THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

Examining Stock Market Reaction to Water Management Information

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FALL 2024

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Accounting
with honors in Accounting

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ABSTRACT

Water management is vastly unexplored in the realm of accounting and finance research on environmental, social, and governance (ESG) topics. Water management is one of the largest ESG areas of interest for sustainable investors, so does the stock market care about the water management practices of firms? This paper examines information about the water management practices of firms and attempts to observe stock market reactions to the information. There are two forms of ESG information analyzed in this study: media news data (gathered from RepRisk) and ESG rating data (gathered from Sustainalytics). Regression analyses are run on 17 years' worth of media news data and 11 years' worth of ESG rating data. I find that industries where water management is a material practice softens the blow of negative news on the stock market's reaction to the news as opposed to if water management is non-material for a firm's industry. This finding is contrary to what is expected based on findings of past studies, signaling the relationship of the market reaction and the interaction of water management news with industry-specific materiality of water management practices as an area for future research exploration.

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ACKNOWLEDGEMENTS

I want to thank Brent Schmidt for all the support he provided while I wrote my thesis. Brent's advice and guidance helped me immensely to understand the research process and plot every next step that I needed to take. I also want to thank Sam Bonsall and the rest of the Schreyer staff that have provided overall support for my thesis development. Creating this paper was one of my most challenging academic hurdles, but the great support around me enabled me to create a work that I am proud of.

Chapter 1

Introduction

Growing Practice of Sustainable Investing

Sustainable investing is the practice of making investment decisions based on indicators that are traditionally viewed as non-financial bearing information for a firm related to environmental, social, and governance (ESG) factors (Mallin 2024). Sustainable investing and interest in the ESG activities of publicly traded firms are growing in the United States. According to Morgan Stanley's 2024 Sustainable Signals Reports, 84% of individual investors in the United States are interested in sustainable investing and 19% of investors have at least half of their portfolio in sustainable investments. Globally, 54% of investors plan to increase their sustainable investment within the next year. ESG has developed into a product, or reason to buy a stock, such as risk detection and investing preferences. Serafeim (2023) defines ESG as a product as "to intentionally allocate capital and influence investees with measurable financial and environmental and/or social outcomes." Studies like this have begun to investigate ESG metrics in unprecedented ways. Likewise, there has been increasing efforts to define measurements and study the effect of ESG indicators within academia.

Lack of Uniformity of ESG Information

Despite the growing attention towards ESG practices, there is currently a lack of regulation around firm disclosure of various ESG related activities in the United States. This

makes ESG information in the US asymmetric, non-standardized, and inconsistent (Economidou 2023, Mallin 2024). This has posed transparency issues, such as greenwashing. Greenwashing is the misrepresentation of a firm's practices as more environmentally friendly, socially impactful, or sustainable than they truly are (Barton 2022). Issues such as this create confusion for investors about how to react to current ESG information and what to believe as true representations of a firm's ESG practices. There have been debates about setting more standardized regulations around ESG disclosures to mitigate these issues. This could also provide investors with new ways of making investing decisions. Setting a standard for firms to regularly disclose ESG information pressures firms into a higher standard of scrutiny and expectation of transparency. For example, there would be more pressure on firms to conform to good ESG practices if it is publicly known that their ESG performance decreases. Likewise, a firm's transparency on their ESG performance can be a way to attract investors. This has motivated research to be conducted regarding how current ESG disclosure practices impact on a firm's valuation and performance. For example, Economidou et al. (2023) finds that firms with ESG performance transparency prior to going public are undervalued before their IPO, have superior post-IPO market performance, and have a higher share of fiscally sophisticated investors. ESG practices can also implicitly affect a firm's balance sheet. Cormier et al. (1997) finds that there are environmental liabilities associated with the pollution output of firms that indirectly affect a firm's market value. Although there is no direct line item for these liabilities on the balance sheet, a negative relationship between market value and pollution levels suggests that these liabilities implicitly exist.

