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How Do ESG Performance and Awareness Affect Firm Value and Corporate Overinvestment?*

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Abstract

Examining the relationship between environmental, social, and governance (ESG) performance and firm value has attracted significant attention, as ESG investing has grown rapidly over the last decade. This study examines this issue by investigating how ESG awareness and performance influence firm value, as proxied by Tobin's Q. The results indicate that as global ESG awareness measured by the number of signatories of United Nations Principles for Responsible Investment (PRI) increases, firms with higher ESG performance are valued higher. Concerning firm investment, our results suggest that firms with better ESG performance have larger investment opportunities through higher Tobin's Q. Given these results, this study also investigates whether firms with higher ESG performance have a higher tendency to overinvest. The overall results find little evidence that ESG performance induces the firms' overinvestment behaviour for most of the sectors. Moreover, the results indicate that, as ESG awareness increases, the firms with higher ESG performance tend to overinvest less for some sectors.

Keywords: Environmental, Social, Governance, Controversies, Tobin's Q, Overinvestment
JEL classification: D25, G30, G32

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1 Introduction

Over the last decade, there has been an increasing interest in environmental, social, and governance (ESG) investing, which refers to a class of investing also known as "sustainable investing." Consequently, the level of ESG investment has grown significantly over the past 10 years. For example, the total assets under management in ESG investing reached more than 100 trillion US dollars in 2020, increasing nearly five times since 2010. In addition, the number of signatories of the United Nations Principles of Responsible Investment (PRI) has exceeded 3,800 signatories among institutional investors, more than quadrupling over the last decade (Figure 1). These increases are clear evidence that many asset owners are looking to increase investments that have a positive social and environmental impact to pursue long-term investment performance.

[Figure 1]

One natural question related to ESG investment is whether investing in high-ESG-characteristic firms improves overall portfolio performance. Similarly, it is considerably instructive to examine whether a higher ESG performance leads to higher firm values. As will be reviewed in the next section, many recent studies document a positive relationship between ESG performance and firm value. Nevertheless, to the best of the authors knowledge, few studies investigate how ESG awareness might influence this relationship. The first objective of this study is to provide new empirical evidence on this issue. Specifically, this study examines how ESG awareness and performance affect firm values as assessed by Tobin's Q. Furthermore, we examine which ESG pillar(s) have more effects on firm values in which sectors.

Concerning firm investment, higher firm values, as represented by high Tobin's Q, could provide firms with larger investment opportunities. Therefore, it could be inferred that firms with better ESG performance could have more investment opportunities if higher ESG scores are associated with higher firm values. Another aspect of the relationship between investments and ESG scores is that firms might need to invest intensively to obtain and maintain high ESG scores, as discussed by, among others, Duque-Grisales and Aguilera-Caracuel (2019). This implies that those firms with higher ESG scores might have some tendency to invest more than the expected investment level from the economic condition, which is defined as overinvestment in this paper, following Richardson (2006), and discussed more formally later. Thus, higher ESG scores could have two different impacts on overinvestment. On the one hand, the higher ESG scores induce less overinvestment by giving firms with higher ESG performance larger investment opportunities. On the other hand, obtaining and maintaining the higher ESG scores tend to require firms to overinvest, as firms need additional effort to enhance ESG engagements. Therefore, it would be an interesting empirical exercise to examine whether higher ESG scores have any relationship with firms' overinvestment behaviour. In addition, if there exists, it is also instructive to investigate which ESG pillar(s) can explain their overinvestment more. We also attempt to empirically find answers to these questions while at the same time examining the influence of increasing ESG awareness.

This study contributes to the current strand of literature in four ways. The first is related to ESG scores and firm values. Many previous studies have documented a positive relationship between ESG scores and firm values. This study sheds light on additional aspects of this literature by examining which ESG pillar(s) have more impact on firm values in which sectors. The second is about the relationship between ESG and firms' financial decision-making. Many studies have focused on how ESG performance affects firm valuation. Nonetheless, few studies discuss the financial decision-making characteristic of firms related to their ESG performance. This study contributes to this strand by providing a comprehensive examination of how firms' ESG performance may affect

their investment decision-making. Third, concerning the overinvestment literature, many studies, including Richardson (2006), Wei et al. (2019), and Irawan and Okimoto (2020), discuss how economic conditions and firms' internal financial factors may cause overinvestment. This study extends this literature block by identifying the relationship between ESG factors and overinvestment behaviour. Lastly, fourth, this study investigates how the global increase in popularity and awareness of ESG investing has an influence on firms. The number of PRI signatories is employed as a proxy to measure the awareness of ESG investing and this study investigate how the awareness affects the impacts of ESG performance on firm values and investment decisions. These four contributions highlight the importance of this study.

To this end, three analyses are performed in this study. The first analysis examines the relationship between ESG scores and firm values measured by Tobin's Q. The second analysis focuses on overinvestment by implementing the framework from Richardson (2006) to identify over- and underinvestment among firms in the sample. The third analysis investigates the relationship between ESG scores and overinvestment. For this analysis, the framework from Irawan and Okimoto (2020) is adopted and extended.

This study has several significant findings. The first analysis shows a positive relationship between ESG performance and awareness and firm values (Tobin's Q) for many sectors, indicating that, as ESG awareness increases, firms with higher ESG performance are valued higher. The second analysis suggests the vital role of firms' internal financial factors in influencing investment decision-making. More importantly, the results show that Tobin's Q is positively related to firms' investment, confirming that firms with higher investment opportunities tend to invest more. Finally, the third analysis demonstrates that firms' environmental and social performance tend to induce overinvestment. However, as the global awareness of ESG increases, this overinvestment tendency becomes lower. One explanation for this is that firms become more familiar with ESG performance and have accommodated ESG consideration, implying that they become more efficient in maintaining high ESG performance and decision-making.

The remainder of this paper proceeds as follows. Section 2 reviews a block of literature that is fundamental to this study. Section 3 discusses the dataset, and Section 4 details the methods implemented for the three analyses. Section 5 lists the empirical results and discusses them in the context of the current literature strand. Finally, section 6 concludes the paper.

2 Literature Review

2.1 ESG Performance and Market Value

Literature discussing the relationship between ESG performance and firm value is emerging. The majority have found a positive relationship between ESG performance and firm value. For example, Hartzmark and Sussman (2019) provide strong evidence that investors attract value sustainability. Specifically, they found that sustainability warranties a better future performance. Aligned with this, Li et al. (2018) find that ESG report disclosure positively affects firm value. Many other studies, such as Wong et al. (2020), Fatemi et al. (2018), Mervelskemper and Streit (2017), and Dimson et al. (2015), also find similar results. In addition, Auer (2016) finds that excluding firms with bad ESG performance or unrated performance does not negatively affect the overall portfolio performance. However, Duque-Grisales and Aguilera-Caracuel (2019) find that the relationship is significantly negative for firms in Latin countries.

Related to ESG sub-indices, Aouadi and Marsat (2018) find that ESG controversies score do not have a direct effect on firm value, although the interaction between controversies score and other variables appears to be highly significant and positive. Li et al. (2019) document that firms

tend to engage only in symbolic instead of substantive CSR activities and this factor, along with the low level of controversies, contribute positively to market value. Nirino et al. (2021) document a positive relationship between controversies score and market value.

Furthermore, many studies discuss the relationship between corporate social responsibility (CSR), a component of the ESG score, and firm value. Lins et al. (2017) find that firms with high CSR scores have higher stock returns, profitability, growth, and sales per employee. Ferrell et al. (2016) also find a significantly positive relationship between CSR performance and firm value. Conversely, Krüger (2015) find that positive news about firms' CSR resonates negatively (though to a weak extent) with investors due to agency problems, while negative news resonates strongly negatively.

In terms of technical specifications, Tobin's Q is an extremely popular measure of a firm's market value. Many studies discussed above employ Tobin's Q as the primary measure of firm value, such as Wong et al. (2020), Fatemi et al. (2018), Aouadi and Marsat (2018), Li et al. (2018), and Dimson et al. (2015).

2.2 Market Value and Corporate Investment

The basic logic of the Q-theory of investment argues that firms with high Tobin's Q will have a greater opportunity to invest. This logic suggests that firms with higher Q have greater access to funding in the form of either equity or debt issuance. This is because if the market regards the investment that the firm wants to make as profitable in the future, the share price of the firm will tend to increase (Tobin (1969), Tobin and Brainard (1976), Yoshikawa (1980), Hayashi (1982), Abel and Eberly (1994)). Furthermore, Chirinko (1993) outlines the poor empirical performance of the Q theory of investment. Later, many studies such as Barnett and Sakellaris (1999), Kalyvitis (2006), and Abel and Eberly (2011) improve the empirical performance of the theory. In this study, the logic suggests a strong nexus between market value and investment: firms with higher Q tend to invest more.

Empirically, many studies document the relationship between market value and corporate investment. Foucault and Fresard (2014) find that peer valuation is significantly related to a firm's investment decision. Asker et al. (2015) find that short-termism tendency puts pressure and distorts investment decisions of publicly-listed firms. Their results show that publicly listed firms are less responsive to investment opportunities and, in general, invest less.

Furthermore, Cao et al. (2019) find that financial frictions weaken the relationship between Q and investment. Lin et al. (2018) find that interest rate explains the relationship between Q and investment. Chalak and Kim (2020) study the role of Tobin's Q as a proxy of marginal q in affecting firms' investment, saving, and debt. Furthermore, Jinji et al. (2019) examine the preference of firms with high Tobin's Q toward foreign direct investment and foreign outsourcing. Wu et al. (2021) examine the role of endogenous discounting to explain the relationship between Tobin's Q and investment.

2.3 ESG Performance and Corporate Investment

A recent study by Duque-Grisales and Aguilera-Caracuel (2019) find that for certain firms, attaining high ESG performance requires a significant level of investment. The amount of investment can be substantial, which may hamper the financial performance of firms. In line with their study, Rassier and Earnhart (2010) argue that to increase the environmental standard of production of a firm and adjust with tighter regulation, a firm needs to make substantial investments. On many occasions, this investment is excessive and tends to drive the firm to over-compliance.

