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Implications of Material Sustainability Reporting on Profitability

A Textual Analysis of Material Sustainability Reporting in Annual Reports, and Implications on Profitability

Project/Research Master's Thesis submitted by
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Abstract

I research whether material sustainability reporting has a positive impact on profitability. Although I find a significant relation between material sustainability reporting efforts and profitability within several sectors, the explanatory power is close to zero in all cases. This indicates that material sustainability reporting is not correlated to profitability. To perform my analysis, I develop a textual analysis tool that is applied on a sample of 38,530 Form 10-K reports. The textual analysis tool calculates a material sustainability reporting score for each Form 10-K, which is used as the independent variable in a linear regression model. My research on material sustainability reporting and its impact on profitability fills a gap in the literature, and my findings may be of help to those looking to evaluate firms' material sustainability efforts.

List of Contents

List of Figures

List of Tables

1. Introduction and Background

1.1 Introduction

In this master thesis, I investigate whether companies with strong reporting on material sustainability issues outperform companies with poor reporting on material sustainability issues. I look for a relation between companies' material sustainability reporting and their profitability. Instead of analyzing actual sustainability investments, I consider the possibility that material sustainability disclosure in annual reports is a good indicator of firm profitability.

For four of the eleven sectors analyzed, I find a positive correlation between material sustainability reporting and profitability that is significant on either the 1-, 5- or 10 % level. I find a negative correlation that is significant on the 1 % level for one of the eleven sectors analyzed. However, the R^2 is nearly zero for all regressions, which means that firms' material sustainability reporting efforts account for close to none of the variation in profitability in my data sample. Thus, my results imply that companies with strong reporting on material sustainability issues do not outperform companies with poor reporting on material sustainability issues.

My analysis is performed on a sample of 38,530 Form 10-K annual reports filed between 1993 and 2018. I analyze the relation between material sustainability reporting and profitability on a sector level, to account for sector-specific differences in profitability. Information on sector-specific material sustainability issues is retrieved from the Sustainability Accounting Standards Board (SASB). To define companies' sector membership, I match NACIS codes, which is the standard classification system used by U.S. Federal statistical agencies, with the eleven sectors defined by SASB.

Each annual report is tokenized and added to a corpus depending on the company's sector membership. For every Form 10-K in my sample, I gather financial information for the corresponding firm and year. I analyze the relation between material sustainability reporting and profitability on a sector level, to account for sector-specific differences in profitability.

My thesis fills a gap in the literature. An analysis of annual reports in the search of material sustainability reporting efforts has not been done before. The fact that my results indicate

that there is no relation between material sustainability reporting and profitability, can be a valuable piece of information to those interested in evaluating companies' sustainability efforts. Whether there is in fact no relation between material sustainability reporting and profitability, or my analysis is poorly constructed, is unknown. Nonetheless, my results support the age-old saying that actions speak louder than words.

1.2 Background

Today, sustainability has become a buzzword. Sustainability issues are constantly mentioned in the media, and it is becoming increasingly relevant for businesses as well. A likely reason why companies seem to care more about sustainability now than before, is the increased attention firms' unsustainable activities receive from the public, the media, and from governments. Recent examples of unsustainable business practices include Wilmar's palm oil production (Amnesty International, 2016), child labor at large, international companies' factories (Kelly, 2019), toxic wastewater from fracking (Kaufman, 2018), and the Volkswagen emission scandal (Hotten, 2015).

Thus, companies are forced to pay more attention to sustainability issues to prevent negative attention – which could have a considerable negative impact on company image and repel customers – and potentially even costly sanctions from governing institutions. In contrast, developing an image of being sustainable can attract customers (The Nielsen Company (US), 2018). In addition, a growing body of literature find that there might be a positive correlation between sustainability- and company performance (Kiron, Kruschwitz, Haanaes & Velken, 2012; Eccles, Ioannou & Serafeim, 2014; Khan, Serafeim & Yoon., 2016).

Today, large amounts of company data, including annual reports and financial information, are easily accessible through a wide range of resources. This makes for a wide range of opportunities to perform analyses. My interest in both data analytics and sustainability, in combination with having taken the master course "Applied Textual Data Analysis for Business and Finance" at NHH, gave me the idea to perform a sustainability-related textual analysis for my master thesis.

The rest of the paper proceeds as follows. In section 2, I review relevant literature, explain my motivation, and present my research question. Section 3 presents my data and sample. In section 4, I explain my methodology, and section 5 presents and discusses the results from my research design. In section 6, I conclude and summarize limitations of my research.