Market Reaction to ESG Information

With growing attention to ESG practices, it begs the question, how does ESG reputation affect stock market performance? Many studies within the last decade have examined the relationship between ESG reputation of a firm and market reaction (Serafeim 2022, Krüger 2015, Flammer 2013, Dimson 2015, Grewal 2020, Gibson 2021, Capelle-Blancard 2019, Cui 2020, Dorfleitner 2024). Large focal points in this research include the reaction to negative versus positive ESG information, correct sourcing of data for ESG information (Capelle-Blancard 2019, Dorfleitner 2024, Dimson 2015, Gibson 2021, Serafeim 2022), ESG and materiality interaction (Serafeim 2022, Khan 2016, Grewal 2020), and past ESG performance/reputation (Serafeim 2022, Dorfleitner 2024). These papers are examined in detail in the literary review.

Focus on Water Management

Some hot topic ESG metrics have been explored in greater detail for their relationship with market valuation. Matsumura et al. (2014) examines carbon emissions and market value of firm common equity. They find that firm value decreases by $212,000 for every additional thousand metric tons of carbon emissions on average. The growing concern for sustainable practices coupled with the recent studies examining ESG data's relationship with financial trends elicits the exploration of other isolated ESG metrics' effect on the market. Globally and in the United States, water solutions are the most common topic of interest for investors interested in sustainable investing (74% of investors globally and 78% of US investors are interested) (Morgan Stanley 2024). The topic of water solutions focuses on investing in firms that develop clean water and enable access to water solutions and/or restricting investments to firms that

hinder clean water and water access. This demonstrates the market's interest in the water management practices of firms. Despite this large interest in water management practices, there currently is no extensive research on the isolated effect of waters management practices on a firm's market reputation. This paper seeks to explore the relationship of information on water management practices and stock market reaction.

Industry-Specific Materiality of Water Management Practices

I use two datasets and six regression models in this study. The two datasets represent two different forms of data: news/media data sourced from RepRisk and ESG rating data sourced from Sustainalytics. Each regression model predicts cumulative abnormal returns on a three-day event window (one day before and after the date of the event). The first two regression models examine if water management information has a corresponding market reaction. These are two separate regression models for each dataset. The next two regression models include an interaction term between the ESG information variable and a materiality variable (which identifies if water management is a material practice to a firm based on its industry). These are two separate regression models for each dataset. The final two regression models include the interactions of negative news with a novelty variable. These regression models only analyze the news/media datasets. The first interaction examines negative news and if the water management issue is a reoccurring issue for the firm. The second interaction examines negative news and if the water management issue is a new issue for the firm. Of the six regression models, I find statistically significant results for one model.

I find conclusive evidence for the model regarding the market reaction to the interaction of firm materiality on water management practices and negative news. I find that in the presence of negative news regarding a firm's water management practices, firms where water management is a material practice for their industry experience a smaller market reaction, as compared to firms where water management is not a material practice. This is contrary to what is expected based on past studies, signifying that water management information (isolated from other ESG topics) may have different market effects than other ESG topics. Likewise, further research that isolates water management from all ESG topics can be conducted to further explore the individual implications of water management information.

Chapter 2

Literature Review

There are three primary sources of ESG information: firm disclosures, ESG rating agencies/NGOs, and news/media announcements. Of the three, news and media announcements tend to be the most informative for stock reaction. Studies that find little to no market reaction for firm disclosures and ESG rating agencies suggest that investors prefer media as a more neutral source of information, with fear that firm disclosures have greenwashing and ESG ratings are too inconsistent (Capelle-Blancard 2019, Dorfleitner 2024). Although some studies find significant relationships between these sources and their variables of interest. Gibson et al. (2021) examines the relationship between ESG rating disagreement and stock price return. ESG rating disagreement occurs when various ESG rating agencies give a single firm drastically different rating. This study finds that ESG rating disagreement and stock price returns are positively correlated. ESG rating disagreement is quite common, which is largely attributed to the lack of standardized regulations for measuring and reporting ESG practices. This suggests that there are varying levels of informativeness of ESG ratings from individual rating agencies (Gibson 2021). Flammer (2013) finds that over time, there have been smaller positive market reactions to eco-friendly firm announcements and stronger negative reactions to eco-harmful announcements. This study also finds that firms with stronger environmental performances have smaller market reactions for both eco-friendly and eco-harmful announcements. Grewal et al. (2020) studies the relationship between the Sustainability Accounting Standards Board (SASB) identified disclosures and stock price informativeness (measured as the stock price synchronicity within its industry). SASB-related sustainability disclosures had a positive reaction to price informativeness while non-SASB sustainability disclosures did not have any significant reaction.