Furthermore, Sueyoshi and Goto (2009) find that environmental investment, be it long-term (investment) or short-term (expenditure), are not significant or positively related to firms' financial performance. This finding emphasises that increased costs of environmental investment do not benefit firms financially both in the short and long term. This case is especially true for industries that require a high upfront investment, such as electricity generation. Concerning social pillars, Reimann et al. (2012) find that pressures from local stakeholders will induce firms to invest socially to gain social legitimacy. In other words, firms need to spend more on achieving higher social performance. The above studies are substantial to make an important inference: to perform well in ESG, firms need to make higher investments. The question then is regarding whether this induces overinvestment.

Literature on overinvestment has recently emerged, especially after the global financial crisis (GFC) in 2008. In general, overinvestment is defined as a phenomenon in which firms' investment exceeds the amount they should invest, given their financial condition and economic situation. Although overinvestment could yield a higher return in the short run, it might have an adverse impact in the long run by consuming future demand ahead of time, which would be potentially damaging to the economy. Therefore, it is instructive to investigate the tendency of firms to overinvest and their possible factors.

Attempts to explain firms' overinvestment behaviours can be traced to Fazzari et al. (1988), who identify the financial constraints proxied by a dividend payout as a cause of overinvestment. Following their study, other studies, such as Bond and Meghir (1994), Chapman et al. (1996), Whited and Wu (2006), Almeida and Campello (2007), Carpenter and Guariglia (2008), and Wang et al. (2016), have examined the role of financial constraints in overinvestment by using various proxies of financial constraints.

Richardson (2006) introduces an accounting-based framework to measure the overinvestment phenomenon. He defines overinvestment as a form of investment at an amount that exceeds the normal or expected level, given the firm's characteristics and economic conditions. Specifically, the residual from the firms' estimated investment function is defined as misinvestment. A positive value of this residual represents overinvestment, while a negative value represents underinvestment. This definition is among the most popular measures because of its straightforward and easy-to-compute characteristics, requiring only balance sheet information. Studies that adopt this framework for overinvestment analysis include Zhang and Su (2015), Guariglia and Yang (2016), Wei et al. (2019), Yu et al. (2020), and Irawan and Okimoto (2020). For example, Irawan and Okimoto (2020) analyse the overinvestment phenomenon among natural resource companies across G20 countries and find that the overinvestment phenomenon is both sector- and time-specific. Further, macroeconomic uncertainties play an essential role in explaining firms' over- and underinvestment behaviour. This study contributes to the literature by examining whether ESG scores play a role in inducing firms' overinvestment.

3 Data

This study involves companies that are constituent members of the S&P Global 1200 index, which capture approximately 70% of global market capitalisation. A total of 1,045 companies are included in the analysis after excluding several companies that are dual-listed. Furthermore, following the Industrial Classification Benchmark (ICB), companies are grouped into 11 sectors.[1] The data are in annual frequency, covering the period from 2002 to 2019.

[1]The eleven sectors are as follows: (1) basic materials; (2) consumer discretionary; (3) consumer staple; (4) energy; (5) financials; (6) health care; (7) industrials; (8) real estate; (9) technology; (10) telecom; and (11) utilities.

3.1 ESG Performance

For ESG performance, this study employs the ESG score provided by Refinitiv Datastream. The scores are reported annually, with a total of more than 450 ESG metrics assessed. The earliest data are collected in 2002.[2]

There are four levels of ESG scores provided by Refinitiv Datastream. The highest level, or level 1, is the *ESG combined score* , which is the highest aggregation of all metrics assessed. Level 2 comprises two broad scores. These are the *ESG Score* and *ESG Controversies Score*. Level 3 categories are called pillars. The ESG Score comprises the three main ESG pillars: environmental (E), social (S), and governance (G). Further, in level 4, the environmental pillar comprises three categories: resource use, emissions, and innovation. The social pillar comprises four categories: workforce, human rights, community, and product responsibility. The governance pillar comprises three categories: management, shareholders, and CSR. Meanwhile, the ESG Controversies Score comprises only one pillar in level 3, the *ESG Controversy*. In level 4, this pillar comprises 10 controversial categories, which are aggregated as one pillar.

Specifically, this study conducts analyses using data at level 1 (ESG combined score) and level 3 (ESG pillars). There are two reasons for focusing on these two levels. The first is to ease the analysis because it is difficult to find a general pattern if numerous categories are involved. Second, the two levels are consistent and comparable to many other studies. Many studies have analysed ESG scores from various sources, which may involve different metrics of analysis. Nevertheless, in general, all are aggregated into the three main pillars of the ESG: the environment, social, and governance pillars. The descriptive statistics of the ESG scores are presented in Table 1.

[Table 1].

3.2 PRI Signatories

The PRI is a global movement supported by the UN to promote sustainable and responsible investment practices among investors. The focus is given on actively incorporating and promoting ESG factors in investment activities. The initiative was launched in April 2006 and since then the number of institutional signatories has grown from 100 to almost 4,000 in 2021.

This study employs the number of signatories data as a proxy of responsible awareness and interacts the number of signatories with ESG score and pillars. This approach aims to investigate whether and how a significant increase in ESG awareness gives more substantial influence to firms in the sample.

3.3 Firm-Level Financial Data

For all firm-level variables, the data are in annual frequency, mainly referring to the end-of-year financial statement for each year. All variables are transformed into natural log forms or divided by total assets. All data are retrieved from Refinitiv Datastream in the local currency where the firm is listed. There are nine variables employed from the firm financial statement: (1) total book assets, (2) market capitalisation, (3) book equity, (4) book liabilities, (5) gross income, (6) total sales, (7) capital expenditure, (8) cash dividend, and (9) cash.[3] The descriptive statistics of the variables are presented in Table 1.

[2]For detailed information about the ESG scores, see Refinitiv Datastream (2020).

[3]Respective Refinitiv Datastream code for each variable is as follows: (1) total book assets - WC02999, (2) market capitalization - WC08001, (3) book equity - WC03995, (4) book liabilities - WC03351, (5) gross income - WC01100, (6) total sales - WC01001, (7) capital expenditure - WC04601, (8) cash dividend - WC04551, and (9) cash - WC02003.

3.4 Macroeconomic Data

The firms analysed in this study come from various countries. Thus, it is crucial to acknowledge country heterogeneity in the analysis. To this end, macroeconomic data at both the world and country levels are employed.

At the global level, three variables are employed. The first is the annual world GDP growth ($WGDP$), which represents the global business cycle and isa retrieved from the World Bank. The second variable is the annual commodity price growth ($COMM$), which represents the commodity price cycle and is measured by the Goldman Sachs Commodity Index (GSCI). The GSCI is chosen because it is one of the most popular commodity price indices in the financial market. In addition, it is based on the future instead of spot prices. This characteristic is essential as a proxy for the expectation of future prices. The GSCI is available almost in real-time, and the annual average of the daily closing price is used to calculate commodity price growth. The third variable is the global economic policy uncertainty ($GEPU$) index from Davis (2016). This index is a media-based index measuring global economic policy uncertainty based on words related to uncertainty found in key mass media worldwide.[4]

At the country level, three variables are employed. The first two variables are the annual home country GDP growth ($HGDP$) and annual home country inflation rate ($INFL$), which represent the home country's business cycle and inflation, where the company domiciles. These data are retrieved from the World Bank. The third is the Worldwide Governance Index (WGI), which is an average of six categories: (1) voice and accountability; (2) political stability and the absence of violence/terrorism; (3) government effectiveness; (4) regulatory quality; (5) the rule of law; and (6) control of corruption. The WGI ranges from -2.5 to 2.5, where a higher value indicates better governance. For ease of analysis, the WGI is inverted by multiplying by -1, so that a higher value represents higher uncertainty.

4 Methodology

Based on the literature discussed in section 2, this study formulates three analyses, as described in Figure 2. The first analysis focuses on the relationship between ESG performance and awareness and firm value. The second analysis focuses on the overinvestment patterns of firms in the dataset, which are analysed using the framework of Richardson (2006). From this analysis, the overinvestment dummy will be acquired, which refers to whether each company is either over- or underinvesting at every point in time. The third analysis focuses on whether ESG performance and awareness can explain the overinvestment phenomenon of companies in the sample. This analysis extends the framework of Irawan and Okimoto (2020), which is developed to analyse how macroeconomic uncertainty might induce overinvestment in natural resource companies worldwide.

[Figure 2]

Each analysis in this study adopts and extends the methodologies from the literature. All three analyses use firm-level data, especially the first and second analyses. Such settings make analyses prone to endogeneity and reverse causality issues. To address this concern, following the strategy implemented by Richardson (2006), all independent variables for each analysis are lagged by one period.

[4]The data are updated monthly by Davis (2016) and published on the respective website of the author at https://www.policyuncertainty.com/global_monthly.html.

4.1 ESG and Firm Value

In this analysis, the relationship between ESG performance and firm value is examined. The dependent variable for this analysis is Tobin's Q, which represents the firm market value of assets divided by the book value of assets, as follows:

$$Tobin's\ Q = \frac{Market\ Equity + Book\ Liabilities}{Book\ Equity + Book\ Liabilities}. \tag{1}$$

The basic framework for analysis is adapted from many studies analysing the relationship between firm value and ESG performance, such as Aouadi and Marsat (2018), Fatemi et al. (2018), and Li et al. (2018). The estimation is conducted using panel ordinary least squares (OLS) with firm fixed effects and the Huber-White robust standard error is calculated. All independent variables are lagged for one period, including the lagged dependent variable, to mitigate an endogeneity issue. The equation estimated for this analysis employing the level 1 ESG score is as follows:

$$\begin{aligned} Q_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 COMB_{i,t-1} + \beta_3 (COMB * PRI)_{i,t-1} + \beta_4 SIZE_{i,t-1} + \beta_5 ROA_{i,t-1} \\ + \beta_6 SALES_{i,t-1} + \beta_7 LEV_{i,t-1} + \beta_8 CAPX_{i,t-1} + \beta_9 DIV_{i,t-1} + \Sigma FRID + e_{i,t}. \end{aligned} \tag{2}$$

where subscript i denotes firm, and subscript t denotes the year. The term Q is Tobin's Q, as in (1). The term $COMB$ refers to the combined ESG score. Meanwhile, for the analysis employing level 3 ESG scores, this term is replaced by the four ESG pillar terms: environmental (ENV), social (SOC), corporate governance (CGV), and controversies (CTR). For level 3 analysis, estimations are conducted separately for each pillar to avoid possible multicollinearity problem.

