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# Exploring the Evolving Materiality of ESG News

## Evidence from US and European Public Firms

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*The views stated in this thesis are those of the author and not necessarily those of the supervisor, the second assessor, Erasmus School of Economics or Erasmus University Rotterdam.*

## Abstract

The aim of this study is to examine the changes in ESG news materiality and determine if there has been a structural shift after the COVID-19 pandemic. The research utilizes a dataset of over 2700 publicly listed firms in the US and Europe, covering the period from 2010 to 2022. The study shows that alterations in ESG reputational risk exposure impact stock return and volatility, which may have changed following the pandemic. Furthermore, the research reveals that ESG news materiality was continually evolving before the pandemic and that the impact of ESG reputational risk differs by country and sector. The study contributes to the current literature on ESG, pandemic economics, and behavioral finance studies by providing insights into how ESG news can have diverse effects on stock movements over time, especially in terms of changes in ESG reputation and overall reputational risk exposure. The findings of this research may have practical implications for real-world stock investment.

**Keywords:** ESG Materiality, ESG Reputational Risk, Stock Return, Stock Volatility, Stock Turnover

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# 1 Introduction

ESG materiality<sup>1</sup> relates to how significant ESG factors are to a company's operations, financial performance, and long-term outlook. This thesis is intended to find evidence of ESG materiality evolution in the recent decade. At the start of the 21st century, the notion of ESG (environmental, social, and governance) emerged, prompting scholars to investigate its impact on corporate financial performance (CFP). Ferrell et al. (2016) approached the significance of ESG from an agency viewpoint arguing it's a waste of corporate resources. Whereas Dyck, EffectLins, Roth, & Wagner (2019a) evaluated it through the lens of institutional investors and found that institutions are also motivated by social return. Additionally, after conducting a thorough analysis of existing literature, Gillan, Koch, & Starks (2021) discovered that while there is a significant correlation between ESG factors and a company's market, leadership, shareholder characteristics, as well as its risk and performance, there are still conflicting results that require further research.

In addition to financial returns, investors and customers have begun to prioritize non-financial performance (Godfrey, 2005). Contemporary businesses adopt ESG strategies not just to enhance their performance, but also to demonstrate their principles and make a positive impact on society. The significance of sustainability has also been underscored by governments, as evidenced by initiatives such as the EU taxonomy and recent-enacted environmental regulations in the United States. To measure a company's social responsibility contributions and its ability to withstand ESG risks, ESG ratings were introduced. As a result, many investors have integrated ESG considerations into their investment decision-making processes, assessing

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<sup>1</sup> In the realm of investment strategy, various similar yet popular concepts exist, such as ESG investing, sustainable investing, impact investing, and socially responsible investing. While each strategy focuses on one or more pillars of E/S/G, they are not identical. In this paper, the term ESG materiality encompasses all three pillars - environmental, social, and governance - and thus encompasses the materiality of other similar investment strategies as well.

their portfolio companies using their own ESG risk matrices.

The correlation between ESG performance and corporate financial performance (CFP) has been extensively examined in the literature, with varying results across sectors, regions, and time periods using diverse methodologies. While some studies have shown a negative impact of ESG on CFP (Bing & Li, 2019), others have found no relationship (Friede, Busch, & Bassen, 2015). However, the majority of research indicates a positive influence on CFP (Ding, Levine, Lin, & Xie, 2021), which is consistent with shareholder expectations (Freeman, 2016). In addition, there is ongoing discussion regarding the measurement of ESG performance through ESG ratings, which have significant disparities across rating agencies, leading to challenges in investment decision-making (Berg, Kölbel, & Rigobon, 2022). There is also ongoing research into how to incorporate ESG factors into valuation models (Bolton & Kacperczyk, 2021 & Giese, Lee, Melas, Nagy, & Nishikawa, 2019). Despite the substantial body of ESG literature, limited research has explored changes in ESG materiality, which evaluates the relevance and significance of ESG factors for a company's financial performance and business operations.

After the pandemic, global ESG-focused funds experienced a surge in inflows and total assets under management (AUM) in 2021, but the market saw its first outflow in ESG funds in 2022. Refinitiv data shows that \$13.2 billion was withdrawn from ESG-related assets, leading to a 29% decrease in the total net assets managed by ESG funds<sup>2</sup>. Capital raising in both bonds and equities also significantly dropped by 35% and 50%, respectively. In 2021 and 2022, more than 18 American states introduced regulations to limit state investments in funds that adopt certain ESG policies. Opponents of ESG regulations argue that investments should prioritize maximizing shareholder benefits, and cutting expenses on certain industries could increase the risk for financial institutions and slow down the decarbonization process of carbon-intensive industries. The Russian-Ukraine war has led to a significant increase in energy prices in Europe, causing countries to resort to using more polluting sources of energy, such as oil and coal. This

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<sup>2</sup> Source: <https://www.reuters.com/business/sustainable-business/esg-funds-set-first-annual-outflows-decade-after-bruising-year-2022-12-19/>

has resulted in governments facing a dilemma in balancing inflation and sustainable development, and the European ESG market has also experienced a downturn during this time.

Recent research indicates that macroeconomic factors, such as GDP growth, can influence the materiality of ESG issues (Al Amosh & Khatib, 2023). Additionally, scholars have examined individual ESG pillars to investigate how the pandemic affects ESG materiality (Nils Engelhardt, Jens Ekkenga, & Peter Posch, 2021). However, there are varying opinions on the impact of a crisis on a company's ESG performance, with some arguing that companies perform poorly in ESG during a crisis (Dias, Rodrigues, & Craig, 2016), while others suggest that the relationship is specific to the performance of each country (Henk Berkman, Michelle Li, & Helen Lu, 2020). Despite the limited research on changing ESG materiality over time, there is an increased focus on ESG performance in the market during times of crisis. Given the popularity of ESG investing for more than a decade and the significant changes in the macroeconomic environment due to the recent pandemic, it would be intriguing to investigate how ESG materiality evolved both during and beyond the pandemic.

When considering measuring ESG performance, ESG The ESG ratings are popular measurements for firms' ESG performance, but there is a large divergence among rating agencies (Berg, Kölbel, & Rigobon, 2022). Meanwhile, numerous ESG rating agencies use information from companies' self-disclosed reports, which are often selective. Drawing upon the signaling theory, negative ESG news can harm a firm's reputation and serve as a signal to investors and lead to negative adjustments in the firm's valuation (Wong & Zhang, 2022). When there is negative ESG news where the content of the news is never disclosed and it is the first time comes out of the public, the information asymmetry can lead to further harm when a company's usual image is distorted.

In order to mitigate the impact of discrepancies in ESG ratings, this thesis has opted for an alternative method of evaluating ESG performance, which involves assessing ESG risk exposure using negative ESG news. To minimize bias, the RepRisk database has been utilized as it only includes publicly available information and excludes self-reported data. The RepRisk Index was chosen due to its extensive coverage and comprehensive methodology. Employing

negative ESG news as a means of evaluating ESG risk exposure can offer a supplementary perspective on a company's ESG performance. Negative ESG news, such as reports of environmental accidents, labor disputes, or ethical violations, can be indicative of potential risk or areas of concern for stakeholders and investors. This study explores the materiality of ESG news as a means of assessing ESG materiality. **Hence, the research question is: “Has the materiality of ESG news undergone changes over time, and has there been a significant shift in this regard following the pandemic?”**

The aim of this thesis is to investigate the evolution of ESG materiality over time and whether the COVID-19 pandemic has caused any changes. The study focuses on the impact of negative ESG news on stocks in the US and Europe between 2010 and 2022, using the ESG reputational matrix RRI to assess the severity of the news<sup>3</sup>. The analysis relates reputational risk to stock return, volatility, and trading turnover to identify variations in the effect of ESG news on stocks over time. The results indicate that changes in ESG reputational risk exposure (RRI growth) affect stock return and volatility, and that the impact may have changed following the COVID-19 pandemic. The study also shows that ESG news materiality was continuously evolving before the pandemic, with the effect of RRI growth on stock excess return and volatility changing from positive to negative since 2010. The findings suggest that firms with higher ESG reputational risk may be associated with lower stock volatility and return. The study further finds that the impact of RRI on stock relative turnover is influenced by the aggregate ESG reputational risk level (RRI mean), rather than changes in ESG risk exposure (RRI growth), and that the effect of ESG news materiality varies by sector and region.

The present research delves deeper into the existing ESG literature by exploring the changes and developments in ESG materiality, an area that has not received much research attention in the past. The results are in line with previous studies that suggest that macroeconomic factors could affect ESG performance (Al Amosh & Khatib, 2023), which might result from changes

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<sup>3</sup> See Appendix A for the RepRisk tagged topics and research scope.

in the emphasis placed on ESG issues (Chintrakarn, Jiraporn, & Treepongkaruna, 2020). The study also emphasizes the significance of considering the impact of ESG news materiality on stock return, volatility, and turnover, considering industry-specific and regional variations. Furthermore, the research provides valuable insights into the influence of ESG news on stock movements and distinguishes between the impact of ESG reputation and changes in reputational risk exposure, offering practical implications for stock investment in the real world.

The rest of this paper is as follows. In Section 2, a critical review of the literature on ESG research is provided, with a focus on ESG relevance to financial performance, valuation, and past research on ESG reputational risks. Section 3 describes the data and methodology used in this study, which involved analyzing the impact of ESG news on stock performance and trading metrics to measure ESG materiality. Section 4 presents the results of the analysis, including any sectoral and regional differences that were identified. Finally, Section 5 offers concluding remarks.

## **2 Literature Review and Hypothesis Development**

### **2.1 Development of ESG Investing**

The development of ESG (Environmental, Social, and Governance) investing can be traced back to the early 1960s, with the introduction of socially responsible investing (SRI) strategies (Townsend, 2020). SRI was primarily focused on avoiding investments in companies that were engaged in activities such as tobacco, gambling, or weapons production, which were deemed socially undesirable. Over time, SRI evolved into a more sophisticated approach that incorporated ESG factors into investment analysis. In the 1990s, the United Nations launched the Principles for Responsible Investment (PRI), which encouraged investors to integrate ESG considerations into their investment decision-making processes.

Since then, ESG investing has gained widespread acceptance, with a growing number of investors recognizing the importance of considering ESG factors in their investment decisions (Van Duuren, Plantinga, & Scholtens, 2016). Today, ESG investing has become mainstream, with a growing number of asset managers offering ESG funds and products to investors. In recent years, there has been a significant increase in the amount of ESG data and reporting, as well as regulatory initiatives aimed at promoting ESG investing (Freiberg, Rogers, & Serafeim, 2020). For example, the EU has developed the EU Taxonomy, a classification system that aims to define what constitutes an environmentally sustainable economic activity. Additionally, in the US, the Securities and Exchange Commission (SEC) has proposed rules that would require public companies to disclose information about their ESG risks and opportunities.

### **2.2 Valuating ESG Materiality**

#### **2.2.1 ESG and Corporate Financial Performance (CFP)**

ESG materiality refers to the extent to which ESG factors are relevant to a company's operations, financial performance, and long-term prospects. While the majority of existing literature supports the notion that ESG is positively associated with firm value, there are also

dissenting voices that make economic sense and are supported by statistical evidence. The relationship between ESG and financial performance is complex, and the most effective methods for integrating ESG factors into valuation models are still being refined.

The relationship between ESG and corporate financial performance (CFP) is a highly discussed topic. Different studies conducted at different times and in different countries have yielded varying results. However, an aggregated study of 2,000 empirical studies found that the majority of them showed a positive relationship between ESG and CFP, while some found negative relationships and others found no relationships (Friede, Busch, & Bassen, 2015). Moreover, recent research suggests that firms with stronger pre-2020 finances suffered less during the pandemic, indicating that ESG may provide protection for firm value (Ding, Levine, Lin, & Xie, 2021). Interestingly, while sustainability is generally seen as a positive signal for future performance, experimental evidence suggests that there is no significant difference in performance between high-sustainability funds and low-sustainability funds (Hartzmark & Sussman, 2019). There are different opinions on how ESG links to CFP.

According to some researchers, the implementation of ESG practices can have a positive impact on a firm's value. Over time, there has been an increased focus on corporate responsibility, with scholars contending that it is equally imperative to address the social and environmental issues faced by non-owner stakeholders as it is to meet the profit objectives of shareholders (Freeman, 2016). Studies have shown a favorable link between a firm's implementation of ESG practices and its overall value (Clarkson, 1995). The reasoning behind this correlation is that firms that are attentive to the needs and expectations of all stakeholders, and are proactive in addressing their ESG concerns, are less vulnerable to ESG-related risks (Albuquerque, Koskinen, & Zhang, 2019). As a result, such companies are likely to witness an increase in their value.

Despite the evidence supporting the positive relationship between ESG practices and firm value, some researchers have put forth counterarguments. One theory that supports this claim is the shareholder theory, which suggests that investing in ESG initiatives can redirect funds that would have been allocated towards a firm's core business operations, ultimately hurt

shareholder's interest (Milton Friedman, 1970). Similarly, some argue that based on cost-benefit analysis, an "ideal" level of corporate social responsibility has a neutral impact on financial performance, rather than a positive one (McWilliams & Siegel, 2001). Others have found a negative correlation between a firm's engagement in ESG practices and its value, indicating that allocating resources towards ESG initiatives can lead to a reduction in the firm's overall value. However, scholars studying new ventures have argued that socially responsible activities can help offset the liability of newness and generate positive economic returns (Wang & Bansal, 2012). Meanwhile, a study of publicly listed firms in China has revealed a negative relationship between the firm's value and its CSR activities (Bing & Li, 2019).

Numerous studies have investigated the integration of ESG factors into valuation models. One such study found that ESG information affects the discounted cash flow model through three distinct channels: the cash flow channel, the idiosyncratic risk channel, and the valuation channel (Giese, Lee, Melas, Nagy, & Nishikawa, 2019). As investors respond to ESG information, the firm's price should reflect the underlying ESG risks. Another study (Bolton & Kacperczyk, 2021) demonstrated that investors already demand a premium for their exposure to carbon emission risk. Additionally, investors may be willing to accept lower returns in order to hedge against climate risk (Pástor, Stambaugh, & Taylor, 2021). Scholars have also proposed that ESG can impact both firm fundamentals and investor preferences by constructing an ESG frontier that highlights the costs and benefits of responsible investing (Pedersen, Fitzgibbons, & Pomorski, 2021).

### **2.2.2 The Materiality of ESG News**

The materiality of ESG news is linked to how investors perceive such news. ESG ratings are one of the most important sources for investors to measure firms' ESG performance. However, it has been examined that there is large divergence among rating agencies (Berg, Kölbel, & Rigobon, 2022). Uncertainty regarding a firm's profile can also affect the risk-return trade-off and market efficiency (Avramov, Cheng, Lioui, & Tarelli, 2022). This is because the dissatisfaction and disengagement of this significant stakeholder group can result in an increase

in the cost of capital, or even worse, harm a company's ability to raise equity and sustain its operations (Clarkson, 1995). Drawing upon the signaling theory, negative ESG news can harm a firm's reputation and serve as a signal to investors about possible future cash flow risks or property damage. As a result, this could lead to negative adjustments in the firm's valuation (Wong & Zhang, 2022). A firm with a good ESG rating could have more exposure to ESG risks due to its international status and its diversified geography footprint (Lourenço, Callen, Branco, & Curto, 2014). In the present day, numerous ESG rating agencies are assessing a company's ESG performance based on the company's voluntary report, which is often selective. This information asymmetry can lead to further harm when a company's usual image is distorted.

