and manageable costs for agents.

The second essay comes again with a set of limitations. First, the experimental subjects were predominantly university students, mostly under 30 years old, limiting the findings' generalisability. Second, the experiment focused on the quantity of ESG disclosure, overlooking the quality of the information, which also influences investment decisions. I omitted qualitative aspects to simplify the experiment, following the method by De Villiers et al. (2021), but I acknowledge that subjects may correlate more disclosure with higher information quality. Lastly, specific experimental choices, such as quadratic disclosure costs, might have affected the results and different parameters might have led to other conclusions.

Chapter 4 covers the results achieved as part of my third essay. Motivated by vaguely described European directives and lacking evidence about specific effects in today’s scientific literature (Misiuda & Lachmann, 2022), I analyse the effects of different characteristics of the CSRD among a set of more than 100 non-professional investors to answer the question whether reasonably assured and long-term, forward-looking sustainability information adds value over

limitedly assured and short-term, forward-looking sustainability information. Within my research, I find reasonable assurance and a long-term perspective to significantly affect how information is evaluated and weighted, with assurance having a more significant impact in long-term scenarios. Non-professional investors are more likely to invest when provided with long-term forecasts, but varying levels of assurance do not affect their willingness to invest. When directly questioned, investors preferred reasonable over limited assurance in line with Low and Boo (2012), though they did not consider time horizons as influential. Overall, reasonable assurance and extended time frames positively impact investor decision-making.

As within the previous essays, essay III is associated with certain limitations. First, I experimented with a controlled university lab using predominantly young German male students. This may limit the external validity as this demographic only represents some non-professional investors. Second, choosing a financially robust automotive company may have influenced the results and different industries or company performances might have yielded other effects (Pflugrath et al., 2011; Shen et al., 2017). Third, participants reviewed a simplified annual report from one year to reduce experiment duration and prevent fatigue (Lavrakas, 2008). Investors typically analyse multiple reports or use additional sources, indicating that the experimental setup simplified actual investment decision processes.

5.2 Avenues for future research

As described in the previous chapter, my research contains multiple limitation areas, providing various opportunities for future research. Some of these limitations apply to all essays, while others are specific to individual essays. Starting with overarching limitations and connected areas for future research, two main aspects are noteworthy: (1) expansion of geographical focus and (2) expansion of regulatory focus. Starting with the first aspect, expanding the current focus on German companies and investors to other European countries or overseas regions can provide a more comprehensive set of data, allowing for a broader understanding of ESG impacts across different economic, cultural, and regulatory backgrounds. Moreover, including multiple countries within a research project allows for the creation of more robust comparative analyses that enhance the relevance and applicability of the generated findings to global stakeholders. The second overarching aspect, i.e., expansion of regulatory focus, constitutes a connected avenue for further research. For instance, comparing the impact of the CSRD in the EU to other regulatory directives, such as those in

the United States or Asia-Pacific region, bears the potential to understand which aspects of each directive positively influence ESG performance within the affected areas. Thus, insightful learnings could be generated to further enhance European directives into a practical yet efficient directive and by that optimise the effort and outcome of ESG reporting.

Besides the overarching areas for future research that are universally valid for all essays, each essay bears the potential for future research individually. Within essay I, I developed a new set of environmental management archetypes tailored to family-owned companies based on 13 case study companies. Testing these archetypes in a broader scientific study, e.g., via archival data, if available, or a survey design, has the potential to verify or further shape the identified archetypes. Moreover, this approach would include all relevant industries and companies with a higher and lower sustainability focus. In addition, a longitudinal perspective could be added with this approach either again via archival data or via a survey that is answered multiple years in a row. Showing not only the status of ESG awareness among family-owned companies but also its development can provide relevant and new insights into the existing sustainability and family firm literature.

The scope of essay II was deliberately chosen to ESG quantity while leaving ESG reporting quality aside, similar to the approach chosen by De Villiers et al. (2021). Thus, factoring in the quality and the quantity of disclosures as distinct factors in a future research project could constitute a new angle of analysing principals' decision behaviour. It would be insightful to examine how principals might prioritise quality over quantity and determine which elements are more important to them. Future regulations will likely require adherence to specific minimum quantity and quality standards. Understanding how principals appreciate agents' attempts to surpass these benchmarks could offer valuable perspectives on agent behaviour and, consequently, on company practices overall.

Turning to essay III, the propositions for future research relate to the chosen data sample and the use of advanced technologies. The data sample was deliberately chosen to consist of non-professional investors, constituting a good fit with the framework developed by Maines and McDaniel (2000) specifically designed for this target audience. Nevertheless, two modifications in future research projects could yield valuable results. First, increasing the average age of the data sample and comparing these results to my results could prove the generalisability of my results to all non-professional investors. If the results are genuinely different, this could demonstrate how investor preferences shift over time regarding ESG

matters. Instead of increasing the average age of the sample, a sample shift from non-professional to professional investors could again yield relevant insights. The comparison between these two investor groups could primarily provide insights into their investment preferences and focus. Companies and policymakers could benefit from such results in tailoring their reports and directives to the most relevant target group. Additionally, the research could be enhanced from a technological perspective. By employing eye-tracking technology, experiments could detect the significance of different information sources to investors and determine the degree of importance of financial and non-financial information in their decision-making processes.