Furthermore, the term PRI is the number of PRI signatories divided by 1,000. For the period before 2006, the number is zero. The term is interacted with ESG score (combined and pillars) to take the growth of ESG awareness and popularity into account since 2006.

Other variables are control variables that have been commonly employed in previous studies. Term $SIZE$ refers to log-transformed total assets, while the term ROA refers to the return on assets, calculated as gross income divided by total assets. $SALES$ represents total sales divided by the total assets. LEV represents the ratio of total liabilities to total assets. $CAPX$ represents total capital expenditure divided by total assets. DIV represents the total cash dividend payout divided by total assets. $\Sigma FRID$ represents firm fixed effects. Finally, the term e represents the residuals.

4.2 Overinvestment

The analysis in this stage aims to examine the overinvestment patterns of firms in the sample during the sample period. Simultaneously, this analysis also focuses on how market value influences firms' investment decisions.

The framework from Richardson (2006) is adopted for this purpose. This framework is extremely popular for measuring overinvestment, mainly because of its intuitive definition and ease of implementation, which requires only financial statement information. This framework has been implemented in many studies, such as Zhang and Su (2015), Guariglia and Yang (2016), Wei et al. (2019), Yu et al. (2020), and Irawan and Okimoto (2020). Capital expenditure divided by total assets ($CAPX$) is employed as a proxy for new firm investment. This proxy adopts the practice from Richardson (2006), which proxies investment as the total new capital in the firm. Another alternative would be to use stock or total investments in the company. However, the analysis in this paper focuses on how companies decide on new investments, and therefore, the flow of investment is a better representative.

This proxy of investment is used to predict the investment functions of firms in the sample. The equation is estimated as panel OLS with firm and time fixed effects and the Huber-White robust standard error is calculated. Specifically, the investment function regression of firms is as follows:

$$\begin{aligned} CAPX_{i,t} = \beta_0 + \beta_1 CAPX_{i,t-1} + \beta_2 Q_{i,t-1} + \beta_3 LEV_{i,t-1} + \beta_4 CASH_{i,t-1} \\ + \beta_5 SIZE_{i,t-1} + \beta_6 RTRN_{i,t-1} + \Sigma FRID + \mu_{i,t}. \end{aligned} \tag{3}$$

where $CASH$ represents total cash divided by total assets, and $RTRN$ is the annual growth in the market capitalisation of the firm. Designs of the estimation adopt the framework from Richardson (2006), including the choice of independent variables. All independent variables are lagged by one year to avoid the endogeneity problem, as in Richardson (2006).

The last term, μ, technically the residual, is the proxy of over- and underinvestment. A positive value of μ represents overinvestment, and a higher value indicates a higher degree of overinvestment. Conversely, a negative value of μ represents underinvestment, and a more negative value indicates a higher degree of underinvestment.

4.3 ESG and Overinvestment

The third analysis focuses on examining whether ESG performance can explain over- and underinvestment behaviour observed in the second analysis. To this end, this study employs the framework of Irawan and Okimoto (2020), who examine the impact of macroeconomic uncertainty on resource firm overinvestment behaviour. In this framework, the proxy of overinvestment, μ, based on Equation (3), is transformed into a dummy variable, $OVIT$, as follows:

$$OVIT_{i,t} = \begin{cases} 1 & if \quad \mu_{i,t} > 0 \\ 0 & if \quad \mu_{i,t} < 0 \end{cases} \tag{4}$$

In other words, overinvestment is proxied by value 1, while underinvestment is proxied by value 0. Furthermore, the value of $OVIT$ is employed as the dependent variable for the estimation. The estimation is conducted using a panel probit with firm fixed effects and the clustered standard error with firm as the cluster is calculated. The equation estimated for this analysis when employing level 1 ESG score is as follows:

$$\begin{aligned} Prob(OVIT_{i,t} = 1) = \Phi\Big(\beta_0 + \beta_1 COMB_{i,t-1} + \beta_2 (COMB * PRI)_{i,t-1} + \beta_3 OVIT_{i,t-1} \\ + \beta_4 COMM_{i,t-1} + \beta_5 WGDP_{i,t-1} + \beta_6 HGDP_{i,t-1} \\ + \beta_7 GEPU_{i,t-1} + \beta_8 WGI_{i,t-1} + \beta_9 INFL_{i,t-1} + \Sigma FRID\Big), \end{aligned} \tag{5}$$

where $OVIT$ denotes the overinvestment dummy. For analyses employing level 3 ESG scores, estimations are conducted separately for each of the four pillars by replacing the term $COMB_{i,t-1}$ is replaced with ESG pillar terms: environmental (ENV), social (SOC), corporate governance pillar (CGV), and controversies pillar (CTR). Other variables are the macroeconomic variables described in the previous sections, which serve as controls. The number of PRI signatories is employed again in this estimation and interacted with ESG scores (combined and pillars).

5 Empirical Results

This section presents the empirical results of the three analyses conducted in this study. The first analysis examines the relationship between ESG performance and firm value, as assessed

by Tobin's Q. The second analysis discusses the overinvestment patterns of firms in the sample. Finally, the third analysis further examines the results of the second by investigating the connection between ESG performance and the over- and underinvestment of firms in the sample. For each analysis, results are presented based on the ESG scores (combined score and pillars) and sectors. Furthermore, the first and third analyses investigate the effects of the increasing popularity and awareness of ESG factors globally as proxied by the number of PRI signatories.

5.1 ESG and Firm Value

Many studies exhibit a positive relationship between ESG performance and firm value, such as Hartzmark and Sussman (2019), Li et al. (2018), Wong et al. (2020), Mervelskemper and Streit (2017), Dimson et al. (2015), Aouadi and Marsat (2018), and Fatemi et al. (2018). This analysis aims to replicate those studies for firms in the dataset and provide additional insights by considering the ESG pillars and awareness. ESG awareness is proxied by the number of PRI signatories. The framework from Aouadi and Marsat (2018) is adopted, as expressed by Equation (2). The dependent variable for this analysis is Tobin's Q, calculated using Equation (1). One significant contribution of this analysis to the literature is that it takes ESG awareness (PRI signatories) into consideration to assess the impacts of ESG scores on firm values.

Tables 2-3 present the results of the estimation using combined ESG score ($COMB$) with and without the interaction term between the ESG score and the PRI signatories. Each table presents the results for the full sample and 11 sectors. Table 2 shows that $COMB$ has significant positive impacts for the full sample, as well as the basic materials, financials, health care, technology, and utilities sectors. This is a straightforward result that confirms the findings of previous studies, which outline the positive connection between ESG performance and firm value, although those sectors with a positive relationship seem to be limited. Table 3 reports the estimation results with interaction between the ESG score and the PRI signatories; the results here are more compelling. The $COMB$ variable is significant, but has negative signs for the full sample, as well as consumer discretionary, industrials, and real estate sectors in this estimation. However, the interaction term $COMB * PRI$ is significant and positive for more sectors, specifically for the full sample, as well as the consumer discretionary, consumer staple, health care, industrials, real estate, technology, and utilities sectors. The results demonstrate that, as ESG awareness increases over time, the influence of ESG performance upon firms' value becomes more substantial.

[Table 2

[Table 3]

Of the other variables that serve as controls, some are found to be statistically significant (Table 2–3). In general, $SIZE$ is found to be significant and negative for many sectors. These results indicate that large firms generally have a lower Q. ROA and $SALES$ are generally not significant, while LEV is significant and positive for the industrial and technology sectors. Meanwhile, $CAPX$ is significant and negative only for the industrials and real estate sectors. Finally, DIV is significant and positive for the full sample, and for the basic materials, consumer staple and energy sectors. These results are very logical and show that firms with bigger dividends have higher valuations.

[Table 4]

In addition, Table 4 summarises of the estimation results for each pillar. The design for these estimations follows Equation (2) and Table 3; however, the results for control variables are suppressed.

The results are mostly consistent with those from combined score estimation. In particular, the interaction of each pillar with PRI signatories are significant and positive for the full sample, and for the same sectors, namely consumer discretionary, consumer staple, health care, industrials, real estate, technology, and utilities. For the governance and controversy pillow, the interaction term also has a significantly positive impact on firm values in the basic materials sector. The results further demonstrate that the increase in ESG awareness makes the ESG pillars' performance more crucial for firms' valuation.

To graphically see the results of the increasing impact of ESG performance on firm values as ESG awareness develops, Figure3 plots the dynamics of the total effects of ESG scores on firm values, which are expressed by $\beta_2 + \beta_3 \cdot PRI_{t-1}$. As can be seen, the impact of ESG scores remained very low until 2010, but started to grow steadily with the ESG awareness since then, with a faster increase over the last five years. Consequently, the total effects of each score in 2020 ranges from 0.0033 (GOV) to 0.0042 ($COMB$). Given that each ESG score takes a value between 0 and 100, this implies that ESG scores could raise Tobin's Q by a maximum of 0.33 to 0.42 in 2020, demonstrating the sizeable impact of ESG scores on firm values.

[Figure 3]

There is a strong pattern that can be inferred from this analysis. A considerable number of proofs have shown that the interaction between ESG performance and PRI signatories has a positive impact on firm values. The results not only confirm the positive relationship between ESG performance and firm value found in many studies, including Hartzmark and Sussman (2019), Li et al. (2018), Wong et al. (2020), Mervelskemper and Streit (2017), Dimson et al. (2015), Aouadi and Marsat (2018), and Fatemi et al. (2018), but also provide new important insights, such as that increasing ESG awareness will enhance a positive impact of ESG performance on a firm's valuation. These results are also found consistent for the combined score and for each pillar; however, some sectors, including energy, financials, and telecommunications, seem to have different results than the general pattern. It could be argued that, for these sectors, the divergence in results is sector specific. For instance, for the energy sector, the influence of ESG score and awareness is generally not significant. Even for certain estimations for which they are significant, the signs are negative. One logical explanation for this is that, for the energy sector, achieving a high ESG performance requires firms extra investments, and therefore to lower profitability and valuation. A study by Duque-Grisales and Aguilera-Caracuel (2019) observe such a phenomenon among Latin American companies.

