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The value relevance of the environmental impact of firms: Evidence on data provided by the impact-weighted accounts initiative

Master Thesis

By

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Abstract

In the absence of sophisticated and clearly defined ESG metrics, companies' positive and negative impacts on the planet are likely to be absent from decision-making. To provide accurate signals for business leaders and investors, and to allow firms to internally generate company impact data, rather than using external rating agencies, company impact should be connected to the financial statement. Impact-weighted accounts are a line on the financial statement, such as the income statement or the balance sheet, to supplement the financial health and financial performance by reflecting companies' positive and negative impacts on the customers, employees, environment, and overall society. The idea of impact-weighted accounts is based on a project from Harvard Business School. Their mission is to drive the creation of financial accounts that reflect companies' financial, social, and environmental performance. This thesis investigates the value relevance of the environmental impact, measured by impact-weighted accounts, of selected firms from 2010 to 2019. Using various types of regression models, we find robust evidence of a positive, statistically significant coefficient on environmental impact. Therefore, our results suggest that firms' environmental impacts are associated with their stock price and Tobin's Q, respectively. In addition, these relations are more pronounced for stock prices and Tobin's Q during the second half of our sample period. Overall, these results suggest that the environmental impacts of firms, measured by their impact-weighted accounts, are relevant to their values.

Keywords – Impact-weighted accounts, environmental impact, value relevance, ESG, sustainability, corporate social sustainability, sustainable accounting

Contents

List of variables

Size *Natural logarithm of total assets*

EPS *Net income/ outstanding shares*

ROA *Net income/ total assets*

BVPS *Book value of equity/ outstanding shares*

Leverage *Total debt/total shareholders equity*

Tobin's Q *Market value of equity/ total assets*

Dividends *Common dividends (cash)*

StockPrice *Market value of equity/ outstanding shares*

PPE/Assets *Property, plant and equipment's/ total assets*

Book/Market *Book value of equity/ market value of equity*

CAPEX/Assets *Capital expenditures/ total assets*

Env.IMPACT/Sales *Environmental impact/ total sales*

Env.IMPACT/Assets *Environmental impact/ total assets*

Intangible.Assets/Assets *Intangible assets/ total assets*

1 Introduction

Over the last 20 years, companies' environmental impact has become a central consideration for stakeholders, and the interest in measuring and analysing environmental impact has grown exponentially (Freiberg et al., 2021). The increasing public awareness of climate change has changed our society, and this sustainability trend has spilled over to financial markets (Amel-Zadeh and Serafeim, 2018). As a result, the market continues to evolve from its traditional focus, which mainly involved companies taking actions against an issue that could harm their business, to one that is more purpose-focused, where doing something good for the planet, drives business decisions (TD Asset Management Inc, 2021). The increasing public awareness of companies' impact on climate and the overall society has increased stakeholders' (i.e., investors, suppliers, customers) interests in companies' environmental and social impact (Freiberg et al., 2021). The latest edition of the European CFO survey asked close to 1,200 financial executives across Europe to what extent their companies feel the pressure to act on climate change (Coppola et al., nd). The key insight from the survey is that companies are feeling pressure from various stakeholders to act on climate change.

1.1 Current sustainability practice in the financial market

In recent years, investors' interest in Environmental (e.g., carbon emissions, waste generation, water consumption), Social (e.g., staff turnover, incidence rate, percentage of female employees), and Governance (e.g., board of director size, board of directors' diversity, executives' diversity) (ESG) data has increased (Amel-Zadeh and Serafeim, 2018). The integration of ESG information in investment decisions has been one of the most significant developments in financial markets. The extensive use of ESG data has pushed companies to disclose non-financial information, such as the environmental and social impact companies have on the planet. As a result, the number of public companies issuing public ESG information has increased exponentially in the last decades.

As such, the most prominent companies issuing sustainability reports have increased by 75% from 1993 to 2017 (Serafeim et al., 2019).

With the increasing disclosure of non-financial information among companies, there have been many ideas for improving business reporting, focusing on providing more non-financial information (Eccles et al., 2011). Several non-profit organizations, such as the Global Reporting Initiative (GRI) and the Sustainable Accounting Standards Board (SASB) have prompted the disclosure of ESG data. They have developed disclosure standards to identify the ESG metrics that corporations should disclose (Rouen and Serafeim, 2021). To capture ESG information, some investors are using ESG ratings from ESG providers (i.e., ESG rating agencies). Nevertheless, recent research and media publications have commented on the rating agencies' high degree of disagreement (e.g., Chatterji et al. (2016); Christensen et al. (2022)). When rating agencies rank the same companies for their creditworthiness, they are often in agreement. However, this is not the case when it comes to ESG agencies. The commissioner Peirce of the Securities and Exchange Commission (SEC) mentioned that the different ESG ratings might vary so widely that the results would be difficult to use as a guide in an investment decision (Christensen et al., 2022). The disagreement between rating agencies might illustrate a lack of agreement on what ESG ratings should reflect. As a result, there might be a lack of consistency in the use of ESG data when making investment decisions.

Despite numerous efforts by non-profit organizations to improve ESG reporting among corporations, there are still several challenges. The lack of agreement and inconsistency of current ESG metrics are among the remaining challenges which may prevent integrating ESG information into investment decisions (Freiberg et al., 2021). Another weakness of the current ESG metrics is that the matrix is based on input and activities (i.e., policies, disclosure, management systems) and not the outcomes and impact on stakeholders (i.e., carbon emissions, working conditions, diversity in the company) (Serafeim et al., 2019). In addition, there is no clear or universal methodology to apply the ESG metrics (Freiberg et al., 2021).

In the absence of sophisticated and clearly defined ESG metrics, companies' positive and negative impacts on the planet are likely to be absent from decision-making (Serafeim et al., 2019). It is plausible that decisions might continue to be based on the current financial metrics that do not reflect a holistic overview of how a company creates value, as it might continue to ignore the impact on the customers, employees, environment, and the overall society. To provide accurate signals for business leaders and investors, and allow firms to internally generate company impact data, rather than using external rating agencies, company impact should be connected to the financial statement (Serafeim et al., 2019). As a result, the measurements of companies' impact could be translated into comparable units across companies. Furthermore, by connecting companies' impact to the financial statement, company impact could be aggregated and compared without obtaining detailed information.

Implementing impact-weighted accounts on the accounting statement could allow investors to use existing financial tools and analyses to assess performance. The measurement, recognition, and disclosure of impact-weighted financial accounts might allow companies to incorporate an assessment process of impact in the decision-making process.

1.2 Impact-weighted accounts

Impact-weighted accounts are a line on the financial statement, such as the income statement or in the balance sheet, to supplement the financial health and financial performance by reflecting the companies' positive and negative impacts on the customers, employees, environment, and overall society (Serafeim et al., 2019). The impact-weighted account could allow managers to make more informed decisions due to potential increased relevance, reliability, and comparable reported information. In addition, since accounting standards are defined as a common set of principles, standards, and procedures (Vorster, 2007), impact-weighted accounts might allow investors to compare and assess impact across different companies and industries. Furthermore, it might enable investors and other stakeholders to operate in a more transparent market since information about a company's impact is present.

The idea of impact-weighted accounts is based on a project from Harvard Business School. Their mission is to drive the creation of financial accounts that reflect companies' financial, social, and environmental performance (Serafeim et al., 2019). The aim of impact-weighted accounts for investors is that ESG-labeled companies could use impact-weighted accounting numbers in their due diligence, underwriting, engagement, and reporting effort. Investors and asset owners could utilize impact-weighted accounts as monitoring and selection tools to assure their investments are aligned with positive impact.

Despite the current accounting statement ignoring companies' impact, we aim to investigate whether and how the implementation of impact-weighted accounts on the accounting statement is related to the value of firms, or more precisely, the stock price. Due to time constraints and lack of data, we are mainly focusing on investigating whether and how the environmental impact of a company (a component of the total impact-weighted account) is related to the stock price of a firm. As such, we arrived at the following two-part research question:

"Whether and how the environmental impact of firms, measured by their impact-weighted accounts, is related to their stock prices."

2 Literature review

The following chapter reviews and discusses the current literature on companies' current sustainability reporting, focusing on practices used to measure and analyse the environmental impact and its value relevance.

2.1 Development of ESG information

The role of ESG information in business and its value relevance has undergone changes over history. According to Eccles et al. (2011), ESG factors have been discussed in the academic literature for more than 35 years. Nevertheless, it is apparent that the role of ESG disclosure has changed over time. In the past, it was claimed that the social responsibility of a business was to increase profit because activities relating the sustainability of a business did not provide payoffs (Friedman, 1970). Furthermore, it has also been claimed that socially responsible activities are costly for the shareholders (Palmer et al., 1995). However, companies' environmental and social impact has more recently become a central consideration for stakeholders, and the interest in measuring and analysing environmental impact has grown exponentially (Freiberg et al., 2021). Companies are nowadays actively encouraged by public expectations and regulatory pressure (e.g., The EU Taxonomy for Sustainable Finance) because sustainability has now become one of the central issues of the management of the business (Marsat and Williams, 2011; Panwar et al., 2006). Further, companies' sustainability practices have also become one of the central issues for stakeholders after the UN Global Compact (2004) and UNEP Finance Initiative (2005) circulated the concept of ESG information *"that ties corporate social performance and corporate financial performance together"* (Lo and Kwan, 2017, p. 607). As a result, corporate reports of ESG issues have become increasingly important to investors (EY, 2014; London Stock Exchange Group, 2018; Nasdaq, 2017).

2.2 Sustainability reporting and firm value

The relationship between companies' sustainability practices and their values has been investigated from different theoretical perspectives. Some studies have found that sustainability generates financial performance (Alexander and Gentry, 2014; Lu and Taylor, 2018; Margolis and Walsh, 2003; Orlitzky, 2005; Ruf et al., 2001), while other studies have found a negative relationship (Brammer et al., 2006; Griffin and Mahon, 1997; Madorran and Garcia, 2016; Seifert et al., 2003; Teoh et al., 1999). Firm value can be examined in terms of Earnings Per Share (EPS), market capitalization, or growth opportunities, among others (Berger and Ofek, 1995; Shin and Stulz, 2000). However, research and evidence on how to capture environmental impact in monetary terms and how sustainability reporting is associated with market value remain incomplete. Due to a lack of consistency between ESG rating providers and the lack of a framework for systematic measurement of impact, there seem to be limitations in assessing the association between firm value and sustainability. The lack of consistency between ESG ratings agencies and the absence of a framework for measuring impact is frequently discussed in the literature. Diouf and Boiral (2017) investigates the perception of Social Responsible Investments (SRI) practitioners in Canada and the quality of sustainability reporting using the GRI framework. Evidence from the study shows that the widely used GRI standard still does not have the same level of credibility and transparency as financial reporting (Diouf and Boiral, 2017). Diouf and Boiral (2017) demonstrate that sustainability reporting is biased as the companies in the sample were trying to present the good incidences and avoiding mentioning flaws in the performance in their financial reports. The findings by Diouf and Boiral (2017) are also consistent with other findings within the field, where GRI remains problematic due to observed inconsistencies that limit the quality and credibility of the published information (Fortanier et al., 2011; Hahn and Kühnen, 2013; Moneva et al., 2006).

The study by Diouf and Boiral (2017) is limited to only 33 interviews carried out in Canada for the purpose of SRI practitioners. However, Perego and Kolk (2012) explores the same topic as Diouf and Boiral (2017), but for multinational

corporations (MNCs). The study by Perego and Kolk (2012) uses a panel of Fortune Global 250 firms over a period of 10 years. They investigate the use of a third party to report sustainability data. The results illustrate great variability in the adoption of assurance practices and a preference for combining different standards, such as standard AA1000 or IASE3000 in combination with GRI (Perego and Kolk, 2012). Perego and Kolk (2012) illustrate the findings by Diouf and Boiral (2017) on a bigger scale, as their findings illustrate the application and quality of standards differ substantially for practitioners. Perego and Kolk (2012) argue that the differences in the application are due to no mandatory standard, and many assurors make use of a combination of different guidelines.

Despite the lack of consistency in the sustainability reporting and a standard framework on how companies should report such data, there have been various efforts in the literature to investigate the association between firm value and sustainability reporting and quality. Nguyen (2020) examines the association between sustainability reporting and firm value by investigating whether having a higher adherent level to GRI tends to have greater firm value. The findings of the study indicate a significant negative relationship between firm value and a firm's adherent level to GRI of sustainability reporting (Nguyen, 2020). The results could mean that firms with a greater GRI adherent level in sustainability reporting, tend to have lower values. Nguyen (2020) explains that this negative association might come from incomplete sustainability reporting, along with self-centeredness and insincerity from those who produce sustainability reports (Aras and Crowther, 2009; Gray, 2006; Unerman et al., 2007). The findings by Nguyen (2020) illustrate the opposite of the study by Bachoo et al. (2013), which finds a positive significant association between the quality of a firm's sustainability disclosures and the ex-ante cost of equity. In addition, the study by Bachoo et al. (2013) finds a significant positive association between sustainability reporting quality and expected future performance, which relates to firm value. Bachoo et al. (2013) argues that higher sustainability reporting quality decreases investors' perception of the riskiness of a firm. The findings by Bachoo et al. (2013) suggest that rational investors pay a premium for each

dollar expected for short-run earnings of high-quality reporting firms, and for higher future cash flow as sustainability reporting lowers the likelihood of future sustainability-related cash outflows (e.g., costs and fines).