2. Literature Review, Research Question, and Hypothesis Development

In this section, I review existing and relevant literature, present my research question, and develop my hypotheses.

2.1 Literature Review

The body of research on the relation between companies' sustainability performance and financial performance is large. However, there is no clear consensus on whether sustainability investments have a positive effect on firms' profitability or not. Several studies within the neoclassical economics tradition find that sustainability investments are unnecessary costs which create a competitive disadvantage (Friedman, 1970; McWilliams & Siegel, 1997; Jensen, 2002). On the other hand, a growing body of research find evidence that strong sustainability performance is good for business (Salmones, Crespo & Bosque, 2005; Kiron et al., 2012; Eccles et al., 2014).

In their 2014 study, Eccles et al. categorize 180 U.S. companies into two matched groups; one consisting of companies that voluntarily adopted sustainability policies by 1993, and one that adopted almost none of the policies. They find that the companies that had voluntarily adopted sustainability policies by 1993 outperform the companies that had not, both on stock market performance and accounting-based performance (Eccles et al., 2014).

In their 2015 working paper, Khan, Serafeim and Yoon hand-map sustainability investments classified as material by SASB into firm-specific performance data on various sustainability investments. By using their hand-mapped data, they were the first to find evidence that firms with good performance on material sustainability issues outperform firms with poor performance on material sustainability issues. What is particularly interesting about the findings of Khan, Serafeim and Yoon (2015) is that they differentiate between material and immaterial sustainability issues. While earlier research has not differentiated between material and immaterial sustainability, Khan, Serafiem and Yoon (2015) successfully prove that firms should be conscious about the difference between material and immaterial sustainability issues.

2.2 Research Question and Hypothesis Development

Inspired by the SASB reporting standards and the findings of Khan, Serafeim and Yoon (2015), I wish to investigate whether firms report on material sustainability issues in their annual reports. Khan, Serafeim and Yoon (2015) describe a tedious research process that demanded a high degree of manual mapping of data. Therefore, an interesting question is whether material sustainability efforts and their implications on profitability can be analyzed in a more automated manner. The development of a textual analysis tool would allow for the evaluation of annual reports and could be applied on large samples of reports – without having to gather and categorize firms' sustainability investments. The analysis of annual reports, as opposed to the analysis of sustainability-related investments, could potentially be far less demanding in terms of time and labor. The rationale behind utilizing textual analysis to look for material sustainability reporting in annual reports, would be that there is a relation between material sustainability reporting and material sustainability performance.

Based on my interest in investigating this topic, I ask the following research question:

Do companies with strong reporting on material sustainability issues outperform companies with poor reporting on material sustainability issues?

I develop the following null- and alternative hypothesis:

H_0: *There is no relation between material sustainability reporting and profitability.*

H_A: *There is a relation between material sustainability reporting and profitability.*

3. Data and Sample

In this section, I present my data collection and sample creation.

3.1 Data Collection

I collect Form 10-Ks for my textual analysis. The U.S. Securities and Exchange Commission (SEC) requires all publicly listed companies to file such annual reports (SEC, 2009). I obtain all filings listed with the SEC from January 1993 to December 2018, through University of Notre Dame's online Software Repository for Accounting and Finance. All filings have been stripped of HTML code, embedded PDFs and pictures by Bill McDonald, professor at Mendoza Business School, University of Notre Dame (University of Notre Dame, 2020). As a result, the file size of the filings is small and therefore efficient to analyze (University of Notre Dame, 2020).

I retrieve fundamental financial company data from the CRSP/Compustat merged database, which is available through Wharton Research Data Services (WRDS). Specifically, I retrieve share price, total revenue, and EBIT, as well as CUSIP, CIK, and share class, which are company identifiers. All the financial data I retrieve is reported annually.

To develop my material sustainability reporting score (MSRS), I gather necessary material sustainability information from SASB. Specifically, I retrieve information about sector-specific material sustainability issues. Information on how SASB designs sector-specific material sustainability reporting standards, is presented in more detail in Appendix 1. I also use the ESG word list created by Baier, Berninger and Kiesel (2019) in the development of my material sustainability reporting score. Their ESG word list is presented in Table 7 in Appendix 3.

I use Yahoo Finance to retrieve sustainability data on a sample of 53 U.S. firms, which is compared with those firms' MSRS.