5.2 Overinvestment Pattern

This analysis examines the overinvestment patterns of companies in the sample. The basic framework employed for this analysis is adopted from Richardson (2006) and based on residuals from firm investment functions (3). Technically, the investment functions for all firms are estimated together as a one-panel regression using OLS with firm fixed effects. The dependent variable for this analysis is $CAPX$, which is calculated as capital expenditure divided by total assets.

Table 5 presents estimation results of investment function (3). In general, all estimations have relatively high R^2, suggesting the high ability of the models to explain variation in the investment rate of companies in the sample. Lagged $CAPX$ is found significant with positive signs for all sectors. The positive sign implies that firms with a high investment rate in the previous year have a higher investment rate in the current year. Q is significant for many sectors, with positive signs. The results indicate that firms with higher valuations have more opportunities to invest and

therefore have a higher investment rate. LEV is found significant for the full sample, consumer discretionary, energy, health care, technology, and utilities sectors, all with negative signs. The negative sign indicates that firms with high leverage tend to have a lower investment rate. The results are considerably logical because the high leverage makes it difficult to increase debt further, which is one of the main sources of investment. The variable $CASH$ is insignificant for most of the sectors. Meanwhile, $SIZE$ is generally significant with negative sign, meaning that bigger firms have relatively smaller capital expenditure to asset ratio compared to smaller firms. Meanwhile, $RTRN$ is significant with a positive sign for a half of sectors, indicating that firms with higher value growth invest more.

Misinvestment is defined based on the error term μ, of the investment function (3), or, more precisely, if μ is positive, the firm is classified as overinvesting and if μ is negative, the firm is considered as underinvesting. To see the pattern of misinvestment, we summarise μ by sector and country.

Figure 4 presents μ grouped by sector. The figure shows the variety of misinvestment behaviour in each sector during the sample period. As can be seen, the energy, telecommunications and utilities sectors tend to overinvest during this period. Meanwhile, the financials, health care, industrial, and technology sectors are underinvested.

[Figure 4]

Figure 5 presents μ grouped by country of domicile. As can be observed, some countries tend to overinvest during the period, while others tend to underinvest. Countries that are observed as overinvesting are Austria, Chile, China, Colombia, Japan, South Korea, Mexico, Norway, Papua New Guinea, and Portugal. Conversely, Belgium, Bermuda, Finland, France, Germany, Hong Kong, Ireland, Isle of Man, Luxembourg, Netherlands, New Zealand, Sweden, Switzerland, United Kingdom and United States are seen to be underinvesting during the period.

[Figure 5]

As the framework for the analysis uses residuals, and estimation is conducted in a panel setting, these results represent a comparison of the investment rate between sectors and countries in the observation. The variation between sectors and countries could be caused by several factors, including (1) the firm's fundamental characteristics, (2) economic conditions, and (3) macroeconomic uncertainties. Therefore, the third analysis, presented in the next section, examines the role of several variables from these factors in the overinvesting behaviour of the firm.

5.3 ESG and Overinvestment

The analysis in this section aims to examine whether higher ESG scores induce firms' overinvestment behaviour and, if so, which ESG pillar(s) can explain their overinvestment more. In general, higher ESG scores can have two different impacts on overinvestment: on the one hand, they can reduce overinvestment by giving firms greater investment opportunities; on the other hand, firms may need to overinvest to obtain and maintain higher ESG scores, thereby requiring extra effort to enhance ESG engagements. Therefore, it would be instructive to empirically find answers to the above questions.

To this end, the misinvestment residual (μ) from the previous analysis is transformed into a dummy variable ($OVIT$) based on Equation (4) and then employed as a dependent variable for the analysis as expressed by Equation (5). The basic framework for this analysis is developed

from Irawan and Okimoto (2020), who study how macroeconomic uncertainties may induce overinvestment among natural resource firms worldwide. The framework is extended by adding ESG variables, including both the combined score ($COMB$) and the pillars (ENV, SOC, CGV, and CTR). The samples are estimated together as one panel using probit estimation with firm fixed effects. All regressors are lagged by one year to mitigate the endogeneity issue; Additionally, the increase of ESG awareness is taken into account by employing the interaction of the ESG scores and the number of PRI signatories.

Table 6 shows the estimation results with $COMB$. In general, the McFadden R^2 shows that the estimated models have considerable power to predict $OVIT$; however, there are only two strongly significant variables, the lagged $OVIT$ and $WGDP$. This finding indicates that current overinvestment behaviour is mainly due to firms' overinvestment in the previous period and the global business cycle. The variable of interest in this analysis, $COMB$, is not significant for almost all panels, except for the full sample and for the health care (+) and technology (+) sectors; this means that $COMB$ induces overinvestment behaviour only in these cases. Interaction between $COMB$ and PRI is significant for full the full sample (-), and for the financials (-), technology (-), and telecommunications (+) sectors. These results imply that there is little relationship between ESG performance and overinvestment for most of the sectors and, if anything, increasing ESG awareness and performance tend to decrease overinvestment.

[Table 6]

Other variables in the model, which are mostly macroeconomic variables at both the global and country levels, have mixed results (Table 6). $COMM$ is generally not significant for all sectors, while $WGDP$ is positively significant for the full sample, consumer discretionary, energy, financials, health care, industrials, and technology sectors. These results indicate the procyclicality of overinvesting behaviours toward the global business cycle. $HGDP$ is negatively significant only for the industrials sector, implying that the home country business cycle has little impact on overinvestment. $GEPU$, which represents global economic uncertainty, is significant for the consumer discretionary (+), energy (+), financials (+), and telecommunications (−) sectors; thus, it can be inferred that global economic uncertainty tends to have a mixed influence upon these sectors. The country-level governance uncertainty proxy, WGI, is positively significant for the full sample, and for the energy and telecommunications sectors. The home country inflation rate, $INFL$, is significant for the basic materials (+), energy (+), and real estate (+) sectors. Overall, our results indicate that no macroeconomic variables systematically affect the overinvestment behaviour of the firms across sectors, with the exception of the global business cycle, which induces overinvestment for several sectors.

[Table 7]

Table 7 presents the estimation results with the environmental score and its interaction with PRI as regressors in the model. The environmental score is significant and positive for the full sample, and for the consumer staple, financials, health care and industrials sectors, indicating that higher environmental performance induces overinvesting behaviour in these cases. Meanwhile, interaction between ENV and PRI is negatively significant for the full sample, and for the basic materials, energy, and financials sectors, indicating that as ESG awareness increases, firms with high environmental scores tend to overinvest less. Furthermore, Table 8 presents the estimation results with the social score and its interaction with PRI as regressors in the model. The social score is found to be positively significant for the full sample, and for the consumer discretionary and health care sectors; meanwhile, its interaction with PRI is negatively significant for the full

sample, and for the energy, financials, and healthcare sectors. These results are generally consistent with those of the combined scores, that is, there is little relationship between the ESG performance and overinvestment for most sectors and, if anything, increasing ESG awareness and performance tend to decrease overinvestment.

[Table 8]

On the contrary, for the corporate governance score (Table 9), CGV and its interaction with PRI are generally not significant. For the controversies score, CTR is significant for the industrials (-) and technology (+) sectors (Table 10). Meanwhile, its interaction with PRI is significant for the same sectors, but with inverted signs. These results indicate that CTR has little impact on firms' overinvestment behaviour, even if ESG awareness is taken into account.

[Table 9]

For the macroeconomic variables in Tables 7-10, which serve as controls, some patterns can be inferred. In general, $WGDP$ is significant and positive, confirming the procyclicality of overinvestment behaviours. $GEPU$ is significant with mixed signs. Finally, WGI is considerably significant with mixed signs. Other macro variables ($COMM$, $HGDP$, and $INFL$) are generally not statistically significant.

[Table 10]

From the analysis presented in this section, several patterns can be inferred regarding the relationship of ESG performance and its interaction with PRI to the overinvestment behaviour of firms in the sample. First, there is little evidence that the ESG performance induces firms' overinvestment behaviour in most sectors. Although some studies, such as Duque-Grisales and Aguilera-Caracuel (2019), have argued that firms must invest more to achieve high ESG performance, our results indicate that there is no clear relationship between ESG scores and overinvestment. Second, the interactions between ESG scores and PRI signatories are generally insignificant or negative, indicating that, as ESG awareness increases, the overinvestment behaviour tends to become lower. One explanation for this is that higher ESG scores induce less overinvestment by giving firms larger investment opportunities. Addition, it might be the case that firms become more familiar with ESG performance and have accommodated ESG consideration, implying that they become more efficient in maintaining high ESG performance and decision-making.

6 Conclusion

In this study, we examine the relationship between firms' ESG performance and awareness of overinvestment behaviour. The sample of analysis is a constituent member of the S&P 1200 Index, which comprises companies with the largest capitalisation from around the world, capturing about 70% of the total global market capitalisation. The dataset covers the 2002–2019 period in annual frequency.

The first analysis found a positive relationship between ESG performance and awareness and firm value (Tobin's Q). The results support many previous studies documenting a similar positive relationship, but this study provides additional insight by accommodating the number of PRI signatories as a proxy of ESG global awareness. Analysis at the pillar level also showed a similar pattern. All interactions of the four pillars with PRI signatories are generally significant and

positive, suggesting that the high ESG performance tends to raise firm values, as the ESG awareness increases. However, the results also indicate that the relationships are sector specific.

The second analysis showed that internal firm factors play a significant role in determining firms' investment decisions. One important finding from this analysis confirmed that firms with higher Q tend to invest more, as shown by the significant estimation results with positive signs. Furthermore, some sectors were identified as overinvested in the sample period. They are energy, telecommunications, and utilities. Other sectors identified as underinvested during the sample period are the financials, health care, industrial, and technology sectors. In addition, based on the country of domicile, the estimation also showed that firms from Austria, Chile, China, Colombia, Japan, South Korea, Mexico, Norway, Papua New Guinea, and Portugal have overinvested. Meanwhile, Belgium, Bermuda, Finland, France, Germany, Hong Kong, Ireland, Isle of Man, Luxembourg, Netherlands, New Zealand, Sweden, Switzerland, United Kingdom and United States were identified as underinvesting.