5.3 Concluding remarks

This dissertation contributes to the existing literature on ESG-related decision-making among companies, investors, and policymakers. The deployment of multiple research methods allows me to capture different perspectives in different ways to synthesise these into a holistic picture regarding today's regulatory landscape in Germany and derive potential implications for future policy design on a European level. In total, I want to highlight three key results from this dissertation, which all connect to the initial quote by UN Secretary-General António Guterres (WEF, 2024a), where he calls for rebuilding trust and governance reforms.

First, German family-owned companies, i.e., the dominant company type within Germany, are already advanced in their ESG accounting. Thus, other than what Guterres claimed, this company type profoundly cares about the shared future. Moreover, ESG regulation is not the primary motivation for performing ESG accounting. Rather, generational thinking and customer demand push companies to collect and disclose such information. Nevertheless, regulation can facilitate the standardisation of data and reporting formats, thus resolving a significant resource burden for companies today.

Second, Guterres stated that all business participants need to rebuild trust. Rebuilding this trust is especially crucial in the ESG context, given that today's ESG reporting is still evolving and subject to limited scrutiny. As a result of this dissertation, I see that higher levels of external assurance and long-term perspectives enable higher investments and thus constitute a means of rebuilding the current distrust. Using such mechanisms can potentially give

companies a competitive advantage as this reduced information asymmetry yields, for instance, better access to financing or higher customer loyalty.

Finally, the results prove that some external regulation already safeguards stakeholders while additional regulations only constitute limited additional value. Thus, policymakers should be careful in their future decision-making to find the right balance between safeguarding stakeholders, finding common and appropriate data standards and reporting formats while maintaining manageable resource efforts for reporting entities. Connecting this to Guterres' statement, regulation can thus foster and support rebuilding trust among company stakeholders, while such regulations must not result in losing trust among companies either. Regulations must be proportional to the risks they aim to mitigate, ensuring they do not impose excessive burdens on businesses or the economy.

6 Appendix

6.1 Appendix to essay I

FIGURE 6.1: Matching of cases to identified archetypes

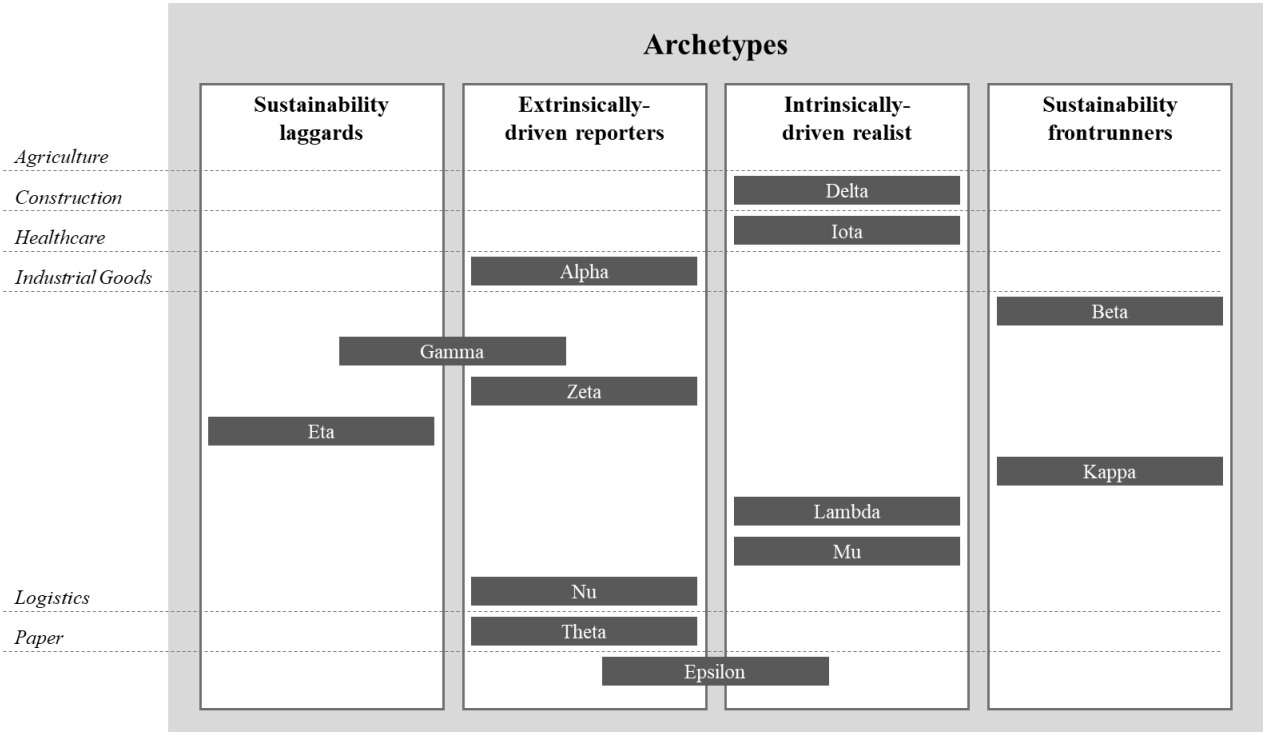


FIGURE 6.2: Case study guideline and interview questionnaire

Topic: Measurement and accounting of GHG emissions in family-owned companies

Objective of this work: Understand why family-owned companies account for their GHG emissions, how they measure and account for their GHG emissions and which challenges they face when measuring and accounting their GHG emissions along their value chain.