Firm value and quality of sustainability reporting have also been examined by Sutopo et al. (2018). The study by Sutopo et al. (2018) investigates whether companies receiving a sustainability reporting award (SRA) have a higher value relevance to financial statements than firms that do not receive an SRA. The study by Sutopo et al. (2018) indicates the value relevance of EPS for the SRA firms is higher than for non-SRA firms. The findings by Sutopo et al. (2018) could indicate that the market perceives firms with excellent sustainability reporting as having information about the future prospect in favor of sustainability development (Sutopo et al., 2018). As such, investors might perceive such companies as less risky (Bachoo et al., 2013).

Sustainability reporting and investor perception of a firm could be value-increasing themselves. The study by Miralles-Quiros et al. (2017) reveals that European investors consider Corporate Social Responsibility (CSR) information when valuing a company. Furthermore, Miralles-Quiros et al. (2017) find that GRI disclosure is positively and significantly associated with the market value of equity. Overall, the findings by Miralles-Quiros et al. (2017) are similar to the findings by Kaspereit and Lopatta (2016), for the largest European companies. The findings by Kaspereit and Lopatta (2016) and Miralles-Quiros et al. (2017) could indicate that sustainability reporting itself can be value-increasing as the amount of information about the company to investors is greater, which reduces the asymmetric information. Therefore, investors' perception of riskiness might be lower (Bachoo et al., 2013).

2.3 Sustainability reporting and value relevance

As indicated in the previous discussion, there seem to be mixed results about the relation between companies' sustainability disclosure and their value relevance in the current academic literature. The discussion above is also in line with other research that has found positive, negative, or no relation between sustainability disclosure on the firms' values (Cañón-de Francia and Garcés-Ayerbe, 2009; Chetty et al., 2015; Gladysek, 2012; Keele and DeHart, 2011; Luffarelli and Awaysheh, 2018; Yadav et al., 2016).

Despite the inconsistent results regarding companies' sustainability disclosure and its value relevance, research on value relevance is extensive. However, many studies of value relevance have focused on accounting variables (e.g., Amir and Lev (1996); Barth and McNichols (1994); Carnevale and Venturini (2012)). As such, the definition of "value relevance" is often connected to accounting information by researchers. For example, Beisland (2009) suggests "relevance" reflects the ability of accounting information to capture or summarize market value. Nevertheless, research of value relevance has also been investigated with non-accounting variables (e.g., sustainability data) (Aureli et al., 2020). Research by Lapointe-Antunes et al. (2006) and Xu et al. (2007), illustrates that accounting information alone is not enough to explain companies' market value and its variation.

The discussion above suggests that there is an agreement in the academic literature on the importance and relevance of sustainability data and market values. Furthermore, the discussion illustrates that the market values of firms are not purely based on accounting information alone since considering a company's environmental and social impact when valuing a company is of importance. However, the lack of a common understanding and methodology to use ESG is plausibly making it challenging to incorporate such data in traditional valuation models (i.e., the Discount Cash-flow model). In addition, the lack of a common methodology and understanding of how to consider environmental and social aspects of firms might also make it challenging to compare companies in different industries, but also those companies in the same industries. To provide accurate signals for business leaders and investors,

Serafeim et al. (2019) argues that company impact should be connected to the financial statement. Several studies follow the argument by Serafeim et al. (2019), that companies' social and environmental externalities should be connected to the financial statement (Hartwig et al., 2019). Incorporating companies' environmental and social impacts on the income statement or balance sheet, could result in accounting that provides the most promising fit for use by various stakeholders in impact valuation, and to be an objective method based on well-established accounting principles and practices (Buchholz et al., 2020).

Despite the lack of a standard and mandatory practice of sustainability reporting, there exist at least seven well-known sustainability reporting frameworks. All these frameworks are backed by credible organizations with reputable individuals on their boards (El-Jisr and Rogmans, 2022).

2.3.1 Frequently used sustainability frameworks

In the absence of a universal method to measure firms' environmental and social impacts, there exist numerous standards and frameworks for sustainable, energy, and emission reporting. Several of these are voluntary, while some are mandatory in specific countries. The current frameworks and standards are the following: Streamlined Energy & Carbon Reporting (SECR), Mandatory Greenhouse Gas Reporting (MGHGR), Energy Savings Opportunity Scheme (ESOS), GHG Protocol, ISO 14064, PAS 2060, ISO 50001, Net-Zero Standard, The Climate Change Agreement (CCA), The Environmental Permitting Regulations (EPR), The Medium Combustion Plant Directive (MCPD), EU Emissions Trading Scheme (EU ETS), The UN Global Compact, The Sustainable Development Goals (SDGs), EcoVadis, The Global Reporting Initiative (GRI), The Task Force on Climate-related Financial Disclosures (TCFD), FTSE4Good, The Dow Jones Sustainability Indexes (DJSI), Sustainability Accounting Standards Board (SASB), CDP, Climate Disclosure Standards Board (CDSB), Principles for Responsible Investments (UN PRI), Green Taxonomy, BREEAM, Global Real Estate Sustainability Benchmark (GRESB), and Leadership in Energy and Environmental Design (LEED) (Ecoact, 2022).

As indicated above, there are numerous initiatives and standards that strive to push companies to disclose their impact on the overall society. Some of the above standards do not apply to all companies and industries. Nevertheless, the list of the different frameworks and standards illustrates why it can be challenging to compare non-financial data across companies, as there is no universal framework or standard for all firms. However, some initiatives aim to develop a universal framework for all firms, to allow stakeholders to compare firms in measurable units across different countries, sectors, and industries. The impact-weighted accounts project at Harvard Business School is one of the efforts to measure companies' social and environmental impact on society. As such, they have proposed the concept of impact-weighted accounts. The aspiration is an integrated performance measure allowing investors and managers to make informed decisions based on monetary gains and losses, and the impact a company has on the border society (Serafeim et al., 2019).

2.4 Emergence of impact-weighted accounts

In September 2019, the project on the impact-weighted accounts published their first research paper on the topic, where they proposed several benefits of impact-weighted accounts for investors and companies. Since that time, the team of the project has published seventeen papers about the methodology of monetizing impact accounts across environmental, employee, and product impact. However, the research on impact-weighted accounts is limited. There are few papers provided by other researchers than the impact-weighted account project team. As such, this thesis aims to bring insight to the literature. Our goal is to provide a deeper insight into impact-weighted accounts and its relevance to the value of a firm. The aspiration of an accounting system that considers a company's impact might be the missing piece for an impact economy. That is because the data can be used to create incentives for companies to improve impact (e.g., through governments and regulations that can tie tax rates or procurement requirements to impact-weighted accounts). As such, by implementing impact-weighted accounts, companies might understand that every action has a consequence and that all companies produce a positive or negative impact on the planet.

In the absence of impact-weighted accounts, it is plausible most companies regard social and environmental impact considerations as philanthropic and volunteering. Instead of being at the stage where sustainability is incorporated into companies' corporate strategy with sophisticated KPIs to prove how the company is developing and where the company strives to create shared value, it is plausible the majority of companies are at the stage where sustainability is something that they do in order to attract investors. This is the stage where sustainability is incorporated into the strategy, but there is a lack of a sustainability management system that measures companies' impact (Rangan et al., 2015). As such, impact-weighted accounts might increase the salience of business impact and make it an obligation for companies to report their impact. In such a case, it is plausible all companies with such an obligation will be at the stage where the companies strives to create shared value.

As a result of the climate crisis we are facing today, the effort to reduce and managing the environmental and social impacts of corporate activities is receiving rising attention, where the recurring warnings from the World Economic Forum and investors serve as an example (Value Balancing Alliance, 2021). In Europe, this has developed further with the Green Deal and a comprehensive set of policies and regulations provided by the EU Commission. The EU Taxonomy regulations and the Non-financial Reporting Directive (NFRD) revision are two examples that support the transition towards a more sustainable economy. Nevertheless, corporate reporting and disclosures are only at the surface. One of the main remaining challenges is to generate reliable information to manage environmental and social impacts better. This is related to the challenge of accounting and reporting that support today's economy, where the ecological and social impacts are not integrated (Value Balancing Alliance, 2021).

Due to the ongoing impact-weighted account project at Harvard Business School, several companies have tried to incorporate impact-weighted accounts in their annual report. Examples of companies reporting impact-weighted accounts in their annual report 2020 are Summa Equity and Acciona. We believe this project provides interesting knowledge, and the fact that it is already in use in some companies is promising.

3 Development of hypothesis

To answer our research questions; *"Whether and how the environmental impact of firms, measured by their impact-weighted accounts, is related to their stock prices"*, we have developed three hypotheses. In this chapter, we discuss and explain the motivation of each hypothesis.

3.1 Environmental impact and value relevance

Companies' environmental impacts have become a central societal consideration, thereby affecting how various stakeholders perceive an organization and its impacts on the environment. Current knowledge demonstrates that investors view environmental impact as a financial matter (Freiberg et al., 2021; Miralles-Quiros et al., 2017; Yadav et al., 2016) and therefore, one could expect that firms with more negative environmental impact exhibit lower corporate market valuation (Freiberg et al., 2021). On the other hand, other studies have found a negative relationship (Brammer et al., 2006; Griffin and Mahon, 1997; Madorran and Garcia, 2016; Seifert et al., 2003; Teoh et al., 1999). Hypothetically, the environmental impact of a firm should be value relevant, either positively or negatively, since it includes important information regarding a firm's impact on the environment. It is plausible investors perceive positive environmental impact as a positive factor when valuing firms because it is likely these firms are causing less damage to the environment. Furthermore, firms with positive environmental impact could avoid sustainability-related cash outflows due to violations of certain regulations (e.g., The EU taxonomy or carbon emission fees) to a greater extent. As such, creating a positive environmental impact could positively affect a firm's income and/or performance, or create a competitive advantage. On the other hand, creating a negative environmental impact could negatively affect a firm's income and/or performance as they could be exposed to cash outflows since they might not comply with certain regulations. Additionally, in a society where the interest in measuring and analysing environmental impact has grown exponentially, firms creating negative environmental impact could affect how long-term investors view such companies' attractiveness.

We find it plausible to believe that the environmental impact of a firm, either positively or negatively, is of importance when investors value a firm. Furthermore, it is plausible having a more negative environmental impact is negatively related to the stock price of a company, consistent with investors who are more likely to favor and attain long-term support for companies that adopt social responsibility practices (Nguyen, 2020).

Based on the discussion, we will investigate the following hypothesis:

Hypothesis I: *The environmental impact of firms is associated with their stock prices.*

As indicated in the previous discussion, the environmental impact of a company is viewed as a financial matter for investors. Therefore, we expect a company's negative environmental impact to have a negative association with the value of a company. As such, we will investigate the following hypothesis:

Hypothesis II: *The environmental impact of firms is negative associated with theirs stock prices.*

3.2 Time variation and value relevance of environmental impact

Freiberg et al. (2021) investigate whether market prices reflect environmental intensity (i.e., environmental impact), and find a moderate, yet significant relationship between environmental intensity and valuation multiples. Additionally, the study by Freiberg et al. (2021) demonstrates that the negative association between environmental impact and market valuation has become more pronounced in recent years. These results are reasonable due to investors increased awareness and interest in companies' environmental information (Amel-Zadeh and Serafeim, 2018; Freiberg et al., 2021; Kaspereit and Lopatta, 2016; Marsat and Williams, 2011; Miralles-Quiros et al., 2017; Panwar et al., 2006).

On this basis, our study hypothesizes that:

Hypothesis III: *The value relevance of firms' environmental impact has increased over time.*

4 Data

In the following chapter, we describe the data sources used and briefly describe the type of data used. Further, we will go deeper into the data from the impact-weighted accounts initiative to define and describe the main characteristics of the data sample.

4.1 Data sources

The data we have used in this thesis are obtained from two sources; data provided by the impact-weighted accounts initiative at Harvard Business School through Freiberg et al. (2020) and financial information collected from Refinitiv Eikon. The data from the impact-weighted accounts initiative are used to define the environmental impact variable. The data for all the control variables are obtained from Refinitiv Eikon. The companies in our data sample are defined by the sample provided in Freiberg et al. (2020).

4.2 Panel data

Our data sample is described in detail in Freiberg et al. (2021), and contains 14,096 observations. We arrive at our final sample by starting with the environmental impact data, which covers 2,494 firms across 68 countries over a period from 2010 to 2019. We match these data with data from Refinitiv Eikon and require positive book values. Thereafter, two companies with missing variables on the data from Refinitiv Eikon are removed, and then we obtain a final sample of 13,923 observations. Our final sample represents 2,492 unique companies from 68 different countries, and 11 industries over a period from 2010 to 2019. Table I provides an overview of how the companies in our sample are structured between 2010 to 2019, across industries, and across countries, respectively. As such, the data is structured as panel data. The data sample is structured as an unbalanced panel because of missing observations in data obtained by Refinitiv Eikon, and not every firm exists in every year from 2010 to 2019. Regardless of the unbalanced data, we regard the sample to be valid due to the high number of observations.