3.2 Sample Creation

On the initial sample of 1,057,969 SEC filings, I start by removing all filings that are not Form 10-Ks. This includes removing amendments and quarterly reports (Form 10-Q). I remove all annual reports where financial data is missing for the corresponding firm and year. To avoid market microstructure effects, I remove all annual reports belonging to firms where the stock price is less than $3. I also drop all annual reports where the firm does not issue common stock, which means removing all firms that do not have CRSP share code 10 or 11. Finally, I remove the annual reports where I am unable to assign the firm to any of the sectors defined by SASB.

The number of Form 10-Ks varies greatly for each sector, with an average number of reports per sector of 3,502 and a standard deviation of 1995 reports. The average number of reports for each year is 1482, with a standard deviation of 573.

The sample construction is illustrated in Panel 1 of Table 1. Panel 2 shows the frequency of annual reports for each SASB sector, while Panel 3 shows the frequency of annual reports for each year.

Table 1. Sample creation

Panel A: Sample Construction

	Dropped	Sample Size
Loughran-McDonald Stage One 10-X Parse files		1,057,969
Less: Quarterly filings and amendments	812,719	245,250
Less: Missing financial data	111,072	134,178
Less: Stock price below $3	21,070	113,108
Less: Not common stock or unknown share code	62,937	50,171
Less: Not covered by SASB sector	2,044	48,127
Less: Annual report missing	9,597	38,530
Total		38,530

Panel B: Frequency by Sector

Sector	Sample Size
Consumer Goods	3,686
Extractives & Minerals Processing	3,415
Financials	7,139
Food & Beverage	2,188
Health Care	695
Infrastructure	3,073
Renewable Resources & Alternative Energy	571
Resource Transformation	4,844
Services	4,507
Technology & Communications	6,247
Transportation	2,165
Total	38,530

Panel C: Frequency by Year

Year	Sample Size	Year	Sample Size
1993	2	2006	1,578
1994	1,019	2007	1,462
1995	1,661	2008	1,214
1996	2,420	2009	1,270
1997	2,731	2010	1,265
1998	2,403	2011	1,176
1999	2,249	2012	1,145
2000	1,923	2013	1,144
2001	1,853	2014	1,121
2002	1,727	2015	1,074
2003	1,811	2016	1,042
2004	1,738	2017	1,011
2005	1,661	2018	830

4. Analyzing Material Sustainability Reporting

In this section, I present how I analyze whether firms that perform well at reporting on material sustainability issues, are more profitable than firms that perform poorly at reporting on material sustainability issues. The section is organized as a walk-through of my analysis. Results are presented in subsection 4.6.

4.1 Organizing the Data

I extract the Central Index Key (CIK) of all firms whose Form 10-Ks are present in my sample of 38,530 Form 10-Ks. The CIKs are used to retrieve financial data from the merged CRSP/Compustat database. Since my sample of annual reports range in publishing year from 1993 to 2018, I retrieve all available data for the period 1993 to 2018 for all CIKs in my sample. For both the annual reports and the financial data, I know CIK and year. Therefore, I use a combination of CIK and year as a key to match financial data and annual reports.

Next, all companies in my sample, which are classified according to the North American Industry Classification System (NAICS), must be matched with the sectors defined by SASB. This is necessary for two reasons. First, it is necessary in order to determine which of SASBs sustainability issues that are material to each of the companies in my sample. Second, it is necessary in order to be able to analyze the relationship between material sustainability reporting and profitability on a sector-level. Therefore, it increases the granularity of my analysis. The conversion process from NAICS sectors to SASB sectors is explained in detail in Appendix 2.

Once all 38,530 Form 10-Ks have been matched with firm, year, financial data and SASB sector membership, the next step is to develop the material sustainability lexicons that are used to determine firms' material sustainability reporting efforts.

4.2 Material Sustainability Lexicons

I create one lexicon for each of the 26 sustainability issues defined by SASB. The lexicons are created for a very specific purpose, which is to evaluate whether companies report on the sustainability issues defined by SASB. Because they are specific word lists, as opposed to more generic word lists, they are called lexicons (Loughran & McDonald, 2016). The 26 sustainability issues are, according to SASB, "… likely to affect the financial condition or operating performance of companies within an industry" (2018). SASB's sustainability issues are listed in the "General Issue Category" column in Table 8 in Appendix 3. The rationale behind creating the lexicons is that, if specific vocabularies are used for the discussion of each sustainability issue in annual reports, then the lexicons will function as "material sustainability issue identifiers". The level of disclosure of a certain material sustainability issue in an annual report can be measured by how frequent terms from the corresponding material sustainability lexicon are used.

I base my lexicons on two components: An existing ESG word list developed by Baier, Berninger and Kiesel (2019), and sustainability issue descriptions provided by SASB. Baier, Berninger and Kiesel's ESG word list (2019), as well as an explanation of how they develop their word list, is presented in Appendix 3. Their ESG word list is included in Table 7 in Appendix 3.