Interestingly, scholars have discovered that news related to ESG issues can impact the value of a firm and be reflected in its stock price. For instance, research conducted on publicly listed companies in the UK found a positive relationship between corporate environmental responsibility and the firm's anticipated future earnings (Hussainey & Salama, 2010). Furthermore, research on the Sustainability Accounting Standards Board's (SASB) definition of Material Environmental, Social, and Governance activities has shown that various types of ESG news have differing effects on stock prices (Mingying Cheng, Joseph Micale, & Iftexhar Hasan, 2022). This suggests that ESG information can help to mitigate information asymmetry, reduce agency costs, and prevent adverse selection. According to the positive resource-based theory, a strong Corporate Social Responsibility (CSR) reputation is an intangible resource that can enhance the value of a firm's anticipated cash flows, decrease the volatility of its cash flows, and result in a higher market valuation of its net income (Lourenço et al., 2014). A similar study on European listed also demonstrated the significant impact of ESG on the financial materiality of these companies (Agoraki, Giaka, Konstantios, & Patsika, 2023). Using various econometric techniques, including 2SLS, the Heckman selection model, and a quasi-natural experiment, they found evidence that ESG reputational risk has a negative effect on the financial performance of firms.

The market response to negative ESG news varies among different companies, depending on their unique characteristics (Wong & Zhang, 2022). Prior research has proposed that the size

of a firm impacts the risk-return trade-off, and that smaller firms face greater information asymmetry, resulting in wider bid-ask spreads (Chiang & Venkatesh, 1988). Stocks within the S&P 500 are believed to have a lower information asymmetry index (Lindsay Baran & Tao-Hsien Dolly King, 2012). As a result, these stocks may have a lower probability of experiencing significant declines in price because the market has already incorporated this information into their stock prices. For smaller firms, media news plays a critical role in reducing information asymmetry. Scholars showed that information collected by outsiders and the firms' self-disclosed reports help limit insider trading, and company financial statement news no matter good or bad is positively related to insider purchase frequency (Richard Frankel & Xu Li, 2004). Furthermore, sin stocks are tested to be less sensitive to ESG news (Wong & Zhang, 2022) compared to firms in other industries such as banks and insurance. It would be interesting to examine whether ESG-related news is related to trading behavior and whether the level of materiality is related to other firm characteristics.

### **2.3 Pandemic Effect on ESG Materiality**

According to recent studies, macroeconomic factors, such as GDP growth, have an impact on the materiality of ESG issues (Al Amosh & Khatib, 2023). A paper on 29 OECD countries during the 1996-2014 period found a positive long-term relationship between ESG and GDP per capita, although no such relationship was observed in the short term (Marc-Arthur Diaye, Sy-Hoa Ho, & Rim Oueghlissi, 2021). A study on socially responsible investment (SRI) peculiarities was conducted over different regions, including Europe, the US, Canada, Asia, and Japan (Shkura, 2019). The researcher's findings indicate that SRI investments are influenced by macroeconomic indicators, such as economic openness and development. This is in line with the conclusions drawn by another paper that explores the relationship between ESG factors and the level of financial institution ownership (Dyck, Lins, Roth, & Wagner, 2019b). However, the pandemic in 2020 caused a global GDP contraction as a result of lockdowns and restrictions on businesses and individuals, which may have affected the materiality of ESG issues as identified in earlier research.

There are studies on materiality in terms of ESG pillars. The pandemic temporarily stopped economic activities, which was good for the environment. Previous literature showed that there is an inverted U-shape relation between environmental degradation and income per capita (David I. Stern, Michael S. Common, & Edward B. Barbier, 1996). A recent study showed that the pandemic increased the company's environmental and social pillar performance but negatively affected the governance pillar performance (Al Amosh & Khatib, 2023). Researchers who utilized a European firm sample also discovered that there is a positive correlation between a firm's abnormal return and its ESG rating, with a specific emphasis on the social pillar rating (Nils Engelhardt, Jens Ekkenga, & Peter Posch, 2021).

However, opinions are divided on the impact of a crisis on a company's ESG performance. Some researchers have pointed out that companies perform poorly in SRI during a crisis, citing the example of the 2008 global financial crisis based on a sample analysis (Dias, Rodrigues, & Craig, 2016). In a more recent study on the impact of the pandemic on ESG performance, researchers did not find any evidence of a negative influence of the pandemic on ESG ratings (Al Amosh & Khatib, 2023). Hence, the impact of the pandemic on ESG performance and materiality remains uncertain. The degree of ESG materiality is also linked to the prevailing market consensus on this issue, legal classification, and the need for self-reporting on ESG concerns in a given region. Using samples of 23,000 companies from 114 countries, researchers discovered that firms from common law countries have lower ESG ratings than those from countries with a civil law system (Liang & Renneboog, 2017). A study focusing on how Japanese firms ESG ratings reacted during the 2008 global finance did not find evidence of any added value that ESG ratings have for the firm performance (Henk Berkman, Michelle Li, & Helen Lu, 2020). This is explained by country-specific factors such as the Japanese civil law system and the collectivistic society. It was suggested that the degree of sensitivity towards ESG materiality during a crisis varies across countries.

During times of crisis, there is an increased emphasis on ESG performance in the market. Typically, companies face financial difficulties and liquidity issues during such periods, resulting in fewer resources being available to support their regular corporate responsibility

activities. Nevertheless, corporations still tend to uphold their ESG standards, as managers believe it can help mitigate corporate risk exposure (Chintrakarn, Jiraporn, & Treepongkaruna, 2020). However, a study using sequential experiments found that how material ESG integrated into a company's strategy does not affect investors' price assessments or investment allocation (Espahbodi, Espahbodi, Juma, & Westbrook, 2019). Nonetheless, ESG initiatives can enhance a company's reputation and marketing efforts, as research found CSR could become a serious threat if it was not well managed (Coombs & Holladay, 2015). This highlights the significance of maintaining a good ESG reputation during a crisis. Despite the fact that ESG performance was emphasized, researchers failed to find evidence to show that ESG ratings can safeguard ETFs' performance during covid pandemic (Nils Engelhardt et al., 2021).

Overall, the current literature explores the impact of the pandemic on ESG performance, as well as its effect on stocks and company financial performance during times of crisis. However, there is a lack of research examining the evolution of ESG materiality, including before and after covid. The existing body of literature on how the pandemic affected ESG performance serves as a basis for the hypothesis of this thesis, which aims to investigate changes in ESG materiality.

## **2.4 Literature Gap and Hypothesis Development**

To the best of my knowledge, no prior research has been conducted to specifically investigate the evolution of ESG materiality in the aftermath of the pandemic. Given the recent outflow of ESG investments, the first in a decade, this study seeks to gather evidence to determine whether there has been a change in the materiality of ESG reputation by examining its impact on European and US stocks. The research question that guides this thesis is: *"To what extent has the materiality of ESG reputational risks on stocks undergone changes over time, and has there been a significant shift in this regard subsequent to the pandemic?"* In order to obtain a comprehensive understanding of the impact of ESG news on stock movements, the research question is further broken down into three dimensions: stock return, stock volatility, and stock turnover.

Prior literature has investigated the materiality of ESG by analyzing ESG performance in relation to stock abnormal returns and corporate financial performance (Friede et al., 2015). Most of these studies have utilized ESG ratings in their analysis, but there is limited research that has tested ESG materiality using data from ESG-related news. Existing literature on ESG news suggests that such news is material for certain firms within specific industries, and that different types of news can have varying effects on stock returns (Wong & Zhang, 2022). Some argued that different types of news have different effects on stock return (Mingying Cheng et al., 2022). Moreover, there are conflicting conclusions regarding how ESG materiality changes based on different samples in various regions (Shkura, 2019) and time periods, which scholars believe may be related to regional economic development level (Al Amosh & Khatib, 2023), the law system, and societal consensus (Liang & Renneboog, 2017). Therefore, I propose the following research hypothesis:

***Hypothesis 1.1:*** *The COVID-19 pandemic in 2020 significantly impacted the relationship between ESG reputational risks and stock excess return.*

***Hypothesis 1.2:*** *Over time, there has been a significant evolution in the relationship between ESG reputational risks and stock excess return before the COVID-19 pandemic in 2020.*

Macroeconomic conditions change stock volatility (Schwert, 1989). Economic conditions, interest rates, market trends, and overall investor sentiment can all affect stock volatility. In addition, company-specific news such as earnings reports, changes in management, or legal issues, can affect the volatility of its stock (Donders & Vorst, 1996). According to the literature mentioned above, there is potential for investigating the impact of ESG news on stock volatility. Since the onset of the COVID-19 pandemic, remote work has become more prevalent, and companies are paying more attention to their employees' mental health (Hamouche, 2020). These societal changes, in combination with macroeconomic conditions, could increase the significance of a firm's ESG performance. Thus, the following hypotheses are proposed.

***Hypothesis 2.1:*** *The COVID-19 pandemic in 2020 significantly impacted the relationship*

*between ESG reputational risks and extra stock volatility.*

***Hypothesis 2.2:*** *Over time, there has been a significant evolution in the relationship between ESG reputational risks and stock excess volatility before the COVID-19 pandemic in 2020.*

The volume of shares being bought and sold usually have a positive relationship (Clark, 1973), but some study also showed that volume did not necessarily relate to stock volatility (Ane & Ureche-Rangau, 2008). Recent literature documented that a significant rise in stock market volatility and a decline in stock prices (Abdullah M. Al-Awadhi, Khaled Alsaifi, Ahmad Al-Awadhi, & Salah Alhammadi, 2020). Later with a sample of Asia-Pacific regional firms, researchers showed that the volatility declined after pandemic control measures were taken (Duc Hong Vo, Chi Minh Ho, & Tam Hoang-Nhat Dang, 2022). As a result, ESG news may have a greater influence on a firm's trading volume. This could serve as an indicator of changes in investor attitudes towards ESG, and the hypothesis can be tested to determine if there is a shift in ESG's relevance to investors in the public market.

***Hypothesis 3.1:*** *The COVID-19 pandemic in 2020 significantly impacted the relationship between ESG reputational risks and stock turnover.*

***Hypothesis 3.2:*** *Over time, there has been a significant evolution in the relationship between ESG reputational risks and stock turnover before the COVID-19 pandemic in 2020.*

## 3 Data and Methodology

### 3.1 Data

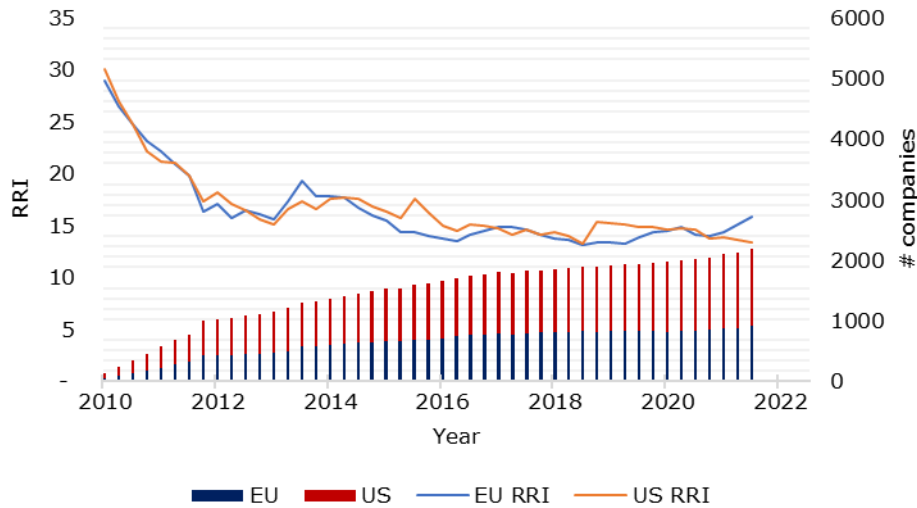
#### 3.1.1 RepRisk Index (RRI)

The RepRisk Database provides a measurable way to assess reputational risk exposure to environmental, social, and governance (ESG) risks for 20,000 publicly traded companies worldwide between 2007 and 2022. The RepRisk Index (RRI) is employed to gauge a company's level of risk exposure, with a higher score indicating greater exposure. The RRI is computed based on several factors, such as the extent of information sources, frequency and timing of ESG risk incidents, and the severity and uniqueness of the issues addressed. An increase in negative ESG news corresponds to a rise in the RRI. The current RRI reflects the company's present media and stakeholder attention concerning ESG matters. The Country-Sector Average is calculated by giving equal weightage to the company's home country and all other countries associated with the company's ESG issues. ESG news is not weighted by sector or country, and the RRI score has no specific environmental, social, or governance components. The RRI score increases with each new risk incident and decays after 14 days of no new risk exposure.

This study employs a dataset sourced from RepRisk, which consists of roughly 40 gigabytes of data encompassing 190,210 distinct companies, of which 21,455 are publicly traded. To narrow down the dataset, a filtering procedure was implemented, which retained only companies headquartered in the European Union, United Kingdom, or the United States, resulting in a subset of 8,309 companies. This filtered subset will be merged with a financial dataset, and only firms with financial data will be included in the analysis.

#### 3.1.2 Financial Data

**Stock And Index Price.** To retrieve stock information for EU and US companies, I utilized the ISIN from the RepRisk database. For EU companies, I directly used the ISIN to locate stock data, while for US companies, I first converted the ISIN to CUSIP and then to GVKEY, which

**Figure 3.1***Current RRI Over the Years (public firms in the US and EU)*

is the unique code for companies in Compustat. Then I use GVKEY to locate US stock data. For all stocks, I choose the ones which are still active in order to study the effect of the pandemic on stocks. The daily stock data includes closing price, trading volume, shares outstanding, and the adjustment factor for stock splits or dividend payment (if there is any). The daily close price is used to calculate the quarterly holding period return, which will be used in the regression model.

The FTSE All-World Europe Index<sup>4</sup> was selected as the benchmark performance for the sample of EU stocks, while the S&P 1500 Super Composite was chosen as the market performance metric for evaluating the excess return of the US stocks. Monthly returns of both indexes were collected and aggregated into quarterly holding period returns.

**Company Fundamentals.** Fundamental data for each quarter was obtained from Compustat, which included information on current assets, total assets, net income, total shareholder equity, dividends, current liabilities, total debt, and total revenue. For EU firms, net

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<sup>4</sup> See Appendix B for the index movements since 2010.

income was calculated by adding net income before and after extraordinary items. Using this raw data, I computed profitability (ROA, ROE, revenue growth), liquidity (current ratio), and solvency ratios (debt-ratio), which were transformed into log format and used in the regression model.

### 3.1.3 Merging Dataset

Table 3.1 presents the summary statistics, such as mean, standard deviation, minimum, maximum, and number of observations. The final panel dataset comprises 2874 firms, of which 1249 are located in the EU (including the UK) and 1625 are based in the US (see Table 3.2). The dataset covers a time span from 2010 to 2021 and contains 69296 observations across 10 industries and 28 countries. To analyze ESG materiality over time, the dataset is divided into three periods: 2010-2014, 2015-2019, and 2020-2021. All numerical data are transformed into a logarithmic format to mitigate the impact of outliers<sup>5</sup>.