[Table I about here]

4.3 Data collected from the impact-weighted accounts initiative

Data from the impact-weighted accounts initiative provides comparable monetary, environmental impact estimates for a great number of companies from different industries and countries from 2010 to 2019. That being the case, environmental intensity, referred to as environmental impact, is documented for several companies at a comparable level. For simplicity and consistency in the methodology by Freiberg et al. (2021), we use the environmental impact data by Freiberg et al. (2020) to capture comparable monetized environmental impact.

To measure an organization's environmental impact from operations, Freiberg et al. (2021) use scientifically based methodologies to transform outputs into impacts and monetization factors from the Environmental Priority Strategies database, Available Water Remaining (AWARE) Model, and Waterfund. Additionally, they use organization level data of environmental outputs (e.g., carbon emissions, nitrous oxide, etc.) that are direct results of an organization's operations, and water withdrawal and discharge, sourced from Bloomberg and Thomson Reuters. Comparing companies of different sizes, Freiberg et al. (2020) scale their calculations for total organization environmental impact by sales and operating income as proxies for size. The scaling is defined as environmental intensity and provides an estimate for environmental damage per unit of sales or operating income (Freiberg et al., 2021).

Emission and water use data at the organization-level are acquired from both Bloomberg and Thomson Reuters for years 2010 to 2019 (Freiberg et al., 2021). Freiberg et al. (2021) collects four emissions variables and two water use variables: total greenhouse emissions (i.e., seven gasses covered by the UNFCCC referred to as GHG total), nitrogen oxide (NOx), sulfur dioxide (SOx), volatile organic compound (VOC), and water withdrawal and water discharge. Data points that are not available from Bloomberg or Thomson Reuters are retrieved from Exiobase. The Environmental Priority Strategies database provides publicly available, scientifically based methodology to transform the direct results of operations for an organization (i.e., outputs such as emission) into their impacts (Freiberg et al., 2021). The AWARE model provides supplemental water monetization factors that represent available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystems demand is met (Freiberg et al., 2021). Waterfund is a source for measuring global water prices and is used to calculate the environmental impact of water. The environmental impact of water is the sum of water production and delivery scaled by water consumption and scarcity (i.e., AWARE factor), and wastewater treatment scaled by water consumption.

The dataset is derived from organizations within the Bloomberg ESG Index for only organizations with a market capitalization of greater than 100 million USD (Freiberg et al., 2021). Data collected from 2010 to 2019 from Bloomberg ESG Index captures 9,714 organizations, resulting in 97,140 organization-year observations. Of the 97,140 observations, only 18,202 had GHG total data from Bloomberg ESG Index. Therefore, data from Thomson Reuters´s Asset4 ESG database is also used to expand the quantity of environmental data.

As indicated earlier, environmental data (e.g., ESG data) can vary from one provider to another. This type of variation is found in Freiberg et al. (2021) collection process of data, where reported values do not match the organization's sustainability reports. Therefore, Freiberg et al. (2021) removes obvious outliers reported by Thomson Reuters and Bloomberg and restricts their sample to observations that reports GHG total data from either Bloomberg or Thomson Reuters. These adjustments results in 24,276 organization-year observations.

For missing values of the 24,276 observations, Freiberg et al. (2021) use industry-

country emission data from Exiobase, which provides estimates of emissions and resource extraction by industry. To adjust for the industry-specific estimates from Exiobase to organization-level values, the industry-level values are scaled by the ratio of organization revenue to total industry output in a given year, up to the year 2016, which is the latest year for Exiobase data. Lastly, to ensure robustness and reliability of the results, Freiberg et al. (2021) restricts their sample to observations with less than 25% imputed contribution to environmental impact, and the final sample results in 14,096 observations.

Finally, the environmental impact of a firm i in year t is the sum of the environmental impact of emissions (i.e., reported emission of an organization from the Environmental Priority Strategies database) and the environmental impact of water (i.e., Waterfund's global average price for water and AWARE factors for measuring water scarcity).

5 Methodology

In the following chapter, we will discuss the methodology of our data sample. We will also discuss the models used and comment on their strengths and weaknesses.

The goal of our master thesis is to examine whether and how the environmental impact of firms, measured by their impact-weighted accounts, is related to their stock prices. As we seek to clarify the phenomenon of impact-weighted accounts and its value relevance to the value of a firm, we follow an explanatory research methodology. Explanatory research seeks to gain insight into a topic and to clarify an understanding of an issue or phenomena (Saunders et al., 2016). Our goal is, therefore, not to draw inferences on causal relationships but to draw inferences on the association between firms' environmental impacts and values.

5.1 Models

Panel data structure is an essential factor to consider when selecting models. Panel data contains information about the cross-section and about time-series. Hence, inferences are obtained using more information than just cross-section or just time-series data. It also provides a greater capacity for capturing the complexity of human behavior (e.g., constructing and testing more complicated behavior hypothesis, controlling for omitted variable bias, and generating more accurate predictions) (Hsiao, 2007). On the other hand, there are also limitations when using panel data. A typical limitation of using panel data is that the data often is obtained through surveys, interviews, and questionnaires, which often are costly. Further, there are limitations to the execution of surveys, interviews, and questionnaires (e.g., lack of responsiveness, typos in the interpretation of the results, bias in response of the individuals and/or the companies in the sample) that can prevent researchers of creating data set of a high quality (Anchev, 2018). Nevertheless, as described earlier, the data used in this thesis is not obtained through surveys, interviews, or questionnaires. As such, none of the problems described appears in this thesis.

To answer the research questions, we choose to base one of our models on the Ohlson (1995) model because this is a theoretical model about the relation between stock prices and earnings, and book values. As such, the Ohlson (1995) model allows us to examine the value relevance between accounting values and firm values. Furthermore, we will also estimate various types of regressions models, such as models with different combinations of fixed effects and Fama and MacBeth (1973) models. The fixed effects models allow us to exploit the variation in our variables over time for a given firm. The Fama and MacBeth (1973) models extend our interpretation of the Ohlson (1995), and allow us to study the relation between firms' values and environmental impact.

5.1.1 Ohlson model

The market value of equity has been widely accepted as an indicator of the value of a company in financial literature. Ohlson (1995) proposed a model for the valuation of listed companies based on this premise, where the market value of equity to a given company is a function of the company's financial information. The model expresses the value of a firm as a linear relationship between the book value of equity and earnings (Ohlson, 1995). The price model has appealing features and offers a suitable point of reference when conceptualizing how the market price of equity is related to accounting variables. However, the return model by Easton and Harris (1991) can also be adopted when investigating the value relevance of accounting variables. Nevertheless, the pricing model has advantages since the model is better specified economically due to the estimated slope coefficients are less biased compared to the return model (Kothari and Zimmerman, 1995).

One of the models we have adopted in our analyses follows Ohlson (1995). The price model has been extensively used in previous studies investigating the value relevance of accounting variables. However, non-financial information, such as the environmental and social information about a firm, is also considered relevant for the pricing model and has been used extensively within the field of CSR research (e.g., Sinkin et al. (2008)).

Since the goal of our study is to investigate the value relevance of an accounting variable, we consider the Ohlson (1995) model as the appropriate model to

adopt in our study. However, Barth and Clinch (2009) proposed a modified version of Ohlson (1995) with scaling of the variables in the initial model, using the number of outstanding shares. From that study, Barth and Clinch (2009) concluded that a model with price specification mitigates the scale effects effectively, while maintaining the significance of the variables being studied. Therefore, our study aims to evaluate the value relevance of the environmental impact of a company on the stock price of that company. The Ohlson (1995) price model is stated as follows:

$$StockPrice_{it} = \beta_0 + \beta_1 EPS_{it} + \beta_2 BVPS_{it} + \epsilon_{it} \quad (1)$$

To achieve our objective, we have added environmental impact (represents a company's positive or negative impact based on the methodology described in the previous section) as a variable in the pricing model to analyse whether this information is relevant to the stock price of a company, in addition to the other accounting information. The price model, including the environmental impact variable, is stated as follows:

$$StockPrice_{it} = \beta_0 + \beta_1 Env.IMPACT/Assets_{it} + \beta_2 EPS_{it} + \beta_3 BVPS_{it} + \epsilon_{it} \quad (2)$$

$$StockPrice_{it} = \beta_0 + \beta_1 Env.IMPACT/Sales_{it} + \beta_2 EPS_{it} + \beta_3 BVPS_{it} + \epsilon_{it} \quad (3)$$

were StockPrice_{it} is the market price per share for firm i at the end of year t; EPS_{it} is the earnings per share for firm i at the end year t; BVPS_{it} is the book value per share for firm i at the end year t; $\text{Env.IMPACT/Assets}_{it}$ is environmental impact scaled by assets for firm i at the end year t; $\text{Env.IMPACT/Sales}_{it}$ is environmental impact scaled by sales for firm i at the end year t; ϵ_{it} is the error term for firm i at the end year t.

In model (2), we choose to scale environmental impact on assets instead of earnings which is used by Freiberg et al. (2021) (i.e., operating income), since total assets is a better proxy for size than any type of earnings. Additionally, earnings are seasonal and can vary a lot over time which will have an effect on the ratio. Since we want most of the variation in our ratio to come from the numerator and not the denominator, we will use total assets instead of earnings to scale environmental impact. Firstly, we expect β_1, the estimated coefficient on

Env.IMPACT/Assets$_{it}$ and Env.IMPACT/Sales$_{it}$ to be statistically significant, and as such, support our Hypothesis I. Secondly, we expect β_1 to have a positive value, supporting our Hypothesis II.

The models above represents pooled regression models since it does not properly account for the structure of the data: firm i, year t. To fully exploit the richness of the data, we want our model to account for the fact that the data contain repeated observations over time for the same unit (same firm over time). Such a model allows us to study relations between variables in the cross-section of firms, over time for the same firm, or both.

To better handle more complex data, we will also use a fixed effect model that allows us to consider a combination of cross-sectional and time-series data in a single test. The fixed effect model allows us to control for time-invariant unobservable firm characteristics (company effect) in addition to the endogenous nature of the explanatory variables (Aureli et al., 2020).

5.1.2 Fixed effect model

Since our data is structured as panel data, we will also examine the behavior of the entities across time. The common techniques used when analysing panel data are models with fixed effects and random effects. We will include the fixed effects model in our analyses, since the random effects model makes strong assumptions and is rarely used in research in finance, accounting, or business (Midway, 2022). Furthermore, the fixed effect model allows us to exploit the variation in the variables over time for a given firm, and to control for the unobservable characteristics that were fixed during the year.

The fixed effect model assumes that each entity has its own individual characteristics that may or may not influence the dependent variable. Therefore, we need to control for this (Torres-Reyna, 2007). By using fixed effects, the effect of the time-invariant unobservable characteristics is removed to be able to assess the net effect of the independent variables on the dependent variable. To control for variation across entities, the model has a entity-specific intercept captured by $\beta_0 + \beta_4 Z_i$ (Hanck et al., 2016). Our regression with fixed effects is the following:

$$StockPrice_{it} = \beta_0 + \beta_1 Env.IMPACT/Assets_{it} + \beta_2 EPS_{it} + \beta_3 BVPS_{it} + \beta_4 Z_i + \epsilon_{it} \quad (4)$$

$$StockPrice_{it} = \beta_0 + \beta_1 Env.IMPACT/Sales_{it} + \beta_2 EPS_{it} + \beta_3 BVPS_{it} + \beta_4 Z_i + \epsilon_{it} \quad (5)$$

The Z_i present the unobserved time-invariant heterogeneity across the entities in our sample.

5.1.3 Fama and MacBeth

Our overall goal is to identify whether and how the environmental impact is related to the stock price of a given firm. In the previous discussion, we mentioned that the stock price of a company is a good measure to use when analysing the value relevance of accounting variables. However, Tobin's Q can be used as a proxy for firm value.

The Fama and MacBeth (1973) model is commonly used for identifying patterns in the cross-section of stock returns (e.g., Heston and Sadka (2008)). The Fama and MacBeth (1973) regression is a two-step procedure. When estimating such a model, we start to estimate regressions at the end of each time period, with the characteristic of a certain stock as the dependent variable. After that, we estimate the characteristics of that stock as the independent variable. The estimated coefficients on each dependent variables can be different at the end of each time period since we estimate the cross-sectional regression and time-series regression in two different steps. The reported coefficients are typically equally weighted time series means of these coefficients (Anchev, 2018). As such, the standard errors are based on the time-series of the estimated coefficients over all periods. These standard errors are adjusted for the cross-sectional correlation of the error terms, but they are not adjusted for their auto-correlation. To adjust for both heteroskedasticity and auto-correlation with a maximum time lag order of one or more time periods, Newey-West standard errors are commonly used (Petersen, 2009).

Fama and MacBeth (1973) models allow us to analyse how much of the environmental impacts of firms are driving their stock prices and Tobin's Q. The advantage of the Fama and MacBeth (1973) regression models is that they can provide marginal effects for many independent variables. Further, precise inference about the functional forms of the relation between the environmental impacts of firms and their stock prices and Tobin's Q can be made. However, the results from the regression estimated with equally weighted observations can be influenced by the large number of small-cap stocks, which usually have more extreme characteristics. Since the characteristics of certain stocks can be extreme, the results from the Fama and MacBeth (1973) models can be sensitive to the presence of stocks with such characteristics (Anchev, 2018). We will include Fama and MacBeth (1973) regressions models in our analyses to analyse how much a firm's environmental impact is driving the stock price and Tobin's Q. We will also use Neway-West standard errors to adjust for heteroskedasticity and auto-correlation.