This suggests that SASB-identified sustainability disclosures contain financially relevant information. Dimson et al. (2015) examines how the market reacts to active ownership, which are ESG engagements between corporations and investors. Collecting monthly stock prices, they find a positive increase in abnormal returns of +2.3% over a year for firms with active ownership. Successful engagements alone generate a much larger increase in abnormal returns of +7.1% over one year. Furthermore, 46.6% of the engagements in these studies were preceded by public news regarding an ESG risk for the companies. This demonstrates how important news coverage of ESG practices is to investors that are conscious of ESG issues.

ESG information gained from news and media sources has been supported in many studies as having a relationship with market reaction. A handful of studies suggest that there is a positive relationship between ESG news sentiment (positive news versus negative news) and stock market reaction (Serafeim 2022, Dorfleitner 2024). Serafeim et al. (2022) conducts a sentiment analysis on company ESG news and its market reaction. They find that ESG news and industry adjusted returns have a positive relationship. Furthermore, they find that news that is financially material to a firm's industry has a much larger market reaction. Firms with better ESG ratings saw a smaller market reaction to positive ESG news, which is due to positive ESG practices already being reflected in the current stock price. Dorfleitner and Zhang (2024) use a modern sentiment analysis technique called BERT to analyze the relationship between the sentiment of ESG related news articles and cumulative abnormal returns over various event windows. They find that positive news has a positive market reaction of +0.31% and negative news has a slightly larger negative reaction of -.075% on average. Furthermore, companies with a historically better ESG record have smaller negative abnormal return decreases from negative

news and companies with historically worse ESG records see greater abnormal return increases to positive news.

Although there are many studies that fail to find a relationship between positive ESG news sentiment and increasing stock prices. Among these studies, they still find that there is a significant relationship between negative ESG news sentiment and decreasing stock prices (Krüger 2015, Capelle-Blancard 2019, Cui 2020). Krüger et al. (2015) find that, on average, there is a negative market reaction to both positive and negative corporate social responsibility (CSR, these practices overlap heavily with ESG practices) news, although the reaction to positive news is much weaker and less systematic. Although, a positive reaction occurs when agency problems are less likely for the positive CSR news, or the CSR event occurs as managerial effort to improve a previous CRS mistake. Capelle-Blancard and Petit (2019) study the relationship between various ESG news sources and the market's reaction. On a 3-day event window, they find that cumulative abnormal returns are 0.1% lower on average in reaction to negative media news, while there is no significant reaction to positive news. Cui and Docherty (2020) find that the market overreacts to negative ESG news. This study finds a negative relationship between cumulative abnormal returns and negative ESG news on an event window for -10 days to +10 days. Although on -10 days to +90 days event window, cumulative average returns revert to pre-negative event levels. This suggests the market overreacts to negative events due to investors assuming that a negative practice will be repeated by a firm. Furthermore, this reaction had a greater magnitude among smaller firms, suggesting that investors are more skeptical about poor negative ESG practices for smaller firms.

Chapter 3

Hypothesis Development

There are some mixed inferences across current studies regarding the true relationship between a firm's ESG reputation and its performance in the stock market. The largest inconsistency being a reaction to positive information. A proportion of studies prove a statistically significant market reaction to both positive and negative ESG information (Serafeim 2022, Flammer 2013, Dorfleitner 2024), while other studies only find a negative market reaction to negative information (Krüger 2015, Capelle-Blancard 2019, Cui 2020). To examine both reactions, the first alternative hypothesis of this study is as follows:

> *H_1: Negative (positive) information regarding a firm's water management practices has a negative (positive) market reaction.*

A large issue in studying market reaction to ESG information is the unstandardized and lack-of-uniformity nature of current available ESG information on firms. The differing findings in these papers can in part be attributed to this lack of uniformity. Although, these studies do come together in a shared empirical finding that negative information about a firm's ESG practices yields a market reaction (or that negative news typically has a stronger reaction than positive information). Another shared finding among some studies is that media news yields the greatest market reaction (Capelle-Blancard 2019, Dorfleitner 2024, Dimson 2015). ESG ratings have been an area for mixed empirical evidence due to rating disagreements (Gibson 2021, Dorfleitner 2024, Serafeim 2022).