As part of my investigation, I also examined the period gaps among observations in the panel dataset and discovered that 464 firms had missing data points (Details see Appendix D). While there are various reasons why public firms may not provide quarterly financial reports and release them after several quarters, such as significant disruptions in their operations, unexpected accounting issues or errors, and other factors, the majority of the dataset provides continuous observations. These continuous observations provide a solid and reliable foundation for subsequent analysis.

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<sup>5</sup> Appendix C features two histograms showcasing the correlation between different variables before and after log transformation. Upon applying a logarithmic transformation, the correlations become more evident, and the influence of outliers is mitigated.

**Table 3.1***Summary Statistics*

Variable	Obs	Mean	Std. dev.	Min	Max
Abnormal Return	69,264	1.03	0.37	0	79.876
Excess Volatility	69,257	1079.51	142417.40	0	36500000
Relative Turnover	69,162	0.88	49.97	0	11310
Current RRI Mean	69,296	15.43	12.16	0	73
Country Sector Average RRI	69,296	24.50	8.41	0	70
Current RRI Growth	53,859	0.98	0.70	0	29
ROA	68,387	0.001	0.87	-161.300	3.050
ROE	68,712	0.006	5.39	-1190.227	330.519
Debt Ratio	68,476	0.631	0.60	0	119.000
Current Ratio	62,027	0.822	1.08	-0.028	101.000
Revenue Growth	62,078	0.114	5.09	-319.212	728.000
Dividend (Dummy)	69,296	0.007	0.08	0	1
Market Cap (billion)	69,229	426.431	24822.10	0	2302503
Year Dummy					
Year2010~2014	69,296	0.255	0.44	0	1
Year2015~2019	69,296	0.508	0.5	0	1
Year2020~2021	69,296	0.237	0.43	0	1
Sector Dummy					
Industrials	69,296	0.200012	0.400012	0	1
Consumer Discretionary	69,296	0.165219	0.371381	0	1
Energy	69,296	0.077292	0.267056	0	1
Materials	69,296	0.098491	0.297979	0	1
Consumer Staples	69,296	0.087134	0.282033	0	1
Healthcare	69,296	0.079658	0.270765	0	1
Financials	69,296	0.081404	0.273457	0	1
IT	69,296	0.07543	0.264086	0	1
Communication Services	69,296	0.055198	0.228368	0	1
Utilities	69,296	0.056699	0.231268	0	1
Real Estate	69,296	0.017909	0.132621	0	1
Regional Dummy					
US	69,296	0.573684	0.494544	0	1

Note: Definitions of non-dummy variable are provided in Appendix E.

**Table 3.2***Data Distribution by Country*

Country	No. of Firms	No. of Observations	Country	No. of Firms	No. of Observations
US	1625	39612	Portugal	22	566
UK	281	6777	Luxembourg	22	539
France	162	4269	Ireland	20	430
Germany	148	3738	Romania	12	219
Sweden	96	1922	Cyprus	11	214
Italy	75	1792	Croatia	8	141
Spain	70	1641	Hungary	5	130
Finland	60	1425	Estonia	5	77
Netherlands	52	1252	Malta	4	68
Poland	48	1077	Bulgaria	4	64
Denmark	42	974	Latvia	3	62
Belgium	42	849	Lithuania	3	61
Austria	26	731	Slovenia	3	61
Greece	22	572	Czechia	3	33
In Total				2874	69296

**Understand RRI.** The RRI-related variables are crucial components of this study, serving as a key indicator of a company's ESG reputational risk. The Country-Sector Average is used as a benchmark for a company's RRI, facilitating comparisons across sectors and countries. Over the years, there is a decline in RRI over time for US and EU firms<sup>6</sup>, but an upward trend in the benchmark Country-Sector RRI<sup>7</sup>, indicating a rising ESG reputational risk in a global context. To understand the distinct movements and get a holistic view of the firm's ESG reputational risk exposure, Figure 3.2 displays the distribution of current RRI for all observations, revealing that a significant number of observations have a value of 0 RRI.

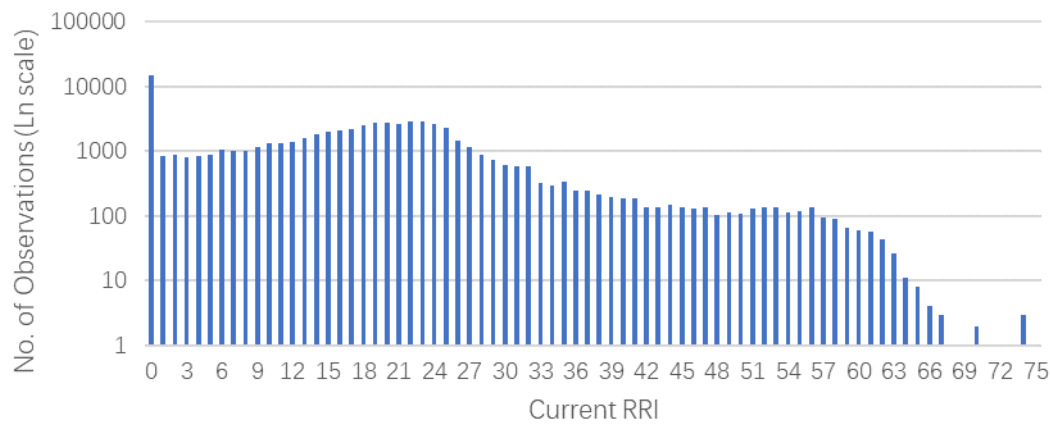
Combining the facts, a potential explanation for this decline in overall ESG reputational risk for US and European firms can be attributed to the increase in 0-RRI firms over the years, which are likely newly listed firms with limited media coverage in the ESG field. These findings

<sup>6</sup> The graph *Distribution of Current RRI by Year* is available in Appendix F.

<sup>7</sup> The graph *Yearly Mean Country-Sector-Average RRI Overtime* is available in Appendix G.

**Figure 3.3**

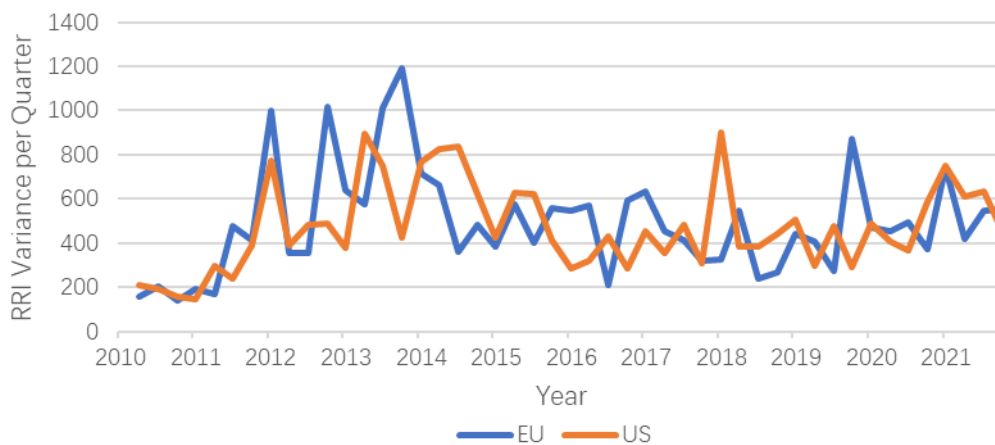
*Distribution of Current RRI*



Note: This figure presents an overview of the distribution of RRI (RepRisk Index) values for all observations included in the sample. It is notable that a significant proportion of the observations have an RRI value of 0. To enhance visual clarity, the number of observations is plotted on the vertical axis using a natural logarithmic scale, while the RRI values are depicted on the horizontal axis.

**Figure 3.2**

*RRI Variance Overtime*



underscore the significance of considering country and sector factors when examining ESG reputational risk.

Notably, Figure 3.3 reveals the volatility of reputational risk exposure for all observations, as measured by the RRI variance, and reveals a lagging consistency between US and EU firms before 2015. This may be due to growing public concerns regarding ESG issues during this

time period. Beginning in 2016, we observe a shift toward more regionally focused and less correlated ESG news influences. In 2020, both EU and US firms experienced a decrease in RRI variance, followed by a rapid increase in 2021. Overall, the preliminary analysis of the RRI underscores the importance of examining ESG reputational risk over time, and considering the unique factors that shape this risk across different sectors and countries.

## 3.2 Methodology

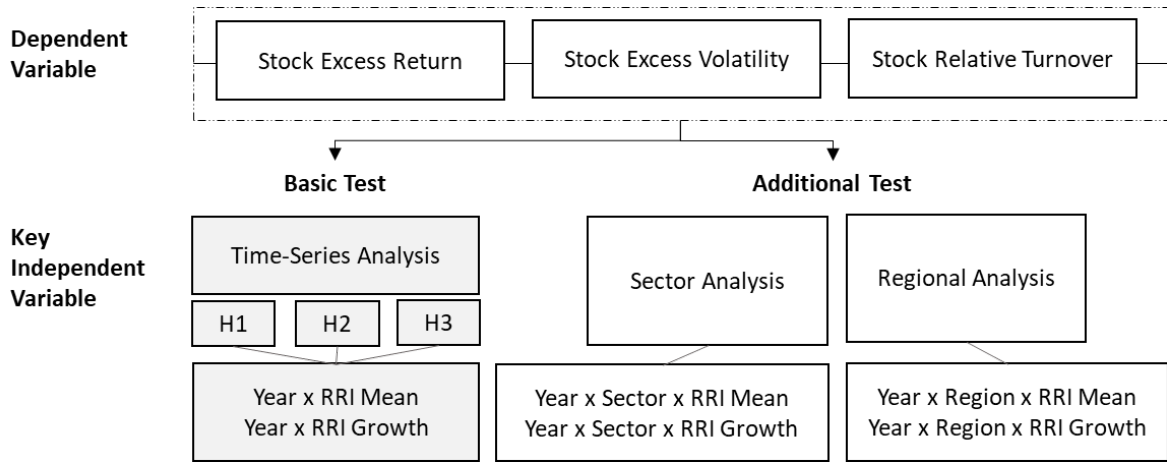
Figure 3.4 provides the methodology overview of this research. In this thesis, I investigate the evolution of ESG materiality over time for public firms in the EU and the US and see whether there is a significant change after covid. In the basic test, I utilize a set of regression models where the RRI mean (quarterly average ESG reputational risk exposure) and RRI growth (quarterly change of RRI) are regressed on excess stock return, stock volatility, and trading turnover. The three-set regression models employ the same independent variables but different dependent variables. Additional tests are run for sector and regional analysis. Firm-specific control variables are included in each of the regression models. To mitigate the effect of outliers, all the variables except RRI are logarithmically transformed. The effect of logarithmic transformation and the correlation between variables are shown in Appendix C. To determine whether to use a fixed effect model or a random effect model in the basic test, I conducted the Hausman test for panel data. The results of the test indicated that a fixed-effect regression model is more appropriate. Furthermore, I conducted diagnostics tests for panel data and detected heteroskedasticity and serial correlation. To account for these issues, I used robust standard errors in the fixed effect model.

### 3.2.1 Relationship Between RRI and Stock Excess Returns

Hypothesis 1 suggests that the impact of ESG reputational risk on stock excess returns has changed following the 2020 COVID-19 pandemic and the ESG materiality evolved over time. To test the hypotheses, the data was partitioned into three distinct subsets: 2010-2014, 2015-2019, and 2020-2021. For Hypothesis 1.1, a regression analysis was conducted to determine the significance of RRI pre- and post-COVID. Hypothesis 1.2 aimed to uncover evidence

**Figure 3.4**

*Methodology Overview*



Note: The paper utilizes three primary analyses, including a basic time-series test and two supplementary tests examining sector and region. While these analyses employ the same dependent variables, they focus on distinct key variables. The paper aims to evaluate the materiality of ESG reputational risk through these analyses, with two central objectives: firstly, to investigate whether a structural shift occurred following the COVID-19 pandemic, and secondly, to track the evolution of ESG materiality before the pandemic.

supporting the evolution of ESG news materiality prior to the COVID pandemic. Thus, the following regression models are proposed:

Hypothesis 1.1:

*Stock Excess Return*<sub>*i,t*</sub>

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} \\
 &+ +\beta_{MRRI}Country\_Sector\_Average\_Mean\_RRI_{i,t} + \beta_{R}FIRMcontrols_{i,t}^T \\
 &+ \beta_{2015\_2019} * Year2015\_2019_t + \beta_{2020\_2021} * Year2020\_2021_t + \beta_1 \\
 &* Year2015\_2019_t * RRI\_Mean_{i,t} + \beta_2 * Year2020\_2021_t * RRI\_Mean_{i,t} + \beta_3 \\
 &* Year2015\_2019_t * RRI\_Growth_{i,t} + \beta_4 * Year2020\_2021_t * RRI\_Growth_{i,t} \\
 &+ u_{i,t}
 \end{aligned}$$

## Hypothesis 1.2

*Stock Excess Return*<sub>*i,t*</sub>

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} \\
 &+ \beta_{MRRI}Country\_Sector\_Average\_Mean\_RRI_{i,t} + \beta_R FIRMcontrols_{i,t}^T \\
 &+ \beta_{2010\_2014} * Year2010\_2014_t + \beta_{2015\_2019} * Year2015\_2019_t + \beta_1 \\
 &* Year2010\_2014_t * RRI\_Mean_{i,t} + \beta_2 * Year2015\_2019_t * RRI\_Mean_{i,t} + \beta_3 \\
 &* Year2010\_2014_t * RRI\_Growth_{i,t} + \beta_4 * Year2015\_2019_t * RRI\_Growth_{i,t} \\
 &+ u_{i,t}
 \end{aligned}$$

Where  $R_{i,t}$  is the quarterly stock return,  $R_{M,i,t}$  is the quarterly index return. And the outperformance of the stock is measured as follows:

$$Stock\ Excess\ Return_{i,t} = \log((R_{i,t} + 1)/(R_{M,i,t} + 1))$$

The FTSE All-World Europe Index and S&P 1500 are used as benchmarks for EU and US firms respectively. When calculating the returns for stocks and index, the holding period return method is employed. The  $RRI\_Mean_{i,t}$  refers to the quarter average of current RRI (the RepRisk Index), which is a continuous variable that measures the level of reputational risk faced by the firm. The quarterly growth rate of the current RRI, denoted as  $RRI\_Growth_{i,t}$ , is computed as the ratio of the end-of-quarter current RRI to the begin-of-quarter current RRI, indicating an increase or decrease in ESG reputational risk exposure. The coefficient  $\beta_{RRI}$  represents the change in the dependent variable (i.e., excess stock returns) associated with a one-unit increase in the RRI Mean variable.  $Country\_Sector\_Average\_Mean\_RRI_{i,t}$  refers to quarterly mean of the RRI benchmark “Country-Sector Average” provided by RepRisk.  $FIRMcontrols_{i,t}^T$  is a vector including a set of firm-specific control variables (such as ROA, ROE, Debt Ratio, Revenue Growth, and Current Ratio, Market Cap in log format). The binary variable  $Year2015\_2019_t$  takes a value of 1 for observations in the period 2015-2019 and 0 otherwise (the same for other year dummies).