5.2 Descriptive statistics

Table II presents the descriptive statistics. The variable environmental impact scaled by sales and assets is our main variable of interest. As expected, both variables have a negative mean, which indicates that the average company in our sample has a negative environmental impact. The minimum environmental impact scaled by sales and assets is -2.45, and -4.46, respectively. Furthermore, the maximum value for the environmental impact scaled by sales and assets is 1.90, and 1.00, respectively. This indicates that some of our observations have a positive environmental impact. Having positive environmental impact is rare, but it can be caused by two distinct scenarios: a firm led carbon offset effort, or the observations of NOx and SOx emissions were large in volume. In the latter scenario, where NOx and SOx have a cooling effect, which can offset the warming effect of carbon emission, resulting in a positive environmental impact. Freiberg et al. (2021) argues that positive impact could also be due to discrepancies in reporting. For example, a company might report water discharged and withdrawn in different units, which could result in skewed positive values (Freiberg et al., 2021).

As indicated in the previous section, we use Ohlson's (1995) valuation model to examine the value relevance of the environmental impact of firms. For that reason, the book value of equity, the market value of equity, share price, and stock returns are important variables. As mentioned in section 4.2, we have excluded all the negative observations of the book value of equity in our sample. Therefore, the Book Value Per Share (BVPS) variable will not contain any negative observations. The BVPS is skewed because most of the observations are centered closer to the minimum value than the maximum value. It is expected to have a skewed book value of equity when analysing several companies with different sizes from different countries and industries. To obtain a variable that is closer to a normal distribution, we take the natural logarithm of the BVPS. Skewness is also expected for the variables total assets and market value of equity. As such, Tobin's Q is also expected to be skewed. To obtain variables that are closer to a normal distribution with a bell shape, we take the natural logarithm of Tobin's Q.

The average stock price from 2010 to 2019 is 81.80, with a standard deviation of 1,529.22. We observe that the stock price for most of the observations is between 3.94 and 40.88, which represents the 25 percentile and the 75 percentile. However, we observe some extreme outliers, which are as expected when analysing companies from different countries with different sizes and industries over 10 years period. The extreme outliers are investigated and are in accordance with our expectations. Therefore, we take the natural logarithm of the variable StockPrice.

[Table II about here]

5.2.1 Pearson's correlation matrix

Table III presents Pearson's correlation matrix. From the results provided in this table, we will highlight the high correlation between environmental impact scaled by assets and environmental impact scaled by sales. Further, we would also like to comment on the high correlation between the stock price of a given firm and the book value per share. The high correlation for the latter variables is as expected since the book value and market value of a company are closely related.

We have also investigated the correlation matrix with Tobin's Q as the dependent variable. The results from the correlation matrix do not provide any notable changes from the above correlation matrix. Therefore, we choose not to present these results.

[Table III about here]

6 Results

In this chapter, we present the results from our regression models with the intention of verify our hypotheses and establishing a conclusion. We start to use the Ohlson (1995) model, and the Fama and MacBeth (1973) model to examine the interaction of environmental impact with the stock price and Tobin's Q. Further, we examine the value relevance of environmental impact by controlling for year- and industry- fixed effects. Then, we will discuss the models' validity and comment on their robustness.

6.1 Regression results

In the following section, we present the results from our regression models with the objective of establishing conclusions to our research questions and hypothesis.

6.1.1 Ohlson model

The regression results in Table IV, Panel A, illustrate that the coefficient on environmental impact scaled by assets is positive and statistically significant at all significance levels. As expected, we also see that the coefficients on BVPS and EPS are positive and significant at all significance levels. These results indicate companies with a more negative environmental impact have a lower stock price. The t-statistics are calculated using robust standard errors to correct for heteroscedasticity.

[Table IV, Panel A about here]

We run the same regression model discussed above, except we scale environmental impact by sales. As illustrated in Table IV, Panel B, the coefficient on environmental impact scaled by sales remains roughly the same as the one on the environmental impact scaled by assets. This result is expected since the correlation between total environmental impact scaled by sales and assets is high at 0.82 (Table III). Nevertheless, the coefficient on environmental impact scaled by sales is slightly higher than the coefficient on environmental

impact scaled by assets. We also observe that the t-statistics are higher compared to Table IV, Panel A. Furthermore, the adjusted R-squared is slightly higher in Table IV, Panel B at 66.95%, compared to 66.65% in Table IV, Panel A.

[Table IV, Panel B about here]

The results provided by the simple Ohlson (1995) model in Table IV, Panel A and Panel B, are significant at all significance levels, indicating environmental impact plausibly could be relevant to the stock price of a company. Furthermore, the coefficient on environmental impact scaled by assets and sales is positive, indicating a more negative environmental impact could have a negative influence on the stock price of a company. Hence, our results seem to support Hypothesis I and Hypothesis II.

Since the results in the tables above are very similar, for brevity, in the remainder of the thesis, we present only the results with environmental impact scaled by sales.

As mentioned earlier, Tobin's Q could be used as a proxy for firm value. Table V presents the results obtained with Tobin's Q as the dependent variable. As expected, the models adjusted R-squared is significantly lower than the model using the stock price as the dependent variable. The results obtained on the coefficients remain similar as the results obtained above.

[Table V about here]

In Table VI, we extended our model by including the variables leverage, size, dividends, book-to-market, PPE-to-assets, intangible assets-to-assets, CAPEX-to-assets, and return on assets as control variables. The leverage variable is measured as the ratio of total debt to total equity, and the size variable is measured by the natural logarithm of total assets. Prior literature suggests that such accounting variables can have an influence on the stock price (eg.,(Amir and Lev, 1996; Barth and McNichols, 1994; Carnevale and Venturini, 2012; Chen and Zhang, 2007)). It is, therefore, necessary to analyse if the effect of

environmental impact on stock price holds after including those variables.

The results obtained when including additional control variables are presented in Table VI. As we can see in this table, the results obtained on the environmental impact scaled by sales are the same as those obtained initially. Therefore, the conclusion presented previously holds. The results show that investors positively value companies with a positive environmental impact.

Furthermore, the results obtained on the control variables seem reasonable. The coefficient on leverage, book-to-market, and intangible assets-to assets is negative. It is plausible that a higher leverage ratio adversely influences a company's market value. In addition, a higher book-to-market ratio could indicate that a company is undervalued or financially distressed, which is expected to have an adverse influence on the stock price. Nevertheless, the intangible assets-to-assets ratio is often company and industry-specific. Therefore, it is difficult to determine if the results obtained with respect to this variable are expected or not. Since the companies in our data sample are from various industries all over the globe, we believe the results obtained on the variable are reasonable. The variables size, dividends, PPE-to-assets, CAPEX-to-assets, and return on assets is positive. The results obtained seems reasonable except for the PPE-to-assets ratio, which is also company and industry-specific. Therefore, it is difficult to determine if the results obtained on this variable is reasonable or not. The coefficient on dividends is also positive and indicates higher dividend payout is positive for the stock price. These results are reasonable in terms of expectations of next year's dividends payout, but not for immediate reactions on the stock price.

[Table VI about here]

Table VII presents how the value relevance of environmental impact, on average, has developed over time. As we can see from this table, the coefficient on environmental impact during the first half of the sample period is 0.280, whereas the coefficient during the second half is 0.831. Therefore, these results indicate the value relevance of environmental impact has slightly increased over time. Hence, support our Hypothesis III.

The regression model in Table VII estimates average effects across time, industries, firms, and countries. Therefore, the model does not account for fixed effects independent of time (e.g., time unit-specific effects). We will address this issue in the estimated fixed effects model later in this section.

[Table VII about here]

6.1.2 Fama and Macbeth regression models

To analyse how much a firm's environmental impact is driving the stock price and Tobin's Q, prior literature has typically used Fama and Macbeth regressions (e.g., Fiskerstrand et al. (2020); Gibson et al. (2019); Halbritter and Dorfleitner (2015); Mănescu (2011)).

As previously discussed, Fama and MacBeth (1973) regression models is commonly used for identifying patterns in the cross-section of stock returns. Since stock price and Tobin's Q are relevant measures when analysing value relevance, we will use the Fama and MacBeth (1973) regression models to evaluate the relation between environmental impact and stock price, and between environmental impact and Tobin's Q. To adjust for heteroskedasticity and auto-correlation, we use the Newey-West standard errors.

The results obtained from the Fama and MacBeth (1973) regressions are presented in Table VIII. Table VIII, Panel A, presents the Fama and MacBeth (1973) regression model where the stock price is the dependent variable. As we can see from this table, the results obtained on the coefficient on the environmental impact are positive, and the effect on the stock price remains similar to previously results obtained from the other models analysed. Nevertheless, our results are statistically significant at the 10%. Therefore, the null hypothesis that the coefficient is equal to 0 can be rejected with 90% confidence. The results obtained from the Fama and MacBeth (1973) model in Table VIII, Panel A, indicate the same conclusion as provided from Ohlson's model but with a lower level of significance. Further, the association between environmental impact and stock price is weaker in this model than in Ohlson's model.

[Table VIII, Panel A about here]

Table VIII, Panel B, presents the Fama and MacBeth (1973) regression model where Tobin's Q is the dependent variable. Tobin's Q is defined as the ratio of the market value of equity to total assets. As we can see from this table, the coefficient on environmental impact remains positive and is statistically significant at all relevant significance levels. Nevertheless, the coefficient on

environmental impact is only 0.090. Therefore, the effect of environmental impact on Tobin's Q is lower than the effect of environmental impact on the stock price.

[Table VIII, Panel B about here]

6.1.3 Fixed effects

As mentioned in chapter 5, the fixed effects model allows us to control for the time-invariant unobservable characteristics to assess the net effect of the independent variables on the dependent variable. Table IX presents the correlation between the Env.IMPACT/Sales at time t and Env.IMPACT/Sales at time t-1, denoted as Lag.Env.IMPACT/Sales. This table allows us to analyse the variation of the environmental impact over time.

As we can see from Table IX, the correlation between the variables is high at 0.9196. As such, the environmental impact for a given firm is sticky and does not change much over time. Therefore, we will focus on studying the variation across firms and control for industry-fixed effects.

[Table IX about here]

Table X presents the fixed effects model, where we control for industry-fixed effects. As we can see from this table, the results obtained on the environmental impact remain positive and significant at all significance levels. Therefore, the conclusion presented previously holds, that the environmental impact is relevant for firms' stock prices, and a more negative environmental impact is negatively associated with firms' stock prices. Hence, our results support Hypothesis I and II. Further, the effect of environmental impact is stronger when controlling for industry fixed effects. Nevertheless, the coefficient on the additional control variables, leverage, dividends, book-to-market ratio, PPE-to-Assets ratio, and Intangible Assets-to-assets ratio, is negative. The model's adjusted R-squared is at a level of 27.15%.

[Table X about here]

Table VII presents how the value relevance of environmental impact, on average, has increased over time. However, the regression model presented in this table estimates average effects and does not control for the individual-specific, time-invariant characteristics. Therefore, we have included a model that controls for such characteristics in Table XI. As we can see from this table, we control for year- and industry-fixed effects.

The results obtained in Table XI are almost identical to the results obtained in the model presented in Table VII. Therefore, the conclusion obtained previously holds, that the value relevance of environmental impact has increased over time. Hence, support our Hypothesis III. The model's adjusted R-squared are 25.03% for 2010-2015 and 30.26% for 2016-2019.

[Table XI about here]

6.2 Discussion of results

The general results obtained from our analyses is that the coefficient on environmental impact is positive and statistically significant. Our results suggest that firms' environmental impact is associated to their stock prices and Tobin's Q. These results are in accordance with the findings obtained from Freiberg et al. (2021), Miralles-Quiros et al. (2017), and Yadav et al. (2016), indicating investors view environmental impact as a financial matter when assessing the value of a company.

Based on our analyses, we find that a more negative environmental impact is associated with lower stock prices and Tobin's Q. Thus, our analyses indicate that investors positively view companies with positive environmental impacts and negatively view companies with more negative environmental impacts. Similar to Freiberg et al. (2021), our results suggest that firms with a more negative environmental impact exhibit lower corporate market valuation. A lower corporate market valuation for firms with negative environmental impact could indicate that these firms are causing more damage to the environment than firms with less negative– or positive environmental impact. Moreover, companies with a more negative environmental impact might also be perceived as riskier than those with a less negative- or positive environmental impact (Bachoo et al., 2013). According to the findings by Sutopo et al. (2018), it is plausible that a more negative environmental impact could indicate that the future prospects of a firm are not in favor of sustainability development. As such, investors might perceive such firms either riskier today, as well as in the future, or investors believe that climate change is not a priority for those firms (Coppola et al., nd).