I map the words in Baier, Berninger and Kiesel's ESG word list (2019) to the appropriate lexicon, which is a highly subjective task. To support my decision making, I read SASB's sustainability issue descriptions, which are included in their interactive Materiality Map (2018). The words that I deem irrelevant to all the sustainability issues defined by SASB, are excluded. Additionally, I include words from SASB's sustainability issue descriptions where I consider them to be relevant and specific enough. For instance, in the GHG Emissions lexicon, I include the word "CO2". In total, the 26 lexicons contain a combined 420 terms. All the lexicons are included in Table 8 in Appendix 3.

Once the material sustainability lexicons are finished, I move on to the textual analysis of the Form 10-Ks.

4.3 Term-Document Matrices

4.3.1 Corpus- and TDM creation

I create 11 empty corpuses – one for each of the 11 SASB sectors. Then, I tokenize each Form 10-K in my sample and load it to the correct corpus, based on the sector membership of the company whose Form 10-K it is. I then set out to create Term-Document Matrices (TDMs) for those corpuses – one for each SASB sector. A TDM is a practical way of representing word frequencies in a corpus, where rows represent words and columns represent word counts for each document in the corpus (Loughran & McDonald, 2016). However, the construction of a TDM involves collapsing the documents down to single words, which means that the sequence of words is ignored (Loughran & McDonald, 2016). Textual methods that ignore the order that words appear in are called "bag-of-words" techniques (Loughran & McDonald, 2016). Thus, my method, where I collapse the annual reports down to uni-grams and use the whole annual reports for my analysis, is based on a bag-of-words approach to textual analysis. I tokenize and include the full Form 10-Ks instead of focusing merely on certain parts of the reports. By using the entire reports, I mitigate the risk leaving out important information (Loughran & McDonald, 2016).

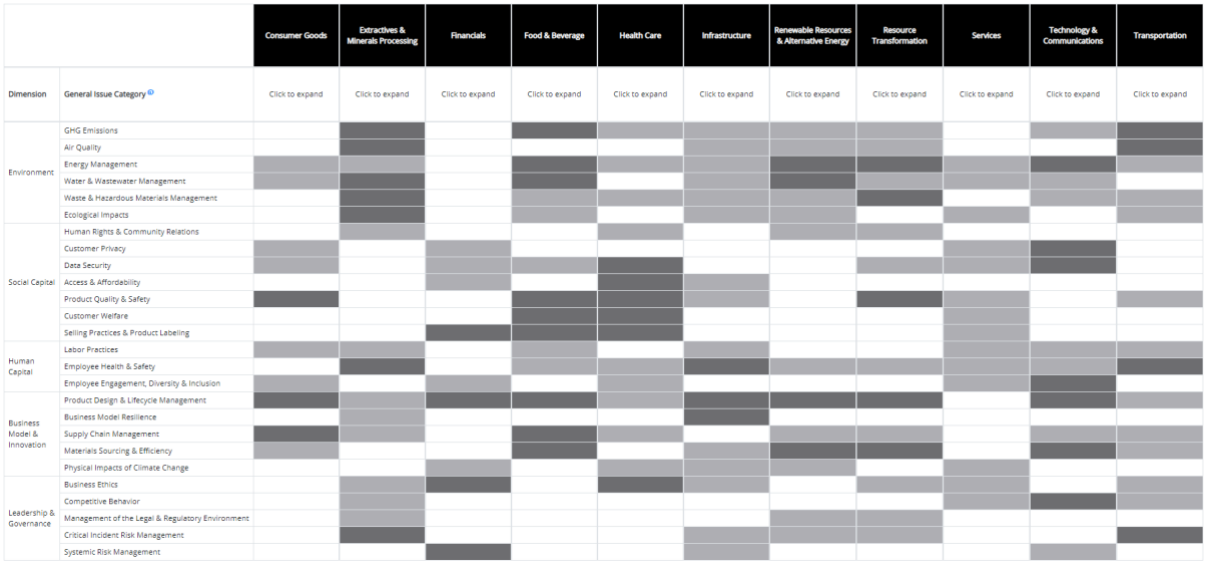
Each column in the TDMs, which contain the word frequencies for each report in each corpus, is named using a combination of the firms' CIK and year. This way, the information in the TDMs is easily matched to the correct firm for the correct year.