The third analysis showed little evidence that the ESG performance induces the firms' overinvestment behaviour for most of the sectors. Although some studies, such as Duque-Grisales and Aguilera-Caracuel (2019), have argued that firms must invest more to achieve high ESG performance, our results indicated that there is no clear relationship between ESG scores and overinvestment. Moreover, the results indicated that as ESG awareness increases, the firms with higher ESG performance tend to overinvest less for some sectors. As the previous two analyses suggested, higher ESG scores can reduce overinvestment by giving firms larger investment opportunities. Our results demonstrate that this conjecture appears to be true for some sectors.

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7 Figures

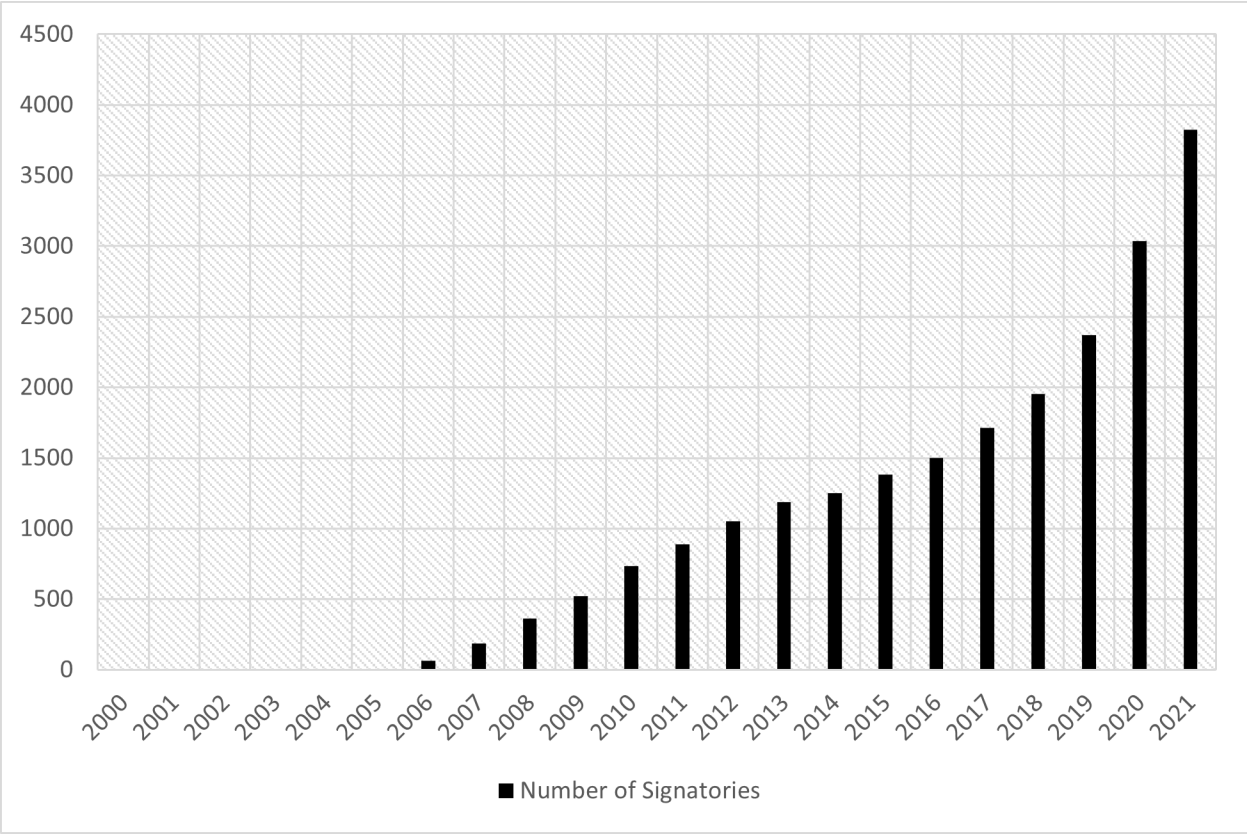

Figure 1: Number of PRI signatories

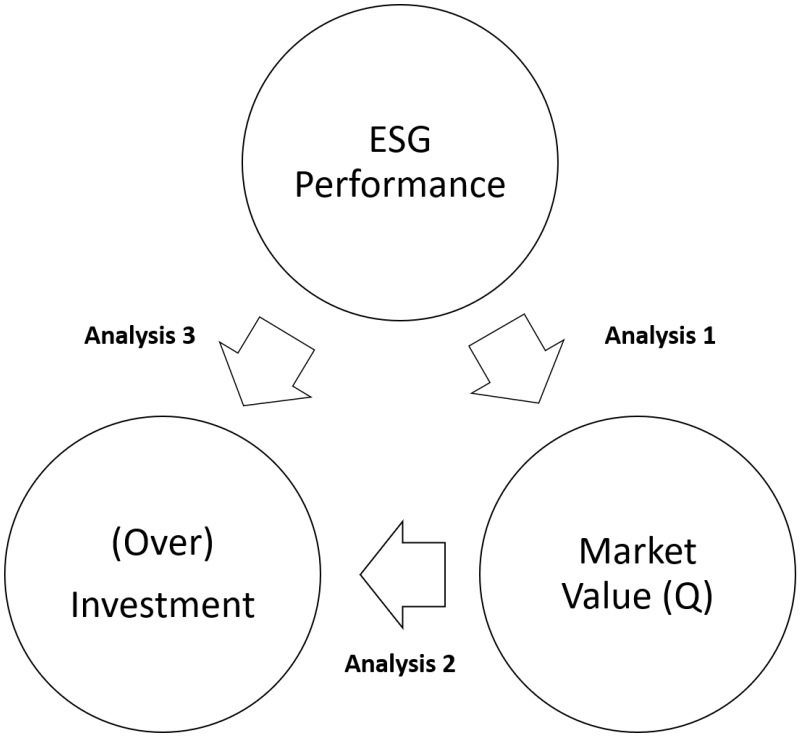

Figure 2: Framework of the Study

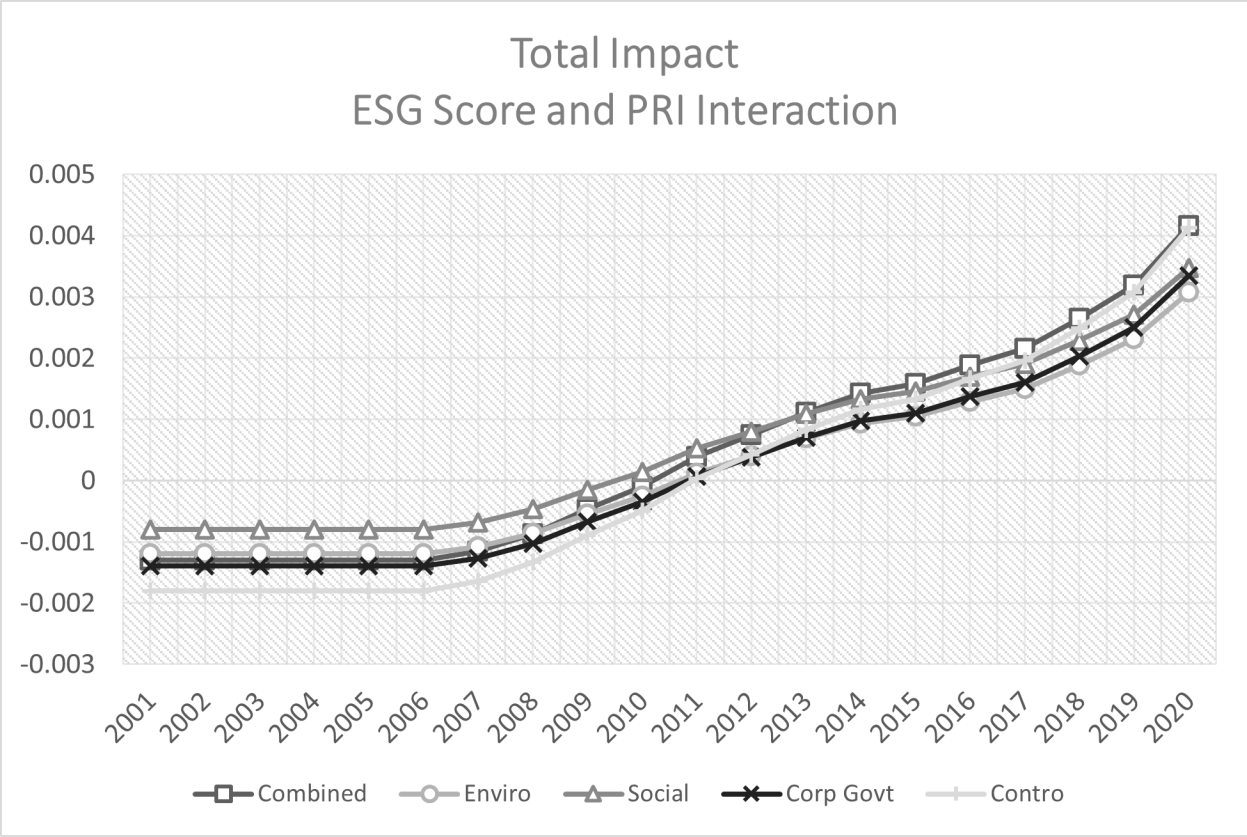

Figure 3: Total Value Impact of ESG Score and PRI Signatories

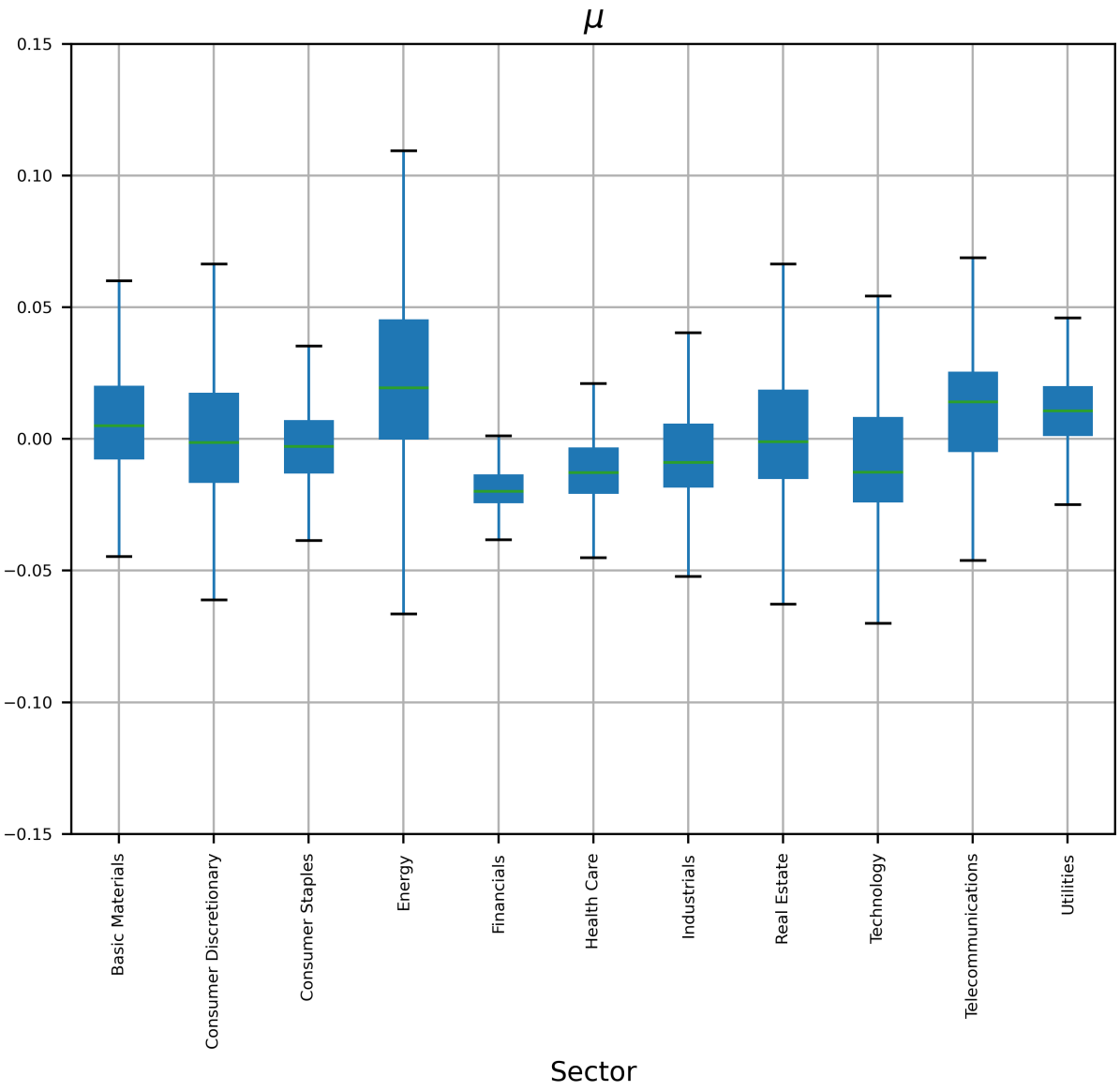

Figure 4: Misinvestment by Sector

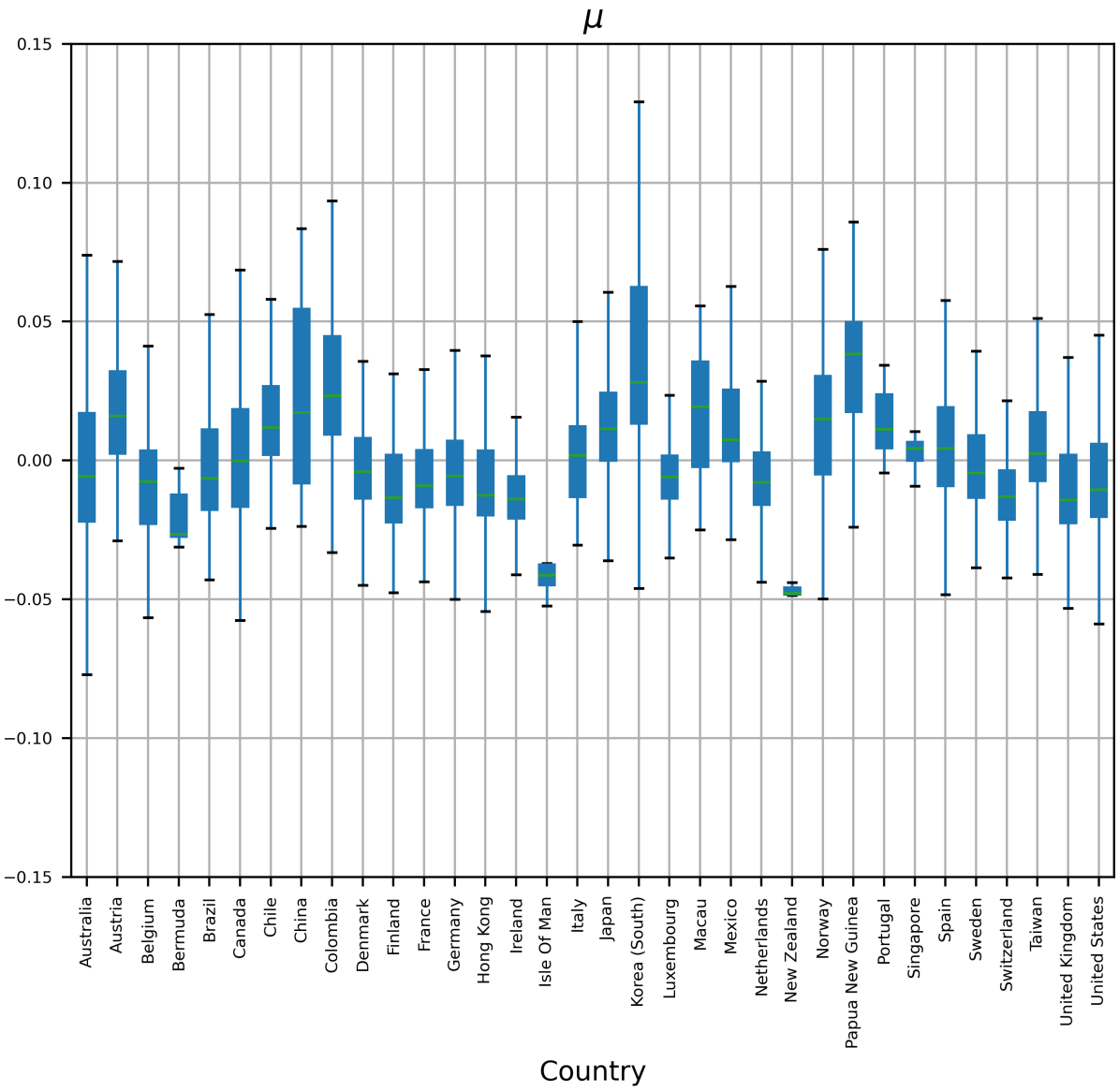

Figure 5: Misinvestment by Country

8 Tables

Table 1: Descriptive Statistics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