As discussed in chapter 2, it has previously been claimed that socially responsible activities are costly for shareholders (Palmer et al., 1995). However, our findings suggest that the benefits of having less negative- or positive environmental impact seem to outweigh the costs. If companies with less negative- or positive environmental impact exhibit higher corporate market valuation, it could mean that the cost associated with having positive environmental impact (e.g., more sustainable operations or doing reforestation) is lower than the benefits

investors believes it provides the company. We also discussed the findings by Nguyen (2020) on firms' sustainability reporting. The findings by Nguyen (2020) suggest that firms with a higher GRI adherent levels tend to have lower corporate values than those with lower GRI adherent levels. Nguyen (2020) explains that this negative association might come from incomplete sustainability reporting, along with self-centeredness and insincerity from those who produce sustainability reports (Aras and Crowther, 2009; Gray, 2006; Unerman et al., 2007). If impact-weighted accounts lead to more informed decisions and higher quality in sustainability reporting due to an increase in relevance, reliability, and comparability, then incomplete sustainability reporting, along with self-centeredness and insincerity from those who produce sustainability reports, might change the results discussed in chapter 2 (Aras and Crowther, 2009; Gray, 2006; Nguyen, 2020; Unerman et al., 2007). For example, the findings by Bachoo et al. (2013) suggest that higher quality on sustainability reporting decreases investors' perception of a firm's riskiness. As such, if the explanations by Aras and Crowther (2009), Gray (2006), Nguyen (2020), and Unerman et al. (2007) concerns quality of reporting, then impact-weighted accounts could potentially correct for this in their findings.

Furthermore, we also find that the value relevance of environmental impact, on average, has increased over time. Our results demonstrate that the value relevance of environmental impact has become more pronounced from 2016 to 2019, than from 2010 to 2015. These results are consistent with the findings by Freiberg et al. (2021). We obtain the same conclusion when controlling for industry-fixed effects. The results obtained are expected, given the increased interest in measuring and analysing the environmental impact, as well as the evidence that various stakeholders have pressured companies to act on climate change in recent years (Coppola et al., nd; Freiberg et al., 2021).

Overall, our results support all three hypotheses. Our findings suggest that the environmental impact of firms, measured by their impact-weighted accounts, are value relevant, and that firms with a more negative environmental impact exhibit lower corporate market valuations. Finally, our results suggest that the environmental impact of firms is more pronounced in the second half of our sample period.

6.3 Validity

In the following section, we discuss the validity of our empirical analyses. We have carefully evaluated our models' validity based on near multicollinearity, measurement error, and omitted variable bias. Some of the relevant threats to validity are partly examined in section 5.2.1.

6.3.1 Multicollinearity

Multicollinearity could appear in two different forms: perfect multicollinearity and near multicollinearity. Perfect multicollinearity occurs when there is a perfect correlation between one or more explanatory variables. Near multicollinearity appears when there is a non-negligible but not a perfect correlation between one or more explanatory variables (Brooks, 2008). The problem with multicollinearity is that the regression model could have a high R-squared and the individual coefficients could have a high standard error, so the model looks good, but the individual variables are not significant. Further, the regression model could be very sensitive to changes in the explanatory variables, meaning a small change in the explanatory variables could lead to large changes in the coefficient value, or lead to significance in other variables. Lastly, multicollinearity could also make the confidence intervals very wide, leading to inappropriate conclusions (Brooks, 2008).

In section 5.2.1, we detected the correlation between the explanatory variables. From the analysis, we found a high correlation between the environmental impact scaled by assets and sales, and between the stock price of a given firm and the book value per share. In the first case, the high correlation between the variables is not addressed further since the variables are not used in the regression models at the same time. In the latter case, the explanatory variable correlates with the dependent variable. Therefore, we choose not to address the issue further.

6.3.2 Measurement error

A measurement error in the predictors causes biases in the estimated regression coefficients (Carroll et al., 2006). One of our data sources is provided by the impact-weighted accounts initiative at Harvard Business School through Freiberg et al. (2020). Therefore, we have used the data provided by Freiberg et al. (2020) to capture environmental impact and are using secondary data as one of our main data sources. The challenge with the use of secondary data is that it could cause some errors in measuring environmental impact since there is no standardized framework or methodology for capturing environmental impact. Hence, how to capture environmental impact in the most balanced and appropriate way cannot be fully known. However, to our best knowledge and in the absence of sophisticated and clearly defined ESG metrics, we believe that the methodology provided by the impact-weighted account initiative is currently the best effort in terms of capturing environmental impact in monetary terms.

6.3.3 Omitted variable bias

Omitted variable bias refers to bias in the coefficient estimates obtained from the regression model when important independent variables are omitted (Collot and Hemauer, 2021). If an independent variable is omitted, the variation would instead be part of the error term. Moreover, if the omitted variable is correlated with one or more independent variables, the error term will be correlated with one or more independent variables. As a result, such a correlation will lead to inconsistent estimates.

We carefully selected independent variables based on sophisticated economic models and evidence from previous research. The fixed effect model removes omitted variable bias by measuring changes within groups across time. However, it should be remained that the methodology used to measure environmental impact and whether and how environmental impact truly affects our dependent variables is not fully discovered. As a result, this issue could potentially lead to a decrease in the validity of our models.

6.4 Robustness check

The following section examines the robustness of our primary results by controlling for heteroskedasticity across the clusters in the sample (i.e., ISIN and countries). Further, we run a year-by-year regression model to examine the association between the independent variable of interests (environmental impact) and the dependent variable (stock price) through time. The robustness checks is included to examine if our results are robust to the possibility that one of the assumptions in the model might not be true (Huntington-Klein, nd).

6.4.1 Ohlson's regression model with clustered standard errors

Table XII, Panel A, presents the linear Ohlson's model with clustered standard errors by ISIN. The results obtained from this table remain positive statistically significant at all significance levels, similar to the results obtained from Table IV, Panel A. Further, in Table XII, Panel B, we analyse the linear Ohlson's model with clustered standard errors by country. The results obtained from this table also remain positive statistically significant at all significance levels, except for the EPS variable, which is significant at a 2.5% significance level. Nevertheless, we conclude that the presented analyses validate the robustness of our results.

[Table XII about here]

Table XIII, Panel A, presents the extended linear Ohlson's (1995) model with clustered standard errors by ISIN. The results obtained remains similar significance levels as the results obtained in Table VI. Therefore, the coefficient on environmental impact remains highly significant. Further, Table XIII, Panel B, presents the extended linear Ohlson's (1995) model with clustered standard errors by country. The results obtained are in accordance with previous results. The results obtained on the coefficient are still at a high level of significance. Therefore, the conclusion obtained previously holds, and these analyses validate the robustness of our observations.

[Table XIII about here]

6.4.2 Year-by-year regression

We examine the association between environmental impact and stock price through time to validate the consistency of the documented positive and increasing relationship between the coefficient on environmental impact and stock price. The year-by-year regressions are performed to confirm that the relation between environmental impact and stock prices has become stronger over time. Table XIV presents the separate year-by-year regressions models sorted by year. Figure 1 illustrates the development of the coefficient on environmental impact from 2010 to 2019. The results from Table XIV and figure 1 illustrate that the coefficient on environmental impact is positive for all years except for 2011. We also see that the development of the coefficient on environmental impact, on average, is increasing. The significance of the coefficient on environmental impact is weaker in the years 2010 to 2012, than from 2012 to 2019. The results obtained in Panel XIV are in accordance with the results obtained in Ohlson's (1995) model presented in Table VII and from the fixed effects model presented in Table XI. Hence, the results obtained illustrate that the relation between environmental impact and stock price is positive and has, on average, become stronger over time. Therefore, the conclusion of our hypothesis holds, that the increasing positive association between environmental impact and stock price is robust for the duration of our sample.

[Table XIV about here]

[Figure 1 about here]

7 Conclusion

The purpose of this thesis is to investigate whether and how the environmental impact of a firm, measured by their impact-weighted accounts, is related to their stock prices.

The panel data sample is obtained from two sources; data provided by the impact-weighted account initiative at Harvard Business School through Freiberg et al. (2020), and financial information collected from Refinitiv Eikon. The data from the impact-weighted accounts initiative through Freiberg et al. (2020) are used to define our environmental impact variable, which is matched with data from Refinitiv Eikon.

Our results suggest the coefficient on environmental impact is positive and highly statistically significant. Thus, our findings indicate that the environmental impact of firms is related to their stock prices and Tobin's Q. We have used the Ohlson (1995) model, Fama and MacBeth (1973) model and fixed effect model to answer our research questions. The Ohlson (1995) model has been applied in order to capture the value relevance of environmental impact as an accounting variable. Further, we have used a fixed effect model to consider a combination of both cross-sectional and time-series data in a single test. The fixed effect model allows us to examine the behavior of the entities across time. Lastly, we used the Fama and MacBeth (1973) model to identify patterns in the cross-section of stock prices and Tobin's Q, and analyse how much a firm's environmental impact is driving their stock price and Tobin's Q.

Our results indicate that the environmental impact, measured by impact-weighted accounts, is value relevant. Furthermore, our findings suggest that firms' negative environmental impact is negatively associated with their stock prices and Tobin's Q. We have repeated all our analyses with environmental impact scaled by assets, and the inference remains the same. Our findings are consistent with the findings by Freiberg et al. (2021), which serve as the central literature for this thesis. Moreover, our results are consistent with our initial thought that the environmental impact of companies has become a central consideration for investors in recent years, as well as how it relates to market

values. Our results also indicate that the environmental impact of firms is more pronounced for their stock prices and Tobin's Q for the second half of our sample period. Based on our results, the environmental impact of firms, measured by their impact-weighted accounts, is value relevant for their stock prices and Tobin's Q.

7.1 Limitations

We acknowledge that our thesis has certain limitations. Impact-weighted accounts are not yet a standardized framework or methodology for capturing environmental impact. As a result of solely relying on the environmental impact data provided by Freiberg et al. (2020), and data from Refinitiv Eikon, our data is subject to measurement error. The research on impact-weighted accounts is narrow, as well as the use of the framework. Therefore, our ability to generalize our findings and to draw inference conclusions is limited. In addition, the environmental impact data is not randomly drawn since it is limited to firms covered by the impact-weighted account initiative at Harvard Business School.

7.2 Implications, future research, and practice

Our research has implications for both investors and companies. As our results suggest, the environmental impact of firms is value relevant for their stock prices and Tobin's Q. For investors, impact-weighted accounts will contribute to a more transparent and comparable measurement of sustainability measures. In addition, it allows investors to make more informed decisions since the decision-making process will be less dependent on ESG rating agencies. From a company perspective, impact-weighted accounts will make it an obligation for companies to act and report on their impact on the overall society. Therefore, it is plausible all companies with such an obligation will be at the stage where the company strives to create shared value. In addition, the standard might prepare companies for new regulations (e.g., The EU Taxonomy for Sustainable Finance).

For future practice, we recommend the use of impact-weighted accounts by investors, companies, and regulators to monetize environmental impact in a scaleable and cost-effective manner to create greater transparency and comparability. The multiple measurement methods and calculations of ESG scores are considered a problem within the research of ESG. We believe that both future research and practice should adopt impact-weighted accounts in order to have a relevant, reliable, and comparable method for measuring environmental impact. Since impact-weighted accounts are not yet a standardized framework or methodology, we implore future researchers to continue to develop the framework.

Table I: Sample description

Panel A: Year Composition

Year	Frequency	Percentage
2010	291	11.68
2011	170	6.82
2012	224	8.99
2013	192	7.70
2014	162	6.50
2015	179	7.18
2016	196	7.87
2017	220	8.83
2018	251	10.07
2019	607	24.36
Total	2,492	100

Panel B: Industry Composition

Industry	Frequency	Percentage
Basic Materials	273	10.96
Consumer Discretion	404	16.21
Consumer Staples	187	7.50
Energy	122	4.90
Fincials	229	9.19
Health Care	117	4.70
Industrials	448	17.98
Real Estate	242	9.71
Technology	235	9.43
Telecommunications	103	4.13
Utilities	132	5.30
Total	2,492	100

Panel C: Country Composition

Country	Frequency	Percentage
Argentina	3	0.12
Australia	100	4.01
Austria	17	0.68
Bahrain	1	0.04
Belgium	10	0.40
Bermuda	2	0.08
Brazil	26	1.04
Canada	82	3.29
China	111	4.45
Chile	9	0.36
Colombia	7	0.28
Croatia	3	0.12
Czech Republic	2	0.08
Denmark	14	0.56
Faeroe Island	1	0.04
Finland	22	0.88
France	80	3.21
Georgia	1	0.04
Germany	69	2.77
Gibraltar	1	0.04
Greece	6	0.24
Guernsey	1	0.04
Hong Kong	88	3.53
Hungary	3	0.12
India	52	2.09
Indonesia	7	0.28
Ireland	13	0.52
Isle of Man	2	0.08
Israel	4	0.16
Italy	38	1.52
Japan	316	12.68
Jersey	3	0.12
Kenya	1	0.04
Kuwait	2	0.08
Luxembourg	5	0.20
Macau	3	0.12
Malaysia	26	1.04
Malta	1	0.04
Mexico	37	1.48
Morocco	1	0.04
Netherlands	26	1.04
New Zealand	6	0.24
Norway	21	0.84
Oman	2	0.08
Pakistan	1	0.04
Peru	1	0.04
Philippines	25	1.00
Poland	7	0.28
Portugal	10	0.40
Qatar	2	0.08
Romania	3	0.12
Russia	14	0.56
Saudi Arabia	2	0.08
Singapore	28	1.12
Slovenia	1	0.04
South Africa	74	2.97
South Korea	91	3.65
Spain	42	1.69
Sri Lanka	5	0.20
Sweden	53	2.13
Switzerland	54	2.17
Taiwan	183	7.34
Thailand	21	0.84
Turkey	14	0.56
Ukraine	1	0.04
United Arab Emirates	3	0.12
United Kingdom	233	9.35
United States	399	16.01
Total	2,492	100

Table II: Descriptive statistics

Variable	Number of observations	Mean	Standard deviation	25th percentile	Median	75th percentile	Min	Max
BVPS	13,923	31.97	406.55	2.15	7.76	19.68	0.00	20,303.79
EPS	13,922	2.83	40.01	0.13	0.69	2.06	-125.92	2,220.44
Env.IMPACT/Sales	13,920	-0.11	0.27	-0.10	-0.02	-0.01	-2.45	1.90
Env.IMPACT/Assets	13,923	-0.06	0.16	-0.06	-0.01	-0.00	-4.46	1.00
Leverage	13,921	1.37	19.55	0.28	0.61	1.20	0.00	2,237.36
Size	13,923	6.88	0.74	6.39	6.84	7.32	4.08	9.43
Dividends	13,910	441,871.12	1,142,284.71	27,633	95,123	322,910	0.00	1.57e+07
StockPrice	13,853	81.80	1,529.22	3.94	14.16	40.88	0.00	88,292.62
Book/Market	10,624	737.50	817.83	277.93	532.57	911.52	0.52	17,354.65
ROA	13,922	0.05	0.09	0.02	0.04	0.07	-1.22	4.11
PPE/Assets	13,903	0.35	0.26	0.14	0.30	0.51	0.00	1.39
Intangible.Assets/Assets	9,840	1.72	11.75	0.01	0.07	0.46	0.00	542.21
CAPEX/Assets	13,911	0.05	0.06	0.02	0.04	0.07	0.00	5.21
Tobin's Q	13,923	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Total observations	13,923							

This table summarize the descriptive statistics of all the variables used in the regression models. Mean is the average value. Standard deviation is the standard deviation observed value. 25th percentile is the first quantile. Median is the median observed value. 75th percentile is the third quantile. Min is the minimum value. Max is the maximum value.

