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Erasmus School of Economics

Characteristics and quality of materiality analyses for sustainability reports

Master Thesis (MSc Accounting and Auditing)

Name student: Milou Bensch

Student ID number: 419493MB

Supervisor: J. Garst

Second assessor: J. Suijs

Abstract: This thesis aims to bridge the research gap in the current practice of materiality analyses and the quality of materiality analyses. By using a dataset composed by the World Business Council for Sustainable Development and the composition of a quality measure based on findings in the existing literature the following was discovered: firms hiring auditors to review their sustainability reports tend to perform higher quality materiality analyses than firms with sustainability reports without a third-party confirmation. Indicating that the work of auditors on sustainability reports is value increasing for materiality analyses. Next to this, a trend is found for firm within environmentally sensitive industries in the dataset to perform higher quality materiality analysis. Beside these findings, the current practice of materiality analyses has shown to be below average and further research and development in this area is necessary to develop a higher standard for materiality analyses.

Keywords: Sustainability, Materiality, Materiality Analysis, Sustainability Reports.

Abbreviations

CSR	*Corporate Social Responsibility*
ESG	*Environmental, Social and Governance*
GRI	*Global Reporting Initiative*
ICC	*Intraclass Correlation Coefficients*
IFRS	*International Financial Reporting Standards*
IIRC	*International Integrated Reporting Council*
ISA	*International Standard on Accounting*
MAQ	*Materiality Analysis Quality*
ROA	*Return on Assets*
ROE	*Return on Equity*
SASB	*Sustainability Accounting Standards Board*
SDG	*Sustainable Development Goals*
SIC	*Standard Industrial Classification*
TA	*Total Assets*
VIF	*Variance Influence Factor*
WBCSD	*World Business Council for Sustainable Development*

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1. Introduction

1.1 Research question

Nowadays, stakeholders including civil society, government agencies, investors, and non-governmental organizations are paying more attention to their environmental and social impact than ever before (Benn et al., 2014). This attention affects lifestyle choices and how businesses are operated, but also affects the stakeholder expectations of firms they interact with. Stakeholders expect firms to operate sustainably and to minimize adverse environmental and social impact. Consequently, firms are facing a growing demand for transparency and disclosure of sustainable information. As a reaction to this demand, firms' business models are shifting to more sustainable business models (Linnenluecke & Griffiths, 2010). An increasing number of firms began to voluntarily release their sustainable performances to communicate their efforts and meet the needs of stakeholders. In these so-called sustainability reports, firms report on the economic, environmental, and social impacts caused by the day-to-day operations of the firm (Sarkis et al., 2019).

Motivated by the increasing popularity of sustainability reports and the upcoming stream of sustainability reports literature, this thesis will research the subject of materiality analysis for sustainable decision making. Current research within the field of sustainability reports mainly focuses on assurance on sustainability reports (Manetti & Becatti, 2009; Simnett et al., 2009; Perego & Kolk, 2012) and the value relevance of sustainability reports on financial performance (Epstein & Roy, 2003a; Guidry & Patten, 2010). However, while working on their sustainability reports, the biggest challenge firms are currently facing is how to determine which non-financial decisions are material. Due to the need for standards regarding non-financial information, it is important to investigate under what circumstances the quality of a materiality analysis will be of the highest possible level. The research question is stated as follows:

"What is the current practice of materiality analysis and which factors affect its quality?"

1.2 Motivation and relevance

While the trend of sustainability reports is moving toward the expected in practice, however the trend in literature and standard-setting is still behind. Rules are absent and the materiality of sustainability reports is still a vague concept. Therefore, one of the biggest challenges for firms is how to determine which non-financial decisions are material. Due to the absence of standards

for materiality and sustainability reports, firms are unable to disclose comparable material information. Therefore, Eccles et al. (2012) call for sector-specific reporting standards on materiality and sustainability reports. For standard setters to be able to create these specific standards, a better comprehension of the current practice and quality of materiality analysis should be obtained. This research is the first step in obtaining a better understanding of the current practice to see in which areas the materiality analyses need more regularization.

This research is of high relevance from both an academic as a practical perspective. First, the current stream of literature on the topic of materiality analyses for sustainability reports consists of qualitative studies or case studies (Edgley et al., 2015; Lee et al., 2018; Lubinger et al., 2019; Beske et al., 2020). However, so far no studies on the current practice and quality of materiality analysis exist. Since this will be the first study on this topic, as I am aware of, it could provide new insights and give a new direction for further research based on these new insights of the current practice.

Second, this study will be relevant to practice. In particular, the findings of this study can be of interest to firms, users of sustainability reports, auditors and accounting supervisory bodies, and the standard setters. It is important to establish if materiality analyses are meeting their purpose in the way they are currently conducted. If not, it is of high relevance for firms to discover how to identify the social, environmental, and economic topics that have a significant impact on the business and the decisions of its stakeholders in the best way possible. This way the sustainability reports issued are of the highest quality possible. Next to this, more general guidelines on how to perform a good quality materiality analysis will make it easier for users to judge the quality of a sustainability report. Thereby improving the reliability and comparability of the sustainability reports. Sustainability reports would be easier to compare among firms for improved analyses (Joshi & Li, 2016). For auditors and accounting supervisory bodies it will become easier to judge sustainability reports and how to respond to vague or ambiguous decisions made in the materiality analysis process if they have a better understanding of the current process and regulation. Moreover, by researching whether or not reviewing sustainability reports affect the quality of materiality analysis is a relevant research topic. The findings will provide insights on whether or not auditing a sustainability report has any added value to the materiality analysis. So far, no previous studies examined if a relationship between the two exists.

1.3 Methodology

To answer the proposed research question, it is important to understand the characteristics and current practice of the materiality analyses and how the quality of the materiality analyses can be measured. Differences, minor and major, can be spotted in different ways. For example, if the materiality analysis is conducted by the firm or outsourced to an outside party. Next to the process, the reporting on the materiality analysis differs among firms. Some firms disclose the entire process in their reports whilst other firms only mention making use of a materiality analysis. Therefore, the first part of this research consists of descriptive statistics on the current practice of materiality analysis in order to answer the first sub-question:

> *"How do firms currently determine which aspects of their sustainable decisions are material and how do firms report on their materiality decisions?"* *(1)*

Using a sample of 365 sustainability reports for the period of 2017-2018 will provide the information to establish the current practice and answer the first sub-question. Next to this, the measurement of the quality of the materiality analysis needs to be determined. Therefore, the second sub-question needs to be answered:

> *"How can the quality of a materiality analysis be measured?"* *(2)*

By using the literature discussion of this research question a concept for quality will be composed to score the sustainability reports in the sample set of WBCSD. When both sub-questions are answered, the last part of the research question can be answered, namely which factors affect the quality of materiality analysis. For this research, the effects of industries and third-party review will be measured using a multilevel regression model.

1.4 Findings, contribution and implications

This study finds that the current practice is currently below average and room for improvement exists as an average *MAQ* of 13 out of 40 was found. Next to the current practice, this study finds a trend in the dataset used. Namely, firms in environmentally sensitive industries perform higher quality materiality analyses than the firms in non-environmentally industries. However, since no significance is reached for this trend, further research is required in order to make conclusions about the effects of different types of industries and materiality quality. Another factor influencing the quality of materiality analysis is auditing a sustainability report. This

study finds that an audit significantly increases the quality of materiality analyses. Thus, the work of auditors is value increasing to the materiality analyses.

These findings imply that more research on the topic of materiality analysis is necessary to determine more factors influencing the quality of materiality analysis as it is proven the quality is subject and affected by different factors. Moreover, the findings show that more defined and clearer, voluntary standards are necessary to guide firms in the performance of their materiality analysis and thereby hopefully increase the quality of materialityanalyses.

The remainder of this thesis is organized as follows: after the introduction section 2 will continue with a literature review of the theories and underlying concepts related to the quality of materiality analysis. Theories regarding sustainability, sustainability reports, sustainability reporting guidelines, materiality analysis and the quality of materiality analysis will be discussed. The last topic will be relevant to the composition of a quality measure. The insights gained during the comprehensive summary of the relevant concepts provides a solid foundation to develop and formulate the hypotheses in the third section. Section 4 includes the research design, in which the hypotheses will be constructed and operationalized into an empirical study, and the data collection method used to conduct the research will be explained. The results of the statistical tests will be presented and discussed in section 5. Finally, the findings, contributions, limitations and recommendations for future research will be discussed in section 6.

2. Theoretical background

There are two streams of relevant literature for this research. These streams are related to the following two concepts: sustainability and materiality. In order to fully understand the materiality concept within the field of sustainability, it is important to first understand corporate social responsibility and sustainability reports. Thereafter, the literature regarding materiality will be discussed. First, the difference between financial and non-financial materiality will be explained. This difference will explain the necessity of materiality analysis. Eventually, the theoretical background makes it possible to create a measure for the quality of materiality analysis.

2.1 Sustainability

2.1.1 Corporate Sustainability

In the existing literature different definitions, such as sustainability, sustainable development, corporate sustainability, and corporate social responsibility, are used interchangeably. However, as said by Bansal & Song (2015) there is a distinction between corporate social responsibility and corporate sustainability. The main differences can be found in the normative character of corporate social responsibility and the system based thinking of corporate sustainability. The authors trynot to define both terms, but rather see both communities clarify their construct and indicate differences. Despite the differences in definitions, the most accepted and cited definition is the one reported by The World Commission on the Environment and Development report, also referred to as the Brundtland Commission (1978). It states ‘sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.’ In order to contribute to sustainability development firms incorporate a sustainable business model to their firm’s strategy. A business model serves as a conceptual tool that contains the objects and concepts and the relationships between these and the business logic of a firm. The understanding of the concepts and relationships results into an description of the value creation for customers, how this value creation is achieved, and the economic consequences hereof (Osterwalder et al., 2005). Mixed evidence in the current literature exists on incorporating corporate sustainability in business models and the effects on value creation. However, the win-win approach as described by Van der Byl & Slawinski (2015) appears to dominate. This approach focuses on combining economic goals with environmental and social goals. This win-win approach could

therefore affect value creation. This answers the question of why firms would report on their sustainability efforts in the first place. Firms want to report on the value created through their sustainability efforts. This leads to the next important stream of literature regarding sustainability reports.

2.1.2 Sustainability Reports

Nowadays stakeholders are more skeptical and have higher expectations when it comes to CSR activities (Mohr et al., 2001). To determine whether the sustainability impact of a firm is positive or negative, the efforts of a firm's CSR activities must be measured. Relating to the agency theory, the communication of this performance will be performed by a sustainability report containing both financial and non-financial information regarding the social, environmental, and economic impact. In this report, a summary of the activities and the performance is presented (Brown et al., 2006). It should also report on the values of the firm, its governance, and how it incorporates sustainable commitment into its strategy (Global Reporting Initiative, 2020a). The sustainability reports have the same function as other disclosures, such as decreasing the information asymmetry and agency problems. These disclosures require new frameworks and standards for stakeholders and other users of the reports to be useful. One of the most common instruments is the GRI, which provides firms with guidelines. More than 93% of the published reports are based on the GRI (KPMG, 2017). Their goal is to assist firms and governments in understanding their sustainability impact and how to communicate this impact. This way the GRI hopes to enable firms in publishing reports that reflect the firms' actual social, environmental, and economic actions. In 2016, GRI published the first global standards for sustainability reports, thereby replacing the G4 guidelines (Global Reporting Initiative, 2016b). The global standards include both the main concepts and disclosures based on the GRI G4 guidelines (Global Reporting Initiative, 2020b). Next to GRI, the Sustainability Accounting Standards Board (SASB) provides industry-specific standards for environmental, social, and governance topics. SASB aims to assist firms in communicating with investors about material information. This information should be credible and comparable across the globe (Sustainability Accounting Standards Board, 2020). In addition to these guidelines, several rating agencies exist such as Dow Jones Sustainability Index (DJSI) and Kinder, Lydenberg, and Domini (KLD). These agencies rate and rank firms based on their corporate social performances. The deficiency of rules complicates the materiality analysis for firms and thereby the contents of sustainability reports.

In 2018, 86% of the firms in the S&P 500 index released sustainability reports. However, six years ago in 2012, this percentage was under 20 (Governance & Accountability Institute, 2019). According to Ernst & Young, sustainability reporting has reached a pivotal moment as sustainability reports are no longer only released by innovative firms but have become more mainstream (Ernst & Young, 2014). Like Allen White, co-founder of the Global Reporting Initiative, said: "sustainability reporting has gone from the extraordinary to the ordinary, to the expected." This trend is also seen in EU regulation. From 2018 large public firms with over 500 employees are required to disclose non-financial information. According to these new standards, circa 6000 large firms are now required to disclose non-financial reports which include sustainability information (European Commission, 2020). The adoption of the new standard is seen in the increase from below 20% up to 86% in 2019.

In contrast to the increase in disclosed sustainability reports, users claim sustainability reports lack quality and credibility. Even in cases where the sustainability reports have been audited (mostly only limited assurance), users tend to doubt its reliability (Lock & Seele, 2016). Another reason for this lack of quality and credibility are the less developed regulations (Hodge et al., 2009). Another issue with sustainability reports is the incompleteness of the covered aspects which are deemed material from a stakeholder view (de Villiers & van Staden, 2010). Therefore, GRI emphasizes that sustainability reports need to contain the topics and indicators that provide the best reflection of a firm's social, economic, and environmental impact (Global Reporting Initiative, 2011a). It is important to understand the issues of sustainability reports since firms try to resolve those issues by conducting their materiality analysis.

In the existing literature, there are multiple theories on the incentives for firms to disclose sustainability reports. Bebbington et al. (2008) explain that one of those theories is the reputation and risk management theory. According to the authors, this theory is based on avoiding factors that could harm the corporate brand. This means that a firm would avoid public scandals. This goes back to the theory that sustainability reports can restore the public image of a firm and that transparency is important to maintain a good reputation (Adams C. A., 2004). Concluding, the voluntary nature of sustainability disclosure and deficiency of mandatory guidelines do not stop firms from publishing sustainability reports. The main reason for this is the reputation and risk management theory. To prevent scandals or reputation damage, it is important to publish information that ought relevant by the stakeholders. This is when materiality becomes important for firms to match stakeholders' demands. Materiality analysis is a tool in this process of matching stakeholders' demand with the information disclosed by the firm and will be later discussed in section 2.2.3.

2.2 Materiality

As can be concluded from the previous section materiality plays a big part in matching the content of sustainability reports with stakeholders' demand. Since non-financial materiality is derived from the concept of financial materiality, but ultimately should be treated in different ways both types of materiality will be discussed separately. To understand the different processes behind determining materiality, the differences in meaning should be explained. After both types of materiality are discussed, the tool for materiality determination for non-financial information will be discussed, namely the materiality analysis. When the foundation of materiality analysis has been explained, the background discussion can move on to the quality of materiality analysis. All knowledge obtained should suffice to compose a framework to research the current practice of materiality analysis and to create a measure for materiality analysis quality.

2.2.1 Financial Materiality

Materiality is one of the most important concepts in accounting. In fact, it is one of the accounting principles issued by the Financial Accounting Standards Board (FASB). Materiality's main objective is providing a level of guidance in the preparation of disclosures. It relates to the information, size and nature of a transaction, and errors in the financial statement. Materiality marks a certain point after which financial information could be material and could potentially affect the users' decision-making. Financial statements must be prepared in material respects. This way stakeholders should be assured of making decisions based on the correct, relevant information.