4.3.2 TDMs Based on Lexicons

Instead of creating TDMs based on all occurring terms in all documents in the corpus, I drastically limit the number of rows in the TDMs by specifying which terms I want to count. I use SASB's Materiality Map (2018a) to determine which sustainability issues are material to each sector. SASB's Materiality Map (2018a) is included in Figure 1. The 11 sectors are listed in the top columns, while the 26 sustainability issues, called "General Issue Categories", are listed in the rows on the left-hand side. A dark gray area means that the sustainability issue is likely to be material for more than 50 % of the industries in that sector, while a light gray area indicates that the sustainability issue is likely to be material for fewer than 50 % of the industries in that sector (SASB, 2018a). A white area indicates that the sustainability issue is likely to be immaterial for all industries within that sector (SASB,

2018a). For the remainder of subsection 4.3.2, I refer to the sustainability issues as light- and dark gray.

Figure 1. "SASB Materiality Map", 2018a, by SASB.
(https://materiality.sasb.org/)



I simplify my analysis by including the lexicons for both the light- and dark gray sustainability issues for each sector in the TDMs. For instance, in the TDM for the Financials sector, I count the frequency of all the words in the lexicons for the following nine sustainability issues: (1) Customer Privacy, (2) Data Security, (3) Access & Affordability, (4) Selling Practices & Product Labelling, (5) Employee Engagement, Diversity & Inclusion, (6) Product Design & Lifecycle Management, (7) Physical Impacts of Climate Change, (8) Business Ethics, and (9) Systemic Risk Management. Those are the sustainability issues that are either light- or dark gray in the Financials-column.

The inclusion of both light- and dark gray sustainability issues might make the analysis less accurate, since there is a high probability that several of the firms within any given sector fall under an industry where the light-gray sustainability issues are in fact considered immaterial. However, the exclusion of the light-gray sustainability issues would lead to the same dilemma; there would be a probability that several of the firms within any given sector fall under an industry where the light-gray sustainability issues are in fact considered material. Being aware of this weakness, I choose to include all light-gray sustainability issues. This means that the lengths of the word lists for each sector range from 148 to 251 terms. There is also a risk that the length of the word lists could cause errors in the analysis, since several of the terms likely have ambiguous meanings (Loughran & McDonald, 2016).

However, I believe that all terms included in the word lists are necessary to capture the reporting on any of the material sustainability issues.

4.3.3 Term Frequency-Inverse Document Frequency

After constructing the TDMs, I implement the common weighing scheme called term frequency-inverse document frequency (tf-idf) on each TDM. Previous research has found that the tf-idf weighing scheme produces more accurate regressions than those based on using simple proportions (Brown & Tucker, 2011; Loughran & McDonald, 2011).

The weighing scheme reduces the risk of overestimating the importance of frequently occurring words and underestimating the importance of rarely occurring words (Loughran & McDonald, 2016). For each TDM, tf-idf weighing is implemented as follows (Jurafsky & Martin, 2009, p. 801-806):

$$w_{i,j} = tf_{i,j} * idf_i$$

$$idf_i = \log(\frac{N}{n_i})$$

In the formula, $tf_{i,j}$ is the frequency of term *i* in document *j*. idf_i is the inverse document frequency of term *i*, which is calculated as the logarithm of the total number of documents in the TDM divided by the number of documents in the TDM in which the term *i* occurs. The weight assigned to term *i* in document *j* is the product of $tf_{i,j}$ multiplied by idf_i.

In Tables 2 and 3, I present the first 14 rows and 8 columns of the TDM for the Renewable Resources & Alternative Energy sector. Table 2 shows the TDM before tf-idf is applied, while Table 3 shows the TDM after tf-idf is applied. For instance, in the far-right column of Table 2, the word “accident” only occurs once, while the word “approved” occurs 21 times. In the same column in Table 3, where tf-idf has been applied, the single occurrence of “accident” receives a higher score of 21 occurrences of the word “approved”.

Table 2. TDM without tf-idf weighting scheme

	1996_352944	1997_352944	1994_4672	1995_4672	1996_4672	1997_4672	1998_4672	1994_8818
accident	NA	NA	NA	NA	NA	NA	NA	1
accidents	NA	NA	NA	NA	NA	NA	NA	NA
agriculture	NA	NA	NA	NA	NA	NA	NA	NA
air	4	13	1	NA	NA	2	2	NA
airborne	NA	NA	NA	NA	NA	NA	NA	NA
approval	20	26	11	NA	NA	3	5	8
approvals	NA	9	NA	NA	NA	NA	NA	NA
approve	7	4	NA	NA	NA	2	NA	1
approved	20	13	19	NA	1	1	NA	21
approves	NA	NA	NA	NA	NA	NA	NA	NA
approving	NA	1	NA	NA	NA	NA	NA	NA
aquifer	NA	NA	NA	NA	NA	NA	NA	NA
assess	NA	NA	NA	NA	NA	NA	NA	NA
assessed	NA	6	NA	NA	NA	NA	NA	1