Research team: Julius Baumgart (PhD Researcher), Prof. Dr. Gunther Friedl (Supervisor)

Research questions:

- How do family-owned companies operationalise their GHG emissions accounting along their value chain?
- Why do family-owned companies account for their GHG emissions along their value chain?
- Which challenges do family-owned companies encounter when measuring and accounting for GHG emissions along the value chain?

Interview guidance:

- Personal introduction of researcher and interviewee (personal background, prior experiences)
- General information (objectives of the interview, information about recording, next steps after the interview)
- Questions Part I: General information about the family-owned company, e.g., industry, age, size, culture, etc.
- Questions Part II: Understanding reasoning behind GHG emission accounting, how it is performed, and which challenges the company has faced so far
- Questions Part III: Future GHG emission accounting

Questions Part I:

Objective of this section is to gather basic information about the family-owned company and learn about the company's culture and the role sustainability plays within the company

Part I.I: Basic information

Company's industry:

- In which industry is the company active?

Company's founding date:

- When was the company founded?

Company size:

- What is the current company revenue [in EUR]?
- How many employees work for the company?

Company ownership:

- What does the current ownership structure look like?
- Is the company fully owned by family members?

Part I.II: Company culture & role of sustainability overall

Involvement of the owner family:

- Do family members work for the company? If yes, in which positions do family members work?
- Has the family always owned the company?

Company identity:

- Does the company identify itself as a family-owned company?
- If yes, how is this image portrayed throughout the company?
- If yes, what impact does this have on the employees?
- If no, why is that the case?

Role of sustainability within the company:

- How does the company value non-financial / sustainability goals compared to financial goals?
- How has this changed over the past years?
- Does the firm have a sustainability department? If no, who is in charge of sustainability initiatives?

Questions Part II:

Objective of this part is to understand the reasoning behind performing the GHG emission accounting, the method how it is performed, and the challenges involved in the GHG accounting which the company has faced so far

General check:

- Do you currently measure GHG emissions (CO_2 equivalents)?

Reasoning behind GHG emission accounting:

- Why do you measure GHG emissions (CO_2 equivalents)?
  - Is the data used for internal reporting or external reporting?
  - Do you feel pressure from external stakeholders to report such data?
  - Do you do it in preparation of future reporting obligations, e.g., Corporate Sustainability Reporting Directive (CSRD)?
  - Do you set CO_2 emission targets and track your performance against these targets (SBTi)?

Method of performing GHG emission accounting:

- How do you currently measure & account for your GHG emissions, i.e., which standards do you use (GHG Protocol, ISO 14064, SBTi, etc.)?
- Why have you decided to use this standard?
- Do you measure GHG emissions along all Scopes, i.e., 1-3?
- Do you include all kinds of GHG emissions or CO_2 only?
- How often have you measured your GHG emissions already?
- Will this be an annual effort going forward?
- Are you developing the accounting fully in-house or together with external service providers?
- Do you use specific software or tools for the GHG accounting?
- How do you report your GHG emissions currently (e.g., company reports or Carbon Disclosure Project)?

Challenges when measuring GHG emissions:

- What effort is required to account for your GHG emissions in terms of time, workload and employees involved?
- Which challenges have you faced so far in measuring your GHG emissions?
- How did you overcome these challenges, if at all?
- What level of confidence do you have in the correctness of your accounting?

Questions Part III:

Objective of this part is to understand how the GHG accounting within the company will change & improve over the next few years

Effort:

- Do you think that the GHG accounting going forward will be more effort or less effort than what it has been in the past? Why?
- Do you think that the current level of data granularity is sufficient for the next years?
- How much potential do you see in automating GHG emission accounting for your company?

Family-owned company versus public corporation:

- Do you see a particular difference why GHG accounting for you as family-owned company might impact your business differently than a public corporation going forward?
- Do you see a difference in how you might use the measured data in comparison to a public corporation?

Any other remarks:

- Are there final thoughts you want to share regarding measurement and accounting of GHG emissions?