Although, no consensus on a materiality definition exists yet the definition for financial settings is already more defined than the definition for non-financial settings. The most commonly used definition is provided by the IFRS. The definition of materiality is as follows: "information is material if omitting, misstating or obscuring it could reasonably be expected to influence decisions that the primary users of general purpose financial statements make based on those financial statements, which provide financial information concerning a specific reporting entity" (International Financial Reporting Standards, 2018).

A common approach for materiality in a financial setting is using a threshold or the so-called rule of thumb. This approach uses a threshold (mostly a percentage) when above this threshold the misstatement of a transaction or balance becomes too high. In this case, it is expected to influence the decision-making of the users (Tuttle et al., 2002; Cho et al., 2003).

I.e. if the users had access to the correct financial information, their decision would have had a different outcome. Setting this materiality threshold is a task for management within the reporting firms. Hereafter, the auditors will give an opinion on whether or not this level of materiality will provide a true and fair view (DeAngelo, 1981). Auditors use multiple approaches to control for these thresholds, common approaches are percentages of net income, percentages of total revenues, or percentages of the total assets. For example, 5%-10% of total net income in which amounts lower than 5% is considered to be immaterial. Amounts between 5% and 10% require the professional judgment of the auditor. Amounts of 10% or higher are considered to be material (Eccles et al., 2012; Brennan & Gray, 2005).

However, materiality must be defined per case and under its specific circumstances. Therefore, an auditor should apply professional judgment per individual case instead of focusing on one mandatory definition with clear rules (Eccles et al., 2014). These judgments could be both of qualitative as quantitative nature and depend on the circumstances per misstatement (Gray & Manson, 2008). As a result of professional judgment, some freedom exists in the determination of a materiality threshold. Management, stakeholders, and auditors each have different incentives (Leuz et al., 2003). Therefore, a difference in materiality thresholds can be found. While management might have incentives to engage in earnings management to receive their bonuses, stakeholders on the other hand could be risk-averse and prefer stability. Based on those different incentives users tend to prefer lower percentages compared to management's preferences. Auditors' preferences differ based on firm characteristics such as audit experience, firm size, and industry (Wright & Wright, 1997).

Now the meaning and reasoning behind financial materiality is explained, the following section will continue with the materiality in non-financial settings.

2.2.2 Non-financial Materiality

The concept of materiality is extended to social and environmental items by the International Accounting Practice Statement (IAPS) 1010 (IFAC, 1998). According to Deloitte (2016), using a definition of materiality in a sustainable setting is useful for making a selection out of the large variety of sustainability information. This will simplify the process for firms and assist them in making more precise decisions in the interest of investors and other stakeholders' interests. The definition for materiality according to the IFRS as discussed in the previous section however only refers to 'the decisions primary users of general purpose financial statements make on basis of those financial statements, which provide financial information.' This definition does not apply to the non-financial disclosures for multiple reasons. First, the

users of sustainability reports do not portray a perfect overlap with the users of financial statements. Financial materiality has a market function whereby the shareholders will benefit. I.e. with the help of financial materiality the value of a firm is captured and presented to the shareholders who will benefit from this. Incorporating this concept in the field of sustainability introduced a new level of shareholders since a much broader audience benefits from sustainability (Edgley et al., 2015). As with financial materiality, the firm's value was captured, now with non-financial materiality, the value of a much broader area is captured since sustainability relates to the economy, society, and environment. The audience for example includes government and regulatory bodies, but also employees, press, and the public. Therefore, the main difference between financial and non-financial materiality can be found in the intended audience. Financial materiality is focused on investors and non-financial materiality is focused on all stakeholders (Whitehead, 2016). Second, the concept of materiality for non-financial information is related to the decision made based on non-financial topics. This means next to quantitative information, which is also present in financial statements, there will also be decision-making based on qualitative information. Consider employee satisfaction or respecting human rights. Concluding, both differences demonstrate that non-financial materiality has a wider scope. Therefore, decision-making in sustainable materiality is much more subjective (Edgley et al., 2015). Due to these differences between financial and non-financial materiality and deficiency of regulatory measures for non-financial materiality, the concept is interpreted differently.

Currently, there is no consensus on a definition for materiality yet. Multiple different bodies try to provide guidance on how to define materiality. For example, ISA 320 guides materiality (IFAC, 2010a;2010b), however, the organization believes that materiality can be explained in different ways, under different circumstances. Thus, instead of focusing on one general definition, ISA believes an item could be material in case it could influence the decisions of users ((Edgley et al., 2015). According to the GRI, materiality should be defined by identifying opportunities and risks that are of most importance for stakeholders, but also for the economy, environment, society and regulatory bodies (Global Reporting Initiative, 2011b). With these different interpretations, it is hard to create one consistent understanding resulting in an expectation gap between users and auditors (Edgley et al., 2015).

The adoption of materiality in a non-financial context resulted into a new type of materiality which goes with a wider group of stakeholders. This group of stakeholders questions the ethics in capitalism resulting in institutional changes (Lounsbury et al., 2003). Financial materiality has quantitative metrics, such as net profit, which simplify the threshold process.

Non-financial materiality, on the contrary, is still developing quantitative metrics. However, the non-financial materiality is also of high importance for sustainability reports since it affects both presentation and disclosure of the data used for the reports (Deegan & Rankin, 1997). Materiality will even help firms improve their CSR strategy and performance (Edgley et al., 2015). The wide range of stakeholders has more trust in sustainability reports that confirm with GRI or AccountAbility reporting standards (Dawkins, 2004). Further research is necessary to assist non-accounting organizations provide the necessary guidance on reporting.

2.2.3 Materiality Analysis

The GRI states that in the wide area of sustainable topics to report on, the firm should report on the topics reflecting the firms' societal, environmental, and economic impact based on a dialogue with their stakeholders to identify the major impacts on sustainability(Global Reporting Initiative, 2016a). This is where a materiality analysis becomes helpful for firms. The materiality analysis assists firms in determining and prioritizing relevant topics. All prioritized topics should be included in the sustainability report (Beske et al., 2020). In 2006, Moneva et al. found that the existing guidelines have not been able to improve a firm's communication regarding CSR to its stakeholders and they are not adequate to assist in the materiality analysis. However, Beske et al. (2020) found that the issue lies more in how firms report on their materiality analysis. The reports lack details of the processes behind the determination process of materiality. Rather than issues with guidelines, the issues arise while reporting on the materiality analysis. Therefore, it is important to clarify the existing literature and guidelines on materiality analysis to understand the underlying processes.

According to Eccles et al. (2012), the analysis should consist of the following steps: identifying and engaging stakeholders, defining dimensions and labels, identifying and describing issues, and scoring issues. The first step, stakeholder identification, and engagement, is crucial to the analysis. understanding stakeholders is necessary when deciding on what sustainability impacts to report on (Global Reporting Initiative, 2011a). Stakeholders are often consulted, but not involved when decisions must be made in the materiality process. This will negatively affect the credibility of sustainability reports (Manetti, 2011). According to the GRI (2011a), firms need to discover a balance between the firm's values and the values of key stakeholders. To improve the quality and credibility of the sustainability report firms must apply received feedback and collaborate with stakeholders to obtain more knowledge (Boesso & Kumar, 2009). Because, if a firm does not meet the stakeholders' requirements, the positive effects of the CSR intentions can be reduced (Becker-Olsen et al., 2006). Therefore, firms must

engage their stakeholders in the process of CSR strategy and implementation. Unfortunately, there are no effective tools to support the identification and analysis of stakeholder groups (Boesso & Kumar, 2009). Stakeholder identification tools are limited according to Eccles et al. (2012) and they establish that only 12% of the sustainability reports disclose information on the identification process. However, more firms report on the stakeholder engagement process, which includes interviews, surveys, and discussions.

The second step in the materiality analysis is defining the dimensions and labels. Most firms use the X-axis for the impact on the firm and Y-axis for impact on stakeholders (Eccles et al., 2012). In this case, impact is defined as 'the effect an organization has on the economy, the environment, and/or society, which in turn can indicate its contribution to sustainable development (Global Reporting Initiative, 2016a). Another way to define dimensions is according to significance. This method is based on the significance of the organization's economic, environmental, and social impacts and subsequently the influence this impact has on the decision-making of stakeholders (Global Reporting Initiative, n.d.).

The third step focuses on the identification and description of issues. Issues relevant to the organization and topics relevant to stakeholders are considered (Hsu et al., 2013). GRI (2015) prescribes four steps, namely: identification, prioritization, validation, and review. Identification of the issues starts with identifying all issues that might be relevant to the report. The most common methods used to determine which topics could be relevant to stakeholders and the firm happens through stakeholder engagement (Eccles et al., 2014). The most common methods are questionnaires, interviews, panels, and media (Eccles et al., 2014). Prioritization is focused on which issues might be reported on. This happens by assessing the impact of all the issues on the established dimensions in the second step. The prioritized issues should be visually reflected (Bellantuono et al., 2016; Eccles et al., 2014). After prioritizing, the issues should be validated based on completeness and stakeholder inclusiveness according to the GRI (2015). To complete the third step, the identified and prioritized topics need to be reviewed since this will benefit the materiality cycle. All topics considered material in this part of the analysis need to be addressed in the sustainability reports (Bellantuono et al., 2016).

The fourth and final step refers to the issue scoring process. It must be clear to readers of the report which information and methods are used to score topics. If firms do not clarify this, only the firm's point of view will be explained and not how they reached this view (Eccles et al., 2012). Currently, only 8% of firms report on this process. However, readers must understand the weight of the stakeholders' view compared to the firm's view. Since it could lead to potential conflicts if stakeholders believe the topics of their concern are not represented

in the sustainability report (Beske et al., 2020). It then might be believed that management pursues interest other than that of the stakeholders. Beske et al. (2020) find that reporting on the materiality analysis lack detail of the underlying process and materiality analysis can be misused by firms when these underlying processes are unclear. If stakeholders are not involved in the materiality analysis for the reports, the chances of stakeholders marking the report as not credible will increase. Management should comprehend the relation between reporting on its materiality analysis and the credibility of the sustainability report (Beske et al., 2020).

With this knowledge regarding the materiality analysis and the importance of reporting on this process, this discussion can continue to the question concerning how to measure the quality of the materiality analysis.

2.2.4 Quality Materiality Analysis

The previous section explains the importance of conducting a materiality analysis. The second item of importance is the quality of this analysis. However, the biggest limitation within this area of quality is that that it is only possible to measure what the firms disclose. I.e. the actual quality could differ if for example, a firm undertook more efforts than it disclosed. Nevertheless, a measure will be developed for the quality of materiality analysis. At the same time, it is important to keep in mind till what extent it is possible to measure the actual quality and disclosed quality.

The quality of a materiality analysis will be based on the process described in the previous section, resulting in a quality variable named Materiality Analysis Quality (hereafter MAQ). The quality is based on five different aspects, namely: definition, procedure, justification, content, and audit.

The first important part is a common definition of materiality. As discussed in section 2.2.1 and 2.2.2 materiality for financial and non-financial information differ from each other. It is therefore important to distinguish what the firm defines as material. Beske et al. (2020) did similar research as they analyzed whether or not a definition was given. A report with a definition of materiality increases its *MAQ*. Next to this, linking material topics with Sustainable Development Goals (hereafter SDG) has added value. For firms, it improves the identification of which issues are most material in their industry. As for stakeholders, it clarifies to what sustainable trend the issue relates (Governance & Accountability Institute, Inc., 2018). By linking materiality with SDGs *MAQ* will increase.

The second part, procedure, counts the most for *MAQ*. The process description of all undertaken steps described in section 2.2.3. are required to understand a firm's decision on the content of its sustainability report. Therefore, the process behind stakeholder identification and engagement needs to be present and validated. Stakeholder inclusiveness is important since the reports need to be aligned with stakeholders' interests, as found in the previous sections. However, most sustainability report only mention the basic stakeholders such as customers, investors, employees, government, etc. On average 7.9 groups of stakeholders are included in the engagement. However, these groups are mostly only mentioned and only a few reports further explain how these groups influence the organization (Eccles et al., 2014). It is more useful to discuss the stakeholder on an individual level, the cluster is part of, and the location of the stakeholder. Eccles et al. (2014) find no consistent practice for a stakeholder identification method. Methods range from informal surveys to firms consulting outside parties. The third part of the materiality analysis in section 2.2.3. addresses the issue scoring. It is helpful for sustainability report users to gain more insights into the process behind the scoring of topics. If the users comprehend the data used, the methodology to collect the data the usefulness of the materiality matrix will increase. Without this information, users will only obtain information regarding the firm's view on the significance of issues instead of how firms got to that opinion (Eccles et al., 2014). Therefore, *MAQ* increases if firms report on the issue scoring process. Lastly, for the procedure section of it is important *MAQ* that the materiality analysis is up to date. To improve the quality and credibility of the sustainability report firms must apply received feedback and collaborate with stakeholders to obtain more knowledge (Boesso & Kumar, 2009). I.e. if a firm conducted a materiality analysis before, they are able to improve the process and analysis over time through dialogue with stakeholders, feedback and experience. Therefore, a materiality cycle increases *MAQ*.

The third part, justification, is based on the guidelines and standards that are used in the sustainability report. Guidelines support and improve the sustainability performances of a firm (Epstein & Roy, 2003b). Therefore, the use of guidelines to create and justify a sustainability report increases *MAQ*.

The fourth part, content, relates to the visual representation of the materiality analysis and how the material issues are followed up in the report. As described in section 2.2.3. the dimensions and labels are important items in the materiality analysis. Approximately, there are 23 material topics per matrix, ranging between 7 to 69 on an individual report basis (Eccles et al., 2014). In these material topics, there should be a balance between the significance of the organization and the significance for stakeholders (Global Reporting Initiative, 2011b).

Therefore, the materiality matrix should have an axis focused on each type of significance. Eccles et al. (2014) found that in 88% of the reports the X-axis is used for organization based significance and the Y-axis mostly refers to society's significance. For stakeholders to comprehend why a topic is rewarded a certain level of significance the meaning of significance must be explained. Reports having this explanation place, score higher on *MAQ*. The follow up on the identified material issues is highly important. If stakeholders deem the follow up incomplete, this might harm the quality and reliability of sustainability reports (de Villiers & van Staden, 2010). Therefore, a complete follow up on issues also results in a higher *MAQ*.

Lastly, audit/review is the final item affecting the quality of materiality analysis. External reviews of the sustainability disclosures and management practice increases the accuracy of the information in the report (Global Reporting Initiative, 2013). Therefore, a materiality analysis reviewed by a third-party will increase.

By reviewing the quality increasing items of a materiality analysis, the second sub-question how can the quality of a materiality analysis be measured is answered.