$COMB$	ESG Combined Score	13,728	3.88	0.34	1.99	4.56
ENV	Environmental Pillar Score	13,722	4.09	0.41	1.56	4.60
CGV	Corporate Govt Pillar Score	13,722	4.08	0.40	1.32	4.60
SOC	Social Pillar Score	13,728	3.99	0.44	1.23	4.60
CTR	Controversies Pillar Score	13,722	3.32	1.20	-2.21	4.42
Q	Tobin's Q	16,073	1.99	3.31	0.40	284.36
$SIZE$	Log of Total Assets	16,076	17.43	2.42	7.96	26.58
ROA	Gross Income / Total Assets	14,864	0.27	0.20	-1.32	1.57
$SALES$	Sales / Total Assets	16,076	0.77	0.62	-0.10	10.99
LEV	Liabilities / Total Assets	16,070	0.25	0.18	0.00	3.39
$CAPX$	Capex / Total Assets	16,076	0.05	0.04	0.00	0.52
DIV	Dividen / Total Assets	16,074	0.40	0.23	-6.17	1.11
$CASH$	Cash / Total Assets	15,804	0.08	0.09	0.00	0.89
$RTRN$	Annual Market Cap Growth	16,073	0.08	0.36	-4.03	4.28
$COMM$	Annual Growth of GSCI Index	14,747	0.00	0.03	-0.07	0.03
$WGDP$	Annual World GDP Growth	14,747	2.87	1.33	-1.68	4.40
$HGDP$	Annual Home Country GDP Growth	14,734	1.88	2.18	-21.59	25.16
$GEPU$	Log of Glob Econ Pol Uncertainty	14,747	4.76	0.33	4.14	5.22
WGI	Worldwide Governance Index	14,734	-1.32	0.33	-1.97	0.87
$INFL$	Home Country Annual Inflation	14,709	1.64	1.42	-4.48	14.71

Note: Tobin's Q is calculated as (Market Equity + Book Liabilities)/(Book Equity + Book Liabilities).