Table III: Pearson correlation matrix

Log(StockPrice)	1.0000												
Env.IMPACT/Sales	0.1048	1.0000											
Env.IMPACT/Assets	0.1121	0.8241	1.0000										
log(BVPS)	0.8024	0.0373	0.0672	1.0000									
EPS	0.3867	0.0247	0.0193	0.3769	1.0000								
Leverage	-0.0130	-0.0069	0.0044	-0.1019	-0.0400	1.0000							
Size	0.3232	0.0111	0.0760	0.4206	0.0816	0.1506	1.0000						
Dividends	0.2088	0.0405	0.0510	0.1445	0.0683	0.0164	0.5185	1.0000					
Book/Market	-0.2222	-0.1110	-0.0892	0.0888	-0.0193	-0.0156	0.1522	-0.0348	1.0000				
ROA	0.1738	0.0730	0.0177	-0.0707	0.1573	-0.1192	-0.1282	0.1127	-0.2451	1.0000			
PPE/Assets	-0.0792	-0.3343	-0.2637	-0.0086	0.0682	-0.0408	-0.1306	-0.0407	0.1204	-0.0587	1.0000		
Intangible.Assets/Assets	-0.1119	-0.0080	-0.0299	-0.1385	-0.0166	-0.0303	-0.2156	-0.0597	-0.0210	-0.0109	0.0086	1.0000	
CAPEX/Assets	-0.0369	-0.1733	-0.1877	-0.0789	0.0023	-0.0611	-0.1578	0.0044	0.0164	0.0426	0.5340	0.0204	1.0000
Total observations	13,923												

This table presents the Pearson correlation matrix of the variables used in the regression models. The Pearsons correlation matrix is also repeated with Tobin's Q as the dependent variable.

Table IV: Ohlson model with robust standard errors

Panel A: Environmental impact scaled by assets

Dependent variable: Log(stock price)		
Independent variables	Coefficient	t-statistics
Env.IMPACT/Assets	0.334	3.95
Log(BVPS)	0.847	115.15
EPS	0.002	5.86
Constant	0.931	51.75
Adj. R-squared	N	Regression model
66.65%	13,852	OLS

Panel B: Environmental impact scaled by sales

Dependent variable: Log(stock price)		
Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.374	11.83
Log(BVPS)	0.848	115.07
EPS	0.002	5.87
Constant	0.951	53.36
Adj. R-squared	N	Regression model
66.95%	13,849	OLS

This table represents the Ohlson (1995) regression model. Panel A and B shows results for the natural logarithm of stock price as the dependent variable.

Table V: Regression model with robust standard errors

Environmental impact scaled by sales

Dependent variable: Log(Tobin's Q)		
Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.472	12.88
Log(BVPS)	-0.111	-15.49
EPS	0.001	6.87
Constant	-6.934	-380.45
Adj. R-squared	N	Regression model
3.89%	10,621	OLS

This table represents regression model results for the natural logarithm of Tobin's Q as the dependent variable. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Table VI: Extended Ohlson model with robust standard errors

Dependent variable: Log(stock price)

Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.537	6.43
Leverage	-0.035	-2.25
Size	0.901	27.97
Dividends	3.78e-08	-2.83
Book/Market	-0.001	-14.82
PPE/Assets	0.137	1.40
Intangible.Assets/Assets	-0.006	-3.08
CAPEX/Assets	0.872	1.54
ROA	3.953	11.17
Constant	-3.469	-15.63
Adj. R-squared	N	Regression model
21.38%	7,276	OLS

This table represents an extension of the Ohlson (1995) regression model presented in Table IV with the natural logarithm of stock price as the dependent variable. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Table VII: Development of the value relevance of environmental impact from 2010-2015 to 2016-2019

Dependent variable: Log(stock price)

Model 1 (2010-2015)			Model 2 (2016-2019)		
Independent variables	Coefficient	t-statistics	Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.280	2.56	Env.IMPACT/Sales	0.831	6.78
Leverage	-0.042	-1.59	Leverage	-0.026	-1.87
Size	0.832	17.49	Size	0.987	22.16
Dividends	-5.52e-08	-2.83	Dividends	-2.48e-08	-1.34
Book/Market	-0.000	-8.65	Book/Market	-0.001	-10.72
PPE/Assets	-0.100	-0.77	PPE/Assets	0.332	2.32
Intangible.Assets/Assets	-0.006	-1.76	Intangible.Assets/Assets	-0.006	-2.48
CAPEX/Assets	1.479	1.76	CAPEX/Assets	0.439	0.58
ROA	4.342	8.46	ROA	3.405	7.13
Constant	-3.060	-9.48	Constant	-3.959	-12.79
Adj. R-squared	N	Regression model	Adj. R-squared	N	Regression model
18.36%	4,029	OLS (robust std.errors)	25.09%	3.247	OLS (robust std.errors)

This table represents an extension of the Ohlson (1995) regression model presented in Table IV with the natural logarithm of stock price as the dependent variable. Model 1 shows results from 2010 to 2015. Model 2 shows results from 2016 to 2019. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Table VIII: Fama and Macbeth regression models (Newey-West adj. standard errors)

Panel A

Dependent variable: Log(Stock price)

Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.189	1.82
Leverage	-0.060	-4.27
Size	0.860	15.66
Book/Market	-0.001	-5.49
ROA	2.888	5.52
Constant	-3.098	-9.65
Adj. R-squared	N	Regression model
19.56%	10.575	Fama and Macbeth

Panel B

Dependent variable: Log(Tobin's Q)

Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.090	3.88
Leverage	-0.088	-4.83
Size	-0.409	-39.30
Book/Market	-0.001	-21.67
ROA	3.538	7.92
Constant	-3.787	-27.89
Adj. R-squared	N	Regression model
66.91%	10,620	Fama and Macbeth

This table represents the Fama and MacBeth (1973) regression model. Panel A and B shows results for the natural logarithm of stock price as the dependent variable and the natural logarithm of Tobin's Q, respectively. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Table IX: Correlation matrix

Env.IMPACT/Sales	1.0000	
Lag.Env.IMPACT/Sales	0.9196	1.0000

Table X: Fixed effects model

Dependent variable: Log(stock price)

Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.700	7.85
Leverage	-0.030	-2.18
Size	1.021	32.00
Dividends	-5.30e-08	-3.92
Book/Market	-0.000	-14.57
PPE/Assets	-0.268	-2.24
Intangible.Assets/Assets	-0.005	-2.50
CAPEX/Assets	2.613	4.18
ROA	3.730	11.12
Constant	-3.972	-16.85
Adj. R-squared	N	Regression model
27.15%	7,276	Fixed effects
Industry FE	Yes	
Year FE	Yes	

This table represents the fixed effects model and shows results for the natural logarithm of stock price. We control for industry- and year- fixed effects. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Table XI: Development of the value relevance of environmental impact from 2010-2015 to 2016-2019

Dependent Variable: Log(stock price)

Model 1 (2010-2015)			Model 2 (2016-2019)		
Independent variables	Coefficient	t-statistics	Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.466	3.89	Env.IMPACT/Sales	0.958	7.35
Leverage	-0.037	-1.57	Leverage	-0.021	-1.60
Size	0.945	20.98	Size	1.114	24.52
Dividends	-8.36e-08	-4.33	Dividends	-3.31e-08	-1.79
Book/Market	-0.000	-8.56	Book/Market	-0.001	-10.40
PPE/Assets	-0.497	-3.16	PPE/Assets	-0.096	-0.51
Intangible.Assets/Assets	-0.003	-0.90	Intangible.Assets/Assets	-0.006	-2.26
CAPEX/Assets	3.156	3.40	CAPEX/Assets	2.195	2.59
ROA	4.253	8.74	ROA	2.898	5.91
Constant	-3.608	-10.97	Constant	-4.548	-13.90
Adj. R-squared	N	Regression model	Adj. R-squared	N	Regression model
25.03%	4,029	Fixed Effects	30.26%	3.247	Fixed Effects
Industry FE	Yes			Yes	
Year FE	Yes			Yes	

This table represents the fixed effects model and shows results for the natural logarithm of stock price. We control for industry- and year- fixed effects. Model 1 shows results from 2010 to 2015. Model 2 shows results from 2016 to 2019. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Table XII: Ohlson model with clustered standard errors

Panel A: Standard errors clustered by ISIN

Dependent variable: Log(stock price)		
Independent variables	Coefficient	t-statistics
Env.IMPACT/Assets	0.374	5.79
Log(BVPS)	0.848	52.88
EPS	0.002	2.67
Constant	0.951	23.76
Adj. R-squared	N	Regression model
66.95%	13,849	OLS

Panel B: Standard errors clustered by country

Dependent Variable: Log(stock price)		
Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.374	4.10
Log(BVPS)	0.848	13.06
EPS	0.002	2.23
Constant	0.951	5.95
Adj. R-squared	N	Regression model
66.95%	13,849	OLS

This table represents the Ohlson (1995) regression model with clustered standard errors. Panel A shows results for the natural logarithm of stock price as the dependent variable with standard errors clustered by ISIN. Panel B shows results for the natural logarithm of stock price as the dependent variable with standard errors clustered by country. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Table XIII: Extended Ohlson model with clustered standard errors

Panel A: Standard errors clustered by ISIN

Dependent variable: Log(stock price)

Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.537	3.22
Leverage	-0.035	-1.92
Size	0.901	12.86
Dividends	-3.78e-08	-1.33
Book/Market	-0.001	-7.44
PPE/Assets	0.137	0.67
Intangible.Assets/Assets	-0.006	-3.00
CAPEX/Assets	0.872	0.78
ROA	3.953	7.56
Constant	-3.469	-7.15
Adj. R-squared	N	Regression model

Panel B: Standard errors clustered by country

Dependent variable: Log(stock price)

Independent variables	Coefficient	t-statistics
Env.IMPACT/Sales	0.537	2.26
Leverage	-0.035	-1.04
Size	0.901	4.34
Dividends	-3.78e-08	-0.94
Book/Market	-0.001	-3.65
PPE/Assets	0.137	0.45
Intangible.Assets/Assets	-0.006	-2.32
CAPEX/Assets	0.872	0.49
ROA	3.953	4.24
Constant	-3.469	-2.20
Adj. R-squared	N	Regression model
21.37%	7,276	OLS

This table represents an extension of the Ohlson (1995) regression model presented in Table XII, with clustered standard errors. Panel A shows results for the natural logarithm of stock price as the dependent variable with standard errors clustered by ISIN. Panel B shows results for the natural logarithm of stock price as the dependent variable with standard errors clustered by country. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