3. Hypotheses Development

3.1 Hypothesis 1

Firms in an environmentally sensitive industry are more likely to disclose their sustainability practices than firms in non-environmentally sensitive industries (Tagesson et al., 2009; Deegan & Gordon, 1996). This could relate to the reputation and risk management theory as discussed in section 2. Thus, disclosure of sustainability reports is found to be related to the sensitivity of industries. Firms operating in environmentally sensitive industries will be closely monitored by society, government, and NGOs. For example, Greenpeace is a major NGO pressuring firms to be more environmentally friendly. Firms pressured by environmental groups are more likely to disclose a sustainability report (Gamerschlag et al, 2011). Environmentally sensitive industries could for example be the oil & gas extracting industries or chemical manufacturing. Sustainability reports disclosed by firms in environmentally sensitive industries portray higher levels of transparency (Fernandez-Feijoo et al., 2014). The reason for this could be that firms try to improve the public's perception of the (negative) impact the firm has on the environment. To be transparent to the stakeholders, firms need to fully comprehend their stakeholders and the stakeholders' concerns. Materiality analysis is a tool to identify stakeholders and their expectations. Therefore, the question arises whether the relationship of environmentally sensitive industries on the transparency of disclosure can also be related to the foundation of a sustainability report: the materiality analysis. According to the reasoning behind transparency, firms operating in environmentally sensitive industries are more likely to have higher quality materiality analysis than firms in non-environmentally sensitive industries.

H_1: Firms in an environmentally sensitive industry are more likely to issue higher quality materiality analysis than firms in non-environmentally sensitive industries.

The hypothesis is in alternative form. The null hypothesis for H1 is as follows: firms in an environmentally sensitive industry will not have higher quality materiality analysis than firms that do not operate in an environmentally sensitive industry.

3.2 Hypothesis 2

The 'Reporting Matters' report of 2019 by the World Business Council on Sustainability Development demonstrates an increase of a little more than 12% in external assurance on sustainability reports. This increase can be assigned to the fact that assurance on sustainability

reports increases the reliability and accuracy (Global Reporting Initiative, 2013). Thereby, increasing the users' confidence in the report's quality (Carey et al., 2000). However, this effect does not appear to impact the quality of the materiality analysis used for the sustainability report. KPMG (2011) found that one-third of the 250 largest firms made restatements to their sustainability report due to of the risk present in data used for the sustainability report. Since one of the objectives of an assurance engagement is to review the materiality process conducted for the sustainability report (Global Reporting Initiative, 2013) you would expect the opposite and less risk in data. Practice however demonstrates a different situation.

According to GRI (2013) assuring a sustainability report also entails reviewing the processes for stakeholder involvement. Therefore, GRI believes stakeholder engagement would improve. However, Boiral et al. (2019) show no suggestions are made by assurors to involve stakeholders in the verification process of the reports. The authors recommend stakeholders to pressure firms and auditors to release more details regarding the stakeholder engagement process. Stakeholder involvement plays a major role in the materiality analysis and the report's quality resulting from these processes as was concluded in section 2.2.3. The audit process and assurance statement lacks attention for the details of this process. Therefore, an audit will probably not be quality increasing.

Both arguments for the higher quality presented by GRI do not appear to hold as is shown by research. Following the findings in research the second hypothesis is stated as follows:

H_2: Firms that have a third-party review/audit their sustainability reports do not have higher quality materiality analysis than sustainability reports without third-party confirmation.

This hypothesis is the null hypothesis. The alternative form for hypothesis H2 is as follows: firms that only have an internal audit or do not audit their sustainability reports will have lower quality materiality analysis than firms that do have a third party review their reports.

4. Research design

As previously mentioned, this research will first provide descriptive statistics on the current practice of materiality analysis of the dataset. This summary of the data will provide more insights in process-indicators (how much and what do firms report on) and the content-indicators (how do firms report these findings). This comprehension will benefit the second part of this research in which multiple effects on the quality of materiality analysis will be measured. The conceptual relations described in the previous section can be found in the predictive validity framework, also called Libby boxes (appendix 1 & 2). In the Libby boxes, the way these relations will be operationalized and examined can be found.

4.1 Data collection

The main data used for this study has been made available by WBCSD. With their project 'Reporting Matters', they desire to navigate the landscape and create a path forward for sustainable reporting (WBCSD, 2019). Their dataset consists of a total of 549 collected reports of 150 different firms over the past three years. The sample period runs from 2017 to 2019, including the sustainability reports of those three years. All information regarding materiality and materiality analyses in the sustainability reports will be coded with the use of NVivo, a qualitative data analysis computer software. This software allows structuring the data and turning the qualitative character of the data available into a quantitative dataset. Resulting in an opportunity to analyze the current practice of the materiality analysis and its quality. The coding sheet used (see appendix 4) is based on the findings in the literature study of this research (see section 2). The coding system consists of main nodes and child nodes to guarantee a hierarchical level structure in the data collected.

To increase the overall confidence of this research, the reliability of the data collection needs to be proven. Therefore, an interrater reliability test has been conducted. This test will measure the level of agreement between two coders, i.e. do they assign the same codes to the same data available in this case. Cohen's kappa (κ) will be used as a measure as it also takes chance agreement into account (McHugh, 2012). κ can vary between -1 and +1, -1 meaning disagreement, and +1 perfect agreement. The first 30 sustainability reports of the 2017 dataset were coded to test for the homogeneity among code assignments between two coders. For this, test an average κ of 0.40 was found (see appendix 5). This level of agreement is deemed to be acceptable. Next to this, each code's individual Kappa score was also compared between the

two coders. In the case of variation in assigning codes, the difference was reviewed to prevent this type of disagreement on large scale in the full sample set.

Besides the data on the materiality analyses, the data for firm size, firm performance, and industry/SICs will be obtained with the use of COMPUSTAT. Data regarding the firm's ESG ratings will be collected with the use of MCSI's database. The COMPUSTAT database is accessible through the Erasmus University Library. After all data has been collected, the data will be merged and used to calculate a variable for the quality materiality analysis and to predict the hypotheses of this study.

4.2 Methodology

4.2.1 Theoretical construct dependent variable Materiality Analysis Quality

Currently, there is no existing literature yet on how to measure the quality of a materiality analysis. To measure the quality of the materiality analysis (*MAQ*) multiple factors are important. All factors are extensively explained in section (2.2.4). To have an overview of the different factors, a checklist will be used to score *MAQ*. This results in a multivariable *MAQ* (see appendix 5). *MAQ* consists out of five different sub-items on which the quality will be scored, namely: definition, procedure, justification, content, and audit which are part of the main nodes used in the data collection part of this study. Each sub-item consists out of different child items, based on the child nodes used in the data collection. Each child item is scored based on a binary number system, scoring 1 if the item is present in the firm's sustainability report and 0 if otherwise. The more important a sub-item, the more child items this sub-item will be scored on. Therefore, a weighted calculation is not necessary as each item is already weighted by each of its child items. The maximum score of *MAQ* is 40, the lowest score that can be received is 0 and means the firm did not perform a materiality analysis. The maximum score of 40 means that the firm's materiality analysis answered all of the items in the checklist with a yes. Note that the *MAQ* score is based on what the firms report on, this is the only way how the materiality analysis currently can be scored since there is no inside information available about the actual processes behind the analysis other than what the firm report on the analysis in their report.

4.2.2 Independent variables

Independent variable *SIC* is based on the SIC industry classification. *SIC* equals 1 in the case of a firm operating in an environmentally sensitive industry and 0 for non-environmentally

sensitive industries. SIC industries are classified based on the major group codes, which equal the first two numbers of the four number digit codes. This results in 10 different classes, of which five are marked as environmentally sensitive industries, as can be seen in appendix 6.

Audit will equal 1 in the case the materiality analysis is mentioned by the third party/auditor in their assurance statement. The value will equal 0 if there is no third party involved or in the case of a third party present but no mention of the materiality analysis in their assurance statement.

4.2.3 Control variables

To study the effects of the mentioned independent variables on *MAQ*, a few external factors need to be excluded from the research since they could affect the relationship of the *MAQ*. In order to properly conduct a study on *MAQ*, the effects factors need to be ruled out. The following control variables are expected to affect the outcome of the relationship between the independent variables on *MAQ*:

Firm size is a common control variables used in studies on disclosures. Multiple studies show that firm size affects the extent of sustainability disclosures. This effect can be related to a few different reasons. First of all, larger sized firms have a bigger impact on society. This means that large firms have more attention of stakeholders and need to meet the stakeholders' expectations (Knox et al., 2006). Second, the expectations of bigger firms are higher than of smaller sized firms. Therefore, firms will extensively report on sustainability in order to avoid litigation (Scott, 2003). Lastly, bigger firms have more resources available to work on sustainability disclosures than small firms. Where big firms will have entire teams working on their sustainability, a small firm perhaps only has one employee available to work on the sustainability disclosure. Firm size will be measured using the firm's total assets as previous studies have shown (Tagesson, 2009).

The firm performance will be taken into account as multiple studies find a relation between performance and disclosure. One of the reasons for the relationship between profitability and sustainability disclosure is based on the economic position of the firm (Pirsch, et al., 2007). Firms with higher performances also have more resources to deploy for sustainability means. Firms with fewer resources tend to focus on their main operations (Roberts, 1992). Furthermore, higher-performing firms have a bigger impact on society. This means that large firms have more attention to stakeholders and are required to meet the stakeholders' expectations (Knox et al., 2006). Another reason focuses on the political pressure and public image of firms with high performances. Since there is much at stake for these firms,

they voluntarily disclose more information to prevent litigation and regulation. (Ng & Koh, 1994). Therefore, performance will be measured using both *ROA* & *ROE*.

Multiple studies found a correlation between firms' geographic location and CSR reporting (Kolk & Perego, 2010; Adams C. A., 2002). Therefore, a third control variable will be used, namely for the geographic *Region* (1= Asia, 2 = EMEA, 3 = South America and 4 = North America). For each geographic location a dummy will be used. 1 if the firm's headquarters are located in that specific region, 0 if the firm is not located in that specific region.

At last, the study controls for Environmental, Social, and Governance (ESG) scores. The ESG rating gives investors an idea of how a firm is performing and will be able to compare this across different firms. Therefore, there is an incentive for firms to improve performance and establish material topics more accurately. ESG ratings fall into five different risk levels: negligible, low, medium, high, and severe (Systainalytics, 2020). The ratings are scaled from 0 to 100, with 100 being the most severe. A dummy variable will be created for which the firms with ESG ratings scaled under negligible and low risk equal 1. Firms with ESG ratings scaled at medium, high and severe risk equal 0.

An complete overview of the variables used in this research and their definitions can be found in appendix 3.

4.2.4 Multilevel regression hypothesis 1

The hypotheses of this study will be tested with the help of a multilevel regression analysis. The dependent variable (Y) will *MAQ* and the dummy variable *SIC* will be the independent variable. Therefore, the following regression model (1) will apply:

$$\mathrm{MAQ} = \alpha + \beta_1 \mathrm{SIC} + \beta_2 \mathrm{Audit} + \gamma_1 \mathrm{TA}_{1it} + \gamma_2 \mathrm{ROA}_{2it} + \gamma_3 \mathrm{ROE}_{3it} + \gamma_4 \mathrm{ESG}_{4it} + \gamma_5 \mathrm{Region}_{5it} + \epsilon_{it}$$

Hypothesis 1 tests whether or not industry an environmentally sensitive classification impacts the firm to improve performance on its materiality analysis, therefore increasing *MAQ*. Hypothesis 1 has no prediction of the effect of the coefficient of β_1 on *MAQ* (?). Therefore, β_1 could be positive, meaning that firms operating in environmentally sensitive industries have higher quality materiality analysis. On the contrary, β_1 could also be negative, meaning that firms within environmentally sensitive industries deliver lower quality materiality analysis. Another outcome could be that β_1 and *MAQ* are not related to each other.

4.2.5 Multilevel regression hypothesis 2

For the second hypothesis of this study, the same multilevel analysis will be used. The dependent variable (Y) is *MAQ* and a dummy variable will be used for the independent variable third party review/*Audit*. This results in the following regression model (2):

$$MAQ = \alpha + \beta_1 SIC + \beta_2 Audit + \gamma_1 TA_{1it} + \gamma_2 ROA_{2it} + \gamma_3 ROE_{3it} + \gamma_4 ESG_{4it} + \gamma_5 Region_{5it} + \epsilon_{it}$$

Hypothesis 2 predicts that reviewing or auditing a sustainability report does not increase the quality of materiality analysis and therefore has no effect. Therefore, the prediction is that β_1 will not be significant as it does not affect *MAQ*.

4.2.6 Statistical tests

The first part of this research will report on the current practice of materiality analyses. This information will portray process-indicators on the sample level. For example, the amount of materiality analysis by firms in the sample set. The content-indicators portray insights on a firm level. This could be what do firms report on the process behind their materiality analysis. These descriptive statistics will provide a better understanding of the current practice. This understanding will benefit the second part of this research in which multiple effects on *MAQ* are measured. Part of this are the following tests:

4.2.6.1 Pearson's correlation test

The Pearson correlation test measures the strength and direction of the correlation between two variables. R_s can take values from -1 to +1. Whereby +1 indicates a perfect correlation between two variables. 0 would indicate no association between the two variables. Where -1 indicates a perfect, negative correlation between two variables. Values close to zero therefore indicate weaker correlations. Pearson's correlation can be used for categorical and continuous variables. The categorical variable should be coded as a 0/1-coding. Therefore, Pearson is the appropriate test for this research as all variables are continuous or categorical with a 0/1-coding. To test for multicollinearity between the variables the Variance Influence Factors (VIFs) will be determined.

4.2.6.2 Multilevel linear regression analysis

The dataset exists out of firms in both $Fyear_{2017}$ and $Fyear_{2018}$, therefore potential overlapping firms could exist otherwise known as nesting. Meaning a firm is represented in both of the *Fyear* sample sets (see figure 1). This means, that differences between a firm's *MAQ* in $Fyear_{2017}$ and $Fyear_{2018}$ could exists. Therefore, *MAQ* is plotted against *Fyear* to see if these differences exists. Figure 2 shows that indeed firms' *MAQ* change over the period of the dataset. To control for these firm-level fixed effects and random effects, a multilevel linear regression analysis will be performed to predict the relationship between our independent and dependent variables. To conduct a multilevel regression, level 1 and level 2 must be established. For this model the first level is n, indicating a firm number. The second level is *Fyear*. A firm in level 1 can be nested in level 2 as a firm can be present in both *Fyears*.

Six models are established to test for the effects of the independent variables on the dependent variable while controlling for the fixed and random effects. The first model is the base model of this test, the second model includes the dependent and independent variables. The last four models will each include an extra control variable.

For each model the Interclass Correlation Coefficient (ICC) is determined. The ICCs are a measure to determine how strong units in a group resemble one another. For this study it test the correlation between a firm's *MAQ* in $Fyear_{2017}$ and $Fyear_{2018}$. ICCs below 0.500 indicate a low reliability, ICCs between 0.500-0.750 are moderately reliable and ICCs of 0.750 or higher indicate a good reliability (Koo & Li, 2016).

The Wald tests whether or not any of the included explanatory variables in the model increase the fit of the model. If they do not, they should be removed from the model. Prob > chi-square gives the probability of obtaining the chi-square statistics given that there is no effect of the independent variables on the dependent variables. I.e. the chances of making a type 1 error. This probability should be below a certain P-value for the model to be significant. This test is used to explain the goodness of fit of the test.