Table 2: ESG and Firms Value - Combined ESG Scores - Without PRI Interaction

Dependent Variable = $Q_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$Q_{i,t-1}$	0.5179***	0.3414***	0.5282***	0.5956***	0.5204***	0.3445***	0.5426***	0.6818***	0.6685***	0.4659***	0.4077***	0.6666***
$COMB_{i,t-1}$	0.0017***	0.0028**	0.0009	0.0013	-0.0021**	0.0041**	0.0032*	0.0008	0.0001	0.0041**	0	0.0011***
$SIZE_{i,t-1}$	-0.0457*	-0.2528***	-0.0387	0.0369	-0.2095***	0.0304	-0.0455	0.0298	-0.0069	-0.1647**	-0.2654**	-0.0363
$ROA_{i,t-1}$	0.031	0.3306	0.1337	0.1463	-0.153	-1.5596	0.1455	-0.1916	0.4512	0.4166	0.3879	0.1469
$SALES_{i,t-1}$	0.0015	-0.0442	0.0036	-0.0222	0.0491	-1.1009	-0.0543	0.0261	0.2631***	0.141	-0.2359	-0.1330**
$LEV_{i,t-1}$	0.1094	-0.1555	0.0209	0.1567	-0.0961	0.1993	-0.0003	0.3332**	0.0463	0.8342**	0.3645	0.1528
$CAPX_{i,t-1}$	-0.3753	0.0037	-0.9022	-0.1033	-0.2075	1.7132	-3.3756	-1.2912***	-0.7219***	0.8551	-0.3169	-0.346
$DIV_{i,t-1}$	1.5116***	1.8981**	0.8175	3.6595***	2.7375**	3.1977	1.366	1.5696**	1.0193	1.4315*	-0.1658	0.057
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	1.5820***	5.2929***	1.5682	-0.0165	4.4264***	0.7906	1.8444	0.0096	0.5037	3.5022**	5.7162***	0.9903*
OBS	13758	1072	2630	1195	818	432	1238	2831	699	1242	636	965
R^2	0.3742	0.3566	0.3673	0.4702	0.4429	0.3349	0.42	0.4761	0.5204	0.3774	0.3696	0.4911

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 3: ESG and Firms Value - Combined ESG Scores - With PRI Interaction

Dependent Variable = $Q_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$Q_{i,t-1}$	0.5033***	0.3379***	0.5123***	0.5665***	0.5201***	0.3442***	0.5195***	0.6558***	0.6422***	0.4474***	0.4061***	0.6560***
$COMB_{i,t-1}$	-0.0013***	0.0018	-0.0028***	-0.0015	-0.0016	0.004	-0.0033	-0.0018***	-0.0022**	-0.0021	0.0004	0.0006
$(COMB * PRI)_{i,t-1}$	0.0023***	0.0007	0.0032***	0.0025***	-0.0005	0.0001	0.0050***	0.0020***	0.0014***	0.0055***	-0.0005	0.0004*
$SIZE_{i,t-1}$	-0.1417***	-0.2737***	-0.1914**	-0.0834**	-0.1891***	0.0285	-0.2203**	-0.0696**	-0.0594**	-0.3587***	-0.2514**	-0.0640*
$ROA_{i,t-1}$	0.0169	0.3589	0.0419	0.1035	-0.1643	-1.5555	0.2743	-0.2259	0.6341	0.2475	0.409	0.2374
$SALES_{i,t-1}$	0.0177	-0.019	-0.0078	-0.0159	0.0397	-1.1006	-0.0426	0.0364	0.2303***	0.0604	-0.2727	-0.1532**
$LEV_{i,t-1}$	0.086	-0.1198	0.0252	0.1194	-0.0481	0.198	-0.0417	0.3704***	0.1187	0.626	0.4102	0.1575
$CAPX_{i,t-1}$	-0.0989	0.0608	-0.638	0.3242	-0.2401	1.7285	-2.0298	-0.9362**	-0.6335***	2.0594	-0.2883	-0.3546
$DIV_{i,t-1}$	1.0136***	1.7803**	0.2737	2.8250**	2.8010**	3.1672	-0.9133	0.9983	0.6675	0.715	-0.0422	0.0154
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	3.3021***	5.6450***	4.3253***	2.1738***	4.0657***	0.8272	4.9095***	1.7960***	1.4420***	7.0401***	5.4615***	1.4922**
OBS	13758	1072	2630	1195	818	432	1238	2831	699	1242	636	965
R^2	0.3838	0.3579	0.3795	0.4843	0.4434	0.335	0.4343	0.488	0.5318	0.4	0.3703	0.4948

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 4: ESG and Firms Value - ESG Scores Pillars - With PRI Interaction

Dependent Variable = $Q_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
Environmental												
$ENV_{i,t-1}$	-0.0012**	0.0011	-0.0007	-0.0017*	-0.0048***	0.0042	-0.0019	0	-0.001	-0.0056*	-0.0013	-0.0001
$(ENV * PRI)_{i,t-1}$	0.0018***	0.0005	0.0023***	0.0016***	0	0.0004	0.0037***	0.0014***	0.0007***	0.0046***	-0.0001	0.0005**
OBS	13753	1072	2630	1195	818	432	1238	2831	699	1237	636	965
R^2	0.3826	0.3537	0.3796	0.4783	0.4529	0.3382	0.4327	0.4883	0.525	0.399	0.3708	0.4915
Social												
$SOC_{i,t-1}$	-0.0008*	0.0009	-0.0007	0.0005	-0.0012	0.0012	0.001	-0.0021***	-0.0036***	-0.0025	-0.0004	0.0001
$(SOC * PRI)_{i,t-1}$	0.0018***	0.0005	0.0024***	0.0014***	-0.0005	0.0007	0.0028***	0.0018***	0.0015***	0.0043***	-0.0003	0.0003
OBS	13753	1072	2630	1195	818	432	1238	2831	699	1237	636	965
R^2	0.3825	0.3532	0.3804	0.4793	0.4414	0.3275	0.4312	0.4897	0.5408	0.3963	0.3704	0.489
Corporate Governance												
$CGV_{i,t-1}$	-0.0014***	-0.0011	-0.0032***	0.0006	-0.0020*	0.0002	-0.0016	-0.0012**	-0.0007	-0.0023	-0.0014	0.0001
$(CGV * PRI)_{i,t-1}$	0.0020***	0.0009*	0.0030***	0.0012***	-0.0001	0.0011	0.0034***	0.0017***	0.0013***	0.0050***	-0.0003	0.0006***
OBS	13758	1072	2630	1195	818	432	1238	2831	699	1242	636	965
R^2	0.3829	0.3539	0.3814	0.4771	0.4421	0.3295	0.4299	0.4875	0.5344	0.3988	0.3718	0.4967
Controversies												
$CTR_{i,t-1}$	-0.0018***	-0.0002	-0.0029***	-0.0029***	0.0005	0.0022	-0.0047***	-0.0015***	-0.0016**	-0.0027*	0.0009	0.0002
$(CTR * PRI)_{i,t-1}$	0.0025***	0.0014*	0.0028***	0.0034***	-0.0007	-0.0006	0.0051***	0.0019***	0.0015***	0.0051***	-0.0005	0.0004*
OBS	13753	1072	2630	1195	818	432	1238	2831	699	1237	636	965
R^2	0.3822	0.3573	0.3761	0.4918	0.4395	0.3286	0.4319	0.4852	0.5333	0.3913	0.3707	0.4912

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 5: Investment Function

Dependent Variable = $CAPX_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$CAPX_{i,t-1}$	0.4945***	0.4421***	0.4974***	0.5582***	0.5242***	0.5090***	0.4160***	0.5711***	0.3163***	0.3863***	0.5827***	0.5738***
$Q_{i,t-1}$	0.0004***	0.0129***	0.0003***	0.0022**	0.0167***	0.0003	0.0009***	0.0006	0.0305***	0.0013	0.0004	0.0060*
$LEV_{i,t-1}$	-0.0156***	0.0087	-0.0258***	-0.0081	-0.1125***	-0.0035	-0.0121*	-0.0023	-0.0112	-0.0272***	-0.002	-0.0562**
$CASH_{i,t-1}$	0.0031	0.0117	0.0133*	-0.008	-0.0192	-0.0039	-0.0074	0.0037	0.0211	0.0105	0.0187*	-0.0131
$SIZE_{i,t-1}$	-0.0034***	0.0022	-0.0053***	-0.0032***	-0.0074***	-0.0011	-0.0035***	-0.0034***	-0.0136***	0.0004	-0.0011	-0.0024
$RTRN_{i,t-1}$	0.0061***	0.0004	0.0064***	0.0029	0.0078**	0.0012	0.001	0.0054***	0.0081***	0.0053	0.0045**	0.0029
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	0.0839***	-0.0281	0.1217***	0.0711***	0.1785***	0.0226	0.0772***	0.0735***	0.2241***	0.0181	0.0445	0.0829
OBS	15744	1144	2802	1215	810	1527	1489	2908	770	1410	690	979
R^2	0.3067	0.2921	0.3371	0.4531	0.4633	0.3551	0.2944	0.3465	0.3052	0.2289	0.4172	0.3926

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 6: Overinvestment Analysis - Combined Score

Dependent Variable = $OVIT_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$OVIT_{i,t-1}$	0.5781***	0.4972***	0.4185***	0.4045***	0.6573***	0.8935***	0.6985***	0.4961***	0.1767	0.5187***	0.4732***	0.5721***
$COMB_{i,t-1}$	0.0029*	-0.0038	0.0009	-0.0013	0.0023	0.0049	0.0153***	0	-0.0038	0.0089**	-0.0038	0.0033
$(COMB * PRI)_{i,t-1}$	-0.0018*	-0.003	-0.0023	0.0001	-0.0039	-0.0059**	-0.0019	0.0016	0.0046	-0.0062**	0.0060*	0.0021
$COMM_{t-1}$	1.5351**	0.2407	-0.3055	2.9429	3.7851	-0.6066	2.2899	2.3339	3.1504	-1.843	-0.6506	0.1387
$WGDP_{t-1}$	0.0976***	0.0939	0.1175***	0.0157	0.1115*	0.1974**	0.1609***	0.1866***	0.04	0.2579***	-0.0045	0.0484
$HGDP_{t-1}$	0.0039	0.0348	0.022	0.0045	-0.0652	0.0066	-0.0039	-0.0417**	-0.0206	-0.0572	0.0524	0.0331
$GEPU_{t-1}$	-0.0069	0.0507	0.3502*	-0.3555	0.6011*	0.6724**	-0.1432	-0.252	-0.6041	0.0777	-0.9645***	-0.3334
WGI_{t-1}	0.3732***	-0.251	0.0308	0.4513	0.5029**	0.6104	-0.8515	-0.0354	0.1695	0.2018	0.6865*	-0.0434
$INFL_{t-1}$	0.0073	0.1235**	-0.0636	0.0163	0.1027*	-0.0658	-0.0627	-0.0118	0.1688**	-0.0622	-0.1206*	-0.0211
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	-0.587	-1.2923	-2.4824**	1.7555	-2.9695*	-4.2108***	-2.1288	-0.1737	2.3877	-1.6799	5.3497***	0.8168
OBS	12673	889	2232	971	653	1294	1155	2406	591	1094	566	822
R^2	0.2297	0.2746	0.2258	0.2070	0.2584	0.2322	0.2827	0.2087	0.2613	0.2729	0.2642	0.2121