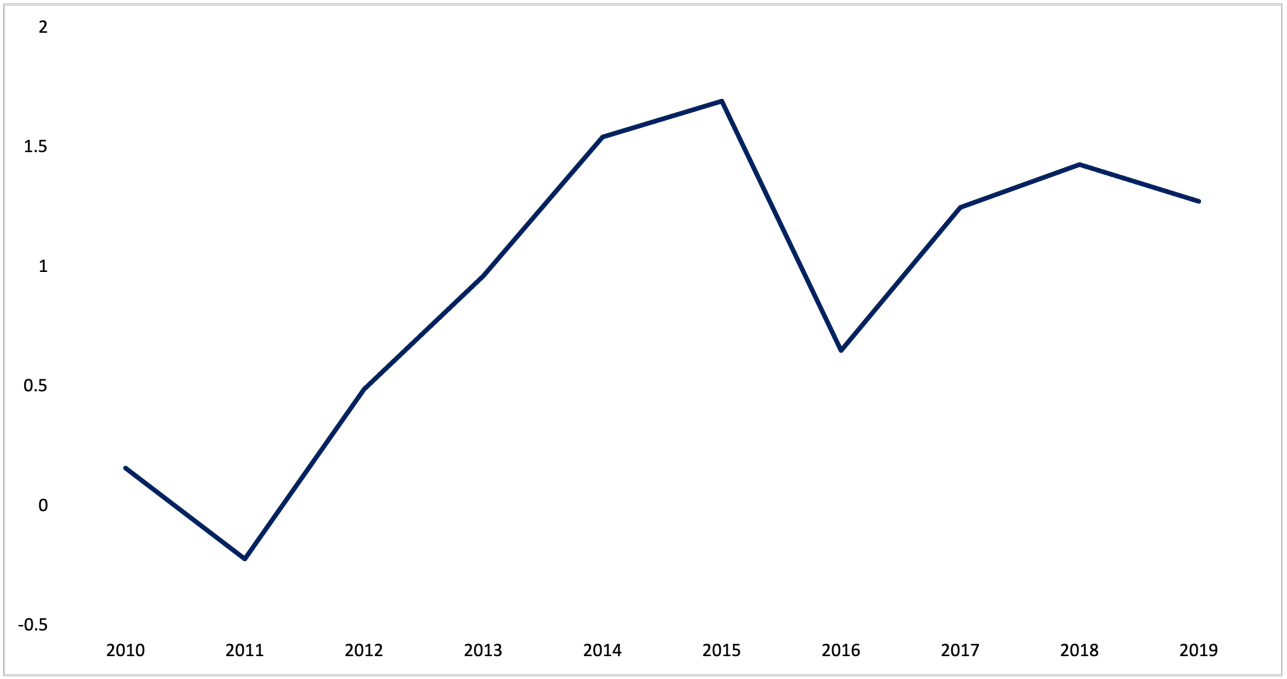
Table XIV: Development of the value relevance of environmental impact from 2010-2015 to 2016-2019

Dependent variable: Log(stock price)

Independent variables	Model 1 (2010)	Model 2 (2011)	Model 3 (2012)	Model 4 (2013)	Model 5 (2014)	Model 6 (2015)	Model 7 (2016)	Model 8 (2017)	Model 9 (2018)	Model 10 (2019)
Env.IMPACT/Sales$_{Year}$	0.158	-0.221	0.487	0.962**	1.542***	1.693***	0.649***	1.248***	1.428***	1.274***
	(0.183)	(0.181)	(0.333)	(0.448)	(0.427)	(0.450)	(0.203)	(0.427)	(0.333)	(0.232)
Leverage	-0.081***	-0.079	-0.096**	-0.110***	0.007	-0.075***	-0.039	-0.000	-0.046**	-0.014
	(0.029)	(0.051)	(0.038)	(0.035)	(0.008)	(0.020)	(0.031)	(0.035)	(0.023)	(0.012)
Size	0.925***	0.810***	1.011***	1.036***	1.038***	0.942***	1.204***	1.021***	1.136***	1.105***
	(0.104)	(0.112)	(0.112)	(0.100)	(0.100)	(0.098)	(0.101)	(0.099)	(0.090)	(0.081)
Dividends	-1.45e-07***	-7.86e-08*	-1.29e-07***	-1.09e-07**	-8.97e-08*	-2.65e-08	-3.98e-08	-2.42e-08	-3.31e-08	-3.71e-08
	(4.38e-08)	(4.71e-08)	(4.36e-08)	(4.28e-08)	(4.87e-08)	(4.46e-08)	(4.26e-08)	(3.67e-08)	(3.71e-08)	(3.29e-08)
Book/Market	-0.000***	-0.000***	-0.000***	-0.000**	-0.000***	-0.000***	-0.000***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PPE/Assets	0.261	-0.110	-0.459	-0.267	-0.699**	-0.827**	0.027	0.078	-0.161	-0.201
	(0.415)	(0.337)	(0.389)	(0.364)	(0.348)	(0.390)	(0.316)	(0.457)	(0.384)	(0.362)
Intangible.Assets/Assets	0.875***	0.000	-0.007**	-0.002	0.001	0.001	-0.002	-0.009	-0.007***	-0.004
	(0.325)	(0.004)	(0.003)	(0.009)	(0.008)	(0.005)	(0.003)	(0.010)	(0.003)	(0.006)
CAPEX/Assets	3.645*	1.472	2.944	1.801	3.190	3.853*	3.664**	0.333	2.582*	2.469
	(2.098)	(2.325)	(2.521)	(1.953)	(2.140)	(2.119)	(1.564)	(2.253)	(1.540)	(1.652)
ROA	3.893***	4.902***	5.936***	3.574***	4.702***	2.821***	3.113***	3.462***	2.581***	3.003*
	(0.986)	(1.195)	(1.139)	(0.784)	(1.015)	(0.750)	(0.812)	(1.099)	(0.822)	(0.996)
Constant	-3.691***	-2.935***	-4.275***	-4.066***	-4.108***	-3.448***	-5.512***	-3.422***	-4.495***	-4.286***
	(0.775)	(0.812)	(0.822)	(0.714)	(0.721)	(0.694)	(0.694)	(0.721)	(0.625)	(0.597)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	677	677	677	669	674	674	749	727	786	985
Adjusted R-Squared	19.75%	19.59%	24.72%	27.51%	29.46%	29.17%	24.86%	27.12%	32.00%	33.45%

This table presents the aggregated fixed effects regression models for 2010 to 2019. The table shows results for the natural logarithm of stock price as the dependent variable with industry- and year- fixed effects. The statistical significance of the variables is illustrated as the following: ***1% significance level, **5% significance level, *10% significance level. We have repeated this analysis with environmental impact scaled by assets, and the inferences remain the same.

Figure 1: Development of the coefficient on environmental impact over time



List of abbreviations

EPS *Earnings per share*

ROA *Return on assets*

BVPS *Book value per share*

PPE/Assets *Property, plant and equipment's/ total assets*

Book/Market *Book value of equity/ market value of equity*

CAPEX/Assets *Capital expenditures/ total assets*

Env.IMPACT/Sales *Environmental impact/ total sales*

Env.IMPACT/Assets *Environmental impact/ total assets*

Lag.Env.IMPACT/Sales *(Environmental impact/ total sales) in t-1*

Intangible.Assets/Assets *Intangible assets/ total assets*

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Appendix

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BI Norwegian Business School - Preliminary Thesis Report

Implementation of Impact-Weighted Accounts on the Accounting Statement; Whether and How Impact-Weighted Accounts is Related to Firm Value? A Study Based on Data Provided by the Impact-Weighted Accounts Initiative at Harvard Business School

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Table of Contents

1.0 Introduction

1.1 Background

Over the last years, companies' environmental impact has become a central consideration for stakeholders, and the interest in measuring and analyzing environmental impact has grown exponentially (Serafeim et al., 2020). The increasing public awareness of climate change has changed our society, and this trend has spilled over to financial markets (Amel-Zadeh & Serafeim, 2018). The market continues to evolve from its traditional focus, which mainly involved companies taking actions against an issue that could harm their business, to one that is more purpose-focused, where doing something good for the planet as a whole, drives business decisions (TD Asset Management Inc., 2021). The increasing public awareness of companies' impact on climate and the overall society, has increased stakeholders' (i.e., investors, suppliers, customers) interests of companies' environmental and social impact. The latest edition of the European CFO survey asked close to 1,200 financial executives across Europe to what extent their companies feel the pressure to act on climate change (Michela Coppola et al., n.d.). The central insight from the survey is that companies are feeling pressure from various stakeholders to act on climate change. As a result, companies might feel pressure from stakeholders to adjust accordingly.

1.2 Current Practise

In recent years, investors' interest for Environmental (carbon emissions, waste generation, water consumption), Social (staff turn-over, incidence rate, percentage of female employees), and Governance (board of director size, board of directors diversity, executives diversity) data (ESG) has increased (Amel-Zadeh & Serafeim, 2018). The integration of ESG information in investment decisions has been one of the most significant developments in financial markets. The extensive use of ESG data has pushed companies to disclose non-financial information, such as environmental and social impact. As a result, the number of public companies issuing public ESG information has increased exponentially in the last decades. As such, the most prominent companies issuing sustainability reports have increased by 75% from 1993 to 2017 (Serafeim et al., 2019).

With the increasing disclosure of non-financial information among companies, there have been many ideas for improving business reporting, with a focus on providing more non-financial information (Eccles et al., 2011). Several non-profit organizations, such as the Global Reporting Initiative (GRI) and Sustainable Accounting Standards Board (SASB) have prompted the disclosure of ESG data. They have developed disclosure standards to identify the ESG metrics that corporations should disclose (Rouen & Serafeim, 2021). To capture ESG information, several investors are using ESG ratings from ESG providers (i.e., ESG rating agencies). Nevertheless, recent research and media publications have commented on the rating agencies' high degree of disagreement. When rating agencies score the same companies for their creditworthiness, they are often in agreement. However, this is not the case when it comes to ESG agencies. The commissioner Peirce of the Securities and Exchange Commission (SEC) mentioned that the different ESG ratings might vary so widely that the results would be difficult to use as guidance in an investment decision (Christensen et al., 2021). The disagreement between rating agencies might illustrate a lack of agreement on what ESG ratings should reflect. As a result, there might be a lack of consistency in the use of ESG data when making investment decisions.

Despite numerous efforts by non-profit organizations to improve ESG reporting among corporations, there are still challenges. The lack of agreement and inconsistency of current ESG metrics is among the remaining challenges which may prevent integrating ESG information into investment decisions (Serafeim et al., 2020). A weakness of the current ESG metrics is that it is based on input and activities (i.e., policies, disclosure, management systems) and not the outcomes and impact on stakeholders (i.e., carbon emissions, working conditions, diversity in the company) (Serafeim et al., 2019). In addition, there is no clear or universal methodology to apply the ESG metrics (Serafeim et al., 2020).

In the absence of sophisticated and clearly-defined ESG metrics, companies' positive and negative impacts on the planet are likely to be absent from decision-making (Serafeim et al., 2019). It is plausible that decisions might continue to be based on current financial metrics that do not reflect a holistic overview of how a company creates value, as it might continue to ignore the impact on the customers, employees, environment, and the all-over society. To provide accurate signals for

business leaders and investors, and allow firms to internally generate companies impact data rather than using external rating agencies; company impact should be connected to the financial statement (Serafeim et al., 2019). As a result, the measurements of companies' impact might be translated into comparable units across companies. Furthermore, by connecting companies' impact to the financial statement, company impact could be aggregated and compared without obtaining detailed information. In addition, it might allow investors to display financial and impact data in the same financial statement. Implementing impact-weighted accounts on the accounting statement could allow investors to use existing financial tools and analysis to assess performance. The measurement, recognition, and disclosure of impact-weighted financial accounts might allow companies to incorporate an assessment process of impact in the decision-making process.

1.3 Impact-Weighted Accounts

Impact-weighted Accounts are a line on the Financial Statement, such as income statement or in the balance sheet to supplement the financial health and financial performance, by reflecting the companies positive and negative impacts on the customers, employees, environment, and all over society (Serafeim et al., 2019). The impact-weighted account could allow managers to make more informed decisions due to potential increased relevance, reliability, and comparable reported information. In addition, since accounting standards are defined as a common set of principles, standards, and procedures, impact-weighted accounts might allow investors to compare and assess impact across different companies and industries. Furthermore, it might enable investors and other stakeholders to operate in a more transparent market since information of companies' impact is present.

The idea of impact-weighted accounts is based on a project from Harvard Business School. Their mission is to drive the creation of financial accounts that reflect companies' financial, social and environmental performance (Serafeim et al., 2019). The aim of impact-weighted accounts for investors is that ESG labeled companies could use impact-weighted accounting numbers in their due diligence, underwriting, engagement, and reporting effort. Investors and asset owners could utilize impact-weighted accounts as monitoring and selection tools to assure their investments are aligned with positive impact. Despite the current accounting

statement ignoring companies' impact, we aim to investigate whether and how the implementation of impact-weighted accounts on the accounting statement are related to the value of firms. Due to the limitation of time, we are mainly focusing on investigating whether and how impact-weighted accounts are related to the value of firms. As such, we arrived at the following two-parts research question;

"Whether and how impact-weighted accounts could be related to the value of firms"

2.0 Literature review

2.1 Development of ESG information

The role of ESG information in business and its value relevance has undergone changes over history. According to Eccles et al., (2011), the ESG factors have been discussed in the academic literature for more than 35 years. Nevertheless, it is apparent the role of ESG disclosure has changed over time. In the past, it was claimed that the social responsibility of a business was to increase profit (Friedman, 1970) because such activities did not provide pay-offs. Furthermore, it has also been claimed that socially responsible activities are costly for the shareholders (Palmer et al., 1995). However, companies' environmental and social impact has more recently become a central consideration for stakeholders, and the interest in measuring and analyzing environmental impact has grown exponentially (Serafeim et al., 2020). Companies are nowadays actively encouraged by public expectations and regulatory pressure (e.g., the EU Taxonomy for Sustainable Finance) because sustainability has now become a central role of the management of the business (Marsat & Williams, 2011; Panwar et al., 2006). Further, companies sustainability practices have also become a central role for stakeholders after the UN Global Compact (2004) and UNEP Finance initiative (2005) circulated the concept of ESG information *"that ties corporate social performance and corporate financial social performance together"* (Lo & Kwan, 2017, p. 607). As a result, corporate reports of ESG issues have become increasingly important to investors (EY, 2014; London Stock Exchange Group, 2018; Nasdaq, 2017).