4.2.6.3 Additional tests

To test whether or not the results found in the regression analysis hold, a robustness check will be performed to see how these results behave when the regression is modified. If the results appear robust, this shows evidence of validity for this study. First, the effects of the independent variables *SIC* and *Audit* will be checked by isolating their effects by performing the following two regressions:

$$MAQ = \alpha + \beta 1SIC + \gamma 1SIZE1it + \gamma 2ROA2it + \gamma 3ROE3it + \gamma 4GEO4it + \gamma_4 ESG_{5it} + \epsilon it$$

$$MAQ = \alpha + \beta 1AUDIT + \gamma 1SIZE1it + \gamma 2ROA2it + \gamma 3ROE3it + \gamma 4GEO4it + \gamma_4 ESG_{5it} + \epsilon it$$

Performing the single regressions for both $Fyear_{2017}$, $Fyear_{2018}$ and both years will show if the effects of the multilevel model still hold.

A threat related to the robustness of linear regression analysis is the error distribution. The error distribution needs to be normally distributed. Only sample sizes of 50 or more can have correct estimates of the standard errors. For sample sizes below this level, estimates of standard errors are biased (Maas & Hox, 2004). However, this is not a threat to this study since it consists of a sample size above 50. Another threat to regressions is heteroskedasticity. I.e. when the standard deviation of our variable *MAQ* is non-constant over the range of our independent variable. To test for heteroskedasticity the Cook-Weisberg test will beperformed.

4.3 Sample selection

The sample includes sustainability reports in the fiscal year 2017 and 2018. The sample period starts in 2017 since this is the year WBCSD started collecting data. The data was first coded by hand via NVivo and afterward scored based on the measure for materiality analysis quality. Due to time constraints it was not feasible to include the year 2019. The full sample exists out of 345 observations. Since this research aims to measure effects on the quality of materiality analysis a minimum score for *MAQ* is set at 1, meaning they conducted a materiality analysis. An outlier test has been conducted and has shown no outliers exist in the observation. The minimum of *MAQ* =1 is therefore sufficient. If the described steps are followed, the final subsample consists out of 313 firm-year observations. This is the sample required for the current practice sample set.

To test for the hypotheses of this research the same steps as mentioned above are followed. Next to this, all observations are required to have financial data available through COMPUSTAT for the necessary control variables. As hypothesis one tests for the effect of environmentally sensitive industries on *MAQ*, all observations are required to have a SIC code available. To test for the second hypothesis, the same requirement for *MAQ* = 1 and the availability in COMPUSTAT apply. Next to this, the observations are required to have an ESG score, as this effect is used as a dummy variable in the regression model. Due to the different control variables included in the models used in this study, the sample selection gives three

different subsamples. For model 2 the subsample includes 287 firm-years. Model 3 and 4 include 256 firm-years and model 5 and 6 include 180 firm-years.

A more extensive overview of the sample selection process can be found in table 1.

5. Empirical results

5.1 Descriptive statistics current practice

Table 2 provides an overview of the current practice of materiality analyses.

Panel A demonstrates the current region contribution in the dataset. The main finding here is the high representation of the *EMEA* region in the WBCSD dataset as they account for more than half of the dataset. This finding is important to keep in mind for the following findings in this study since these findings will say more concerning the current practice in EMEA region than the other regions. *EMEA* is currently scoring highest with an average *MAQ* of 14, with *Asia* scoring the second-highest average *MAQ* of 12,6, then *North America* with an average *MAQ* of 11,9 and last *South America* with a score of 10.

Panel B demonstrates the current industry distribution for the dataset. Environmentally sensitive industries account for 74% of the dataset. This could mean that firms operating in environmentally sensitive industries are more likely to release sustainability reports. However, the data collected by WBCSD is based on data collected amongst firms holding the WBCSD-membership. As these firms are already more aware and concerned with their corporate social responsibility it is also more likely that they issue a sustainability report than a firm not holding a WBCSD-membership. This results in a biased selection procedure. The average *MAQ* for environmentally industries is slightly higher than *MAQ* for non-environmentallyindustries.

Panel C demonstrates the current *ESG* distribution in the dataset. MAQ appears to increase as the ESG score increases. This shows that firms that score higher materiality analysis, also perform good on Environmental, Social, and Governance topics. This finding shows that including a control variable for ESG scores is correct. However, the trend appears not to hold for observations with the lowest ESG score in this dataset, as they show an average *MAQ* of 15,7.

Panel D demonstrates the current *Audit* distribution for this dataset. As previously established, more and more firms are conducting audits for their sustainability reports. The same trend can be seen in the dataset used in this study. 63% of the sustainability report were audited. Therefore, this dataset is suited well to test for our second hypothesis.

Panel E demonstrates the current *MAQ* item distribution. I.e. it shows the means of each item on which *MAQ* was scored, to see in which areas firms lack quality in their materiality analysis and room for improvement exists. The first column shows the averages for $Fyear_{2017}$, column two shows the results for $Fyear_{2018}$ and the third and final column the averages for both $Fyear_{2017}$ and $Fyear_{2018}$. This way any improvements or deteriorations in the two years can be

noticed. Most variables remain similar over the years, however, some variables demonstrate changes. *SDG_materiality-link* demonstrates an increase in time from 26,7% to 77,1%. Showing that an increasing amount of firms adopted the SDGs to link these goals with their material topics. In section 2.2.3 the importance of stakeholder identification and engagement was stressed, however only 7% of the firms in the dataset define what is a stakeholder to the firm (*Def_stakeh*). This percentage is in accordance with the low percentage found by Eccles et al. (2014). However, an increase in *Categ_int and Categ_ext* stakeholders can be seen in 2017-2018 which translates into an increase in identified stakeholders. Already 70,6% of the firms use standards and guidelines throughout their disclosure on their materiality analysis (*Just_Standard*). As previously discussed, stakeholders need to know how their views weigh against the firm's view in order the fully comprehend a materiality matrix. However, only 7% explains how the stakeholders'view is weighed against the firm's view (*Weight_SH*). There is a small decrease in *Audit_Review*, the outcome for hypothesis two would be relevant for this variable. If an audit positively affects the quality of the materiality an increase in *Audit_Review* would be expected. Especially since 32,7% of the firms perform a yearly materiality analysis (*Yearly_Analysis*).

Concluding, there is still room for improvement for firms conducting materiality analyses. The average *MAQ* of 13 out of 40 is considerably low. For most of the variables less than half of the firms perform that specific step in the materiality analysis. Again, it is important to remember that the information in table 2 is based on what firms report on. The actual quality of the analysis could differ from the reported materiality analysis.

5.2 Descriptive statistics MAQ

Table 3 provides an overview of descriptive statistics for the dependent variable *MAQ*, the independent variables *SIC* and *Audit*, and the control variables for *ROE*, *ROA*, *TA*, and *Region*. Panel A demonstrates descriptive statistics for $Fyear_{2017}$, panel B demonstrates the descriptive statistics for $Fyear_{2018}$, and panel C demonstrates the descriptive statistics for both years.

Panel A consists of 148 observations for $Fyear_{2017}$. The dependent variable *MAQ* is calculated based on the checklist in section 4.2.1 and shows an average of 13,25. The range of *MAQ* demonstrates a minimum value of 1 and a maximum value of 29, both the mean and median are therefore closer to the minimum than the maximum value. 74,1% of the firms in this subsample have a SIC code available through COMPUSTAT and 59,5% conducted an audit. In panel B the total firm-year observation equals 165 for $Fyear_{2018}$. In this panel, the

average for *MAQ* is 12,84 and the range starts with a minimum of 1 and ends with a maximum of 29. Both the mean and median are closest to the minimum value. For this sample set, 73% of the firms have a SIC code via COMPUSTAT and 65,5% conducted an audit.

In essence panels A & B demonstrate the same results and no differences are present. The average *MAQ* demonstrates a small decrease of 0,42 in 2018 compared to 2017. For both years the minimum and maximum value of *MAQ* stay the same with a minimum *MAQ* of 1 and a maximum value for *MAQ* of 29. Some minor differences can be found in the values of *ROA*, *ROE* and *TA*. Moreover, the average *ESG* score does not differ significantly and both numbers translate into an average score of B.

Panel C demonstrates a total of 313 firm-year observations for the entire sample. The *MAQ* is constant with the finding in table 2. Furthermore, panel C demonstrates 51,8% of the sustainability reports are released by firms located in the *EMEA* region as is in agreement with table 2.

5.3 Pearons' correlation

As discussed in 4.2.6.1 a Pearson's correlation tests fit our dependent and independent variables best. To refresh, a correlation of -1 is a perfect, negative correlation and +1 a perfect, positive correlation. Table 4 presents the correlations between all the variables used in the regression models to test for this study's hypotheses. A correlation in bold numbers is significant at a 5% level or lower.

The first result standing out is that all dependent variables (*SIC* and *Audit*) have a significant, positive correlation with the independent variable (*MAQ*). *Audit* portrays the strongest correlation of .336, indicating that sustainability reports with an audit score higher on *MAQ*. *SIC* portrays a correlation with *MAQ* of .133, indicating that firms in environmentally industries score higher on *MAQ.* The correlation found for environmentally sensitive industries and *MAQ* confirms the direction of the corresponding hypothesis 1. However, the correlation between *MAQ* and *Audit* is surprising since it demonstrates a positive effect. The corresponding hypothesis 2 is stated as no difference between audit and non-audit firms.

The negative correlations of *ROA* (-.065) and *ROE* (-.070) are somewhat surprising since a positive correlation was expected based on section 4.2.3. However, both results are insignificant and close to zero.

It is interesting to see that firms located in the *Asia, SA,* or *NA Region* are negatively correlated to *MAQ*. *EMEA* portrays a significant, positive correlation with *MAQ* of .145. This finding is in agreement with the findings in table 2, panel A in which *EMEA* portrays higher

MAQ averages than the other regions. However, as previously established: *EMEA* dominates the dataset with 52%. As the other sub-groups are underrepresented it is hard to generalize these findings outside of this dataset since these findings are based on little data for these sub-groups.

A significant, positive correlation of .121 is found between *SIC* and *Audit*. Firms in environmentally sensitive industries are thus more likely to verify their sustainability reports. The same effect is found for *ESG* on *Audit.* Indicating that firms with higher ESG scores are more likely to audit their sustainability reports. Or firms with audited sustainability reports increase their ESG score.

A significant, negative correlation between *TA*, *ROA* and *ROE* with *SIC* is found. Meaning that firm performances and size decrease for firms in environmentally sensitive industries. The same trend is found for the correlation between *ROA* and *ROE* with *ESG*. Here a significant, positive correlation is found. Meaning that higher ESG scores result in higher *ROAs* and *ROEs.*

Moreover, Pearson's correlation table is helpful in detecting any potential traces of multicollinearity. I.e. are any of the independent variables correlated. The cut-off point of .800 will be used for this test. This illustrates a high correlation between *ROA* and *ROE* of .852. This is an indication of potential multicollinearity. However, *ROA* and *ROE* measure for the same concept, namely *Firm Performance.* Therefore, it is likely both of the variables are highly correlated. The same counts for all four region dummies that are significantly correlated to each other. Since they measure for the same concept, *Region*, this is logical. For each location and each firm performance measure, a separate dummy will be created in the regression models. To exclude multicollinearity with certainty the VIFs are calculated for the variables (see table 8). Only VIFs above 10 require further investigation. As this is not the case for the variables included, no further investigation is necessary. The threat of multicollinearity can be ruled out.

5.4 Multilevel linear regression

Pearson's correlation test already found that *MAQ* and *SIC* were positively correlated, giving a first confirmation of the expected direction in hypothesis 1. Hypothesis 1 was stated as follows:

> **H_1**: *Firms in an environmentally sensitive industry are more likely to issue higher quality materiality analysis than firms in non-environmentally sensitive industries.*

Pearson's correlation test also found that *MAQ* and *Audit* were positively correlated. Hypothesis 2 was stated as follows:

***H_2**: Firms that have a third-party review/audit their sustainability reports do not have higher quality materiality analysis than sustainability reports without third-party confirmation.*

To further examine this relationship between *MAQ* and *SIC* and *MAQ* and *Audit* a multilevel regression is conducted and its results are presented in table 5. Model 2 includes the two independent variables of this study, *SIC* and *Audit.* Additional control variables are added to the regression for model 3 to model 6. Both show a positive result, however only the result of *Audit* is significantly positive.

When the controls are added, the effect for *SIC* decreases from a coefficient of 1.148 (model 2) to 0.530 (model 6). These results both show insignificant p-values. So a trend for firms scoring 1 on *SIC* and the effect on *MAQ* is found. However, the study did not reach statistical significance. Yet, the effect varying between 1.148 and .530 can be of big impact on an average *MAQ* of 13. Therefore, further research is necessary to draw conclusions about the effect of environmentally sensitive industries on *MAQ*. Hypothesis one is rejected, based on the p-values that all 5 are insignificant for *SIC*.

When the controls are added, the effect for *Audit* increases from a coefficient of 4.450 with a significance level of .001 (model 2) to a coefficient of 5.902 with a significance level of .001 (model 6). For all models the coefficient stays significantly positive. For the full model (model 6) the finding can be interpreted as firms scoring 1 for *Audit* (indicating they conduct an audit), score 5.902 higher on *MAQ*. Therefore, the finding for *Audit* can be interpreted as auditing a sustainability report is indeed value increasing to the materiality analyses. Concluding, hypothesis two will be rejected.

All ICCs for the models are between .534 and .631. As previous discussed, ICCs between .500 and .750 are moderately reliable (Koo & Li, 2016). Meaning the level two correlation for this study is moderately reliable.

The goodness-of-fit test based on the Wald chi-square test show significant values for each model. The Prob > chi2 for each model is .000, which is significant at a .001 level. Meaning the explanatory variables show a good fit with the data of this study.

5.5 Additional tests

To see whether or not the significant, positive relationship between the independent variable *Audit* on the dependent variable *MAQ* hold under different circumstances a robustness check will be conducted. The same test will be conducted to see whether or not the positive, insignificant relationship between *SIC* and *MAQ* changes. The dataset will be split into two sample sets. The first sample set holds all observations for $Fyear_{2017}$, the second sample set holds all observations for $Fyear_{2018}$. Since the dataset consists of a short time frame it is useful to control for any potential extremes in one of the years. Finally one final regression of the full sample will be performed and a test for heteroskedasticity is the final part of the robustness check.

5.5.1 Robustness test regression model 1

A separate, linear regression was conducted to see if the trend for environmentally sensitive industries and the quality of the materiality analysis found in table 5 still holds under altered circumstances. The results for this robustness check can be found in table 6. Panel A holds the results for $Fyear_{2017}$ and still demonstrates a positive trend between independent variable *SIC* and dependent variable *MAQ*. Panel B, which holds the results for $Fyear_{2018}$, shows a minor difference as the coefficient decreased to 1.551. In table 5 a coefficient of .530 was found, compared to the full subset coefficient of 2.112 in table 6 this is a smaller trend. However, all results are insignificant and therefore the effect of firms in environmentally sensitive industries conducting higher quality materiality analysis is no more than a trend. The goodness-of-fit for this linear regression can be predicted by the R squared, which in this case is relatively high with a value of .784 (panel c, table 6). Indicating a high goodness-of-fit between the model and variables.

To conclude, the sign, magnitude, and insignificance stay similar for this test. Therefore, the results for hypothesis one are robust.