Table 3. TDM with tf-idf weighting scheme

	1996_352944	1997_352944	1994_4672	1995_4672	1996_4672	1997_4672	1998_4672	1994_8818
accident	NA	NA	NA	NA	NA	NA	NA	0.0084226
accidents	NA	NA	NA	NA	NA	NA	NA	NA
agriculture	NA	NA	NA	NA	NA	NA	NA	NA
air	0.0025576	0.0077960	0.0015049	NA	NA	0.0035981	0.0039979	NA
airborne	NA	NA	NA	NA	NA	NA	NA	NA
approval	0.0094721	0.0115488	0.0122615	NA	NA	0.0039976	0.0074031	0.0085908
approvals	NA	0.0207371	NA	NA	NA	NA	NA	NA
approve	0.0139382	0.0074699	NA	NA	NA	0.0112049	NA	0.0045148
approved	0.0027749	0.0016917	0.0062046	NA	0.0008338	0.0003904	NA	0.0066065
approves	NA	NA	NA	NA	NA	NA	NA	NA
approving	NA	0.0034465	NA	NA	NA	NA	NA	NA
aquifer	NA	NA	NA	NA	NA	NA	NA	NA
assess	NA	NA	NA	NA	NA	NA	NA	NA
assessed	NA	0.0068770	NA	NA	NA	NA	NA	0.0027709

Once the TDMs have been constructed and weighted, I move on to the construction of the material sustainability reporting score.

4.4 Material Sustainability Reporting Score

I construct the MSRS for each annual report by taking the sum of each column in each TDM and assigning it to the correct firm and year. Each column in each TDM represents an annual report, and the matching is achieved by using the combination of firm and year as a key.

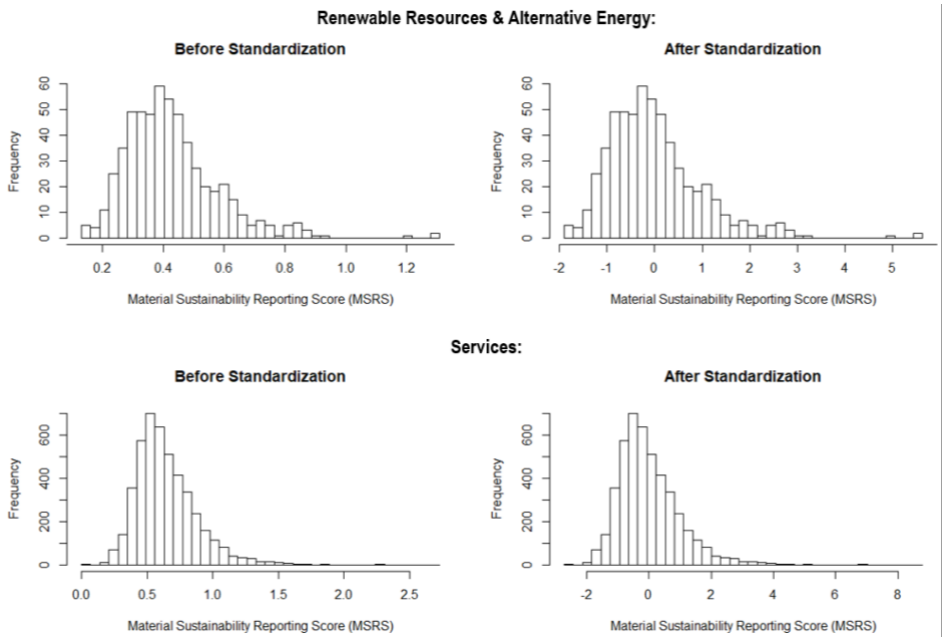
The MSRS can be explained like this for each sector, where *f* is firm, and *y* is year:

$$MSRS_{f,y} = \sum TDM_{f,y}$$

I standardize the material sustainability reporting scores for each sector, using a mean of 0 and a standard deviation of 1. The material sustainability reporting scores for each sector are based on TDMs that consist of different numbers of terms. Therefore, there are systematic differences in the MSRS distribution for each sector. By standardizing the MSRS, I make the MSRS more comparable across sectors.