6.2 Appendix to essay II

FIGURE 6.3: Experimental procedure for essay II

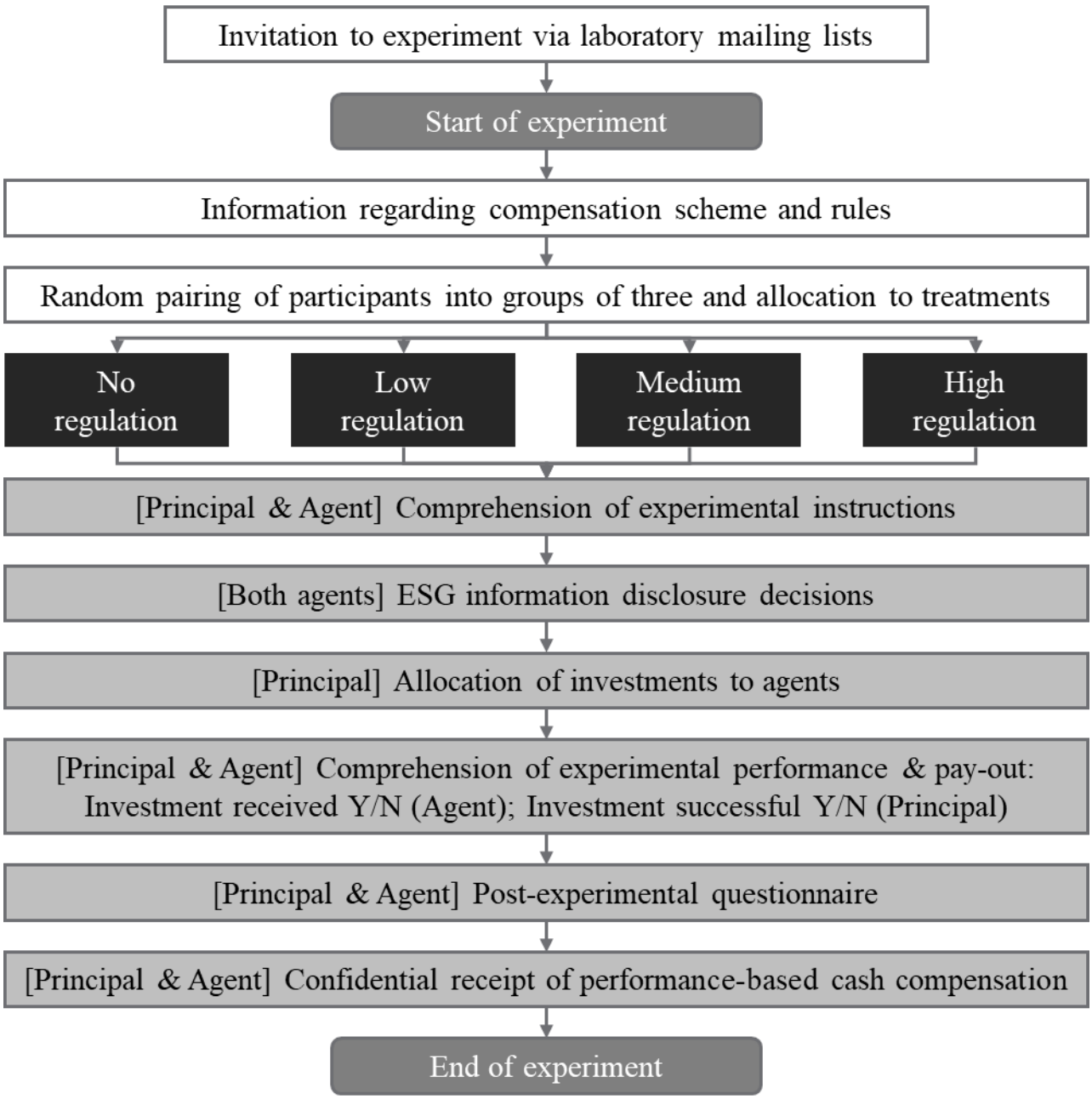


FIGURE 6.4: Pre-experimental text provided to subjects in essay II

In this experiment, there are two types of players. Each player either represents a company or an investor. Two companies are paired with one investor in a group. Initially, both companies decide what level of ESG (Environment, Social, Governance) information they want to disclose. Afterwards, the investor can decide, based on the provided ESG information, which of the two companies to invest in and how much to invest. It is not possible to invest in both companies at the same time, but only in one of the two.

You represent in this case a company/an investor.

For companies: You as a company can generally provide ESG information on a scale of 0 to 10. The cost of providing ESG information is equal to the square of the level of ESG information provided. Thus, an ESG information level of 2 costs your company 4 Experimental Currency Units (ECUs), an ESG information level of 4 costs your company 16 ECUs, etc. Your company's starting capital is 100 ECUs. Your company's profit is thus calculated as the sum of the starting capital minus the costs of providing ESG information plus any investment received from the investor. The exact overview of the costs per level of ESG information is found in the table below.