5.5.2 Robustness test regression model 2

A separate, linear regression is conducted to see if the positive, significant relationship for auditing a sustainability report and the quality of the materiality analysis found in table 5 still holds under altered circumstances. The results for this robustness check can be found in table 7. Panel A holds the results for $Fyear_{2017}$ and again demonstrates a positive, significant relationship of 6.935 between *Audit* and *MAQ*. Again this result is significant at the .001 level.

Panel B holds the result for $Fyear_{2018}$. Again, this panel demonstrates the same result, namely a positive, significant coefficient of 7.175. The goodness-of-fit for this linear regression can be predicted by the R squared, which in this case is relatively high with a value of .823 (panel c, table 7). Indicating a high goodness-of-fit between the model and variables.

To conclude, the sign, magnitude, and significance stay similar for this test. Therefore, the results for hypothesis two are robust.

5.5.3 Heteroskedasticity

To test for heteroskedasticity two approaches are used in this research namely: Cook-Weisberg (Breus-Pagan) test and the visually inspection method. The first method tests for both regressions in the robustness check (see section 4.2.6.3) and results are found in table 9. A low Chi-square indicates heteroskedasticity is not an issue in the dataset. The results found for the two regressions show small Chi-squares of .000 for the first regression model and 0.110 for the second regression model. Heteroskedasticity can be ruled out with the use of this test.

The second method involves scattered plots of the residual bu fitted value plots (see figure 3 & 4). Visual expectation to check whether the results of the Cook-Weisberg test hold. In case of heteroskedasticity the scattered plot will become cone shaped. In the scattered plot for the two regression models no cone shaped scatter plots are visible. Confirming that heteroskedasticity no threat to the data in this study.

6. Conclusion

6.1 Main results

In light of the increasing amount of sustainability reports this thesis aimed to conduct research on the current practice of materiality analyses and to establish which factors influence the quality of materiality analyses. One main finding for the current practice was that the current quality of materiality analyses is still low in contrast to the number of reports published. In 2018 86% of the firms in the S&P 500 index released a sustainability report. However, in our current dataset, only an average score of 13 out of 40 was found for the quality of materiality analyses. Concluding, there is still room for improvement for firms in their materiality analysis.

The second part of this thesis aimed to capture the effects of environmentally industries and audit on the quality of materiality analysis. For firms within environmentally industries was found that they perform higher quality analyses than firms within non-environmentally industries. However, this finding is only applicable to the WBCSD dataset used for this study and not the entire population as no significance was reached. The trend confirms the positive relation between environmental sensitivity and information disclosure due to the reputation and risk management theory (Tagesson et al., 2009; Deegan & Gordon, 1996) also relates to the quality of the disclosed information. To be transparent in disclosure, firms within environmentally sensitive industries perform better during their materiality analyses process. As the materiality analysis is a tool to determine the firm's material topics through processes including its stakeholders, it is important to perform well on this analysis in order to meet the stakeholders' demand. If the sustainability report does not meet this demand, the firm faces reputation risks. However, the results of this study are not sufficient to prove this theory since the results are not significant. One reason could be the firms' WBCSD membership as firms holding this memberships have more incentives to be aware of sustainability efforts and reporting on the efforts.

Due to the current literature on the topic of the audit effects on the quality of sustainability reports, no effect was expected for audit on materiality analysis. However, this study has shown different results as there indeed exists a relationship between both. Firms conducting an audit on their sustainability reports perform higher quality analysis. This result contradicts the findings in the existing literature and supports the opposing side of standard setters. GRI found that part of an assurance engagement is to review the materiality process conducted for the sustainability report (Global Reporting Initiative, 2013). Therefore, the

quality of a materiality analysis increases as the process and outcomes are reviewed. The findings of this study support the standard setters point of view on this matter.

6.2 Contribution and implications

This study is the first study, that I am aware of, that has demonstrated the current practice of materiality analyses in a quantitative manner. This approach has big implications for other studies and literature on the topic of materiality analyses for sustainability reports as it made materiality analysis concrete by quantifying the concept of quality. These new insights provide a new direction for future research on the topic of materiality analysis. For the development of research in this topic, the development of the quality measure of materiality analysis is of high value.

As a call for sector-specific reporting standards for sustainability report and materiality exists (Eccles et al., 2012) it is important to understand in which areas these specific reporting standards are necessary. With this study it was proven in which areas the materiality analyses currently lack quality (see table 2). Next to this, this study found a trend in the used dataset that firms in environmentally sensitive industries are more likely to perform higher quality materiality analyses. Meaning that perhaps firms within non-environmentally industries require more or clearer guidelines to increase materiality analysis quality since they experience less stakeholder pressure. Therefore, this trend needs to be further investigated to find out if the trend applies to the entire population or only the used dataset. Next to these specific areas within the materiality analysis, it was also found which regions in the world score lower on materiality analysis quality. Implicating that not only specific reporting standards per sector are necessary, perhaps even per country or region. These findings can assist standard setters and regulators in the process of defining areas which require more legislation. When standards improve, sustainability reports will become easier to compare for stakeholders. For auditors or supervisory bodies, it becomes easier to judge reports and express an opinion.

Furthermore, this study is contributing to the question of whether or not auditing sustainability reports add value. The results for hypothesis two illustrated that an audit increased the quality of the materiality analysis. This finding has different implications. Firstly, auditors are required to be aware of the effect their audit has on the materiality analysis and preferably express this in their opinion letter to acknowledge this effect. Second, for readers of a sustainability report, this finding means that an audited report could be based on a more reliable materiality analysis. This could increase their trust in the report. Lastly, this finding is

interesting for firms contemplating whether or not to conduct an audit. Conducting the audit could in certain cases result in higher quality materiality analyses.

6.3 Limitations, discussion and further research

While interpreting the findings of this study, it is important to keep in mind that a few limitations are applicable to the set-up of this research. Firstly, the quality of the materiality analyses is based on what the firms report on. It does not necessarily mean that what firms report on is equal to how the firms perform their materiality analysis in practice. Firms could for example perform a materiality analysis to a great extent, but only report little on it. Second, the data collected by WBCSD is based on firms with a WBCSD memberships. Firms holding such a membership are already more likely to be concerned with their corporate social responsibility. Therefore, they are more likely to issue a sustainability report. This results in a selection bias in the dataset used. A third limitation is the representation of different regions in the dataset used for this study. More than half of the firms are located in the region EMEA. This makes it harder to generalize the findings of this study for all four regions. Lastly, the dataset only exists out of two years of data making it difficult to determine whether these findings hold in the long run. Moreover, the effects could now be more extreme as the short time frame is more vulnerable to extremes. Since sustainability reports and auditing sustainability reports is an upcoming trend of the past years it could be possible that there is an assurance time lag. Meaning that there is a period of time between the audit and increase in quality. Therefore, a time frame longer than two years is necessary to draw conclusions with more certainty.

Therefore, I would recommend future research to conduct more research on this topic if more data is available. If a longer timeframe and more balanced data on regions exist, it would be interesting to see how the effects of SIC codes and audits interact with the quality of materiality analyses. Especially for the first model that turned out not to be significant. Further research on the effect of *SIC* on the materiality analysis quality is therefore necessary to make statements regarding the effect with certainty. Furthermore, I would recommend conducting future research on the topic of materiality analysis quality in the area of standards/regulation and their effect on the quality. Since this research has demonstrated that the current practice lacks quality and guidelines play a big role in increasing the quality. It is important to determine whether or not the voluntary guidelines are currently meeting their purpose or whether stricter rules need to be applied. Especially for cases of mandatory sustainability reporting this is an important question.

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8. Tables

Table 1
Sample selection

Description	Observations
Firm years with information available in WBCSD database	345
Less:	
Firm years without Materiality Analysis	(32)
Firm years in final sample current practice	**313**
Firm years with information available in WBCSD database	345
Less:	
Firm years without Materiality Analysis	(32)
Firm years without necessary information in COMPUSTAT database	(15)
Firm years without SIC	(11)
Firm years in final sample model 2	**287**
Firm years with information available in WBCSD database	345
Less:	
Firm years without Materiality Analysis	(32)
Firm years without necessary information in COMPUSTAT database	(46)
Firm years without SIC	(11)
Firm years in final sample model 3 & 4	**256**
Firm years with information available in WBCSD database	345
Less:	
Firm years without Materiality Analysis	(32)
Firm years without necessary information in COMPUSTAT database	(46)
Firm years without SIC	(11)
Firm years without ESG score	(76)
Firm years in final sample model 5 & 6	**180**

Table 2
Descriptive statistics current practice

Panel A: Region distribution						
	(1)	(2)	(3)	(4)	(5)	(6)
	n	%	Mean MAQ	Std. Dev.	Min	Max
Asia	77	25%	12.597	6.146	1	24
EMEA	162	52%	13.957	6.774	1	29
SA	16	5%	10.000	4.427	4	18
NA	58	19%	11.862	6.820	1	24

Panel B: Industry distribution						
	(1)	(2)	(3)	(4)	(5)	(6)
	n	%	Mean MAQ	Std. Dev.	Min	Max
Environmental sensitive	222	74%	13.523	6.642	1	29
Non-environmental sensitive	80	26%	11.550	6,111	1	24

Panel C: ESG distribution						
	(1)	(2)	(3)	(4)	(5)	(6)
	n	%	Mean MAQ	Std. Dev.	Min	Max
AAA	34	18%	15.706	7.218	1	29
AA	42	22%	14.833	5.639	2	28
A	35	18%	14.229	6.839	2	25
BBB	47	24%	13.149	6.352	2	28
BB	16	8%	12.563	6.196	4	24
B	13	7%	10.231	7.769	1	24
CCC	6	3%	15.333	7.174	7	23

Panel D: Audit distribution						
	(1)	(2)	(3)	(4)	(5)	(6)
	n	%	Mean MAQ	Std. Dev.	Min	Max
Audit	196	63%	14.740	6.324	1	29
No Audit	117	37%	10.171	6.056	1	24

Table 2 (continued)
Descriptive statistics current practice

Panel E: MAQ item distribution			
	(1)	(2)	(3)
Variable	Mean 2017	Mean 2018	Mean 17-18
Definitions			
Def_standard	0.220	0.337	0.282
SDG_materiality-link	0.267	0.771	0.533
Procedure			
Def_stakeh	0.073	0.066	0.070
Def_categ	0.380	0.554	0.472
Categ_int	0.393	0.590	0.497
Categ_ext	0.393	0.578	0.491
Proc_stakehID	0.147	0.163	0.155
Just_ID_way	0.047	0.036	0.041
Proc_StakehEng	0.727	0.560	0.639
Proc_StakehEng	0.720	0.560	0.636
Proc_StakehEng	0.700	0.386	0.534
Proc_StakehCount	0.700	0.404	0.544
Just_Eng_Way	0.280	0.235	0.256
Just_NoEngage	0.007	0.018	0.013
Def_Issue	0.287	0.434	0.364
Proc_IssueID	0.407	0.265	0.332
Just_IssueIDway	0.080	0.084	0.082
Just_Dimension	0.340	0.319	0.329
Def_MatScore	0.600	0.343	0.465
Just_ScoringWay	0.033	0.108	0.073
Proc-StakehDivers	0.040	0.072	0.057
Proc_Followup	0.300	0.699	0.510
Proc_ManagRev	0.220	0.102	0.158
Yearly_Analysis	0.409	0.253	0.327
Proc_CyclPast	0.523	0.446	0.483
Proc_CyclyFuture	0.195	0.265	0.232
Proc_CycleChange	0.242	0.114	0.175
Just_Cycle	0.181	0.181	0.181
Justification			
Just_Standard	0.660	0.747	0.706

(continued on next page)

Table 2 (continued)
Descriptive statistics current practice

Panel E: MAQ item distribution (continued)			
	(1)	(2)	(3)
Variable	Mean 2017	Mean 2018	Mean 17-18
Content			
Cont_Matrix	0.553	0.506	0.528
Cont_Matrix_Clear	0.313	0.331	0.323
Cont_X-axis	0.420	0.392	0.405
Cont_Y-axis	0.233	0.271	0.253
Weight_SH	0.069	0.072	0.071
Materiality_Dimension	0.320	0.307	0.313
Issue_Description	0.567	0.349	0.452
Issue_Classified	0.473	0.319	0.392
Issue_TooVague	0.433	0.355	0.392
External_Support	0.280	0.361	0.323
Audit			
Audit_Review	0.247	0.223	0.234
Express_Pos	0.227	0.187	0.206
Express_Neg	0.020	0.030	0.025
Observations	163	182	345

Descriptive statistics for the current practice of materiality analysis based. Column 1 is based on the dataset for 2017, column 2 is based on the dataset for 2018. Column 3 includes both years.

Table 3
Descriptive statistics

Panel A: 2017

Variable	(1) n	(2) Mean	(3) Std. Dev	(4) Median	(5) Min	(6) Max
MAQ	148	13.250	6,.739	13	1	29
SIC	143	0.741	0.430	1	0	1
Audit	148	0.595	0.493	1	0	1
ESG	94	4.809	1.628	5	1	7
TA	129	179.061,50	1.058.667	32.010,34	0	11.900.000
ROA	140	5.315	6.951	4.202	-14.985	48.630
ROE	140	14.613	26.406	9.703	-53.357	236.975
EMEA	148	0.520	0.501	1	0	1
ASIA	148	0.230	0.422	0	0	1
NA	148	0.189	0.393	0	0	1
SA	148	0.068	0.252	0	0	1

Panel B: 2018

Variable	(1) n	(2) Mean	(3) Std. Dev	(4) Median	(5) Min	(6) Max
MAQ	165	12.836	6.484	13	1	29
SIC	159	0.730	0.446	1	0	1
Audit	165	0.655	0.477	1	0	1
ESG	99	4.859	1.597	5	1	7
TA	140	155.634,100	1.010.748	28.563,33	0	11.900.000
ROA	158	5.451	6.597	4.222	-7.506	48.630
ROE	158	14.198	27.119	9.874	-90.021	236.975
EMEA	165	0.515	0.501	1	0	1
ASIA	165	0.261	0.440	0	0	1
NA	165	0.182	0.387	0	0	1
SA	165	0.042	0.202	0	0	1

Panel C: 2017 - 2018

Variable	(1) n	(2) Mean	(3) Std. Dev	(4) Median	(5) Min	(6) Max
MAQ	313	13.032	6.598	13	1	29
SIC	302	0.735	0.442	1	0	1
Audit	313	0.626	0.485	1	0	1
ESG	193	4.834	1.608	5	1	7
TA	269	166.868,800	1.032.133,000	28.965	0	11.900.000
ROA	298	5.387	6.755	4.212	-5.293	48.630
ROE	298	14.393	26.743	9.767	-53.357	236.975
EMEA	313	0.518	0.500	1	0	1
ASIA	345	0.246	0.431	0	0	1
NA	313	0.185	0.389	0	0	1
SA	313	0.054	0.227	0	0	1

Descriptive statistics of the dataset. Panel A displays descriptive statistics of the fiscal year 2017. Panel B displays descriptive statistics of the fiscal year 2018. Panel C reflects the descriptive statistics of both 2017 and 2018. Monetary values are reflected in million $.