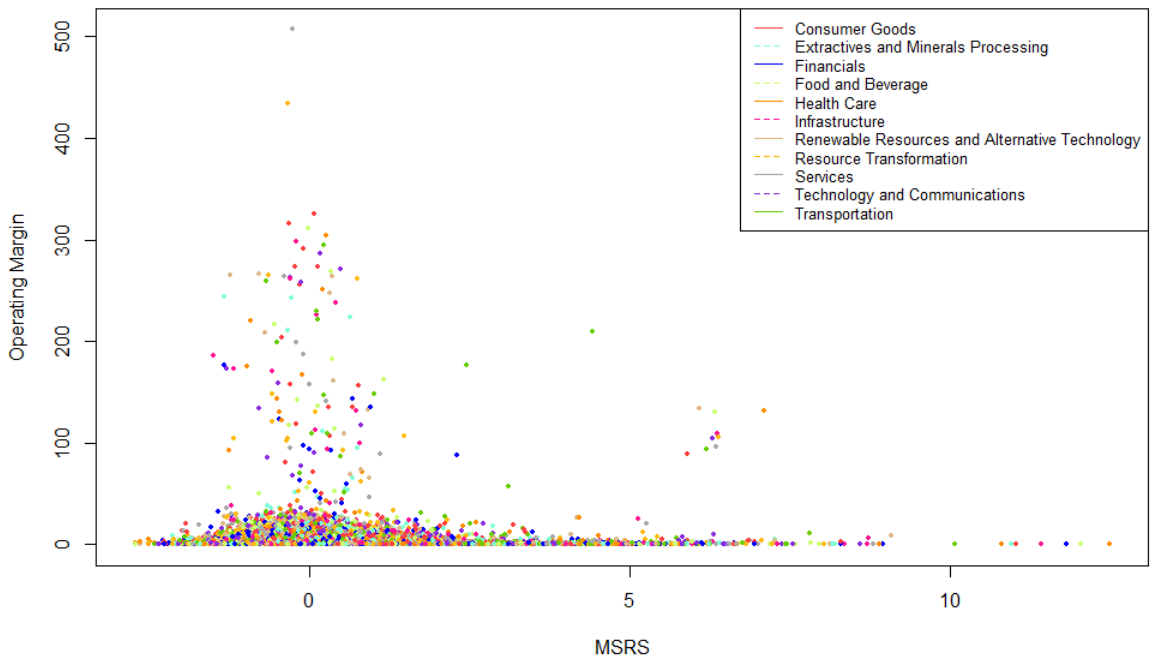
I illustrate the effect of the standardization in Figure 2. The figure contains the MSRS for all companies within the Renewable Resources & Alternative Energy sector in the top two plots, and all companies within the Services sector in the bottom two plots. The MSRS is on the x-axes and the frequency is on the y-axes. As illustrated, the standardization does not alter the distribution whatsoever, but the MSRS is now centered around an average value of 0, with a standard deviation of 1.

Figure 2. MSRS distribution before and after standardization



After standardizing the MSRS within each sector, I plot MSRS against operating margin for all firms across all sectors. I do this to get an overview of my data and look for any obvious trends. The scatterplot is presented in Figure 3. I see no trends.

Figure 3. Scatterplot of MSRS and operating margin for all sectors



Once all the annual reports in my sample have received an MSRS, I attempt to validate it against existing sustainability data.

4.5 Validation of Material Sustainability Reporting Score

I compare the material sustainability reporting scores of 53 firms' annual reports with the firms' ESG Risk Score and find no significant relation between the two variables. I test for a relationship between the two variables by running an ordinary least squares linear regression. The dependent variable is the ESG Risk Score, while the independent variable is MSRS. The regression summary is presented in Table 4.

To control for any potential sector-specific differences in MSRS and ESG Risk Score, all 53 annual reports in my sample are from 2018 and belong to firms in the same sector, being the Finance sector. The ESG Risk Scores, which I manually retrieve from Yahoo Finance, are developed by the ESG information provider Sustainalytics. The ESG Risk Score reflects how well companies are managing industry-specific material sustainability issues (Sustainalytics, 2020). The score is measured on a scale from 0 to 100, with a lower score signaling a better material sustainability performance (Sustainalytics, 2020).

Table 4. MSRS validation: OLS regression

The dependent variable is the ESG Risk score from Yahoo Finance, while the independent variable is MSRS. The constant is the y-intercept.