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 7: Overinvestment Analysis - Environmental Score

Dependent Variable = $OVIT_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$OVIT_{i,t-1}$	0.5770***	0.4973***	0.4216***	0.4012***	0.6771***	0.8814***	0.7161***	0.5008***	0.1645	0.5299***	0.4774***	0.5794***
$ENV_{i,t-1}$	0.0041***	0.0007	0.0025	0.0062*	-0.0001	0.0105**	0.0118***	0.0085**	-0.0009	-0.0003	-0.0059	-0.0004
$(ENV * PRI)_{i,t-1}$	-0.0019**	-0.0040*	-0.0004	-0.0026	-0.0056**	-0.0064***	-0.0036	-0.0018	0.0052	-0.0029	0.0039	0.0011
$COMM_{t-1}$	1.5295**	0.1373	0.1675	2.2848	2.9206	-0.568	1.5814	2.0015	3.6992*	-1.5115	-1.093	-0.1178
$WGDP_{t-1}$	0.0979***	0.1069	0.1074***	0.026	0.1313**	0.1950*	0.1709***	0.1948***	0.0314	0.2649***	-0.0002	0.0524
$HGDP_{t-1}$	0.0057	0.0317	0.0212	0.0104	-0.0655	0.0151	0.0034	-0.0338*	-0.0263	-0.0644	0.0489	0.0328
$GEPU_{t-1}$	0.0075	0.1771	0.1587	-0.1535	0.9275**	0.7323***	0.0424	-0.0274	-0.8057**	-0.0547	-0.8739**	-0.2542
WGI_{t-1}	0.3784***	-0.2118	0.0412	0.4945	0.5368***	0.6315	-0.9884*	-0.0175	0.1478	0.284	0.6468	0.0341
$INFL_{t-1}$	0.007	0.1257***	-0.0505	0.0009	0.0728	-0.0664	-0.0911	-0.0223	0.1909**	-0.0668	-0.1280*	-0.0366
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	-0.7366	-2.038	-1.7316	0.5377	-4.2081**	-4.7801***	-3.0331**	-1.5724	3.1215	-0.5985	5.0934***	0.79
OBS	12669	889	2232	971	653	1294	1155	2406	591	1090	566	822
R^2	0.2312	0.2736	0.2255	0.2087	0.2624	0.2345	0.2788	0.2105	0.2643	0.2714	0.2639	0.2101

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 8: Overinvestment Analysis - Social Score

Dependent Variable = $OVIT_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$OVIT_{i,t-1}$	0.5734***	0.5104***	0.4086***	0.4017***	0.6768***	0.8692***	0.6965***	0.4963***	0.1828	0.5480***	0.4753***	0.5875***
$SOC_{i,t-1}$	0.0058***	0.0061	0.0089**	0.0013	0.0006	0.0042	0.0162***	0.0013	-0.0029	0.0045	-0.0037	-0.0017
$(SOC * PRI)_{i,t-1}$	-0.0020***	-0.0032	-0.0021	-0.0019	-0.0048**	-0.0079***	-0.0045**	0.0002	0.0049	-0.0025	0.0034	-0.0002
$COMM_{t-1}$	1.5443**	0.6907	-0.2012	2.3276	3.1659	-1.3311	1.5251	2.0734	3.3619	-1.1611	-1.0663	-0.5432
$WGDP_{t-1}$	0.0981***	0.1036	0.1170***	0.0247	0.1240**	0.2207**	0.1793***	0.1916***	0.0366	0.2481***	-0.0047	0.0649
$HGDP_{t-1}$	0.0061	0.029	0.022	0.0072	-0.0656	0.0047	0.0004	-0.0395**	-0.0214	-0.0599	0.0547	0.0307
$GEPU_{t-1}$	0.0063	0.0292	0.2644	-0.1642	0.8311**	0.9751***	0.0795	-0.1389	-0.6667*	-0.1828	-0.8361**	-0.098
WGI_{t-1}	0.3909***	-0.2113	0.1185	0.4837	0.5400***	0.6686*	-0.7803	-0.0279	0.1805	0.2747	0.6275	0.1105
$INFL_{t-1}$	0.0061	0.1349***	-0.0583	0.003	0.0813	-0.091	-0.1014*	-0.0201	0.1765**	-0.053	-0.1284*	-0.0528
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	-0.8108*	-1.7339	-2.4416**	0.8494	-3.8372**	-5.4455***	-3.1637**	-0.7154	2.6318	-0.2998	4.7750**	0.2904
OBS	12669	889	2232	971	653	1294	1155	2406	591	1090	566	822
R^2	0.2312	0.2729	0.2278	0.2074	0.2606	0.2367	0.2834	0.2084	0.2620	0.2704	0.2631	0.2101

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 9: Overinvestment Analysis - Corporate Governance Score

Dependent Variable = $OVIT_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$OVIT_{i,t-1}$	0.5799***	0.4993***	0.4206***	0.4046***	0.6666***	0.8746***	0.7152***	0.4976***	0.177	0.5368***	0.4587***	0.5406***
$CGV_{i,t-1}$	0.0016	0.0055	-0.0006	-0.0007	0.0017	-0.001	0.0027	0.0021	-0.0109*	-0.0012	-0.0080*	-0.0031
$(CGV * PRI)_{i,t-1}$	-0.0011	-0.0039	-0.0003	-0.0001	-0.004	-0.0047*	-0.0028	0.0005	0.0063	-0.0014	0.0045	0.0075***
$COMM_{t-1}$	1.6355***	0.5402	0.0737	2.8498	3.4637	-0.7233	1.3501	2.1744	3.3478	-1.06	-0.9281	1.6083
$WGDP_{t-1}$	0.0955***	0.1016	0.1094***	0.0158	0.1158*	0.1992*	0.1679***	0.1893***	0.0285	0.2579***	0.0019	0.0099
$HGDP_{t-1}$	0.0035	0.0331	0.021	0.0055	-0.0642	0.0103	0.0064	-0.0407**	-0.017	-0.0717	0.0522	0.0251
$GEPU_{t-1}$	-0.0482	0.0719	0.1969	-0.3349	0.7267*	0.7240**	0.1009	-0.1839	-0.6192	-0.2536	-0.9036**	-0.9271***
WGI_{t-1}	0.3723***	-0.2137	0.0191	0.4563	0.4970**	0.6048	-0.9608*	-0.0486	0.1771	0.3104	0.6667	-0.0571
$INFL_{t-1}$	0.0097	0.1374***	-0.0537	0.015	0.0978	-0.0707	-0.098	-0.0171	0.1763**	-0.0567	-0.1338*	0.0254
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	-0.3607	-1.8479	-1.7706	1.6534	-3.5220*	-4.1924***	-2.7552*	-0.5765	2.7688	0.3547	5.3523***	3.7224**
OBS	12673	889	2232	971	653	1294	1155	2406	591	1094	566	822
R^2	0.2297	0.2730	0.2253	0.2070	0.2594	0.2337	0.2755	0.2087	0.2637	0.2697	0.2651	0.2186

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.

Table 10: Overinvestment Analysis - Controversies Score

Dependent Variable = $OVIT_{i,t}$

Variable	Full Sample	Basic Materials	Cons Discret	Cons Staple	Energy	Financials	Health Care	Industrials	Real Estate	Technology	Telecom	Utilities
$OVIT_{i,t-1}$	0.5788***	0.5158***	0.4209***	0.4073***	0.6448***	0.8928***	0.7022***	0.4919***	0.1902	0.4810***	0.4907***	0.5966***
$CTR_{i,t-1}$	-0.0001	-0.0044	0.0001	-0.0039	-0.0002	0.0001	0.0012	-0.0054**	0.0006	0.0101***	0.002	0.0024
$(CTR * PRI)_{i,t-1}$	-0.0004	-0.0011	-0.0017	0.0019	-0.0007	-0.0005	0.0039	0.0049**	0.0022	-0.0089***	0.0013	0.0019
$COMM_{t-1}$	1.8218***	1.0217	-0.0674	3.4634*	4.7211*	0.4519	2.9474*	2.8934**	2.614	-2.5491	-1.859	-0.1452
$WGDP_{t-1}$	0.0905***	0.084	0.1104***	0.0104	0.0923	0.1690*	0.1452***	0.1818***	0.0556	0.2692***	0.0144	0.0593
$HGDP_{t-1}$	0.0036	0.0314	0.0217	0.0035	-0.0652	0.0051	-0.0043	-0.0443**	-0.0146	-0.0585	0.0582	0.029
$GEPU_{t-1}$	-0.1215	-0.2367	0.2544	-0.5035**	0.2942	0.2336	-0.3608	-0.4364**	-0.3512	0.1959	-0.4971*	-0.2268
WGI_{t-1}	0.3643***	-0.2398	0.0149	0.4445	0.4695**	0.541	-0.9772*	-0.0152	0.2123	0.2434	0.6782	0.0181
$INFL_{t-1}$	0.0149	0.1401***	-0.0557	0.0244	0.1286**	-0.0299	-0.0498	-0.0025	0.1431*	-0.0799	-0.1540**	-0.036
$FRID$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$CONS$	0.0356	-0.0262	-2.0360*	2.4839**	-1.5723	-2.2051	-0.7511	0.858	1.1349	-2.1355*	3.0498**	0.4804
OBS	12669	889	2232	971	653	1294	1155	2406	591	1090	566	822
R^2	0.2297	0.2748	0.2259	0.2079	0.2571	0.2294	0.2782	0.2109	0.2599	0.2782	0.2628	0.2127

Note: The significance level is shown by ***, **, *, to denote respectively 1%, 5%, and 10% significance level.