Disclosed amount	0	1	2	3	4	5	6	7	8	9	10
Disclosure cost	0	1	4	9	16	25	36	49	64	81	100

For investors: Based on the provided ESG information of the two companies, you as the investor decide to invest capital of up to 110 ECUs in only one of the two companies. Your profit depends on the level of ESG information provided and the associated risk. The higher the level of ESG information into which you have invested, the lower the default risk, but also the lower the profit. An overview of the risk depending on the level of ESG information provided is found in the second table. Your profit is thus calculated as follows: Starting capital minus the invested capital plus the profit, which is calculated as the doubled invested capital multiplied with the risk. The probability of the profit occurring corresponds to the risk. The following example serves as an illustration: If you invest 50 ECUs in a company that has chosen an ESG information level of 4, your profit sums up as follows: 110-50+(2*50/0.75) = 193.

However, this profit only occurs with a probability of 75%. In 25% of the cases, you only make a profit of 60 as the investment failed in that case.

Disclosed amount	0	1	2	3	4	5	6	7	8	9	10
Success rate	65.0%	67.5%	70.0%	72.5%	75.0%	77.5%	80.0%	82.5%	85.0%	87.5%	90.0%

FIGURE 6.5: Post-experimental questionnaire for essay II

Question 1: What gender do you identify with?

- Female
- Male
- Neither
- I prefer not to answer

Question 2: How old are you?

- <25
- 25-30
- >30
- I prefer not to answer

Question 3: For investors only (otherwise, please state n/a): How relevant was it for you that this was ESG information?

- Very relevant
- Somewhat relevant
- Neutral
- Somewhat irrelevant
- Not relevant
- n/a

Question 4: For investors only (otherwise, please state n/a): How would you invest in a next round with ESG information levels remaining the same?

- Invest more
- Invest the same
- Invest less
- n/a

Question 5: For investors only (otherwise, please state n/a): Would you always invest in a company that provides higher ESG information?

- Yes
- No
- n/a

Question 6: Only for companies (otherwise, please state n/a): How relevant was it for you that this was ESG information?

- Very relevant
- Somewhat relevant
- Neutral
- Somewhat irrelevant
- Not relevant
- n/a

Question 7: Only for companies (otherwise, please state n/a): Which ESG information level would you choose in the next round?

- Higher level
- Same level
- Lower level
- n/a

TABLE 6.1: Optimum investment amount for risk-averse investors

Amount disclosed by company [IDUs]	Optimum investment amount for risk-averse investors [ECUs]
0	90.04
1	92.46
2	94.77
3	96.95
4	99.00
5	100.91
6	102.67
7	104.27
8	105.70
9	106.94
10	108.00