	Dependent variable:
	ESG Risk
Constant	29.037***
	(2.544)
MSRS	-5.546
	(4.086)
Observations	53
R^2	0.035
Note:	*p**p***p<0.01

The implications of the result of the regression analysis are difficult to confidently interpret. One interpretation is that my material sustainability reporting score does a poor job of capturing actual material sustainability efforts. This is true if there is indeed a relation between firms' material sustainability disclosure in annual reports and their material sustainability efforts. That is, that firms' material sustainability efforts are correlated with how extensively they report on material sustainability. Baier, Berninger and Kiesel (2019) find a relation between ESG reporting and negative media presence, but it is unknown whether ESG reporting is related to ESG actions. Therefore, another interpretation is that it

does not make sense to validate MSRS by comparing it to the ESG Risk Score. This is true if there is no relation between material sustainability reporting and material sustainability action.

4.6 Results

My results show that material sustainability reporting does not affect firm profitability.

For each of the 11 sectors defined by SASB, I run an ordinary least squares linear regression. In all regressions, the dependent variable is my profitability measure, operating margin, and the independent variable is MSRS. All regression results are presented in Table 5. The explanatory power, R^2, is essentially zero for all regression models. Thus, I cannot reject my null hypothesis, which is that there is no relationship between material sustainability reporting and firm profitability.

Table 5. Sector-specific OLS regressions

The table contains one column for each regression. There is one regression for each sector. The columns are numbered and corresponds to the sectors in the way that is presented below the table. The dependent variable is Operating Margin for all the regressions. Each regression includes the constant y-intercept and MSRS, which is the independent variable.

	Dependent variable:										
	Operating Margin										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Constant	1.76***	3.38***	2.26***	1.82***	1.76***	2.21***	1.61***	3.64***	2.14***	1.85***	1.80***
	(0.05)	(0.32)	(0.14)	(0.06)	(0.12)	(0.13)	(0.12)	(0.28)	(0.11)	(0.08)	(0.06)
MSRS	-0.01	-0.49	0.96***	-0.03	-0.22*	0.25**	0.26**	0.06	0.12	0.14*	0.05
	(0.05)	(0.32)	(0.14)	(0.06)	(0.12)	(0.13)	(0.12)	(0.28)	(0.11)	(0.08)	(0.06)
Observations	3,686	3,415	7,139	2,188	695	3,073	571	4,844	4,507	6,247	2,165
R^2	0.0000	0.001	0.01	0.0001	0.005	0.001	0.01	0.0000	0.0003	0.001	0.0002

Note: *p**p***p<0.01

(1) Consumer Goods
(2) Extractives & Minerals Processing
(3) Financials
(4) Food & Beverage
(5) Health Care
(6) Infrastructure
(7) Renewable Resources & Alternative Energy
(8) Resource Transformation
(9) Services
(10) Technology & Communications
(11) Transportation

5. Conclusion, Limitations and Further Research

This section contains a brief conclusion of my master thesis. I also state limitations of my research.

5.1 Conclusion

I perform a textual analysis of a sample of 38,530 annual reports. The companies whose annual reports are present in my sample are separated into 11 sectors, as defined by the Sustainability Accounting Standards Board (SASB). A term-document matrix (TDM) is constructed for the reports in each sector, where the frequency of terms that capture the disclosure of material sustainability issues are weighted according to the term frequency-inverse document frequency (tf-idf) weighing scheme. The TDMs are used for the creation of a material sustainability reporting score (MSRS). I perform linear regressions to look for a relation between MSRS and operating profitability on the sector-level. I find no evidence that material sustainability reporting has an impact on firm profitability.

5.2 Limitations

Here, I briefly summarize what I believe are the main limitations of my analysis.

First, my analysis is not particularly granular since the analysis is performed on a sector level. The firms within each of the SASB sectors are likely to be so different that a comparison of operating margin against MSRS leads to inaccurate, and maybe even misleading, results. That is, differences in profitability might very likely be the result of industry-, if not even company-, specific differences.

Second, the semi-manual matching of NAICS codes to SASB sectors might lead to a considerable number of firms being misplaced to the wrong sector. If so, my analysis is fundamentally wrong.

Third, SASB is constantly changing and improving on existing material sustainability standards. That means that measuring annual reports that differ in age by as much as a quarter of a century, against each other, could lead to inaccurate results. For instance, although data security is considered a material sustainability issue to the Technology & Communications sector today, data security was probably not a material sustainability issue to the Technology & Communications sector in 1993.

Finally, there exists no evidence on a correlation between material sustainability reporting and actual material sustainability investments. As long as this relationship is unknown, I cannot know whether my findings are the result of my textual analysis tool performing poorly, are if there is indeed no correlation between material sustainability reporting and profitability.

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