Table 4
Pearson's correlation

	MAQ	Audit	SIC	ESG	TA	ROA	ROE	Asia	EMEA	SA	NA
MAQ											
Audit	**0.336**										
SIC	**0.133**	**0.121**									
ESG	**0.172**	**0.194**	-0.084								
TA	0.046	0.042	**-0.174**	0.362							
ROA	-0.065	0.044	**-0.200**	**0.212**	-0.090						
ROE	-0.070	0.014	**-0.166**	**0.148**	-0.051	**0.852**					
Asia	-0.038	0.027	**0.227**	**-0.185**	**0.142**	-0.067	-0.097				
EMEA	**0.145**	**0.232**	**-0.172**	**0.324**	**-0.086**	0.079	0.062	**-0.592**			
SA	-0.107	-0.061	-0.059	**-0.205**	-0.021	**-0.157**	-0.088	**-0.133**	**-0.240**		
NA	-0.085	**-0.294**	0.002	-0.105	-0.044	0.061	0.081	**-0.272**	**-0.494**	**-0.111**	

Pearson's correlation based on the entire sample of 345 firm year observations. Bold numbers indicate a significant correlation at a level of 0,05 or better.

Table 5
Multilevel regression model

Model: $MAQ = \alpha + \beta_1 SIC + \beta_2 Audit + \gamma_1 TA_{1it} + \gamma_2 ROA_{2it} + \gamma_3 ROE_{3it} + \gamma_4 ESG_{4it} + \gamma_5 Region_{5it} + \epsilon_{it}$

	Model 1 (1)			Model 2 (2)			Model 3 (2)		
MAQ	Coefficient	Std. Dev.	P-value	Coefficient	Std. Dev.	P-value	Coefficient	Std. Dev.	P-value
Fixed effects									
Intercept	12.869	0.455	0 ***	9.999	1.237	0.000 ***	10.449	1.437	0.000 ***
Audit				4.450	0.889	0.000 ***	4.534	0.964	0.000 ***
SIC				1.148	0.985	0.244	0.969	1.189	0.415
TA							2.930	4.750	0.537
ROA									
ROE									
ESG									
Asia									
EMEA									
SA									
NA									
Random effects									
Firm: estimate	5.299			4.659			4.877		
Std. Dev.	0.407			0.401			0.423		
ICC	0.631			0.573			0.611		
Wald chi2	55.93			28.23			23.68		
Prob > chi2	0.000 ***			0.000 ***			0.000 ***		
Observations	313			287			256		
Groups	187			170			150		

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**** P-value is significant at the 0,001 level (2-tailed), ** p-value is significant at the 0,01 level (2-tailed), * p-value is significant at the 0,05 level (2-tailed). con*

Table 5 (continued)
Multilevel regression model

Model: $MAQ = \alpha + \beta_1 SIC + \beta_2 Audit + \gamma_1 TA_{1it} + \gamma_2 ROA_{2it} + \gamma_3 ROE_{3it} + \gamma_4 ESG_{4it} + \gamma_5 Region_{5it} + \epsilon_{it}$

	Model 4 (4)			Model 5 (5)			Model 6 (6)		
MAQ	Coefficient	Std. Dev.	P-value	Coefficient	Std. Dev.	P-value	Coefficient	Std. Dev.	P-value
Fixed effects									
Intercept	10.667	1.517	0.000 ***	9.202	2.532	0.000 ***	11.944	2.678	0.000 ***
Audit	4.761	0.975	0.000 ***	5.100	1.203	0.000 ***	5.902	1.227	0.000 ***
SIC	0.788	1.191	0.509	0.762	1.641	0.642	0.530	1.600	0.740
TA	2.430	4.750	0.608	1.350	4.801	0.778	2.140	4.640	0.644
ROA	-0.182	0.154	0.237	-0.160	0.181	0.376	-0.191	0.177	0.280
ROE	0.052	0.044	0.232	0.081	0.048	0.090	0.08	0.048	0.092
ESG				0.315	0.355	0.374	-0.011	0.360	0.976
Asia							9.51	2.646	0.000 ***
EMEA							11.575	2.766	0.000 ***
SA							2.800	3.581	0.434
NA							11.944	2.678	0.000 ***
Random effects									
Firm: estimate	4.823			4.636			4.286		
Std. Dev.	0.428			0.512			0.514		
ICC	0.605			0.576			0.534		
Wald chi2	25.61			25.50			37.79		
Prob > chi2	0.000 ***			0.001 ***			0.000 ***		
Observations	256			180			180		
Groups	150			102			102		

**** P-value is significant at the 0,001 level (2-tailed), ** p-value is significant at the 0,01 level (2-tailed), * p-value is significant at the 0,05 level (2-tailed).*

Table 6
Robustness model H_1:

$$MAQ = \alpha + \beta_1 SIC + \gamma_1 SIZE_{1it} + \gamma_2 ROA_{2it} + \gamma_3 ROE_{3it} + \gamma_4 GEO_{4it} + \gamma_4 ESG_{5it} + \epsilon_{it}$$

Panel A: Fyear 2017

MAQ	(1) Coefficient	(2) Std. Dev	(3) t	(4) P-value	
SIC	2.523	2.398	1.05	0.296	
TA	5.390	6.770	0.80	0.428	
ROA	-0163	0.285	-0.57	0.569	
ROE	0.011	0.092	0.12	0.903	
ESG	0.197	0.532	0.37	0.712	
Asia	10.369	3.692	2.81	0.006	
EMEA	11.139	3.924	2.84	0.006	
SA	4.967	4.943	1.00	0.318	
NA	10.631	3.848	2.76	0.007	
Observations	94				
R-squared	0.770				
Adj. R-squared	0.750				

Panel B: Fyear 2018

MAQ	(1) Coefficient	(2) Std. Dev	(3) t	(4) P-value	
SIC	1.551	2.097	0.74	0.462	
TA	4.040	6.160	0.66	0.514	
ROA	-0.020	0.196	-0.10	0.919	
ROE	-0.015	0.032	-0.47	0.642	
ESG	0.783	0.477	1.64	0.104	
Asia	6.381	3.267	1.95	0.054	
EMEA	10.148	3.414	2.97	0.004	*
SA	5.371	4.448	1.21	0.230	
NA	5.957	3.330	1.79	0.077	
Observations	97				
R-squared	0.806				
Adj. R-squared	0.786				

**** P-value is significant at the 0,001 level (2-tailed), ** p-value is significant at the 0,01 level (2-tailed), * p-value is significant at the 0,05 level (2-tailed).*

Table 6 (continued)
Robustness model H1

Panel C: Full sample

	(1)	(2)	(3)	(4)	
MAQ	Coefficient	Std. Dev	t	P-value	
SIC	2.112	1.561	1.36	0.177	
TA	4.830	4.520	1.07	0.286	
ROA	-0.054	0.153	-0.35	0.724	
ROE	-0.166	0.029	-0.56	0.574	
ESG	-.480	0.351	1.37	0.173	
Asia	8.314	2.427	3.43	0.001	***
EMEA	10.636	2.559	4.16	0.000	***
SA	5.150	3.280	1.57	0.0118	
NA	8.496	2.487	3.42	0.001	***

Observations	191
R-squared	0.784
Adj. R-squared	0.773

**** P-value is significant at the 0,001 level (2-tailed), ** p-value is significant at the 0,01 level (2-tailed), * p-value is significant at the 0,05 level (2-tailed).*

Table 7
Robustness model H_2:

$$MAQ = \alpha + \beta_1 AUDIT + \gamma_1 SIZE_{1it} + \gamma_2 ROA_{2it} + \gamma_3 ROE_{3it} + \gamma_4 GEO_{4it} + \gamma_4 ESG_{5it} + \epsilon_{it}$$

Panel A: Fyear 2017

	(1)	(2)	(3)	(4)	
MAQ	Coefficient	Std. Dev	t	P-value	
Audit	6.935	1.629	4.26	0.000	***
TA	1.700	5.970	0.29	0.776	
ROA	-0.060	0.492	-0.12	0.903	
ROE	-0.342	0.258	-1.32	0.189	
ESG	-0.045	0.084	0.53	0.598	
Asia	9.865	2.573	3.83	0.000	***
EMEA	10.457	2.90	3.63	0.000	***
SA	0.737	4.450	0.17	0.869	
NA	12.624	2.831	4.46	0.000	***
Observations	96				
R-squared	0.811				
Adj. R-squared	0.792				

Panel B: Fyear 2018

	(1)	(2)	(3)	(4)	
MAQ	Coefficient	Std. Dev	t	P-value	
Audit	7.175	1.552	4.62	0.000	***
TA	1.600	5.310	0.30	0.764	
ROA	0.311	0.437	0.71	0.478	
ROE	-0.139	0.171	-0.81	0.418	
ESG	0.001	0.028	0.04	0.971	
Asia	5.435	2.246	2.42	0.018	*
EMEA	8.803	2.554	3.45	0.001	***
SA	0.853	3.966	0.22	0.830	
NA	7.593	2.261	2.90	0.005	**
Observations	99				
R-squared	0.844				
Adj. R-squared	0.829				

**** P-value is significant at the 0,001 level (2-tailed), ** p-value is significant at the 0,01 level (2-tailed), * p-value is significant at the 0,05 level (2-tailed).*

Table 7 (continued)
Robustness model H2

Panel C: Full sample

MAQ	(1) Coefficient	(2) Std. Dev	(3) t	(4) P-value	
Audit	6.994	1.552	6.31	0.000	***
TA	1.730	1.108	0.44	0.662	
ROA	0.126	3.950	0.39	0.698	
ROE	-0.194	0.135	-1.43	0.154	
ESG	-.002	0.026	0.09	0.927	
Asia	7.665	1.680	4.56	0.000	***
EMEA	9.700	1.900	5.10	0.000	***
SA	0.873	2.944	0.30	0.767	
NA	10.331	1.900	5.44	0.000	***
Observations	195				
R-squared	0.823				
Adj. R-squared	0.814				

**** P-value is significant at the 0,001 level (2-tailed), ** p-value is significant at the 0,01 level (2-tailed), * p-value is significant at the 0,05 level (2-tailed).*

Table 8

Variance Influence Factor

Variable	VIF	1/VIF
EMEA	9.35	0.107
Asia	8.24	0.121
NA	5.21	0.192
ROE	1.82	0.549
ROA	1.81	0.554
ESG	1.19	0.843
SIC	1.16	0.863
TA	1.14	0.875
Mean VIF	3.74	

Check for multicollinearity. VIFs >10 require further investigation.

Table 9

Cook-Weisberg test for heteroskedasticity

	Chi2	Prob > chi2
H1	0.000	0.993
H2	0.110	0.742

Ho	Constant Variance
Variables	Fitted values of MAQ

Cook-Weisberg tests if error variances are equal for the H0. A large chi2 indicates heteroskedasticity.