6.3 Appendix to essay III

FIGURE 6.6: Experimental procedure for essay III

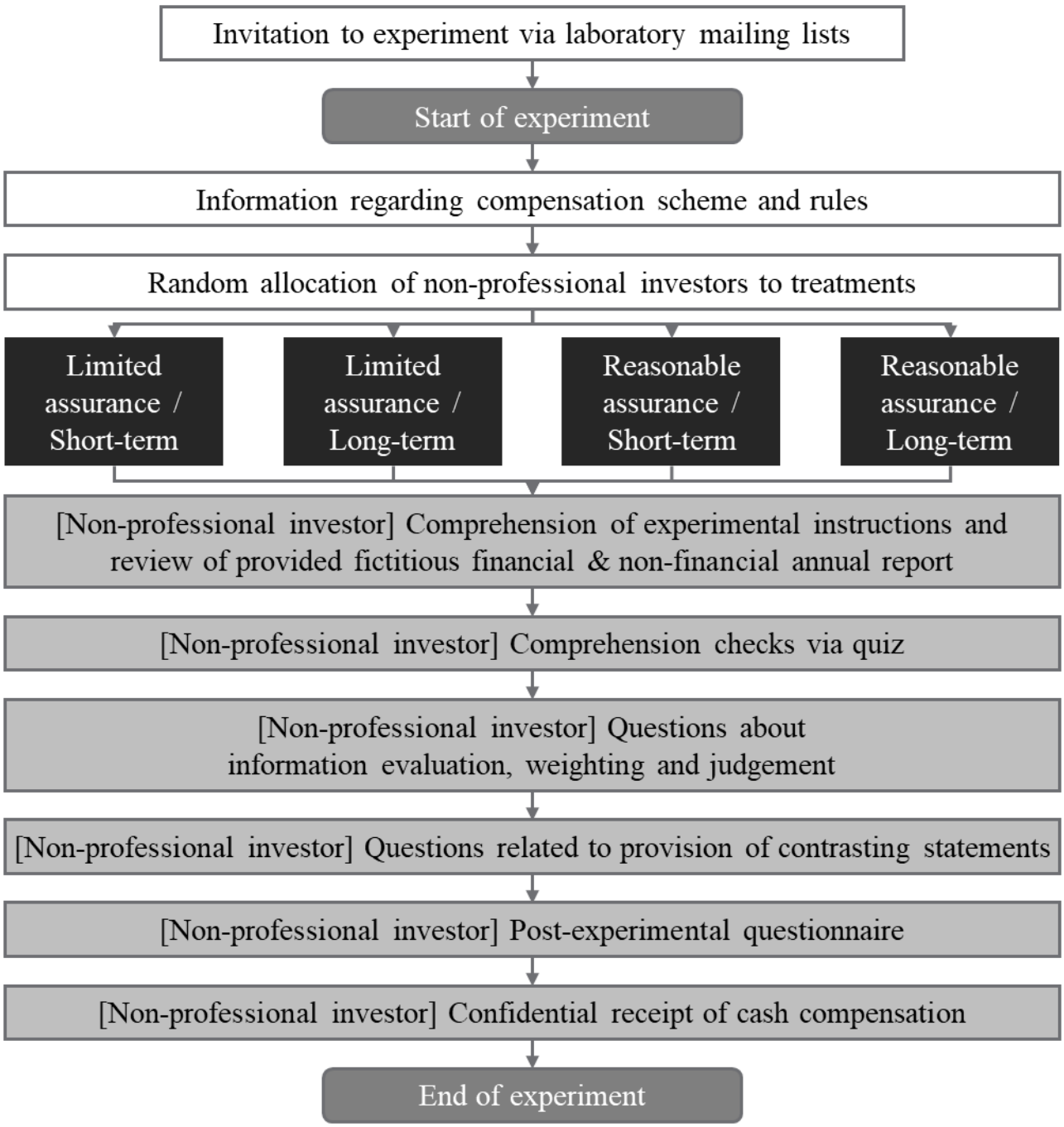


FIGURE 6.7: Pre-experimental instructions on paper hand-out for essay III

Dear participants,

Thank you for your participation in today's experiment. Please follow these instructions to conduct the experiment:

1. Open Google Chrome on your laboratory computer.
2. Enter the following link to start the experiment: https://t.ly/dORF8
3. Answer all questions and then quietly leave the room to receive your compensation

FIGURE 6.8: Experimental questions for essay III

Liebe Teilnehmerin*innen,

vielen Dank für die heutige Teilnahme an diesem Experiment. Im heutigen Experiment werden Sie die fiktive Firma "Sigma AG" auf Basis des Jahresberichts 2022 bewerten, in welchem Sie sowohl finanzielle als auch nicht-finanzielle Kennzahlen zu der Performance der Firma in den letzten 5 Jahren erhalten und eine Aussicht über die Zukunft der Firma bereitgestellt wird.

Die Sigma AG wurde vor ca. 100 Jahren gegründet, ist ein deutsches, international-tätiges Industrieunternehmen mit über 100.000 Mitarbeitern und über 100 Mrd. Euro Umsatz.

Den Jahresbericht erhalten Sie im nächsten Schritt als PDF. Im Anschluss werden Ihnen einige Fragen zur Bewertung der Firma gestellt. Abschließend werden Ihnen noch persönliche Frage gestellt.

Sobald Sie alle Fragen beantwortet haben, dürfen Sie das Experiment verlassen. Alle von Ihnen gegebenen **Antworten sind vollständig anonym** und werden **streng vertraulich behandelt**.

Nach dem Experiment erhalten Sie eine Vergütung. Ihre Angaben werden anonym mit denen von professionellen Investoren verglichen. Je realistischer Ihre Einschätzung ist und der Meinung von professionellen Investoren entspricht, desto höher ist Ihre Kompensation.

Um Ihnen ein Gefühl für die notwendige Zeit zu geben noch folgender Hinweise: Professionelle Investoren haben in der Regel 20-30 Minuten gebraucht, um den Jahresbericht der Sigma AG detailliert durchzuarbeiten, zu verstehen und die Fragen zu beantworten.

Vielen Dank für Ihre Teilnahme!

Sie finden den Report der Sigma AG hier:

Sigma AG Jahresbericht 2022

Um sicherzugehen, dass Sie den Report öffnen konnten und verstanden haben, beantworten Sie bitte folgende zwei Verständnisfragen:

(Geben Sie nur Zahlen an, keinen sonstigen Text wie "Mio. €", "Tonnen CO2" oder Ähnliches)

Verständnisfrage 1: Umsatzerlöse 2021

Die Umsatzerlöse der Sigma AG in 2021 betragen: _____

Verständnisfrage 2: CO2-Emissionen je produziertes Fahrzeug 2022

Die CO2-Emissionen je produziertes Fahrzeug (Tonnen CO2) in 2022 lagen bei: _____

Sollten Sie den Bericht versehentlich geschlossen haben, finden Sie den Report weiterhin hier:

Sigma AG Jahresbericht 2022

Wie schätzen Sie die nicht-finanzielle Performance der Sigma AG ein?

	0 (sehr schwach)	1	2	3	4	5 (neutral)	6	7	8	9	10 (sehr stark)
Ich finde die nicht-finanzielle Performance der Sigma AG...	○	○	○	○	○	○	○	○	○	○	○

Sollten Sie den Bericht versehentlich geschlossen haben, finden Sie den Report weiterhin hier:

Sigma AG Jahresbericht 2022

Wie wichtig sind für sie die finanzielle und die nicht finanzielle Information der Sigma AG, um eine Investitionsentscheidung zu treffen?