2.2 Sustainability Reporting and Firm Value

The relationship between companies sustainability practices and its firm value has been investigated from different theoretical perspectives, whereas some studies have found that sustainability generates financial performance (Alexander & Gentry, 2014; Lu & Taylor, 2018; Margolis & Walsh, 2003; Orlitzky, 2005; Ruf et al., 2001), while other studies have found a negative relationship (Brammer et al., 2006; Griffin & Mahon, 1997; Madorran & Garcia, 2016; Seifert et al., 2003; Teoh et al., 1999). Firm value can be examined in terms of earnings per share (EPS), market capitalization, or growth opportunities, among others. However, research and evidence on how to capture environmental impact in monetary terms and how sustainability reporting is associated with market value remain uncertain and incomplete. Due to a lack of consistency between ESG rating providers and a lack of framework for systematic measurement of impact, there seem to be limitations to assess the association between firm value and sustainability.

The lack of consistency between ESG ratings and the absence of a framework for measuring impact is frequently discussed in the literature. Diouf and Boiral (2017) have investigated the perception of Social Responsible Investments (SRI) practitioners in Canada of the quality of sustainability reporting using the GRI framework. Evidence from the study shows that the widely used GRI standard still does not have the same level of credibility and transparency as financial reporting (Diouf & Boiral, 2017). They found that sustainability reporting was not balanced as users were favorable information and avoided mentioning flaws in the performance. This is also consistent with other findings within the field, where GRI remains problematic due to observed inconsistencies that limit the quality and credibility of information (Hahn & Kühnen, 2013; Moneva et al., 2006; Fortanier et al., 2011)

Diouf and Boiral (2017) study have some limitations concerning that this qualitative study consists of 33 interviews carried out in Canada for the purpose of SRI practitioners. However, Perego and Kolk (2012) explored this topic for multinational corporations (MNCs) by using a panel of Fortune Global 250 firms over a period of 10 years, where they documented the diffusion patterns of third-party assurance of sustainability reports. The results illustrate great variability in the adoption of assurance practices and a preference for combining different

standards, such as standard AA1000 in combination with GRI guidelines or IASE3000 in combination with GRI (Perego & Kolk, 2012). Perego and Kolk (2012) illustrate Diouf and Boiral (2017) results on a bigger scale, namely, application and quality of standards differ substantially for practitioners. Perego and Kolk (2013) argue that the differences in the application are due to no mandatory standard and many assurors make use of a combination of different guidelines.

Despite the lack of consistency and framework, there have been various efforts in the literature to investigate the association between firm value and sustainability reporting and quality. Nguyen (2020) examines the association between sustainability reporting and firm value by investigating whether 97 larger listed German firms having a higher adherent level to GRI tend to show better firm value. The findings indicate a significant negative relationship between firm value and a firm´s GRI adherent level of sustainability reporting (Nguyen, 2020). This could mean that firms sustainability reporting which have higher GRI adherent levels tend to have a lower price than others. Nguyen (2020) explains that this negative association might come from incomplete sustainability reporting, along with self-centeredness and insincerity from those who produce sustainability reports (Gray, 2006; Aras & Crowther, 2009; Unerman et al., 2007)

Nguyen (2020)´s findings illustrates the opposite of what Bachoo et al. (2013) found in their study, which found a positive and significant association between the quality of firms sustainability disclosures and the ex-ante cost of equity, as well as a significant positive association between sustainability reporting quality and expected future performance, which relates to firm value. They argue that higher sustainability reporting quality decreases investors´ perception of the riskiness of a firm´s (Bachoo et al., 2013). These findings suggest that rational investors will pay a premium for each dollar expected for short-run earnings of high-quality reporting firms, and higher future cash flow as sustainability reporting lower the likelihood of future sustainability-related cash outflows (e.g., costs and fines). Firm value and quality of sustainability reporting has also been examined by Sutopo et al. (2018). Sutopo at al. (2018) investigates whether companies receiving a sustainability reporting award (SRA) have a higher value

relevance of financial statements than firms that do not receive an SRA. Sutopo et al. (2018) study indicates value relevance of the EPS for the SRA firms is higher than non-SRA firms. Their findings might indicate that the market views firms with excellence in sustainability reporting having information about future prospects in favor of sustainability development (Sutopo et al., 2018), or investor perception of riskiness could be lower (Bachoo et al., 2013).

Sustainability reporting and investor perception of the firm might be value-increasing itself. Miralles-Quiros et al. (2017) study on listed companies during 2001-2013 reveals that European investors as a piece of whole value information, in terms of CSR following GRI, and GRI disclosure is positively and significantly associated with the market value of equity. Overall, these results are similar to Kaspereit & Lopatta (2016) for the largest European companies. These results could indicate that sustainability reporting itself can be value-increasing as the amount of information about the company to investors is greater, which reduces the asymmetric information or investors' perception of riskiness might be lower (Bachoo et al., 2013).

2.3 Sustainability Reporting and Value Relevance

As indicated, there seems to be inconsistency of companies' sustainability practices and its value relevance in the academic literature today. The discussion above is also in line with other research that has found positive, negative, and no reaction to sustainability disclosure on the firm's value (Cañón-de-Francia & Garcés- Ayerbe, 2009; Chetty et al., 2015; Gladysek & Chipeta, 2012; Keele & DeHart, 2011; Luffarelli & Awaysheh, 2018; Yadav et al., 2016).

The previous literature on value relevance refers to extensive research. However, many applications of value relevance have focused on accounting variables (e.g., Amir & Lev, 1996; Barth & McNichols, 1994; Carnevale et al., 2012). As such, the definition of "value relevance" is often connected to accounting information by researchers. For example, Beisland (2009) suggests "relevance" reflects the ability of accounting information to capture or summarize market value. Nevertheless, research of value relevance has also been investigated with non-accounting variables (Aureli et al., 2020). Research by Lapointe-Antunes et al.,

2006; Xu et al., 2007, illustrates that accounting information alone is not enough to explain companies' market value and its variation.

The discussion above might constitute that there is a consensus on the importance and relevance of sustainability data and the firm value. Research illustrates that the value of a firm is not based on accounting information alone. Nevertheless, as mentioned, several studies underpin the importance of considering a firm's environmental and social impact when valuing a company. However, the lack of a common understanding and methodology to use ESG is plausibly making it challenging to incorporate such data in traditional valuation models (i.e., Discount Cash-flow model). In addition, the lack of a common methodology and understanding of how to consider environmental and social aspects of firms might also make it challenging to compare companies in different industries, but also those companies in the same industries. To provide accurate signals for business leaders and investors; company impact might be connected to the financial statement (Serafeim et al., 2019). Several studies follow Serafeim et al., (2019)´s argument that companies' social and environmental externalities should be connected to the income statement (Hartwig et al., 2019). By incorporating the environmental and social impacts on the income statement or balance sheet, it could result in accounting that provides the most promising fit for use by various stakeholders in impact valuation and to be an objective method based on well-established accounting principles and practices (Buchholz et al., 2020).

As of today, there is a lack of a universal method to measure firms' environmental and social impact. However, some initiatives aim to develop such a framework. The impact-weighted accounts Project at Harvard Business School is one of the efforts trying to measure companies' social and environmental impact on society. As such, they have proposed the concept of impact-weighted accounts. Impact-weighted accounts are a line on the financial statement, which are added to supplement the statement of financial health and performance by reflecting a company's positive and negative impact on the customers, employees, the environment, and the border society. The aspiration is an integrated performance allowing investors and managers to make informed decisions based on monetized

gains and losses and the impact a company has on the border society (Serafeim et al., 2019).

2.4 Emergence of Impact-Weighted Accounts

In September 2019, the project of the impact-weighted account published their first research paper on the topic, where they proposed several benefits with impact-weighted accounts for investors and companies. Since that time, the team of the project has published seventeen papers about the methodology of monetizing impact accounts across environmental, employee, and product impact. However, the research on impact-weighted accounts is limited. There are few papers provided by other researchers than the impact-weighted account project team. As such, our paper aims to bring insight to the literature. Our goal is to provide a deeper insight on impact-weighted accounts and its relevance for the value of a firm. The aspiration of an accounting system that considers the company's impact might be the missing piece for an impact economy. That is because the data can be used to create incentives for companies to improve impact (e.g., through governments and regulations that can tie tax rates or procurement requirements to impact-weighted accounts). As such, by implementing impact-weighted accounts, companies might understand that every action has a consequence and that all companies produce a positive or negative impact.

In the absence of impact-weighted accounts, most companies relegate social and environmental impact considerations as philanthropic and volunteering. Instead of being at the stage where sustainability is nice to prove, and where the company strives to create shared value, the majority of companies are at the stage where sustainability is nice to have. This is the stage where sustainability is incorporated in the strategy, but there is a lack of a sustainability management system that measures companies' impact. As such, impact-weighted accounts might increase the salience of business impact, and make it an obligation for companies to report their impact. In such a case, it is plausible all companies with such an obligation will be at the stage where the company strives to create shared value.

As a result of the climate crisis we are facing today, the effort on reducing and managing the environmental and social impacts of corporate activities is receiving rising attention, where the recurring warnings from the World Economic Forum and investors serves as an example (Value Balancing Alliance, 2021). In Europe, this has developed further with the Green Deal and a comprehensive set of policies and regulations provided by the EU Commission. The Taxonomy regulations and the Non-financial Reporting Directive (NFRD) revision are two actual examples that support the transition towards a more sustainable economy. But corporate reporting and disclosures are only at the surface. One of the main remaining challenges is to generate reliable information to manage environmental and social impacts better. This is related to the challenge of accounting and reporting that support today's economy, where ecological and social impacts are not integrated (Value Balancing Alliance, 2021). Due to the lack of research on impact accounting in current academic literature, this master thesis aims to give a better insight on the topic.

As a result of the ongoing impact-weighted account project at Harvard Business School, several companies have tried to incorporate impact-weighted accounts in their annual report. Examples of companies reported on impact-weighted accounts in their annual report 2020 are Summa Equity and Acciona. We believe this project is providing interesting knowledge, and the fact that is already in use in some companies is promising. As such, this master thesis aims to give more insight into the topic of impact-weighted accounts. In addition, we want to investigate the relevance of such data on the value of a company.

3.0 Methodology

3.1 Plan for data collection

Saunders (2016), states that research design is a plan on how the research question will be answered. Research design specifies the sources from which the data will be collected, its purpose, and how the analysis will be derived. It will also discuss the context of the chosen research design, of which potential limitations and issues are identified (Saunders, 2016).

Since the topic of impact-weighted accounts is not well established in the current literature, we find it plausible to use the existing and recently provided data on impact-weighted accounts. After Harvard Business School first publication of impact-weighted accounts, in September 2019, the team of the project has published several papers about the methodology of monetizing impact accounts across environmental, employee, and product impact. As such, we will use the data of impact-weighted accounts across environmental impact provided in the appendix in Serafeim et al., (2020). The data contains monetized environmental impact for global companies, from 2010 to 2019, for several companies all over the globe. Nevertheless, we exclude those companies where data is missing for some of the years. Environmental impact represents one of the components of impact-weighted accounts in monetary terms. Since our paper is limited to only concern environmental impact, the data set provided by the impact-weighted accounts initiative at Harvard Business School, will provide us with the data we need in our analysis.

Further, to include control variables in our model, we will incorporate data retrieved from Refinitiv Eikon to incorporate independent variables such as firm performance, size, age, industry, among others, to investigate the effect of the variables on firm value. The number and which type of control variables to be included is not yet decided, but we found it plausible to at least include firm performance, size, and age since these variables are used in one of our core papers.

As such, we will use the data provided by Harvard Business School and the data retrieved from Refinitiv Eikon to fulfill our objective. Therefore, our research

design will be based on secondary data, consisting of data collected from data streams (i.e., Refinitive Eikon) and from Harvard Business School.

3.2 Research Design

To investigate how the value relevance of impact-weighted accounts related to the firm value, we aim to use multiple regression. Multiple regression will be applied to test our future, not yet decided, hypothesized relationship between one dependent variable (firm value) and more than one independent variable.

We will use the Ohlson model since it appears to be used in multiple research papers about the valuation of a firm. The Ohlson model is frequently used in valuation theory and is therefore considered appropriate in our master thesis. To test our hypothesis, we will use STATA to examine whether and how impact-weighted accounts are related to the value of firms.

The goal of our master thesis is to examine whether and how impact-weighted accounts could be related to the value of firms. As we seek to clarify the phenomenon of impact-weighted accounts and its value relevance we follow explanatory research methodology. Since the appearance of impact-weighted accounts is absent in the current literature, we seek to get a deeper insight and understanding of the topic.

We aim to have all the statistical and numerical results by the beginning of March. Before we continue our process of writing, we will discuss our results with our supervisor. Further, we will evaluate feedback provided on the model, and use the information to adjust and enhance our analysis. Thereafter, we will use the results to, hopefully, provide an answer to our formulated research question. At the end of May, we will reach out to our supervisor again to discuss our first draft of the final master thesis. From the feedback, we will adjust and enhance our paper to be finished by early June.

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