9. Figures

Figure 1: Multilevel model

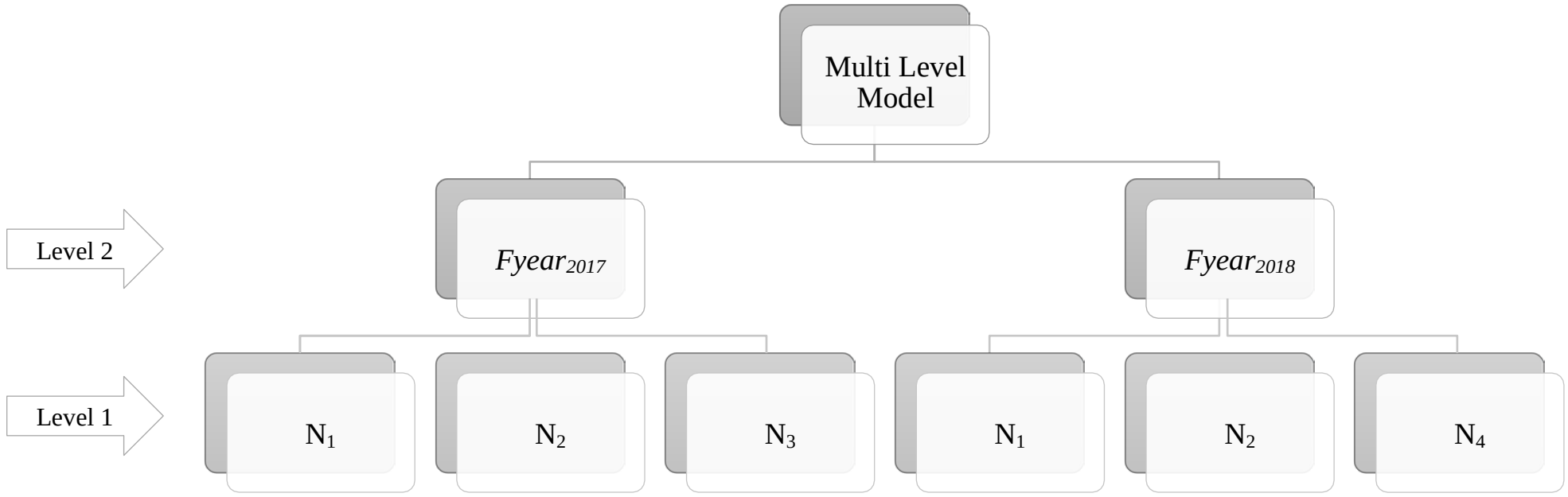


Figure 2: MAQ plot over time

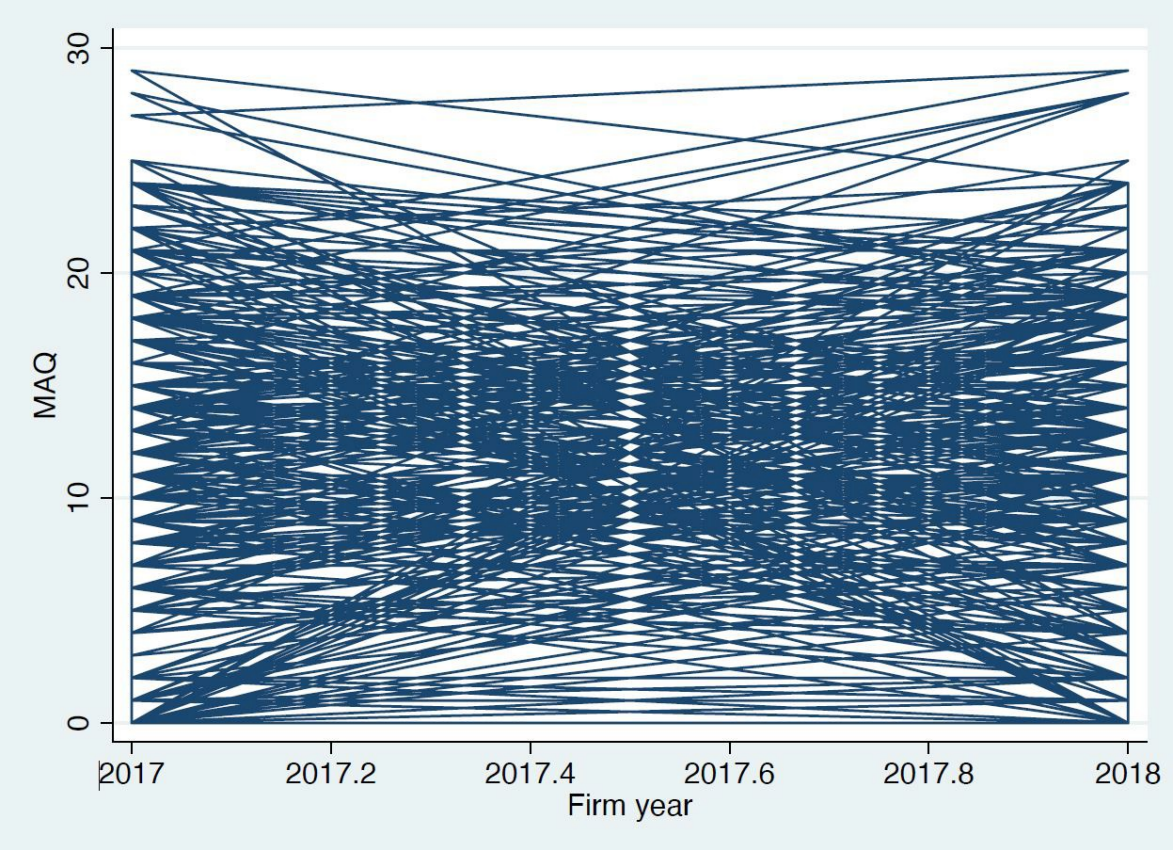


Figure 3: Scatter plot hypothesis 1

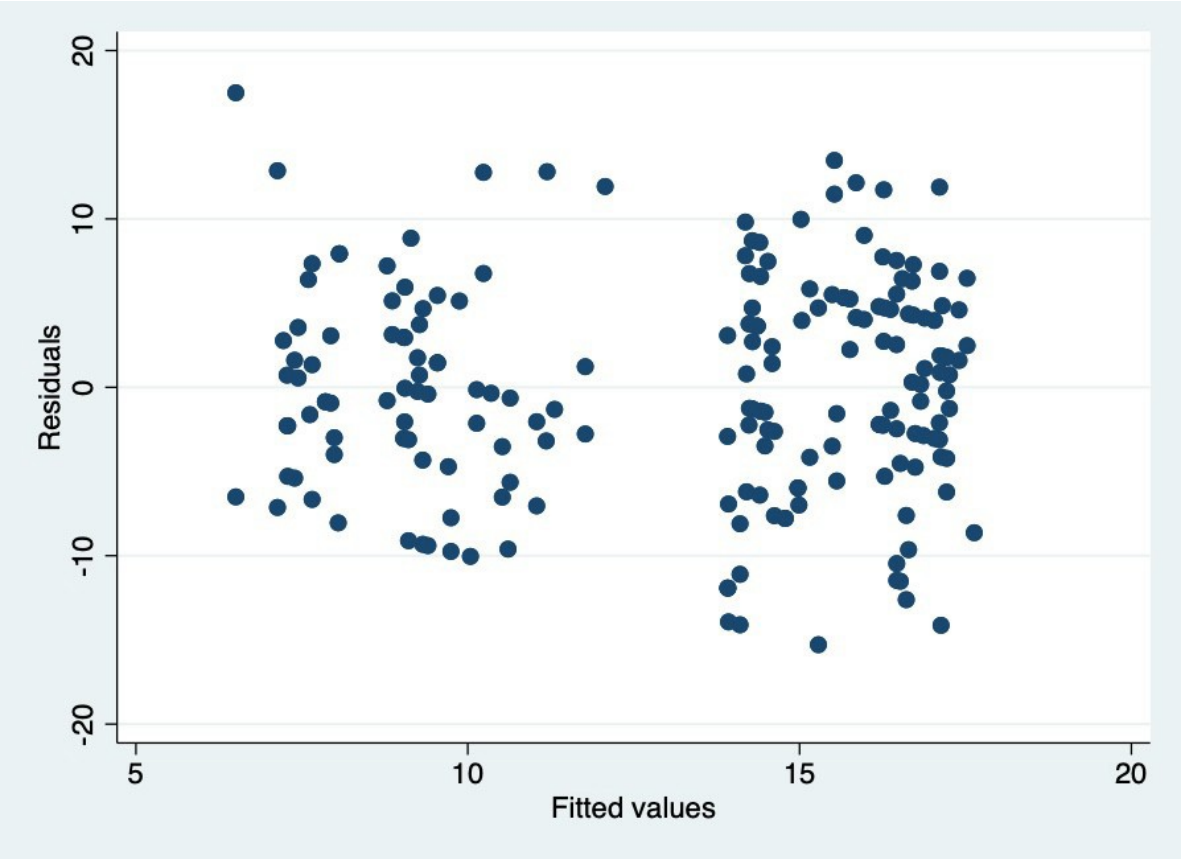
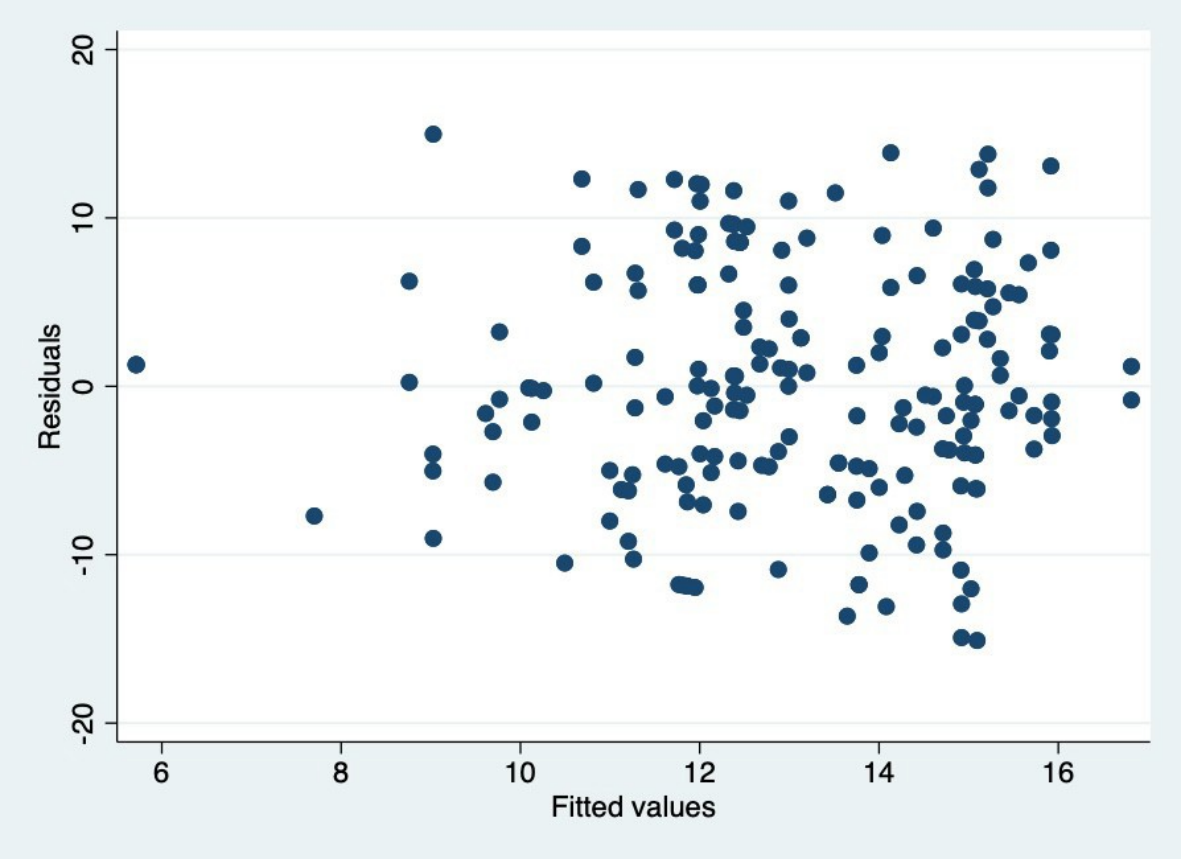
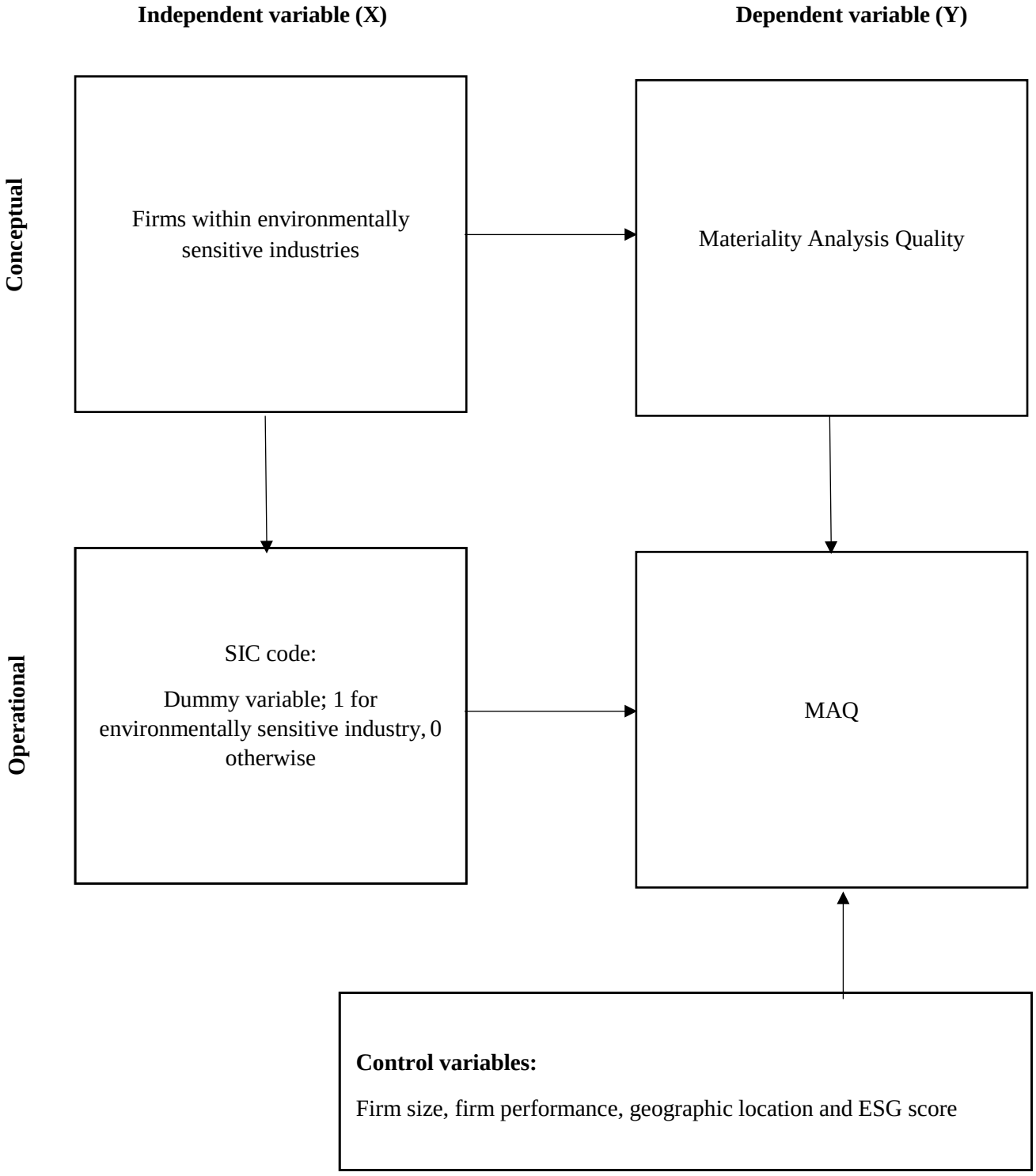


Figure 4: Scatter plot hypothesis 2

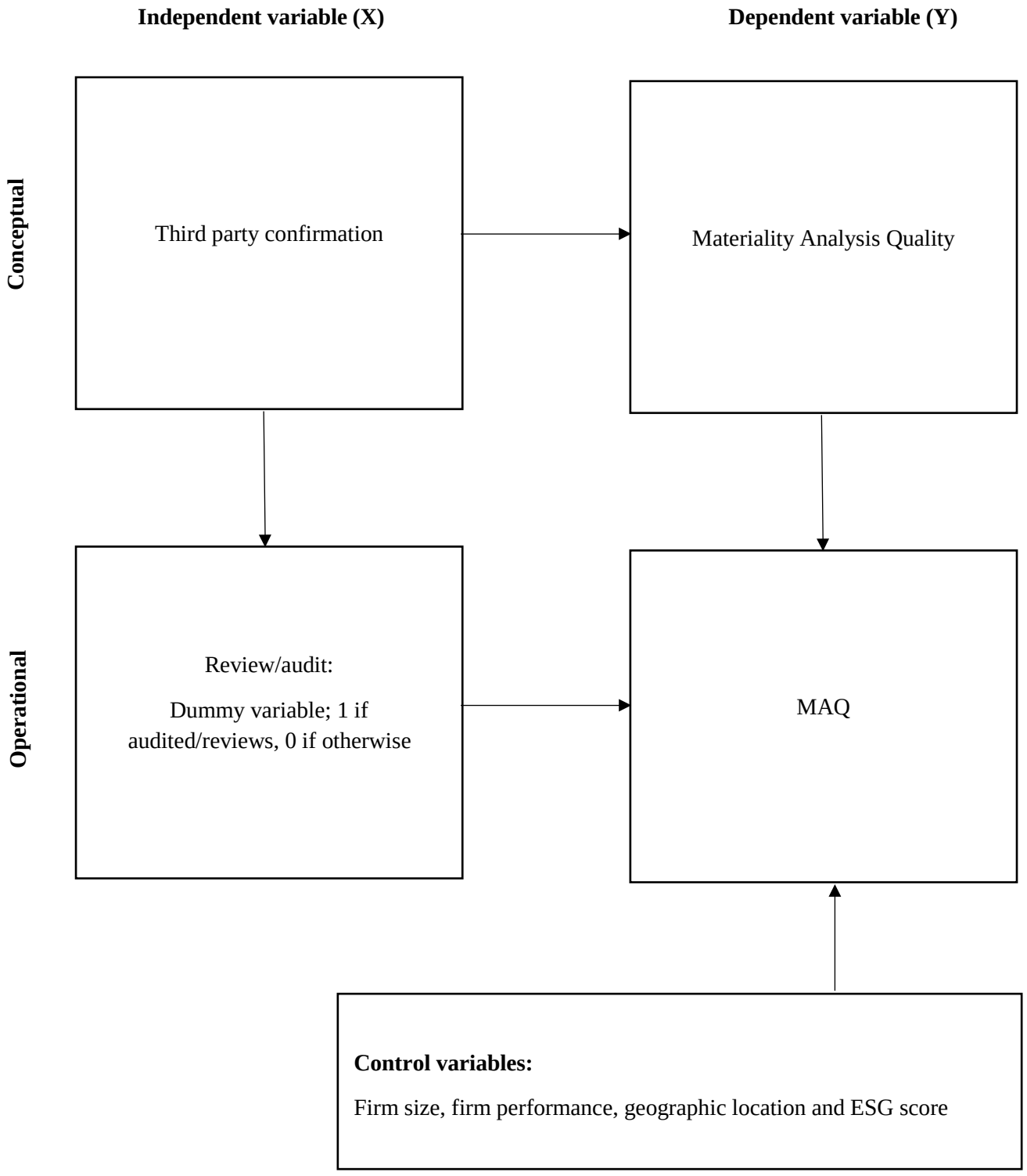


10. Appendices

Appendix 1: Libby box hypothesis 1



Appendix 2: Libby box hypothesis 2



Appendix 3: Variable definitions

Variable	Definition	Dependent/Independent/Control
MAQ	Materiality Analysis Quality: multivariable measure for the quality of the materiality analysis based on review of the currently existing literature. Score reach: minimum of 1 and maximum of 40.	Dependent (continuous)
SIC	Industry Classification to measure environmental sensitivity based on SICs. 1 = environmentally sensitive 0 = non-environmentally sensitive.	Independent (dummy)
Audit	Assurance on sustainability report by third-party. 1 = third-party assurance, 0 = no third-party assurance.	Independent (dummy)
ESG	Environmental, Social, and Governance score. 1 = negligible and low risk, 0 = medium, high and severe risk	Control (dummy)
TA	Total Assets. Measure for firm size	Control (continuous)
ROA	Return on Assets. Measure for firm performance/size.	Control (continuous)
ROE	Return on Equity. Measure for firm performance/size.	Control (continuous)
Region	Geographic location of the firm. 1= Asia, 2 = EMEA, 3 = South America and 4 = North America	Control (dummy)