Another area of relative agreement is the importance of materiality of ESG issues for a firm. Khan (2016) explores the unequal strategic importance placed on isolated ESG issues among various industries. Strategic importance constitutes the level of materiality of an ESG

practice for firms. For example, one industry could have greater strategic importance on environmental practices while another may have a greater strategic importance on social practices. This creates differing materialities for certain practices among different industries. Studies that considered if ESG issues are material to a firm, often industry-specific materiality, find greater magnitude in the market's reaction to the ESG information (Serafeim 2022, Grewal 2020). This leads to the second hypothesis of this study:

> *H_2: Negative (positive) information regarding a firm's water management practices has a more negative (positive) market reaction when water management is a material ESG practice for the firm, relative to firms where water management is not a material ESG practice.*

Some studies also concur that past ESG reputation can affect market reaction to the ESG information. Serafeim et al. (2022) expresses that previously known good ESG scores can lessen a positive market reaction. Dorfleitner (2024) suggests that past good ESG performance decreases the negative market reaction to negative news. For these reasons, I examine the difference of reoccurring versus novelty of negative news with the following hypothesis:

> *H_3: Negative news regarding a firm's water management practices has a larger negative market reaction when water management issues are reoccurring for the firm, relative to firms that do not experience reoccurring water management issues.*
>
> *H_4: Negative news regarding a firm's water management practices has a smaller negative market reaction when water management issues are new to the firm, relative to firms that do not experience water management issues for the first time.*

Analyzing if negative news is reoccurring or new will serve as a proxy for reputation of past ESG practices.

Chapter 4

Data and Sample

ESG News Data – RepRisk Dataset

I utilize data provided by RepRisk for the water management news/media data. RepRisk is a global data science company that compiles risk incident data for 101 ESG related issues. RepRisk has data on 15,000+ publicly traded companies from 2007 through 2023. RepRisk screens over 100,000 sources of news daily and perform analyses that compile data on the related risk factors, severity, reach, novelty, and sharpness of each news source. The news sources that RepRisk screens include print media, online media, social media, blogs, government body announcements, regulatory announcements, think tanks, and newsletters. For this study, the ESG risk factors of interest include wastewater management, water management, and water scarcity. Risk incidents within 2007 through 2023 containing at least one of these water risk factors marked as true were retrieved from the RepRisk database for this study. This data is optimal for analyzing how the stock market reacts to negative news because it provides the exact date when the news is released and the corresponding ESG incident factor(s). Although, its limitation is that it only provides data for negative news, lacking data for positive news. This limitation is addressed within this study through control-treatment event date matching (as explained further in the research design section). For this reason, any findings from this data can only be used to make inferences on a market reaction to negative news. The final RepRisk dataset includes 3,726 events (1,863 treatment and 1,863 control observations) from January 2007 through December 2023 and analyzes 886 unique firms.

ESG Rating Data – Sustainalytics Dataset

In attempt to examine a reaction to both positive and negative information regarding a firm's water management practices, I also retrieve ESG rating data from Sustainalytics. Sustainalytics is an ESG research and rating agency. Sustainalytics's ESG rating database covers 20,000+ companies. The Sustainalytics Legacy Historical Raw Scores - North America data is used in this study, which covers August 2009 through December 2019. This database contains ESG ratings that were released periodically and are on a scale from 0 (poor) to 100 (great). These ratings are calculated based on assessments of preparedness (i.e.: policies, programs, management systems), disclosures (i.e.: GRI, CDP, self-reporting), and performance (i.e.: news on events and controversies, quantitative measures such as carbon intensity). This database has 163 ESG indicators for various ESG focus points. The indicators of interest for this study are Water Intensity (E_1_2_7) and Programs & Targets to Reduce Water Use (E_1_3_4). To conduct an event study with this data, every date of a rating change for either indicator was collected along with the date's corresponding rating changes for these indicators. A limitation of this data is that past studies have found ESG ratings to be poor indicators of market reactions relative to news/media sources(Gibson 2021, Dorfleitner 2024, Serafeim 2022). Despite this, the data was collected for this study as an attempt to analyze the positive market reaction to positive water management information and evaluate the utility of ESG rating scores for market event studies. The final Sustainalytics dataset includes 1,088 events (544 treatment and 544 control observations) from December 2009 through August 2019 and analyzes 555 unique firms.