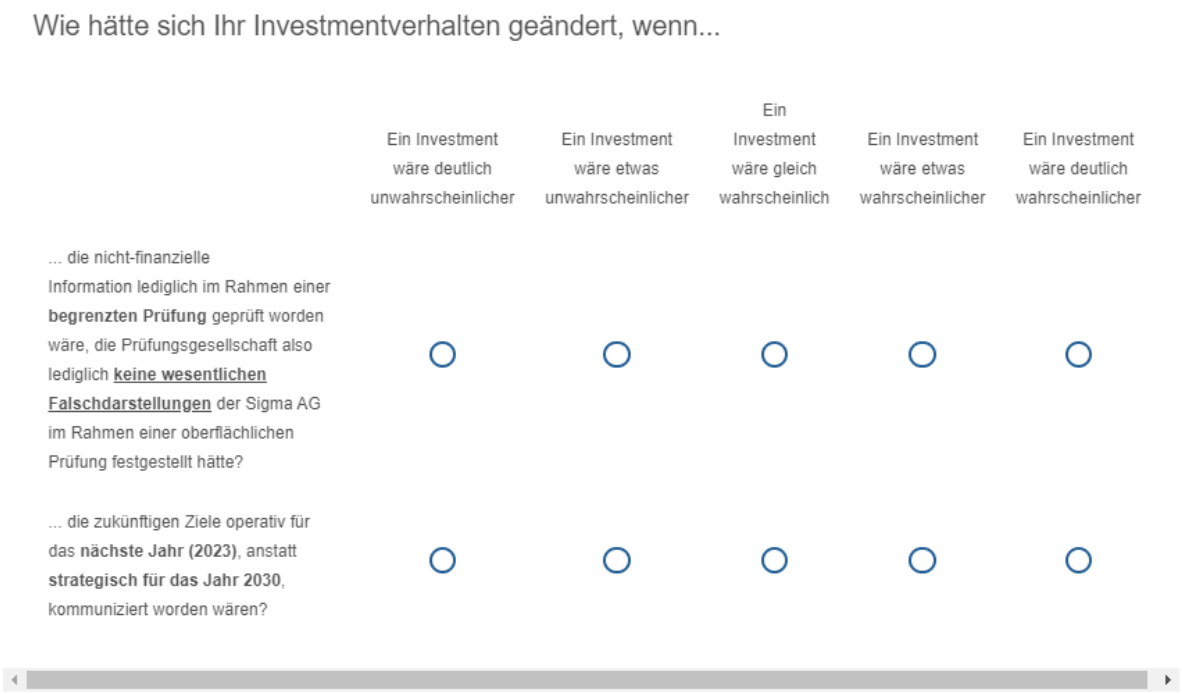
	0 (sehr unwichtig)	1	2	3	4	5 (neutral)	6	7	8	9	10 (sehr wichtig)
Die bereitgestellte **finanzielle** Information ist für mich...	○	○	○	○	○	○	○	○	○	○	○
Die bereitgestellte **nicht-finanzielle** Information ist für mich...	○	○	○	○	○	○	○	○	○	○	○

Sollten Sie den Bericht versehentlich geschlossen haben, finden Sie den Report weiterhin hier:

Sigma AG Jahresbericht 2022

Wie wahrscheinlich ist es, dass Sie in die Sigma AG investieren würden?