Appendix 4: Intercoder reliability

Code		File	Kappa	**Agreement (%)**	A and B (%	Not A and Not B (%	**Disagreement (%)**	A and Not B (%	B and Not A (%
Materiality_codeschem		3M_Sustainability Report	0,199	98,07	0,53	97,54	1,93	0,13	1,8
Materiality_codeschem		ABB-sustainability_perfor	0,3866	99	1,28	97,72	1	0,16	0,83
Materiality_codeschem		Accenture-2016-Corporat	0,9779	99,91	0,95	98,97	0,09	0	0,08
Materiality_codeschem		Acciona Sustainability Rep	0,5	99,41	0	99,41	0,59	0,59	0
Materiality_codeschem		Acer 2016_corporate_resp	0,133	95,42	0,7	94,72	4,58	0,1	4,48
Materiality_codeschem		aditya birla group - idea c	0,2718	98,56	0,66	97,9	1,44	0,62	0,82
Materiality_codeschem		ADM_Sustainability_Corpo	0,5	98,28	0	98,28	1,72	1,72	0
Materiality_codeschem		ADM_Sustainability_Corpo	0	97,1	0	97,1	2,9	0	2,9
Materiality_codeschem		Aecom_sustainability-repo	1	100	0	100	0	0	0
Materiality_codeschem		AECOM-Sustainability-Re	0,5	99,72	0	99,72	0,28	0,28	0
Materiality_codeschem		AkzoNobel_Report 2016	0,1756	99,2	0,18	99,03	0,8	0,1	0,7
Materiality_codeschem		Apple_Environmental_Res	0,5	99,91	0	99,91	0,09	0,09	0
Materiality_codeschem		Arcadis Annual Report 20	0,3032	99,26	0,46	98,8	0,74	0,01	0,73
Materiality_codeschem		ArcelorMittal_Annual Revi	0,5485	99,48	0,03	99,46	0,52	0,42	0,09
Materiality_codeschem		BaoSteel_SR2016en	1	100	0	100	0	0	0
Materiality_codeschem		Barry Callebaut	0,5	99,14	0	99,14	0,86	0,86	0
Materiality_codeschem		BASF_Report_2016	0,6863	99,84	0,05	99,79	0,16	0,08	0,08
Materiality_codeschem		Bayer Annual Report 2016	0,1399	99,69	0,05	99,63	0,31	0,16	0,16
Materiality_codeschem		Bloomberg	0,3437	98,15	1,25	96,91	1,85	0,18	1,67
Materiality_codeschem		BMW Group Sustainable	0	99,27	0	99,27	0,73	0	0,73
Materiality_codeschem		BMW-Group-SustainableV	0,5	99,13	0	99,13	0,87	0,87	0
Materiality_codeschem		Borealis Annual Report 20	0,5	99,79	0	99,79	0,21	0	0,21
Materiality_codeschem		bp-sustainability-report-2	0,2955	99,14	0,37	98,78	0,86	0,06	0,8
Materiality_codeschem		Bridgestone	0	99,61	0	99,61	0,39	0	0,39
Materiality_codeschem		Bridgestone sr2016	0,5	99,01	0	99,01	0,99	0,99	0
Materiality_codeschem		BRISA_RI_2016_ING	0,2226	99,66	0,14	99,52	0,34	0,2	0,14
Materiality_codeschem		BT_DeliveringourPurposeR	0,5461	98,23	1,12	97,11	1,77	0,21	1,57
Materiality_codeschem		canon-sus-2016-e	0	98,61	0	98,61	1,39	0	1,39
Materiality_codeschem		canon-sus-2017-e	0,2055	98,33	0,21	98,12	1,67	0,19	1,47
Materiality_codeschem		Cargill 2017 Annual Repo	0,5	99,86	0	99,86	0,14	0,14	0
Average			0,40	99,026	0,266	98,761	0,974	0,272	0,701

Appendix 5: MAQ measure

Name code	Description	Code	Measure	Cum max score
A. Definition				
Def_standard	Is a definition on materiality given?	A.1	Yes (1)/No(1)	1
SDG_materiality-link	Do they link materiality with SDG's	A.2	Yes (1)/No(1)	2
B. Procedure				
Def_stakeh	Is a definition on stakeholders to the firm given?	B.1.A	Yes (1)/No(1)	3
Def_categ	Are stakeholders categorized?	B.1.A	Yes (1)/No(1)	4
Categ_int	Are internal stakeholders included?	B.1.A	Yes (1)/No(1)	5
Categ_ext	Are external stakeholders included?	B.1.A	Yes (1)/No(1)	6
Proc_stakehID	Is a process description of stakeholder identification given?	B.1.B	Yes (1)/No(1)	7
Just_ID_way	Do they provide reasoning for why this is the right way of identifying stakeholders?	B.1.C	Yes (1)/No(1)	8
Proc_StakehEng_Int	Engagement process description internal stakeholders present?	B.2.B	Yes (1)/No(1)	9
Proc_StakehEng_Ext	Engagement process description external stakeholders present?	B.2.B	Yes (1)/No(1)	10
Proc_StakehEng	Did the company expand their engagement process beyond standard engagement methods?	B.2.B	Yes (1)/No(1)	11
Proc_StakehCount	Did the company expand their process outside of key stakeholders also?	B.2.B	Yes (1)/No(1)	12
Just_Eng_Way	Explanation given of why this is the right way of engaging stakeholders? Is there any thought given to the process?	B.2.C	Yes (1)/No(1)	13
Just_NoEngage	Explanation provided on why certain stakeholders were not included/engaged with?	B.2.C	Yes (1)/No(1)	14
Def_Issue	Explanation on what makes an issue to be concluded in the analysis?	B.3.A	Yes (1)/No(1)	15
Proc_IssueID	Is the process behind issue identification explained?	B.3.B	Yes (1)/No(1)	16
Just_IssueIDway	Do they provide reasoning for why this is the right way of identifying issues?	B.3.C	Yes (1)/No(1)	17
Just_Dimension	Do they provide reasoning for why they chose this dimension?	B.4.C	Yes (1)/No(1)	18
Def_MatScore	Is the determination processs of whether a issue is material or not described? Issue scoring	B.5.A	Yes (1)/No(1)	19
Just_ScoringWay	Explenation given on why they think this is the right way of scoring the issues?	B.5.C	Yes (1)/No(1)	20
Proc-StakehDivers	Did they describe how they incorporate the diversity of views of different stakeholders?	B.5.B	Yes (1)/No(1)	21
Proc_Followup	Does the report follow up on identified material issues?	B.6.B	Yes (1)/No(1)	22
Proc_ManagRev	Where the results of the materiality analysis reviewed by (higher) management?	B.6.B	Yes (1)/No(1)	23
Yearly_Analysis	Materiality analysis was conducted this year or updates for this year's report.	B.7.A	Yes (1)/No(1)	24
Proc_CyclPast	Did they perform a materiality analysis before in the past?	B.7.B	Yes (1)/No(1)	25
Proc_CyclyFuture	Are they planning on conducting or updating the analysis in the future?	B.7.B	Yes (1)/No(1)	26
Proc_CycleChange	Do they discuss changing over time in materiality issues?	B.7.B	Yes (1)/No(1)	27
Just_Cycle	Do they explain why the materiality analysis was/was not updated or new analysis was conducted?	B.7.C	Yes (1)/No(1)	28
C. Justification				
Just_Standard	Do they refer to any standard/guideline to justify materiality analysis?	C	Yes (1)/No(1)	29
GRI			Yes (1)/No(1)	-
SASB			Yes (1)/No(1)	-
AccountAbility			Yes (1)/No(1)	-
ISO			Yes (1)/No(1)	-
verder aanvullen			Yes (1)/No(1)	-
D. Content				
Cont_Matrix	Materiality matrix is present	D.1	Yes (1)/No(1)	30
Cont_Matrix_Clear	Matrix is clear and understandable for readers	D.1	Yes (1)/No(1)	31
Cont_X-axis	X-axis displays impact to the firm and meaning is explained	D.1.B	Yes (1)/No(1)	32

Cont_Y-axis	Y-axis displays firm importance and meaning is explained	D.1.B	Yes (1)/No(1)	33
	Explanation on how stakeholders' view are weighed against firm views		Yes (1)/No(1)	34
Materiality_Dimension	The materiality dimension is visually reflected in the matrix	D.1.B	Yes (1)/No(1)	35
Issue_Description	Material issues are explained in report	D.2.A	Yes (1)/No(1)	36
Issue_Classified	Issues are classified	D.2.C	Yes (1)/No(1)	37
Issue_TooVague	Some explanations are too vague	D.2.C	No (1)/Yes(1)	38
External_Support	Did the firm receive support from any external party in their materiality analysis?	D.8	Yes (1)/No(1)	39
F. Audit				
Audit_Review	Auditor reviewed materiality analysis	F.1	Yes (1)/No(1)	40
Express_Pos	Positive auditor's opinion	F.2	Yes (1)/No(1)	-
Express_Neg	Negative auditor's opinion	F.3	Yes (1)/No(1)	-
Express_Neutr	Neutral auditor's opinion	F.4	Yes (1)/No(1)	-
Total score				40

Appendix 6: SIC code and ESG score coding

SIC CODE	Industry	Environmental Sensitive
1 - 9	Agriculture, Forestry, Fishing	1
10 - 14	Mining	1
15 - 17	Construction	1
20 - 39	Manufacturing	1
40 - 49	Transportation & Public Utilities	1
50 - 51	Wholesale Trade	0
52 - 59	Retail Trade	0
60 - 67	Finance, Insurance, Real Estate	0
70 - 89	Services	0
91 - 99	Public Administration	0

ESG score	Code
AAA	7
AA	6
A	5
BBB	4
BB	3
B	2
CCC	1

Appendix 7: STATA Do File

```
. import excel "/Users/miloubensch/Desktop/Data_Thesis_Final.xlsx", sheet("Dataset final") firstrow clear

. rename ESGdummy dESG

. rename SICdummy dSIC

. rename AvgROA ROA

. rename AvgROE ROE

. rename Firmyear Fyear

. tabulate Region, generate (country_d)
```

Table 2

```
by country_d*, sort : summarize MAQ

by dSIC, sort : summarize MAQ

by dESG, sort : summarize MAQ

by Audit, sort : summarize MAQ
```

Table 3

```
. summarize MAQ dSIC Audit dESG AvgTA ROA ROE country_d* if Fyear<2018,detail

. summarize MAQ dSIC Audit dESG AvgTA ROA ROE country_d* if Fyear>2017,detail

. summarize MAQ dSIC Audit dESG AvgTA ROA ROE country_d*, detail
```

Table 4

```
. pwcorr MAQ Audit dSIC dESG AvgTA ROA ROE country_d*, sig star(.05)

. vif
```

Figure 1

```
. twoway (line MAQ Fyear)
```

```
. graph export "/Users/miloubensch/Desktop/Accounting/Thesis/Graphthesis.pdf", as(pdf)
name("
> Graph")
(file /Users/miloubensch/Desktop/Accounting/Thesis/Graphthesis.pdf written in PDF format)
```

Table 5

Base model

```
. xtmixed MAQ || Firm:
. estat icc
```

```
. save "/Users/miloubensch/Desktop/Accounting/Thesis/Thesis_STATA.dta

. import excel "/Users/miloubensch/Desktop/Data_Thesis_Final.xlsx", sheet("H1") firstrow
clear
(24 vars, 287 obs)

. rename ESGdummy dESG

. rename SICdummy dSIC

. rename AvgROA ROA

. rename AvgROE ROE

. rename Firmyear Fyear

. tabulate Region, generate (country_d)
```

Model 2 independent variables

```
. xtmixed MAQ Audit dSIC Fyear || Firm:
. estat icc
```

Model 3 independent variables and control: firm size

```
. xtmixed MAQ Audit dSIC AvgTA Fyear || Firm:
. estat icc
```

Model 4 independent variables and control: firm size, firm performance

```
. xtmixed MAQ Audit dSIC AvgTA ROA ROE Fyear || Firm:
. estat icc
```

Model 5 independent variables and control: firm size, firm performance, ESG

. xtmixed MAQ Audit dSIC AvgTA ROA ROE dESG Fyear || Firm:
. estat icc

Model 6 independent variables and control: firm size, firm performance, ESG & region

. xtmixed MAQ Audit dSIC AvgTA ROA ROE dESG country_d* Fyear || Firm:
. estat icc

. save "/Users/miloubensch/Desktop/Accounting/Thesis/Thesis_STATA.dta

. import excel "/Users/miloubensch/Desktop/Data_Thesis_Final.xlsx", sheet("Dataset final") firstrow clear

. rename ESGdummy dESG

. rename SICdummy dSIC

. rename AvgROA ROA

. rename AvgROE ROE

. rename Firmyear Fyear

. tabulate Region, generate (country_d)

Table 6

. reg MAQ dSIC AvgTA ROA ROE dESG country_d* if Fyear<2018,noconstant

. reg MAQ dSIC AvgTA ROA ROE dESG country_d* if Fyear>2017,noconstant

. reg MAQ dSIC AvgTA ROA ROE dESG country_d*, noconstant

reg MAQ dSIC AvgTA ROA ROE dESG country_d*

. rvfplot

. estat hettest

. graph export "/Users/miloubensch/Desktop/Heteroscedasticity1.jpg", as(jpg) name("Graph") quality(90)
(file /Users/miloubensch/Desktop/Heteroscedasticity1.jpg written in JPG format)

Table 7

. reg MAQ Audit AvgTA dESG ROA ROE country_d* if Fyear<2018, noconstant

```
. reg MAQ Audit AvgTA dESG ROA ROE country_d* if Fyear>2017, noconstant

. reg MAQ Audit AvgTA dESG ROA ROE country_d*, noconstant

. reg MAQ Audit AvgTA dESG ROA ROE country_d*

. rvfplot

. estat hettest

. graph export "/Users/miloubensch/Desktop/Heteroscedasticity2.jpg", as(jpg) name("Graph")
quality(90)
(file /Users/miloubensch/Desktop/Heteroscedasticity1.jpg written in JPG format)


. save "/Users/miloubensch/Desktop/Accounting/Thesis/Thesis_STATA.dta
```