Chapter 5

Research Design

Cumulative Abnormal Returns and Control Observations

The y-variable of every regression model in this study is cumulative abnormal returns (CAR) of each event on the [t-1, t+1] event window, where t is the event date. The 3-day event window is limited to only one day before and after the event to minimize the impact of outside events occurring and only examine the effect of the event in question. CAR is used as a proxy for stock market reaction. CAR is collected from the Wharton Research Data Service Event Study tool, which sources its data from the Center for Research in Security Prices, LLC (CRSP). This tool calculates abnormal returns as the difference of the estimated return, as predicted by an estimation window of past returns, and the actual return. Then $CAR_{[t-1,t+1]}$ is calculated as the sum of the abnormal returns over the [t-1,t+1] period. The estimation window for this study is from t-70 to t-11 days, like the CAR event window and estimation window used in Capelle-Blancard (2019).

Share time series data from CRSP was added to both the RepRisk dataset and the Sustainalytics dataset for the control-treatment event date matching. Bid/ask price and number of shares outstanding were retrieved from CRSP based on the firm and date for each datapoint in each dataset. The market value of equity (MVE) for each datapoint was then calculated by multiplying these variables. The control-treatment event date matching was performed by labeling all preexisting datapoints in the RepRisk and Sustainalytics datasets as treatment events. Then, each treatment observation was matched to a control observation retrieved from CRSP

with the closest MVE value, within the same Standard Industrial Classification (SIC) code, and within the same event window of [t-1,t+1]. Restrictions of the matched control observation are that they cannot already be a treatment firm with an event within [t-1,t+1] event window in its corresponding dataset, and they cannot repeat once added to the dataset. This was performed for both the RepRisk and the Sustainalytics dataset. The control observations control the impact of industry-specific events on market reaction.

Market Reaction to Water Management Information – Base Models

The overarching research question of this study is whether there is a market reaction to ESG information regarding the water management practices of a firm. Because this study analyzes two forms of information, news and ESG rating, hypothesis #1 is analyzed by two regression models:

RepRisk: $CAR_{[t-1,\ t+1]} = \beta_0 + \beta_1\ neg + Control\ Variable + \varepsilon$

Sustainalytics: $CAR_{[t-1,\ t+1]} = \beta_0 + \beta_1\ \Delta rating + Control\ Variable + \varepsilon$

Within the RepRisk data, treatment events are identified by a value of 1 for the neg variable (signifying that the event has negative news as identified by RepRisk) and control events are identified by a value of 0 (signifying that this observation was added as a control firm to the dataset through control-treatment event date matching). Within the RepRisk model, neg is used as the x-variable. Within the Sustainalytics model, Δrating is used as the x-variable. Δrating is the aggregate value of the rating changes in the Water Intensity and Programs & Targets to Reduce Water Use indicators from Sustainalytics. Some data points from Sustainalytics only have data for one of the two indicators. This issue is mitigated with a conditional. If both

indicators have non-null values on that date, then Δrating is the average of the rating changes for both indicators. If only one indicator is non-null on that date, then Δrating is equal to the rating change of the non-null indicator. These ratings move in intervals of 5 points, so Δrating is the aggregate change value divided by 5, making this variable on a -20 to 20 scale. Each control event has zero as their Δrating value. Two treatment events with a Δrating value of zero and their corresponding control observations were removed from the data.

The control variable in this model is the natural log of the firm's market value (ln(MVE)), which controls the impact that firm size has on the market reaction. Firm size is a common control variable among studies on ESG information's market reaction (Serafeim 2022, Capelle-Blancard 2019, Dorfleitner 2024, Flammer 2013, Gibson 2021). Other control variables, such as advertising expense over sales and research and development expense over sales were tested but not used in the final models that are present in this study due to their utilization lowering the sample size without improving the meaningfulness of the results.