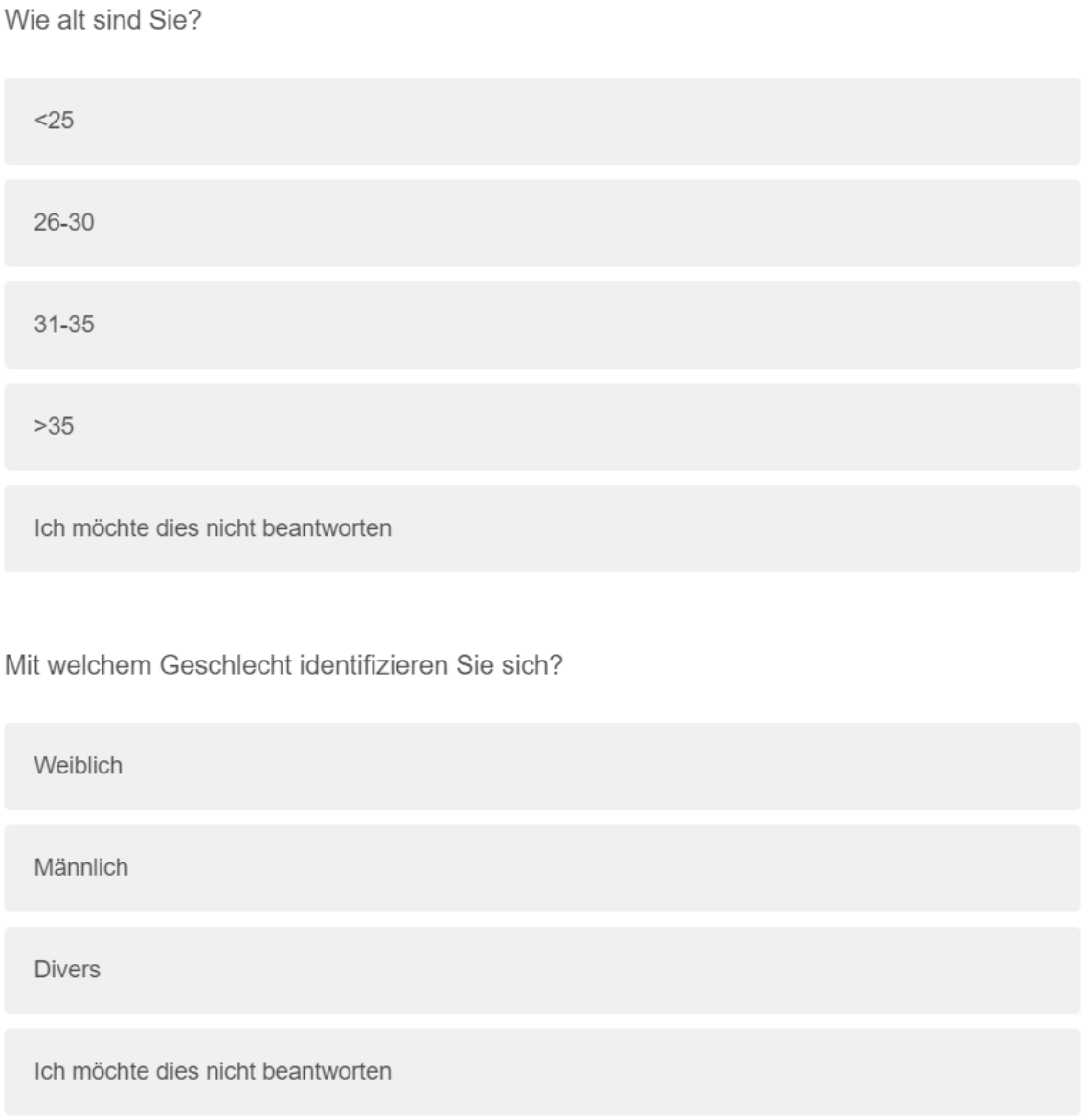
	0 (sehr unwahrscheinlich)	1	2	3	4	5 (neutral)	6	7	8	9	10 (sehr wahrscheinlich)
Ein Investment in die Sigma AG ist...	○	○	○	○	○	○	○	○	○	○	○



Wie hätte sich Ihr Investmentverhalten geändert, wenn...

	Ein Investment wäre deutlich unwahrscheinlicher	Ein Investment wäre etwas unwahrscheinlicher	Ein Investment wäre gleich wahrscheinlich	Ein Investment wäre etwas wahrscheinlicher	Ein Investment wäre deutlich wahrscheinlicher
... die nicht-finanzielle Information lediglich im Rahmen einer **begrenzten Prüfung** geprüft worden wäre, die Prüfungsgesellschaft also lediglich **keine wesentlichen Falschdarstellungen** der Sigma AG im Rahmen einer oberflächlichen Prüfung festgestellt hätte?	○	○	○	○	○
... die zukünftigen Ziele operativ für das **nächste Jahr (2023)**, anstatt **strategisch für das Jahr 2030**, kommuniziert worden wären?	○	○	○	○	○

FIGURE 6.9: Post-experimental questionnaire for essay III



Was ist Ihr Studienhintergrund?

- Betriebswirtschaft (BWL, Management & Technology
- Naturwissenschaft (z.B. Maschinenbau, Elektrotechnik, Mathematik, Informatik, o.ä.)
- Sonstige Geisteswissenschaft (z.B. Jura, Sprachen, o.ä.)
- Sonstiges (bitte spezifizieren):

Bitte bewerten Sie, ob folgende Aussagen auf Sie zutreffen:

	Trifft überhaupt nicht zu	Trifft eher nicht zu	Neutral	Trifft eher zu	Trifft zu
Ich informiere mich regelmäßig über das Wirtschaftsgeschehen in der Welt	○	○	○	○	○
Ich habe Interesse am Kapitalmarkt	○	○	○	○	○

Bitte bewerten Sie, ob folgende Aussage auf Sie zutrifft:

	Trifft überhaupt nicht zu	Trifft eher nicht zu	Neutral	Trifft eher zu	Trifft zu
Das Thema Nachhaltigkeit ist für mich extrem wichtig	○	○	○	○	○

Wie oft investieren Sie in Aktien oder sonstige Wertpapiere am Kapitalmarkt?

- Ich habe noch nie investiert
- Ich investiere ca. einmal im Jahr
- Ich investiere mehrfach, aber unregelmäßig im Jahr
- Ich investiere mehrfach und regelmäßig im Jahr

Welche Informationen nutzen Sie, bevor Sie in Investment am Kapitalmarkt tätigen?

- Ich investiere nicht
- Empfehlungen von Freunden
- Zeitungsartikel
- Social Media
- Firmeneigene Publikationen, z.B. Jahresbericht, Quartalsbericht, Veröffentlichungen auf Website
- Brokerreports
- Sonstiges (bitte spezifizieren):

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