The interaction term  $Year * RRI$  captures the additional effect of ESG reputational level during a specific period of time frame. Comparing this interaction term across different periods

enables the assessment of the influence of ESG reputational risk levels on stock returns. In addition, the interaction term  $Year * RRI\_Growth$  captures the added effect of changes in ESG reputational risk exposure within a given period on stock returns. By comparing the estimates of  $Year * RRI$  and  $Year * RRI\_Growth$  across three distinct periods before and after the onset of the COVID-19 pandemic, the evolution of ESG materiality on stock excess returns can be detected.

### 3.2.2 Relationship Between RRI and Stock Excess Volatility

Similarly, in Hypothesis 2, I proposed that the level and changes of ESG reputational risk exposure has a unique impact on stock volatility after the 2020 pandemic and the effect evolved before covid.

Hypothesis 2.1:

*Excess Volatility<sub>i,t</sub>*

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} \\
 &+ \beta_{MRRI}Country\_Sector\_Average\_Mean\_RRI_{i,t} + \beta_R FIRMcontrols_{i,t}^T \\
 &+ \beta_M Index_{i,t} + \beta_{2015\_2019} * Year2015\_2019_t + \beta_{2020\_2021} * Year2020\_2021_t \\
 &+ \beta_1 * Year2015\_2019_t * RRI\_Mean_{i,t} + \beta_2 * Year2020\_2021_t * RRI\_Mean_{i,t} \\
 &+ \beta_3 * Year2015\_2019_t * RRI\_Growth_{i,t} + \beta_4 * Year2020\_2021_t \\
 &* RRI\_Growth_{i,t} + u_{i,t}
 \end{aligned}$$

Hypothesis 2.2

*Excess Volatility<sub>i,t</sub>*

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} \\
 &+ \beta_{MRRI}Country\_Sector\_Average\_Mean\_RRI_{i,t} + \beta_R FIRMcontrols_{i,t}^T \\
 &+ \beta_M Index_{i,t} + \beta_{2010\_2014} * Year2010\_2014_t + \beta_{2015\_2019} * Year2015\_2019_t \\
 &+ \beta_1 * Year2010\_2014_t * RRI\_Mean_{i,t} + \beta_2 * Year2015\_2019_t * RRI\_Mean_{i,t} \\
 &+ \beta_3 * Year2010\_2014_t * RRI\_Growth_{i,t} + \beta_4 * Year2015\_2019_t \\
 &* RRI\_Growth_{i,t} + u_{i,t}
 \end{aligned}$$

Where

$$\text{Excess Volatility} = \log(V_{i,t}/V_{M,i,t})$$

The dependent variable ( $V_{i,t}/V_{M,i,t}$ ) used in this hypothesis is the excess volatility of the stock compared to the index. The volatility is measured by taking the quarterly variance of the stock prices or the corresponding index. The index price  $Index_{i,t}$  is included here to capture part of the impact of the economic shock. The other independent variables are the same with hypothesis 1.

### 3.2.3 Relationship Between RRI and Stock Relative Turnover

Hypothesis 3 proposes that the level of ESG reputational risk exposure affects stock trading volume in a distinctive manner following the 2020 pandemic, and the effect changed over time. To incorporate the number of outstanding shares, I utilized the log format of the relative turnover, as suggested by previous literature studying trading volume and information asymmetry (Joon Chae, 2005). The independent variables are the same as Hypothesis 1 and 2, except adding  $\beta_M Index_{i,t}$  to capture the effect of overall market performance on the trading volume.

$$\text{Relative Turnover} = \log\left(\frac{\text{Quarterly Trading Volume}}{\text{Share Outstanding}}\right)$$

Hypothesis 3.1:

$$\begin{aligned} \text{Relative Turnover}_{i,t} &= \beta_0 + \beta_{RRI} RRI\_Mean_{i,t} + \beta_{RG} RRI\_Growth_{i,t} \\ &+ \beta_{M} RRI\_Country\_Sector\_Average\_Mean\_RRI_{i,t} + \beta_R FIRMcontrols_{i,t}^T \\ &+ \beta_M Index_{i,t} + \beta_{2015\_2019} * Year2015\_2019_t + \beta_{2020\_2021} * Year2020\_2021_t \\ &+ \beta_1 * Year2015\_2019_t * RRI\_Mean_{i,t} + \beta_2 * Year2020\_2021_t * RRI\_Mean_{i,t} \\ &+ \beta_3 * Year2015\_2019_t * RRI\_Growth_{i,t} + \beta_4 * Year2020\_2021_t \\ &* RRI\_Growth_{i,t} + u_{i,t} \end{aligned}$$

## Hypothesis 3.2

*Relative Turnover*<sub>*i,t*</sub>

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} \\
 &+ \beta_{MRRRI}Country\_Sector\_Average\_Mean\_RRI_{i,t} + \beta_R FIRMcontrols_{i,t}^T \\
 &+ \beta_M Index_{i,t} + \beta_{2010\_2014} * Year2010\_2014_t + \beta_{2015\_2019} * Year2015\_2019_t \\
 &+ \beta_1 * Year2010\_2014_t * RRI\_Mean_{i,t} + \beta_2 * Year2015\_2019_t * RRI\_Mean_{i,t} \\
 &+ \beta_3 * Year2010\_2014_t * RRI\_Growth_{i,t} + \beta_4 * Year2015\_2019_t \\
 &* RRI\_Growth_{i,t} + u_{i,t}
 \end{aligned}$$

### 3.2.4 Additional Tests by Sectors and Regions

Following the testing of three hypotheses, an investigation is conducted to determine whether there are disparities in ESG news materiality on stocks across various sectors. By utilizing the regression model established in Hypotheses 1, 2, and 3, each sector is examined individually.  $Sector_i * YearT_t$  is added to identify the sector effect in each period. To identify the supplementary influence of the RRI of a specific sector during a specific period, the interaction term  $Year_t * RRI\_Mean_{i,t}$  and  $Year_t * RRI\_Growth_{i,t}$  are replaced with  $Sector_i * YearT_t * RRI\_Mean_{i,t}$  and  $Sector_i * YearT_t * RRI\_Growth_{i,t}$  respectively. In order to include Sector and Region as time-invariant variables, random effect is adopted in the model.

*Excess Stock Return*<sub>*i,t*</sub>

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} + \beta_R FIRMcontrols_{i,t}^T + \beta_S \\
 &* Sector_i + \beta_T * YearT_t + \beta_{SY} * Sector_i * YearT_t + \beta_1 * Sector_i * YearT_t \\
 &* RRI\_Mean_{i,t} + \beta_2 * Sector_i * YearT_t * RRI\_Growth_{i,t} + u_{i,t}
 \end{aligned}$$

*Excess Volatility*<sub>*i,t*</sub>

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} + \beta_R FIRMcontrols_{i,t}^T + \beta_S \\
 &* Sector_i + \beta_T * YearT_t + \beta_{SY} * Sector_i * YearT_t + \beta_1 * Sector_i * YearT_t \\
 &* RRI\_Mean_{i,t} + \beta_2 * Sector_i * YearT_t * RRI\_Growth_{i,t} + \beta_M Index_{i,t} + u_{i,t}
 \end{aligned}$$

### *Relative Turnover<sub>i,t</sub>*

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} + \beta_R FIRMcontrols_{i,t}^T + \beta_S \\
 &* Sector_i + \beta_T * YearT_t + \beta_{SY} * Sector_i * YearT_t + \beta_1 * Sector_i * YearT_t \\
 &* RRI\_Mean_{i,t} + \beta_2 * Sector_i * YearT_t * RRI\_Growth_{i,t} + \beta_M Index_{i,t} + u_{i,t}
 \end{aligned}$$

To provide more detail, the three regressions are conducted for each sector across three distinct time periods. The study examined ESG reputation materiality across three dimensions: Stock Return, Stock Volatility, and Stock Trading Turnover. The analysis encompassed three periods for each of the 11 sectors: Year 2010-2014, Year 2015-2019, and Year 2020-2021. The goal is to recognize possible discrepancies in the influence of RRI mean and RRI Growth among various sectors and to uncover any resemblances or shared trends that might occur across sectors during the same timeframe.

In addition, I investigated the regional variations in the impact of RRI using data from both the EU and the US. I utilized the same regression model but replaced the interaction terms with  $Region_i * YearT_t * RRI\_Mean_{i,t}$  and  $Region_i * YearT_t * RRI\_Growth_{i,t}$ . This approach enabled me to assess whether the evolution of ESG materiality over time is comparable between the US and Europe.

### *Excess Stock Return<sub>i,t</sub>*

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} + \beta_f FIRMcontrols_{i,t}^T + \beta_R \\
 &* Region_i + \beta_T * YearT_t + \beta_{RY} * Region_i * YearT_t + \beta_1 * Region_i * YearT_t \\
 &* RRI\_Mean_{i,t} + \beta_2 * Region_i * YearT_t * RRI\_Growth_{i,t} + u_{i,t}
 \end{aligned}$$

### *Excess Volatility<sub>i,t</sub>*

$$\begin{aligned}
 &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} + \beta_f FIRMcontrols_{i,t}^T + \beta_R \\
 &* Region_i + \beta_T * YearT_t + \beta_{RY} * Region_i * YearT_t + \beta_1 * Region_i * YearT_t \\
 &* RRI\_Mean_{i,t} + \beta_2 * Region_i * YearT_t * RRI\_Growth_{i,t} + \beta_M Index_{i,t} + u_{i,t}
 \end{aligned}$$

*Relative Turnover*<sub>*i,t*</sub>

$$\begin{aligned} &= \beta_0 + \beta_{RRI}RRI\_Mean_{i,t} + \beta_{RG}RRI\_Growth_{i,t} + \beta_f FIRMcontrols_{i,t}^T + \beta_R \\ &* Region_i + \beta_T * YearT_t + \beta_{RY} * Region_i * YearT_t + \beta_1 * Region_i * YearT_t \\ &* RRI\_Mean_{i,t} + \beta_2 * Region_i * YearT_t * RRI\_Growth_{i,t} + \beta_M Index_{i,t} + u_{i,t} \end{aligned}$$

Where *Region* refers to US and Europe, T refers to period 2010-2014, 2015-2019 and 2020-2021.

## 4 Results and Discussion

### 4.1 ESG Reputational Risk Effect on Stock Excess Return

**Hypothesis Revisit.** Hypothesis 1.1: The COVID-19 pandemic in 2020 significantly impacted the relationship between ESG reputational risks and stock excess return. Hypothesis 1.2: Over time, there has been a significant evolution in the relationship between ESG reputational risks and stock excess return before the COVID-19 pandemic in 2020.

**Results Discussion.** In hypothesis 1, I examined the impact of ESG reputational risk on stock excess return. The regression results are in Table 4.1. Column (1) presents the results of a basic regression model without any interaction terms. The results tell us that Current RRI Mean and Current RRI Growth are not significantly related to stock excess return. But the Country Sector Average Mean is significantly and negatively related, which means RRI effect is sector specific. To explore how RRI affects stock returns after covid,  $Year2020\_2021_t$ ,  $Year2020\_2021_t * RRI\_Mean_{i,t}$  and  $Year2020\_2021_t * RRI\_Growth_{i,t}$  are added to the basic model. Estimates of these new added variables in Column (2) shows that  $Year2020\_2021_t$  dummy is significantly and positively related to stock excess return, but the current RRI, i.e. the level of ESG reputational risk exposure, is not significantly related. Interestingly,  $Year2020\_2021_t * RRI\_Growth_{i,t}$  is negatively significant. The results of Column (2) demonstrate that after the covid pandemic, change of ESG reputational risk could have a negative effect on stock return. But the current state of ESG reputation does not affect stock excess return.

**Table 4.1**  
*ESG Reputational Risks on Stock Excess Return*

<b>Stock Excess Return</b>	<b>(1) Basic Model</b>	<b>(2) Post Covid</b>	<b>(3) H1.1</b>	<b>(4) H1.2</b>
Constant	0.1001*** (0.0259)	0.1376*** (0.0269)	0.1352*** (0.0298)	0.1504*** (0.0314)
Dividend (dummy)	-0.0015 (0.0063)	-0.0031 (0.0063)	-0.0032 (0.0064)	-0.0032 (0.0064)
ROA	0.1628*** (0.0409)	0.1628*** (0.0409)	0.1627*** (0.0409)	0.1627*** (0.0409)
ROE	-0.0014 (0.0062)	-0.0013 (0.0062)	-0.0013 (0.0062)	-0.0013 (0.0062)
Debt Ratio	0.0599*** (0.0150)	0.0454*** (0.0149)	0.0459*** (0.0150)	0.0459*** (0.0150)
Current Ratio	-0.0097 (0.0082)	-0.0095 (0.0082)	-0.0093 (0.0082)	-0.0093 (0.0082)
Revenue Growth	0.0011** (0.0005)	0.0006 (0.0005)	0.0006 (0.0005)	0.0006 (0.0005)
Market Cap	-0.0045*** (0.0012)	-0.0058*** (0.0012)	-0.0057*** (0.0013)	-0.0057*** (0.0013)
Current RRI Mean	-0.00004 (0.0001)	-0.00005 (0.0001)	-0.00004 (0.0001)	0.00007 (0.0002)
Country Sector Average Mean	-0.0002* (0.0001)	-0.0004*** (0.0001)	-0.0004*** (0.0001)	-0.0004*** (0.0001)
Current RRI Growth	-0.0007 (0.0007)	-0.0005 (0.0007)	0.0003 (0.0007)	-0.0062* (0.0032)
Year 2020-2021		0.0144** (0.0058)	0.0152** (0.0060)	
Current RRI Mean x Year 2020-2021		0.0001 (0.0002)	0.0001 (0.0002)	
Current RRI Growth x Year 2020-2021		-0.0057* (0.0032)	-0.0065** (0.0032)	
Year 2015-2019			0.0020 (0.0033)	-0.0133** (0.0060)
Current RRI Mean x Year 2015-2019			0.00002 (0.0001)	-0.0001 (0.0002)
Current RRI Growth x Year 2015-2019			-0.0019 (0.0014)	0.0046 (0.0034)
Year 2010-2014				-0.0152** (0.0060)
Current RRI Mean x Year 2010-2014				-0.0001 (0.0002)
Current RRI Growth x Year 2010-2014				0.0065** (0.0032)
R2	0.0021	0.0030	0.0030	0.0030
Number of obs	23103	23103	23103	23103
Number of groups	2350	2350	2350	2350

Note: This table shows the results of the regression model testing the impact of ESG reputational risk on stock excess return. Excluding RRI and dummy variables, all other variables are in logarithmic form to eliminate the effect of outliers. The dependent variables for the four regression models are excess stock returns. Column (1) shows the results of a basic regression model. Column (2) further includes Year 2020-2021 variables to test RRI effect on excess stock return after covid. Column (3) presents the result of H1.1 and column (4) H1.2. Variable definitions are provided in Appendix E. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1. Standard errors are reported in the parenthesis.