Market Reaction to Material Water Management Information

To analyze the impact of materiality on ESG information, I conducted cross-sectional regression models. The models corresponding to hypothesis #2 are as follows:

RepRisk: $CAR_{[t-1,\ t+1]} = \beta_0 + \beta_1\ neg + \beta_2\ material + \beta_3\ neg*material + Control\ Variable + \varepsilon$

Sustainalytics: $CAR_{[t-1,\ t+1]} = \beta_0 + \beta_1\ \Delta rating + \beta_2\ material + \beta_3\ \Delta rating*material + Control\ Variable + \varepsilon$

The variable named material denotes if water management is a material practice for the industry of the firm in question as identified by SASB. The SASB Materiality Finder lists out all the ESG practices that are material to every industry. For this study, Water & Wastewater Management is the indicator of interest from the Materiality Finder. If Water & Wastewater Management is listed as a material issue for the industry of the firm in an observation, then a value of 1 is assigned to the material variable. If Water & Wastewater Management is not listed as a material issue, then a value of 0 is assigned to the material variable. The material variable is used as a control variable in these models. The neg*material and rating*material variables are the interaction variables in their corresponding models. Like the base model, ln(MVE) is the control variable.

Market Reaction to Reoccurring and New Negative News

Cross-sectional regression models are also used to observe the impact of negative news novelty on market reaction. The models corresponding to hypotheses #3 and #4 are as follows:

$$CAR_{[t-1,\ t+1]} = \beta_0 + \beta_1\ neg + \beta_2\ neg*reoccurring + Control\ Variable + \varepsilon$$

$$CAR_{[t-1,\ t+1]} = \beta_0 + \beta_1\ neg + \beta_2\ neg*new + Control\ Variable + \varepsilon$$

The variables reoccurring and new both source from RepRisk's analysis on each event. RepRisk provides a variable called novelty for each event listed. The value 1 is assigned to news that is a reoccurring issue that the firm faces and the value 2 is assigned to news that has never occurred for the firm before. For the reoccurring variable, I assign a value of 1 to every datapoint with a RepRisk novelty value of 1 (signifying negative news that is a reoccurring issue for the firm) and assign every other datapoint a value of 0. For the new variable, I assign a value of 1 to every

datapoint with a RepRisk novelty value of 2 (which signifies negative news that is a new issue for the firm) and assign every other datapoint a value of 0. The variables neg*reoccurring and neg*new are the interaction variables of their corresponding models. To avoid the issue of collinearity between the neg variable and reoccurring and new variables, the reoccurring and new variables alone with their own coefficient are not included in their corresponding models. Like the base model, ln(MVE) is the control variable.

Chapter 6

Results

To evaluate the hypotheses, I assess the statistical significance of each variable's coefficient on cumulative abnormal returns as calculated by each regression model test. The base model had no statistically significant outputs, therefore I fail to reject null hypothesis #1. The outputs for this model can be referenced in Table 2.

The material water management information model for the RepRisk dataset yields limited statistically significant explanatory power for $CAR_{[t-1, t+1]}$ with an R-squared value of 0.002. The output figures for this regression can be found in Table 2. The neg coefficient is -0.0088 with a 5% significance level. This predicts that negative news yields an average -0.0088 decrease in a firm's $CAR_{[t-1, t+1]}$ value if water management practices are not material to the firm. The material coefficient is -0.0089 with a 5% significance level. This model finds that the control firms that hold water management as a material practice have an average -0.0089 contribution to the calculation of $CAR_{[t-1, t+1]}$. The interaction variable of interest, neg*material, has a coefficient of +0.0096 with a significance level of 10%. This suggests that if there is negative water management news for a firm where water management is a material ESG practice, it will soften the effect that the negative news has on the firm, as opposed to if water management is not material to the firm. These findings are statistically significant; therefore, I reject the null hypothesis #2 with the RepRisk data. Interestingly, these findings are contrary to what is found in past papers that examine the interaction of materiality with ESG information (Serafeim 2022, Khan 2016, Grewal 2020). A possible explanation for this is that wastewater management, water

management, and water scarcity issues are all very common for firms in these industries where water management practices are material, so the market doesn't fret as much when hearing these incidents as they would for a firm that doesn't encounter water management issues in normal business operations. Furthermore, this disagreement with past studies suggests that the market reaction to an interaction between ESG information and materiality to industry may vary by isolated ESG issues. Past studies discussed in this paper examine overall ESG, not examining material and information interaction on categorical bases. The unexpected outcome of this model warrants further investigation of the interaction materiality of water management with negative news and its impact on market returns in future studies. The results from the material water management information model for the Sustainalytics dataset did not output statistically significant results. Therefore, I fail to reject the null hypothesis #2 with the Sustainalytics data. The explanatory nature of the RepRisk data (news data) as opposed to the unexplanatory nature of the Sustainalytics data (ESG ratings data) follows suit with past studies that suggest lower explanatory utility of ESG ratings data.

Upon analyzing the reoccurring and new interaction regression models, these tests were unable to find statistically significant explanatory power for predicting $CAR_{[t-1, t+1]}$. The R-squared for each model was low and none of the variables of interest yielded betas within a statistical significance level of 10%. With these models, I fail to reject null hypothesis #3 and #4. The outputs for these regression models can be found in Table 2. The summary statistics for each dataset can be found in Table 1.

Chapter 7

Conclusion

After conducting six regression analyses, I find one statistically significant result regarding the market reaction to the interaction of negative water management news with industry-specific materiality of water management. Contrary to past studies, I find that the negative market reaction to negative news regarding a firm's water practices is softened when water management is a material practice to a firm, as opposed to if water management is not a material practice. Past studies have suggested that the materiality of an ESG issue typically magnifies the impact that the corresponding ESG information has on a market response. Although , these past studies did not examine water management practices on the isolated level from the rest of ESG practices, suggesting that industry-specific materiality of water management practices has its own moderating effect on ESG information's market reaction compared to other ESG issues. Likewise, this unexpected finding encourages further research into the effects of water management isolated from the rest of ESG issues in further accounting and finance research.

Research on ESG information's impact on the stock market is still new and optimized research designs are still developing as ESG continues to gain attention. Data availability and quantification continues to be a limitation for studies regarding ESG information. This limitation is present in this study, resulting in the use of two different data sets with their own limitations. Other data sources for ESG news analysis and sentiment analysis that were not available for this study include Factiva's TruValue, Covalence, and Refinitiv's ESG data. Although most testing results from this study were not conclusive, there are inferences on how to conduct future studies

around these topics. Future studies can explore more control variables for these regression models to reduce the noise in the data. For example, advertising expenses over sales and research and development over sales were controls present in past studies that were not included in these studies due to a lack of data available. These can be used in future studies if a data source is found for collecting a larger proportion of these datapoint. ESG information is constantly changing, with chances of becoming more standardized and quantifiable in the future. In the Spring of 2022, the Securities and Exchange Commission (SEC) proposed amendments to standardize the reporting of ESG factors (Mallin 2024). With regulation environment changes like this in the upcoming years, new quantifiable ESG data will arise. This new data can be used as a more direct proxy for measuring ESG information's market reaction. Furthermore, this is the beginning of examining water management practices as an isolated topic in ESG-market research. Future studies on water management can do deeper analysis on news and information impact on a market reaction. Using more definitive data points or control variables could help in finding conclusive results on a market response.