The regression results of Hypotheses 1.1 and 1.2 are displayed in Table 4.1 Column (3) and Column (4). The findings reveal that, across all models, the relationship with stock excess return is consistently significant positive relationship for return on assets (ROA) and debt ratios, and consistently significant negative for variables such as market capitalization and the country sector average of the Resource Risk Index (RRI). This suggests that smaller firms with higher ROA and leverage are more likely to have a better stock return, while the effect of RRI on stock return may vary across sectors and regions.

Furthermore, after the pandemic, there was a negative relationship between RRI growth and stock return which means firms with an increase in ESG reputational risk are more likely to have a lower stock return. This is consistent with the previous finding that the market viewed bad ESG performance as a negative factor (Freeman, 2016) that adversely affected firms, resulting in lower stock returns (Clarkson, 1995). However, during the period of 2015-2019, prior to the pandemic, ESG reputational risk did not appear to have any relationship with stock excess return. The estimates in Column (3) indicate that there was a change in ESG materiality following the pandemic, which supports Hypothesis 1.1.

Based on the results shown in Table 4,1, we could see that ESG materiality continuously evolved over time. During the time in 2010-2014, RRI growth is significantly and positively related to excess stock return, which means that stocks with growing ESG risk exposure (a worse ESG reputation) generated higher returns for investors. Previous literature also presented negative relationship between ESG performance and firm value (Bing & Li, 2019). It is possible that in response to the economic shock caused by the 2008 financial crisis, firms reduced their allocation of resources to ESG concerns in order to prioritize profit generation and survival. This rationale is consistent with the resource allocation view (Milton Friedman, 1970). The impact of ESG reputation on stock return was found to be insignificant during the years 2015-2019 but switched to the opposite in the years 2020-2021, as indicated in Column 3. These findings provide support for Hypothesis 1.2, which suggests that the materiality of ESG factors on stock return evolves over time.

In conclusion, the findings provide support for H1.1, which suggests that the significance of ESG reputational risks on stock excess returns has altered after the COVID-19 pandemic in 2020. Additionally, the evidence indicates that the impact of the RRI on stock return changed prior to the pandemic, further supporting H1.2

## 4.2 ESG Reputational Risk Effect on Stock Excess Volatility

**Hypothesis Revisit.** Hypothesis 2.1: The COVID-19 pandemic in 2020 significantly impacted the relationship between ESG reputational risks and extra stock volatility. Hypothesis 2.2: Over time, there has been a significant evolution in the relationship between ESG reputational risks and stock excess volatility before the COVID-19 pandemic in 2020.

**Result Discussion.** In hypothesis 2, I examined the impact of ESG reputational risk on stock excess volatility. The regression results are in Table 4.2 in a similar order as Table 4.1. In Column (1), a simple regression model is presented without any interaction terms. The outcomes indicate that there is no significant correlation between stock excess volatility and Current RRI and Current RRI Growth. However, the Country Sector Average Mean shows a significant negative relationship, implying that the impact of RRI is specific to the sector. In order to investigate the impact of RRI on stock volatility following the Covid-19 pandemic, the basic regression model was augmented with additional variables:  $Year2020\_2021_t$ ,  $Year2020\_2021_t * RRI\_Mean_{i,t}$  and  $Year2020\_2021_t * RRI\_Growth_{i,t}$ . The estimates for these variables in Column (2) reveal that the  $Year2020\_2021_t$  dummy variable is significantly and negatively correlated with stock excess volatility, while the current level of ESG reputational risk exposure (Current RRI) is not significantly related. Interestingly,  $Year2020\_2021_t * RRI\_Growth_{i,t}$  is found to be significantly negatively related. The effect of RRI on stock excess volatility and returns are both linked to changes in RRI rather than the overall level of RRI. The findings from Column (2) suggest that after the Covid-19 pandemic, an increase in ESG reputational risk could result in a decrease in stock volatility.

**Table 4.2***ESG Reputational Risk on Stock Excess Volatility*

<b>Stock Excess Volatility</b>	<b>(1) Basic Model</b>	<b>(2) Post Covid</b>	<b>(3) H1.1</b>	<b>(4) H1.2</b>
Constant	-19.9007*** (0.9932)	-20.4784*** (1.0057)	-19.7381*** (1.0013)	-20.0108*** (1.0175)
Dividend (dummy)	-0.2939* (0.1629)	-0.2803* (0.1608)	-0.2849* (0.1579)	-0.2849* (0.1579)
ROA	1.9335*** (0.5868)	1.8328*** (0.5757)	1.9160*** (0.5855)	1.9160*** (0.5855)
ROE	0.0234 (0.0679)	0.0117 (0.0657)	0.0137 (0.0657)	0.0137 (0.0657)
Debt Ratio	0.4090 (0.3122)	0.6472** (0.3178)	0.4567 (0.3154)	0.4567 (0.3154)
Current Ratio	-0.2682 (0.1644)	-0.3924** (0.1667)	-0.4295*** (0.1659)	-0.4295*** (0.1659)
Revenue Growth	-0.0127 (0.0150)	0.0052 (0.0152)	0.0037 (0.0151)	0.0037 (0.0151)
Market Cap	0.8336*** (0.0432)	0.8362*** (0.0437)	0.8061*** (0.0437)	0.8062*** (0.0437)
Average Index Price	-0.0030*** (0.0001)	-0.0019*** (0.0001)	-0.0022*** (0.0002)	-0.0023*** (0.0002)
Current RRI Mean	-0.0036 (0.0022)	-0.0036 (0.0023)	-0.0045 (0.0029)	-0.0042 (0.0031)
Country Sector Average Mean	-0.0071** (0.0036)	-0.0006 (0.0036)	-0.0001 (0.0035)	-0.0001 (0.0035)
Current RRI Growth	-0.0063 (0.0199)	0.0041 (0.0203)	0.0172 (0.0295)	-0.1182** (0.0595)
Year 2020-2021		-0.5429*** (0.1058)	-0.2726** (0.1345)	
Current RRI Mean x Year 2020-2021		-0.0002 (0.0027)	0.0003 (0.0036)	
Current RRI Growth x Year 2020-2021		-0.1242** (0.0628)	-0.1354** (0.0665)	
Year 2015-2019			0.2453** (0.0983)	0.5180*** (0.1065)
Current RRI Mean x Year 2015-2019			0.0021 (0.0032)	0.0018 (0.0028)
Current RRI Growth x Year 2015-2019			-0.0295 (0.0383)	0.1069* (0.0638)
Year 2010-2014				0.2726** (0.1345)
Current RRI Mean x Year 2010-2014				-0.0003 (0.0036)
Current RRI Growth x Year 2010-2014				0.1354** (0.0665)
R2	0.2658	0.2796	0.2775	0.2775
Number of obs	23094	23094	23094	23094
Number of groups	2349	2349	2349	2349

Note: This table shows the results of the regression model testing the impact of ESG reputational risk on stock excess volatility. Excluding RRI and dummy variables, all other variables are in logarithmic form to eliminate the effect of outliers. The dependent variables for the four regression models are excess stock returns. Column (1) shows the results of a basic regression model. Column (2) further includes Year 2020-2021 variables to test RRI effect on excess stock volatility after covid. Column (3) presents the result of H2.1 and column (4) H2.2. Variable definitions are provided in Appendix E. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1. Standard errors are reported in the parenthesis.

Table 4.2 presents the regression outcomes for Hypotheses 2.1 and 2.2, displayed in Column (3) and Column (4) respectively. The results consistently demonstrate a positive significant correlation between stock excess volatility, and both return on assets (ROA) and market cap across all models. In contrast, there is a significant negative correlation between stock excess volatility, index price and all year dummies across all models. These findings indicate that smaller firms with higher ROA are more likely to exhibit greater volatility in their stock prices.

In addition, there was a negative correlation between RRI growth (which implies a deteriorating ESG reputation) and stock volatility following the pandemic. However, during the period of 2015-2019, prior to the pandemic, there seemed to be no significant relationship between ESG reputational risk and stock excess volatility. These findings align with prior research suggesting that macroeconomic conditions influence stock volatility (Schwert, 1989). The estimates presented in Column (3) suggest that there was a shift in ESG materiality following the pandemic, supporting Hypothesis 2.1.

The results demonstrate that ESG materiality undergoes continuous evolution over time. This finding aligns with previous research indicating that ESG reputational risk, as firm-specific news (Donders & Vorst, 1996), influences stock volatility, suggesting that ESG-related news can impact firm volatility similarly to financial-related news. During the period of 2010-2014, there is a significant positive correlation between RRI growth and excess stock volatility, indicating that stocks with growing ESG risk exposure exhibit greater volatility during this time frame. Additionally, the impact of ESG reputation on stock volatility was found to be less significant during 2015-2019, and more notably, the relationship switched to negative during this period as well as during 2020-2021, as indicated in Column (3). This means that increasing ESG reputation risk (worse ESG reputation) stabilizes stock prices, which is consistent with the cost-benefits view (McWilliams & Siegel, 2001) that suggests firms allocating fewer resources to ESG can create more value for shareholders. These findings support Hypothesis 2.2, which states that the importance of ESG factors for stock returns changes over time.

In conclusion, the results support both hypotheses H2.1 and H2.2. The study found that ESG reputation materiality has become increasingly significant in affecting stock excess volatility after the covid pandemic. Furthermore, there is evidence showing a shift in the effect of ESG reputational risk on volatility from positive to negative over time.

### 4.3 ESG Reputational Risk Effect on Stock Relative Turnover

**Hypothesis Revisit.** Hypothesis 3.1: The COVID-19 pandemic in 2020 significantly impacted the relationship between ESG reputational risks and stock turnover. Hypothesis 3.2: Over time, there has been a significant evolution in the relationship between ESG reputational risks and stock turnover before the COVID-19 pandemic in 2020.

**Result Discussion.** Previous literature argued that volume did not necessarily relate to stock volatility (Ane & Ureche-Rangau, 2008), thus in Hypothesis 3, the effect of ESG reputational risk on stock relative turnover is tested.

Table 4.3 presents the regression results in a similar manner to Table 4.1 and Table 4.2. Column (1) displays a simple regression model without interaction terms, indicating no significant correlation between stock relative turnover and either Current RRI Mean or Current RRI Growth. To explore the impact of RRI on stock turnover after the Covid-19 pandemic, additional variables were added to the basic regression model:  $Year2020\_2021_t$ ,  $Year2020\_2021_t * RRI\_Mean_{i,t}$  and  $Year2020\_2021_t * RRI\_Growth_{i,t}$ . Column (2) presents the estimates for these variables, indicating that the  $Year2020\_2021_t$  dummy variable is significantly and positively correlated with stock relative turnover, while the current level of ESG reputational risk exposure (Current RRI) is significantly and negatively related. Different from results from H1 and H2, estimate of  $Year2020\_2021_t * RRI\_Growth_{i,t}$  is found to be insignificant. This suggests that the effect of RRI on stock relative turnover is linked to the overall level of RRI rather than the changes of RRI. Based on the findings from Column (2), it can be concluded that after the Covid-19 pandemic, a higher level of ESG reputational risk exposure is associated with lower stock turnover.

**Table 4.3***ESG Reputational Risks on Stock Relative Turnover*

<b>Stock Relative Turnover</b>	<b>(1) Basic Model</b>	<b>(2) Post Covid</b>	<b>(3) H1.1</b>	<b>(4) H1.2</b>
Constant	13.1435*** (4.8976)	13.1609*** (4.8879)	13.2901*** (4.8824)	14.2793*** (5.0903)
Dividend (dummy)	0.0488 (0.0477)	0.0321 (0.0442)	0.0193 (0.0420)	0.0193 (0.0420)
ROA	1.4131 (1.1142)	1.4232 (1.1116)	1.4787 (1.1163)	1.4787 (1.1163)
ROE	-0.2549 (0.4788)	-0.0187 (0.0493)	-0.1484 (0.0494)	-0.1484 (0.0494)
Debt Ratio	0.6177 (0.9014)	0.5925 (0.9107)	0.5353 (0.9044)	0.5353 (0.9044)
Current Ratio	-0.2498 (0.2079)	-0.2220 (0.1991)	-0.2409 (0.2000)	-0.2409 (0.2000)
Revenue Growth	0.0141 (0.0099)	0.0110 (0.0085)	0.0111 (0.0085)	0.0111 (0.0085)
Market Cap	-0.5549*** (0.2120)	-0.5521*** (0.2103)	0.5684*** (0.2126)	0.5684*** (0.2126)
Average Index Price	0.0003* (0.0002)	0.0000 (0.0001)	-0.0002* (0.0001)	-0.0002* (0.0001)
Current RRI Mean	-0.0010 (0.0020)	0.0032 (0.0031)	0.0151 (0.0092)	-0.0157* (0.0089)
Country Sector Average Mean	-0.0008 (0.0029)	-0.0035 (0.0030)	-0.0035 (0.0029)	-0.0035 (0.0029)
Current RRI Growth	0.0084 (0.0067)	0.0038 (0.0060)	0.0032 (0.0096)	0.0145 (0.0381)
Year 2020-2021		0.5502** (0.2473)	0.9891*** (0.3768)	
Current RRI Mean x Year 2020-2021		-0.0183* (0.0109)	-0.0308** (0.0159)	
Current RRI Growth x Year 2020-2021		0.0101 (0.0387)	0.0113 (0.0395)	
Year 2015-2019			0.5478** (0.2580)	-0.4413** (0.2154)
Current RRI Mean x Year 2015-2019			-0.0182* (0.0110)	0.0126 (0.0095)
Current RRI Growth x Year 2015-2019			-0.0010 (0.0128)	-0.0123 (0.0385)
Year 2010-2014				-0.9891*** (0.3768)
Current RRI Mean x Year 2010-2014				0.0308* (0.0159)
Current RRI Growth x Year 2010-2014				-0.0113 (0.0395)
R2	0.0222	0.0211	0.0200	0.0200
Number of obs	23098	23098	23098	23098
Number of groups	2349	2349	2349	2349

Note: This table shows the results of the regression model testing the impact of ESG reputational risk on stock relative turnover. Excluding RRI and dummy variables, all other variables are in logarithmic form to eliminate the effect of outliers. The dependent variables for the four regression models are excess stock returns. Column (1) shows the results of a basic regression model. Column (2) further includes Year 2020-2021 variables to test RRI effect on excess stock return after covid. Column (3) presents the result of H1.1 and column (4) H1.2. Variable definitions are provided in Appendix E. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1. Standard errors are reported in the parenthesis.

The regression outcomes for Hypotheses 3.1 and 3.2 are presented in Table 4.3, Column (3) and Column (4). In both the 2015-2019 and 2020-2021 periods, there is a negative and significant correlation between the level of ESG reputational risk exposure (Current RRI mean) and stock relative turnover, and this effect has become stronger over time. No shift in ESG materiality on stock turnover after covid, thus hypothesis 3.1 is rejected.

However, the estimates in Column (4) suggest a significant and positive relationship between current RRI and stock relative turnover, with the negative impact decreasing over time, as indicated by the insignificant coefficient for  $Year_{2015\_2019_t} * RRI\_Mean_{i,t}$ . During the period 2010-2014, ESG reputational risk (current RRI mean) is significantly and positively associated with stock relative turnover, but not during the period 2015-2019. The estimates for the year dummies show an overall increase in trading turnover, with changes from negative to positive. However, the impact of ESG materiality on stock turnover has changed over time, gradually shifting from positive to negative. Therefore, Hypothesis 3.2 is supported.