Appendix A

Summary Statistics

Table 1 presents the descriptive statistics of the RepRisk and Sustainalytics datasets. The car variable represents cumulative abnormal returns within the event window of t-1 to t+1 days where t is the event date. The neg variable represents treatment observations gathered from the RepRisk database. Treatment firms (datapoints gathered from RepRisk) are assigned value 1 and control firms (gathered from CRSP with the closest MVE within the same SIC industry and a firm that does not have a RepRisk incident on that same event window) are assigned value 0. The material variable represents if water management is material to the firm's industry as identified by the SASB Materiality Finder. Firms where water management is considered material are assigned value 1 and firms where water management is not considered material are assigned value 0. The reoccurring variable signifies if an incident identified by RepRisk has occurred before for the firm. Incidents that are reoccurring are assigned the value 1 and incidents that are not reocurring are assigned value 0. The new variable signifies if an incident identified by RepRisk is new to the firm and has never occurred before. Incidents that are new are assigned value 1 and incidents that are not new are assigned value 0. The Δrating variable represents the cumulative change in water management rating assigned to a firm by Sustainalytics on a given date. All treatment firms (datapoints gathered from Sustainalytics) have a non-zero Δrating. Value 0 is assigned to Δrating for the control firms (gathered from CRSP with the closest MVE within the same SIC industry and a firm that does not have a RepRisk incident on that same event window). Δrating* gives the summary statistics for only the treatment firms. Δrating without the asterisk gives the summary statistics for the treatment and control firms combined. The ln(MVE) variable represents the natural log of the market value of equity for the firms corresponding to each observation. This variable is used as a control in the regression models.

Table 1. Summary Statistics

		N	Mean	Standard Deviation	Minimum	25% Quartile	Median	75% Quartile	Maximum
RepRisk Data	car	3726	0.0018	0.0747	-0.4445	-0.0157	0.0005	0.0179	3.8282
	neg	3726	0.5000	0.5001	0	0	0.5	1	1
	material	3726	0.6758	0.4681	0	0	1	1	1
	reoccurring	3726	0.2040	0.4030	0	0	0	0	1
	new	3726	0.2960	0.4566	0	0	0	1	1
	ln(MVE)	3726	16.5398	2.0557	8.5913	15.2701	16.7686	17.8189	21.7932
Sustainalytics Data	car	1088	-0.0002	0.0309	-0.2475	-0.0153	0.0001	0.0161	0.2109
	Δrating*	544	-0.1820	10.7638	-20.00	-10.00	4.00	5.00	20
	Δrating	1088	-0.0910	7.6082	-20.00	0.00	0.00	4.00	20
	material	1088	0.7059	0.4559	0	0	1	1	1
	ln(MVE)	1088	15.7099	1.5534	8.1532	14.8729	15.8125	16.6956	19.7456

Appendix B

Regression Models

Table 2 presents the output values for each regression model. Models (1) – (4) were performed with the RepRisk dataset and models (5) – (6) were performed with the Sustainalytics dataset. Model (1) represents the base model for the RepRisk data that examines the negative news indicator impact on car. Model (2) represents the interaction model of negative news indicator and materiality of water management issues to a firm's industry indicator. The interaction variable is neg*material. Model (3) represents the interaction model of negative news indicator and reoccurring news indicator. The interaction variable is neg*reoccurring. Model (4) represents the interaction model of negative news indicator and new news indicator. The interaction variable is neg*new. Model (5) represents the base model for the Sustainalytics data that examines the cumulative change in water management rating's impact on car. Model (6) represents the interaction model of the cumulative change in rating and materiality of water management issues to a firm's industry indicator. The interaction variable is Δrating*material. This table provides the coefficients of variable per model along with the t-statistics in square brackets. **,* are statistically significant at the 5% and 10% levels, respectively.

Table 2. Regression Outputs

	Negative News - RepRisk				ESG Rating Change - Sustainalytics	
	(1)	(2)	(3)	(4)	(5)	(6)
neg	-0.0023	-0.0088**	-0.0026	-0.0018		
	[-0.898]	[-1.995]	[-0.882]	[-0.558]		
Δrating					-0.0001	0.0002
					[-0.906]	[0.820]
material		-0.0089**				0.0013
		[-2.414]				[0.614]
neg*material		0.0096*				
		[1.821]				
Δrating*material						-0.0004
						[-1.444]
neg*reoccurring			0.0007			
			[0.201]			
neg*new				-0.0007		
				[-0.201]		
ln(MVE)	0.00005	0.00010	0.00004	0.00004	-0.00030	-0.00030
	[0.080]	[0.192]	[0.069]	[0.069]	[-0.550]	[-0.567]
Observations	3726	3726	3726	3726	1088	1088
R-Squared	0.000	0.002	0.000	0.000	0.001	0.003

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