Based on the estimates of H3, it appears that investors are increasingly drawn to stocks with overall lower ESG reputational risk. Further studies showed that past trading volume predicted the magnitude and the persistence of future price momentum, and that high volume firms earn lower future returns and vice versa (Lee & Swaminathan, 1998). According to the theory, it is possible that companies with a stronger ESG reputation could generate lower returns in the future due to their high trading volume at the present moment. Ongoing research has examined the correlation between stock turnover and stock return, but the findings have been inconsistent.

Nevertheless, analyzing trading volume provides an alternative means of studying the materiality of ESG factors on stocks. Results showed that the effect of ESG reputational risk on stock relative turnover changed gradually over time but there is no structural change captured after covid. Thus, Hypotheses 3.1 is rejected and 3.2 is supported.

#### 4.4 ESG Reputational Risk Effect across Sector and Region

The purpose of this section is to investigate the influence of ESG reputational risk on stocks by analyzing its effect across different regions and sectors. Through multiple regression analyses using the methodology described in section 3.2.4, I examined the relationship between RRI and stock return, volatility, and turnover for different sectors under different time periods. The estimates for  $Sector_i * YearT_t * RRI\_Mean_{i,t}$  are presented in Table 4.4, allowing for a comparison of RRI effects on stocks across various sectors and time periods. To determine the impact of RRI changes on stocks, the same test is conducted on  $Sector_i * YearT_t * RRI\_Growth_{i,t}$ , and the results are shown in Table 4.5. The sector's influence on stocks is captured by  $Sector_i * YearT_t$ , and the estimates for this interaction term can be found in Appendix I.

Based on my analysis, the materiality of ESG news has varying effects on stocks in different sectors. The estimates in Table 4.4 demonstrate that the effect of RRI on stocks differs in the same period (also see Appendix J). For instance, an increase in reputational risk related to ESG negatively affects stock returns in the Energy and Real Estate sectors during 2010-2014. Conversely, negative correlations are found in the Utilities, Healthcare, Consumer Discretionary, and IT sectors during the same period. Similar opposite effects of RRI are observed in relation to stock volatility and turnover. These results support H1, H2, and H3, which indicate that RRI Growth has a greater impact on stocks than RRI mean. However, there is no sector aligning with all the hypotheses simultaneously. The significance of ESG news appears to be diminishing over time in certain sectors like Real Estate and Energy, while most other sectors show no significant structural changes after the Covid pandemic. The study also found that the impact of RRI was only apparent from 2010-2014 and not from 2015 onwards. Overall, the results are consistent with previous literatures which believes that market response to negative ESG news varies among different companies, depending on their unique characteristics (Wong & Zhang, 2022). However, the sector analysis only partially supports the hypotheses.

The impact of ESG on stocks varies between American and European firms in the regional analysis, and the regional estimates of RRI do not align precisely with previous findings. In terms of excess stock returns, an increase in ESG risk exposure (measured by RRI growth) has a more significant negative impact on US stocks from 2020-2021 than from 2015-2019 (see Table 4.5). However, this effect is not observed in EU stocks. Regarding excess stock volatility, EU companies that have a higher overall reputational risk (measured by RRI mean) tend to have greater volatility over time. However, an increase in RRI has a diminishing positive impact on EU stock volatility, which suggests that investors in the EU market are becoming less responsive to negative ESG news and more focused on a company's overall ESG reputation. On the other hand, US stock excess volatility is typically negatively associated with RRI mean and RRI growth. This indicates a different trend compared to the EU. In the US market, companies with poorer ESG reputations tend to have more stable stock prices. Furthermore, RRI growth has a more substantial and significant mitigating effect on US stock excess volatility in 2020-2021 than in 2015-2019. Overall, the regional analysis suggests that the materiality of ESG news changes over time in different regions, but no structural changes were observed due to COVID-19.

The analysis of sectors and regions provides additional insights into the materiality of ESG news and partially confirms the hypotheses tested in earlier analyses. The results demonstrate that the effects of RRI on stocks can be offset among various sectors or regions, resulting in insignificant outcomes in the overall dataset. While the additional tests do not uncover any significant structural shifts after the pandemic, they do offer a better understanding of how the materiality of ESG news evolves when examining industries and regions.

**Table 4.4**

*ESG News Materiality Across Sectors and Time Period: Measured by RRI Growth*

RRI Growth x Sectors x Period	Excess Stock Return			Excess Stock Volatility			Stock Relative Turnover		
	Year 2020- 2021	Year 2015- 2019	Year 2010- 2014	Year 2020- 2021	Year 2015- 2019	Year 2010- 2014	Year 2020- 2021	Year 2015- 2019	Year 2010- 2014
Utilities	-0.0052 (0.0111)	0.0007 (0.0025)	0.0046*** (0.0013)	0.2738 (0.2268)	-0.0566 (0.1003)	0.0997*** (0.0384)	0.0714* (0.0380)	-0.0184 (0.0188)	-0.0163* (0.0097)
Consumer Staples	-0.0198 (0.0135)	-0.0002 (0.0019)	0.0017 (0.0026)	-0.0068 (0.3191)	0.0057 (0.0548)	0.1567*** (0.0450)	-0.0997 (0.0860)	-0.0301* (0.0176)	-0.0049 (0.0315)
Real Estate	-0.0249 (0.0426)	-0.0171** (0.0067)	-0.0844* (0.0494)	0.5830 (0.7429)	-0.0618 (0.1234)	-2.5259*** (0.9264)	0.1003 (0.1373)	0.0138 (0.0165)	0.1298 (0.1246)
Healthcare	-0.0013 (0.0091)	-0.0046 (0.0071)	0.0027** (0.0013)	-0.0622 (0.1705)	0.0361 (0.1529)	0.0644* (0.0360)	-0.0676 (0.0542)	0.0309 (0.0408)	-0.0149 (0.0112)
Industrials	-0.0021 (0.0039)	0.0031 (0.0034)	0.0012 (0.0018)	-0.1635** (0.0767)	-0.0300 (0.1096)	-0.0938*** (0.0365)	0.0800 (0.0811)	0.0018 (0.0144)	-0.0096 (0.0124)
Energy	-0.0054 (0.0111)	-0.0105** (0.0050)	-0.0166** (0.0007)	-0.0682 (0.0721)	-0.0434 (0.0899)	-0.3625*** (0.1392)	0.0492 (0.0464)	0.0906*** (0.0261)	0.0353 (0.0566)
Communication Service	0.0033 (0.0259)	-0.0057 (0.0101)	0.0088*** (0.0027)	-1.4652 (1.5070)	-0.3355 (0.2132)	0.0328 (0.0536)	0.5640 (0.4078)	0.0835 (0.0865)	-0.0345 (0.0544)
IT	0.0044 (0.0170)	-0.0007 (0.0026)	0.0046** (0.0018)	0.1307 (0.2398)	-0.0623 (0.0532)	-0.0013 (0.0399)	0.0488 (0.2209)	0.0281 (0.0356)	-0.0013 (0.0399)
Consumer Discretionary	-0.0094 (0.0123)	0.0004 (0.0019)	0.0030* (0.0016)	-0.1456 (0.1573)	0.0545 (0.0681)	0.1175 (0.1137)	-0.1192 (0.1864)	-0.0113 (0.0162)	0.0149 (0.0393)
Materials	-0.0061 (0.0054)	-0.0002 (0.0022)	0.0015 (0.0020)	-0.1648* (0.0975)	-0.0325 (0.0526)	0.0470 (0.0527)	-0.0106 (0.0212)	-0.0214 (0.0130)	-0.0230* (0.0120)
Financials	-0.0454 (0.0333)	-0.0296*** (0.0039)	-0.0132 (0.0215)	-0.6529 (0.7578)	0.0322 (0.0598)	-0.2348 (0.4876)	-0.0491 (0.1918)	-0.0241 (0.0230)	0.3975 (0.2711)

Note: This table displays the results of regression models that examine the effect on stock excess return, excess stock volatility, and relative turnover, brought by the change of ESG reputational risk (measured by RRI Growth) across various industries during different time periods. Each estimate in the table corresponds to a specific interaction term used in a regression, such as "Utilities x Year 2020-2021x RRI." The methodology used for the analysis is explained in section 3.2.4. The table only presents estimates for the interaction term, estimates for other variables are not included in the table. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1. Standard errors are reported in the parenthesis.

**Table 4.5***ESG News Materiality in Europe and the US*

RRI Mean				RRI Growth			
Region x Period	Excess Stock Return			Region x Period	Excess Stock Return		
	Year 2020-2021	Year 2015-2019	Year 2010-2014		Year 2020-2021	Year 2015-2019	Year 2010-2014
US	0.0003 (0.0002)	0.0001 (0.0002)	0.0001 (0.0002)	US	-0.0100** (0.0041)	-0.0047** (0.0022)	-0.0007 (0.0014)
EU	-0.0002 (0.0003)	-0.0001 (0.0002)	-0.0002 (0.0002)	EU	0.0056 (0.0064)	0.0015 (0.0015)	0.0050** (0.0020)
Region x Period	Excess Stock Volatility			Region x Period	Excess Stock Volatility		
	Year 2020-2021	Year 2015-2019	Year 2010-2014		Year 2020-2021	Year 2015-2019	Year 2010-2014
US	-0.0160*** (0.0053)	-0.0149*** (0.0050)	-0.0179*** (0.0056)	US	-0.2208*** (0.0642)	-0.1289* (0.0670)	-0.0416 (0.0456)
EU	0.0453** (0.0059)	0.0134** (0.0057)	0.0118** (0.0056)	EU	0.0454 (0.1505)	0.0824* (0.0493)	0.1886*** (0.0690)
Region x Period	Stock Relative Turnover			Region x Period	Stock Relative Turnover		
	Year 2020-2021	Year 2015-2019	Year 2010-2014		Year 2020-2021	Year 2015-2019	Year 2010-2014
US	-0.0266* (0.0144)	-0.0085 (0.0073)	0.0215 (0.0153)	US	0.0003 (0.0535)	0.0048 (0.0264)	-0.0006 (0.0114)
EU	-0.0019 (0.0064)	0.0009 (0.0082)	0.0152* (0.0081)	EU	0.0283 (0.0269)	-0.0164 (0.0122)	-0.128 (0.0273)

Note: This table displays the results of regression models that examine the influence of ESG reputational risk on stock excess return, excess stock volatility, and relative turnover in the US and Europe during different time periods. Each estimate in the table corresponds to a specific interaction term used in a regression, such as "RRI Mean x US x Year 2020-2021" or "RRI Growth x US x Year 2020-2021". The methodology used for the analysis is explained in section 3.2.4. The table only presents estimates for the interaction terms of the regression model, estimates for other variables are not included in the table. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1. Standard errors are reported in the parenthesis.

## 4.5 Limitations and Future Research

This study has two main limitations. The first limitation is the potential problem of endogeneity in the regression model. It is possible that the variables used in the regression models, such as stock performance, company financial performance, and RRI movements, are partially correlated with macroeconomic performance. For instance, the same piece of ESG news could bring different impacts on a firm's ESG reputation in different macroeconomic circumstances, leading to a correlation between RRI and the error term. If RRI is endogenous and depends on GDP, the estimated coefficient for RRI may be biased due to omitted variable bias, leading to incorrect conclusions about the relationship between RRI and stock movements and potentially affecting the validity of the analysis.

Second, limitations due to loss of granularity may need to be considered. The regression models in this paper use quarterly data aggregated to match the firm's financial reporting period. However, in this study, stock volatility is calculated using daily stock prices within a quarter to capture intra-quarter fluctuations and maintain a high level of granularity. Similarly, stock relative turnover is also aggregated to capture more detailed information. Despite these efforts, measurement error may still exist in the RRI and stock/index return related variables. Using quarterly data reduces sample size and the amount of variability. Additionally, variables such as quarterly RRI/stock growth may introduce seasonality biases, and taking the mean of quarterly RRI and index prices could cause important patterns and relationships to be lost when compared to using daily or monthly data. As a result, measurement error may reduce the statistical power, making it more challenging to obtain precise estimates of the regression coefficients.

In future research, it may be worthwhile to consider adopting an event study approach to detect the impact of RRI on stock return. In addition, analyzing stock volatility on a daily basis can provide more detailed and informative insights. To mitigate the risk of omitted variable bias, additional variables such as GDP or the firm's age could be included in the regression model. Lastly, future studies may want to incorporate ESG ratings that are based on objective data when examining ESG materiality.

## 5 Conclusion

The objective of this research is to analyze the development of ESG news materiality and assess whether there has been a structural change following the COVID-19 pandemic. Previous studies have covered a broad range of ESG topics, such as the correlation between ESG performance and corporate financial performance, correlation between ESG ratings and cost of capital, and ESG factor valuation. However, the findings on the relationship between ESG and corporate financial performance have been inconsistent. Given the literature that suggests crises can impact ESG performance, coupled with the recent decrease in ESG investment inflows, it is intriguing to investigate whether the COVID-19 pandemic has shifted the original ESG materiality trend. Instead of relying on ESG ratings, which are predominantly based on subjective and selective self-disclosed reports, this research employs ESG reputational risk exposure as a proxy to explore the evolution of ESG materiality.

This thesis investigates the evolution of ESG news materiality over time, utilizing a sample of over 2700 public firms in the US and Europe from 2010 to 2022. The study examines ESG news materiality on three dimensions: stock excess return, stock excess volatility, and stock relative turnover. According to the results, alterations in ESG reputational risk exposure (RRI growth) have an effect on the stock return and volatility, and there could have been a change in this influence after the COVID-19 pandemic, as suggested by Hypotheses 1.1 and 2.1. The research also indicates that the materiality of ESG news on stocks was consistently developing even before the pandemic, as demonstrated by the outcomes of all three hypotheses.

Specifically, the effect of RRI growth on stock excess return and volatility changes from positive to negative since 2010, indicating that firms with higher ESG reputational risk may be associated with lower stock volatility and lower stock return. The impact of RRI on stock relative turnover operates through the aggregate ESG reputational risk level (RRI mean), rather than changes in ESG risk exposure (RRI growth). The study also analyzed the impact of RRI on different sectors and regions, showing that ESG news materiality changes over time and that the RRI impact is specific to the country and sector. While the overall evidence in Hypothesis 1 and 2 suggests that there may be a structural shift in ESG materiality due to the pandemic, the sector and region analysis casts doubt on this proposition.

Although there are several limitations to this research, such as the issue of endogeneity and loss of granularity, the study still makes three main contributions. First, it expands upon existing ESG-related literature by investigating changes and evolutions in ESG materiality, an area that has received limited research attention to date. Specifically, the paper examines the impact of ESG news materiality on stock return, volatility, and turnover, highlighting that such evolution is sector and country specific. The findings could relate to previous ESG papers investigating whether ESG news effect could have firm specific characters (Wong & Zhang, 2022). In addition, this research adds to pandemic related literature. Some evidence in this study is found to support the view that macroeconomics changes could alter ESG performance (Al Amosh & Khatib, 2023). Lastly, the study adds to existing behavioral finance literature in stock trading. Based on the signaling theory, the negative ESG news could alter investors anticipation of the firms' business operations thus influencing stock prices (Hussainey & Salama, 2010). The findings of this paper shed light on how ESG news could have varying effects on stock movements, particularly with regards to changes in ESG reputation and overall reputational risk exposure. This insight could provide practical implications for stock investment in real-world practice.

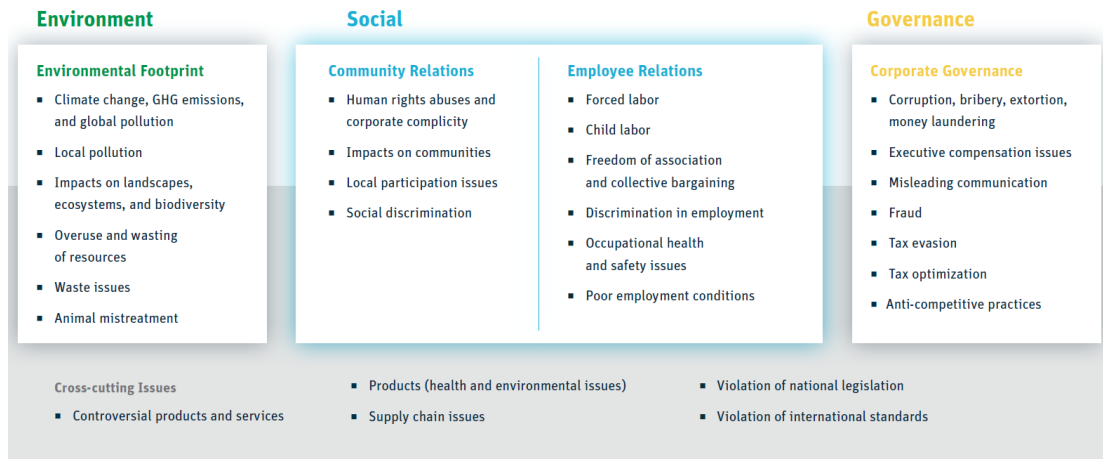
In the context of future research, integration of ESG ratings could be considered in the assessment of ESG materiality, alongside other macroeconomic variables, such as GDP or interest rates. Moreover, employing alternative analytical methods beyond regression, such as the difference in difference methodology, could offer valuable insights into validating the impact of ESG materiality. Additionally, an event study approach could be employed to capture daily or monthly movements and prevent any loss of granularity.

# 6 Appendix

## Appendix A

**Table 6.1**

*RepRisk ESG Topic Tags and Research Scope<sup>8</sup>*



Note: The 28 RepRisk ESG Issues are mapped to the UN Global Compact Principles, the SASB Materiality Map, and the Sustainable Development Goals (SDGs)

**Figure 1: RepRisk's Research Scope – 28 ESG Issues**

Abusive/Illegal fishing	Access to products and services	Agricultural commodity speculation	Airborne pollutants	Alcohol	Animal transportation
Arctic drilling	Asbestos	Automatic and semi-automatic weapons	Biological weapons	Chemical weapons	Cluster munitions
Coal-fired power plants	Conflict minerals	Coral reefs	Cyberattack	Deep sea drilling	Depleted uranium munitions
Diamonds	Drones	Economic impact	Endangered species	Energy management	Epidemics/Pandemics
Forest burning	Fracking	Fur and exotic animal skins	Gambling	Gender inequality	Genetically modified organisms (GMOs)
Genocide/Ethnic cleansing	Greenhouse gas (GHG) emissions	Health impact	High conservation value forests	Human trafficking	Hydropower (dams)
Illegal logging	Indigenous people	Involuntary resettlement	Land ecosystems	Land grabbing	Land mines
Lobbying	Marijuana/Cannabis	Marine/Coastal ecosystems	Migrant labor	Monocultures	Mountaintop removal mining
Negligence	Nuclear power	Nuclear weapons	Offshore drilling	Oil sands	Opioids
Palm oil	Plastics	Pornography	Predatory lending	Privacy violations	Protected areas
Racism/Racial inequality	Rare earths	Salaries and benefits	Sand mining and dredging	Seabed mining	Security services
Ship breaking and scrapping	Soy	Tax havens	Tobacco	Wastewater management	Water management
Water scarcity					

\*New Topic Tags added regularly based on client feedback and emerging trends

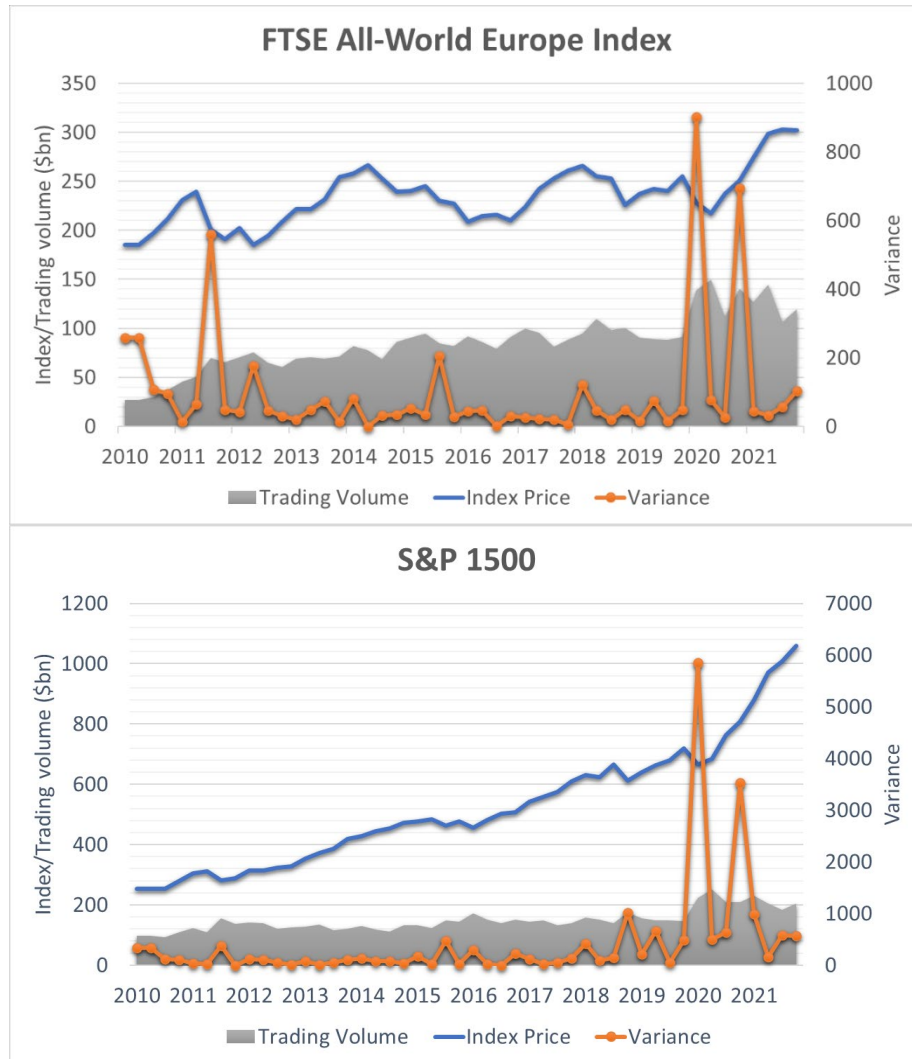
Note: RepRisk screens, on a daily basis, over 100,000 public sources and stakeholders in 23 languages. These include print media, online media, social media including Twitter and blogs, government bodies, regulators, think tanks, newsletters, and other online sources. These sources range from the international to the regional, national, and local level. RepRisk’s core research scope is comprised of 28 ESG Issues covers 73 Topic Tags in ESG “hot topics” and themes.

<sup>8</sup> Source: RepRisk methodology overview manual.

## Appendix B

**Figure 6.1**

*Movements of Stock Indices*



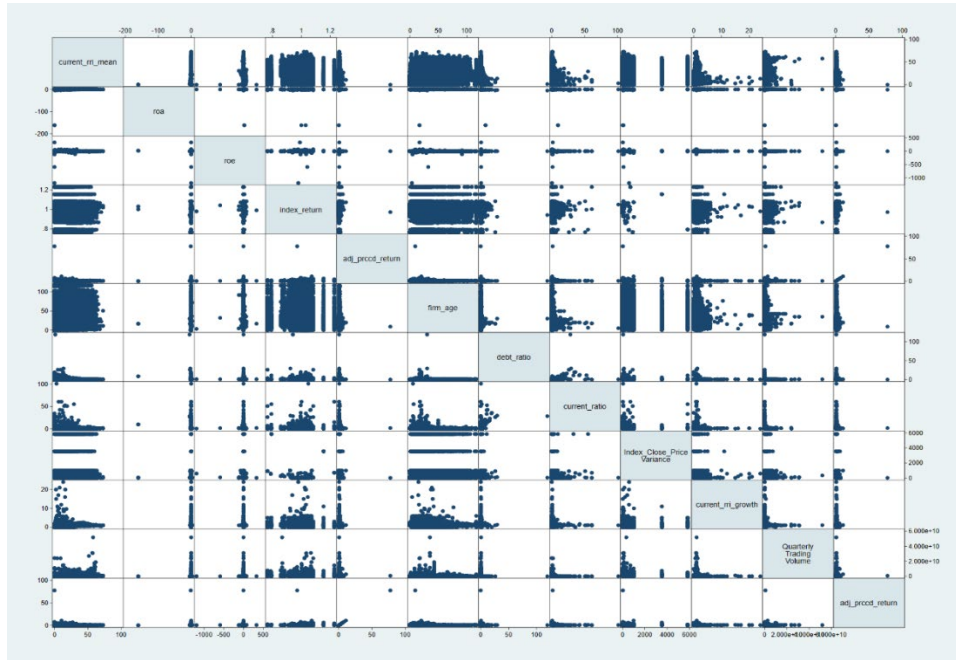
Note: FTSE all-world Europe Index and the S&P1500 serve as the benchmark for the stocks in this paper. The following two figures show the movements of the indices since 2010, including performance, volatility, and trading volume.

## Appendix C

Effect of Logarithmic transformation

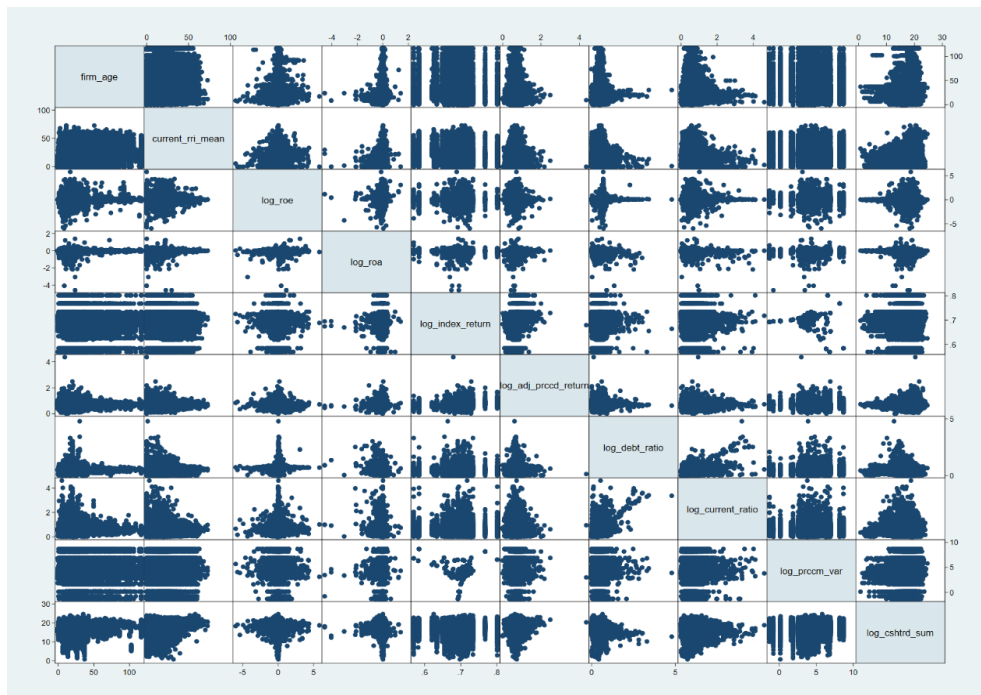
**Figure 6.2**

*Correlations Between variables (before logarithmically transformed)*



**Figure 6.3**

*Correlations Between variables (after logarithmically transformed)*



## Appendix D

**Table 6.2**

*Observation Gap for financial data*

Gap Period	EU	US	Total
1 Quarter	37	27	64
2 Quarters	25	22	47
3 Quarters	56	33	89
> 1 Year	128	136	264
Total	246	218	464

Note: The presented table indicates the count of observation gaps in the final dataset, distinguishing between EU firms and US firms. These gaps result from missing financial data in certain months, such as stock prices or financial performance data that may be unavailable due to unexpected company events. The reliability of the analysis may be impacted by the absence of such data, but the number of observation gaps is comparably minor in relation to the overall number of observations.

## Appendix E

**Table 6.3**

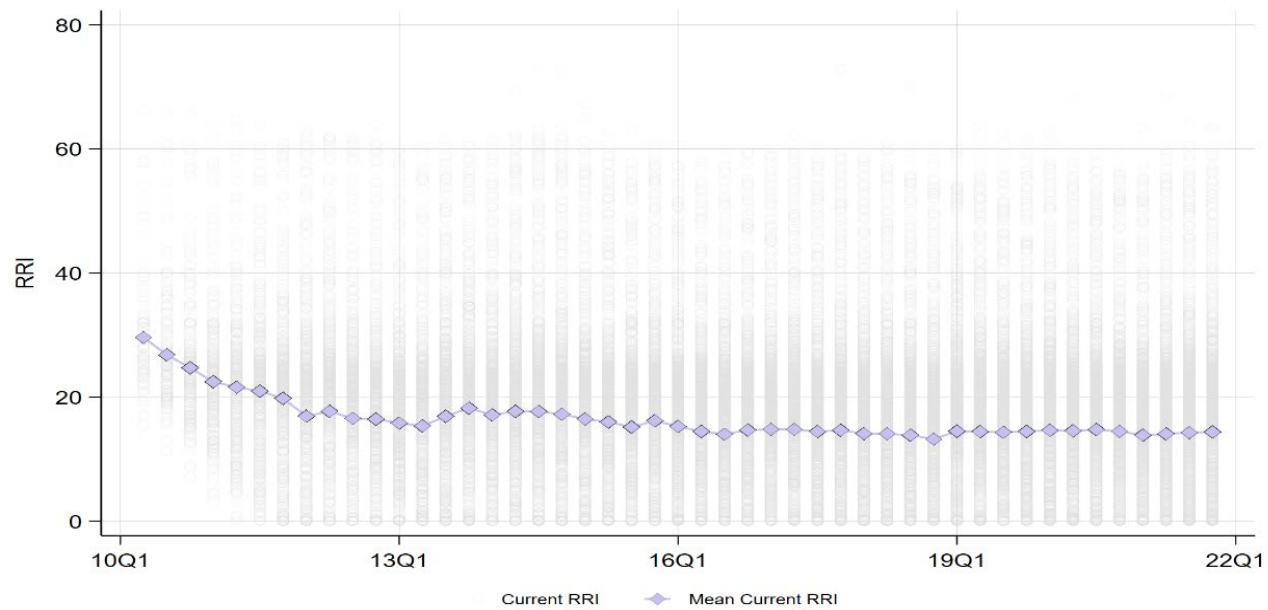
*Variable Description*

Variable	Definition	Data Source
Abnormal Return	(End of Quarter Stock Price/Begin of Quarter Stock Price)-(End of Quarter Index Price/Begin of Quarter Index Price)	Compustat
Excess Volatility	Quarterly Variance of the Stock - Quarterly Variance of the Index	Compustat
Relative Turnover	Quarterly Average of Daily Trading Volume/Quarterly Average Share Outstanding	Compustat
Current RRI Mean	Quarterly Mean of Current RRI	RepRisk
Country Sector Average RRI	Quarterly Mean of Country-Sector-Average RRI	RepRisk
Current RRI Growth	End of Quarter RRI/ Begin of Quarter RRI	RepRisk
ROA	Quarterly Return on Asset: Quarter net income/total asset	Compustat
ROE	Quarterly Return on Equity: Quarter net income/total shareholder equity	Compustat
Current Ratio	Quarter Current liabilities/ Quarter Current Assets	Compustat
Debt Ratio	Total Debt/Total Liabilities	Compustat
Quarterly Average Market Capitalization	Quarter Average Price * Quarter Average Share Outstanding	Compustat
Quarterly Revenue Growth	Current Quarter revenue/Past Quarter Revenue-1	Compustat
Dividend	Dummy variable: 1 means the firm pays dividend in that quarter, 0 means no dividend payment.	Compustat

## Appendix F

**Figure 6.4**

*Distribution of Current RRI by Year*

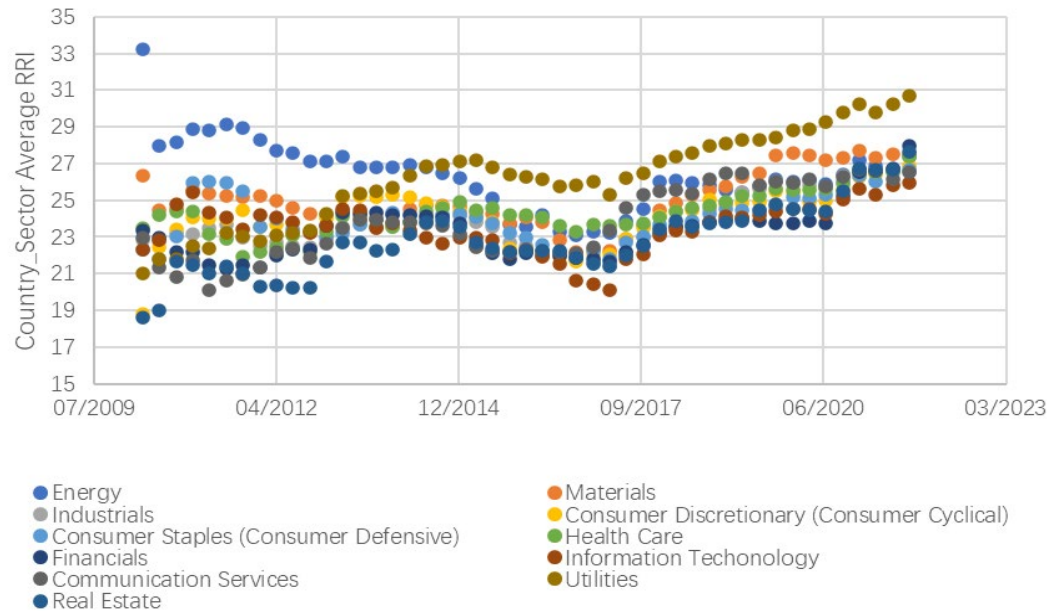


Note: The distribution of Current RRI in the sample from 2010 to 2022 is depicted in this figure. The histogram reveals a gradual decline in the average RRI over time, which has stabilized at approximately 18 in recent years. As time progresses, the number of observations increases, as evidenced by the clustering of points and the darkening of the column color.

## Appendix G

**Figure 6.5**

*Yearly Mean Country-Sector-Average-RRI Overtime<sup>9</sup>*



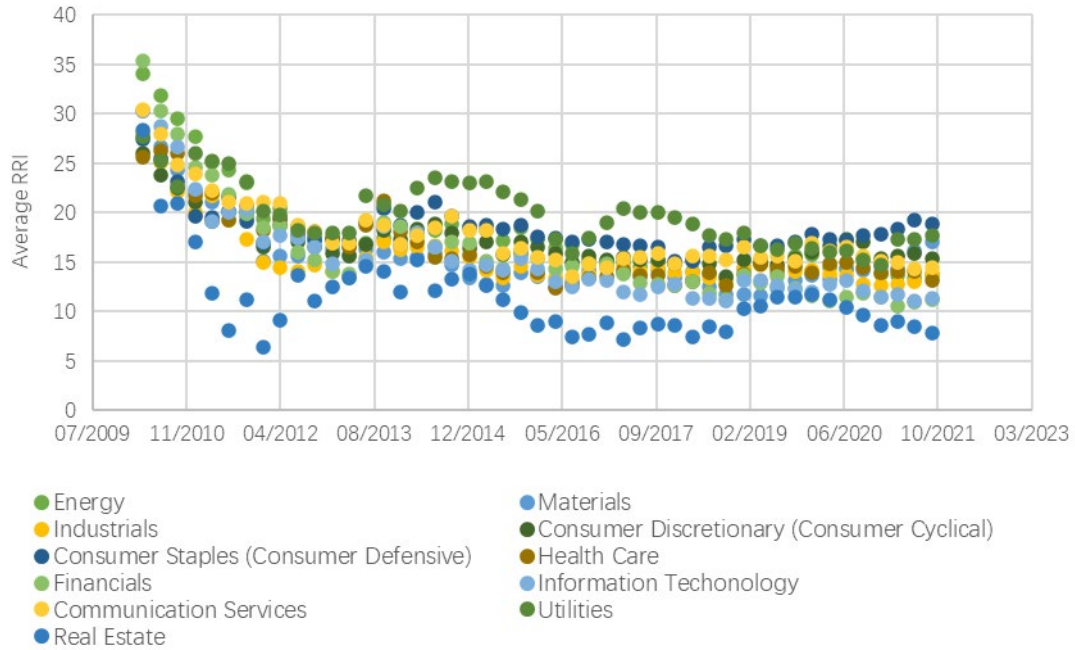
Note: In contrast to the declining average RRI mean in the sample, the annual mean of Country-Sector-Average-RRI rises over time for various sectors. This suggests that the movements in RRI are specific to the country and sector.

<sup>9</sup> The Country-Sector Average of the company is calculated by 1. The Headquarters ESG Risk Exposure value (weighted 50%): The Country-Sector value of the company's country of headquarters and primary sector. 2. The International ESG Risk Exposure value (weighted 50%): The average of all Country-Sector values of the country-sector combinations where the company has been linked to ESG risk incidents.

## Appendix H

**Figure 6.6**

*Sector RRI Performance*



Note: To further understand these trends, I investigate RRI movements of US and EU in different sectors. We can see that RRI of Consumer Staples and Utilities industries are usually the highest, while Information Technology and Real Estate are least exposed to ESG reputational risk.

## Appendix I

**Table 6.4**

*Sector Effect on Stock in Different Periods*

Sectors x Period	Excess Stock Return			Excess Stock Volatility			Stock Relative Turnover		
	Year 2020-2021	Year 2015-2019	Year 2010-2014	Year 2020-2021	Year 2015-2019	Year 2010-2014	Year 2020-2021	Year 2015-2019	Year 2010-2014
Utilities	-0.0042 (0.0151)	0.0021 (0.0078)	0.0041 (0.0086)	-0.7879** (0.3383)	0.6604*** (0.2307)	-0.2966 (0.2973)	-0.3811* (0.2290)	-0.0226 (0.1606)	0.2424 (0.2540)
Consumer Staples	0.0253 (0.0261)	-0.0294** (0.0121)	0.0273*** (0.0089)	-0.6014 (0.3773)	0.0257 (0.2082)	0.6043** (0.2602)	-0.3348 (0.2719)	0.0068 (0.1835)	0.3225 (0.2841)
Real Estate	0.0088 (0.0111)	0.0115 (0.0425)	0.0221 (0.0348)	0.4983* (0.2656)	0.1727 (0.6002)	-0.8583 (0.7664)	-0.2005 (0.2460)	-0.0386 (0.1977)	0.3815 (0.2673)
Healthcare	-0.0285* (0.0154)	0.0262*** (0.0097)	-0.0080 (0.0096)	-0.3506 (0.2849)	0.2068 (0.2245)	-0.0370 (0.2433)	-0.3332 (0.2423)	-0.0229 (0.1825)	0.3072 (0.2687)
Industrials	-0.0008 (0.0108)	-0.0050 (0.0069)	0.0013 (0.0068)	0.1558 (0.2010)	-0.0234 (0.1693)	-0.1164 (0.2117)	-0.5727** (0.2667)	-0.0231 (0.1774)	0.4246 (0.2844)
Energy	0.0009 (0.0189)	-0.0169 (0.0150)	0.0181 (0.0140)	-0.9384*** (0.3001)	-0.4342* (0.2260)	1.2611*** (0.2889)	-0.3434 (0.3052)	-0.1841 (0.1924)	0.5722* (0.3317)
Communication Service	-0.0296 (0.0307)	0.0190 (0.0129)	0.0074 (0.0139)	1.0808 (1.6967)	0.2728 (0.2747)	-0.0891 (0.5567)	0.4217 (0.5059)	-0.6451 (0.8012)	1.3276 (1.3734)
IT	-0.0101 (0.0281)	0.0084 (0.0088)	-0.0117 (0.0084)	-0.0819 (0.3639)	0.4890** (0.2031)	-0.8646*** (0.2743)	0.5497 (0.8419)	1.3545 (0.9517)	-0.8646*** (0.2743)
Consumer Discretionary	0.0156 (0.0187)	0.0099 (0.0089)	0.0046 (0.0080)	0.7298*** (0.2578)	-0.4319 (0.2646)	-0.0583 (0.3050)	1.5073 (1.1313)	-0.4042 (0.5669)	-0.7948 (0.6990)
Materials	0.0086 (0.0124)	0.0072 (0.0089)	-0.0136 (0.0104)	0.3488 (0.2377)	-0.0148 (0.1911)	-0.2851 (0.0244)	-0.4152* (0.2380)	0.0224 (0.1681)	0.3700 (0.2685)
Financials	0.1010 (0.0702)	-0.0187 (0.0327)	-0.0282 (0.0277)	0.5709 (1.3673)	-0.8350 (0.5815)	0.6162 (0.7862)	-0.5589 (0.5441)	0.1196 (0.2511)	0.2883 (0.3800)

Note: This table displays the results of the whole set of regression models that examine the sector effect on stock excess return, excess stock volatility, and relative turnover across various industries during different time periods. Each estimate in the table corresponds to a specific interaction term used in a regression, such as "Utilities x Year 2020-2021." The methodology and variables used for the analysis is explained in section 3.2.4. The table only presents estimates for one interaction term. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors are reported in the parenthesis.

## Appendix J

**Table 6.5**

*ESG News Materiality Across Sectors and Time Period: Measured by RRI Mean*

RRI Mean x Sectors x Period	Excess Stock Return			Excess Stock Volatility			Stock Relative Turnover		
	Year 2020- 2021	Year 2015- 2019	Year 2010- 2014	Year 2020- 2021	Year 2015- 2019	Year 2010- 2014	Year 2020- 2021	Year 2015- 2019	Year 2010- 2014
Utilities	-0.0002 (0.0004)	0.0002 (0.0003)	-0.0002 (0.0003)	0.0023 (0.0087)	-0.0184** (0.0083)	-0.0133 (0.0115)	-0.0071* (0.0042)	-0.0036 (0.0052)	0.0065 (0.0040)
Consumer Staples	-0.0003 (0.0006)	-0.0003 (0.0002)	-0.0004* (0.0002)	0.0110 (0.0084)	0.0077 (0.0080)	-0.0195** (0.0080)	0.0051 (0.0060)	0.0070 (0.0065)	0.0068 (0.0113)
Real Estate	0.0015 (0.0021)	0.0000 (0.0012)	0.0024** (0.0012)	-0.0456 (0.0279)	-0.0053 (0.0329)	0.0672* (0.0389)	-0.0099 (0.0094)	-0.0066 (0.0056)	-0.0041 (0.0052)
Healthcare	0.0005 (0.0004)	-0.0003 (0.0003)	0.0003 (0.0003)	0.0046 (0.0076)	-0.0038 (0.0065)	-0.0099 (0.0089)	-0.0013 (0.0047)	-0.0015 (0.0054)	0.0092** (0.0047)
Industrials	-0.0004 (0.0004)	-0.0004** (0.0002)	-0.0002 (0.0002)	0.0017 (0.0073)	0.0066 (0.0049)	0.0128 (0.0078)	0.0030 (0.0061)	-0.0014 (0.0058)	0.0068 (0.0043)
Energy	0.0001 (0.0005)	0.0005* (0.0003)	-0.0000 (0.0003)	0.0077 (0.0108)	-0.0029 (0.0089)	-0.0184* (0.0099)	-0.0004 (0.0056)	0.0044 (0.0069)	0.0108** (0.0055)
Communication Service	0.0007 (0.0005)	0.0005 (0.0003)	0.0003 (0.0004)	-0.0120 (0.0184)	-0.0144 (0.0129)	-0.0079 (0.0108)	0.0711 (0.0469)	-0.0353 (0.0252)	0.0113 (0.0204)
IT	0.0001 (0.0007)	-0.0003 (0.0003)	-0.0004 (0.0002)	-0.0191 (0.0119)	-0.0223** (0.0088)	0.0030 (0.0010)	-0.0413 (0.0315)	-0.0364 (0.0281)	0.0030 (0.0100)
Consumer Discretionary	0.0005 (0.0005)	0.0003 (0.0002)	0.0003 (0.0003)	0.0024 (0.0064)	0.0165** (0.0082)	0.0092 (0.0063)	-0.0540 (0.0379)	0.0006 (0.0118)	-0.0304 (0.0221)
Materials	0.0000 (0.0004)	-0.0001 (0.0004)	-0.0000 (0.0004)	-0.0054 (0.0086)	0.0038 (0.0080)	0.0045 (0.0091)	-0.0034 (0.0048)	0.0017 (0.0057)	0.129** (0.0054)
Financials	-0.0052* (0.0027)	0.0005 (0.0011)	0.0002 (0.0008)	-0.0091 (0.0473)	0.0261 (0.0246)	0.0076 (0.0266)	0.0264 (0.0240)	0.0047 (0.0116)	0.0062 (0.0071)

Note: This table displays the results of regression models that examine the influence of ESG reputational risk exposure level (measured by RRI mean) on stock excess return, excess stock volatility, and relative turnover across various industries during different time periods. Each estimate in the table corresponds to a specific interaction term used in a regression, such as "Utilities x Year 2020-2021x RRI." The methodology used for the analysis is explained in section 3.2.4. The table only presents estimates for the interaction term, estimates for other variables are not included in this table. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1. Standard errors are reported in the parenthesis.

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