

Are Sustainability Factors Associated with Stock Price Informativeness?

An Examination of Sustainability Performance and Disclosure

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Abstract

This paper investigates whether the financial market prices business sustainability factors by examining the association between the stock price informativeness and sustainability factors of performance and disclosure. We find that non-financial environmental, social and governance (ESG) sustainability performance is positively associated with stock price informativeness after controlling for financial economic performance, using a sample of 18,223 firm-year observations between 1992 and 2015. Employing a reduced sample of 6,632 firm-year observations between 2005 and 2015, we further find that the association between ESG sustainability performance and stock price informativeness is stronger for firms with higher ESG sustainability disclosure. We explore the impact of economic performance on the association between the ESG sustainability factors of performance and disclosure and stock price informativeness and find that the association is stronger when economic performance is weaker.

Keywords: Business Sustainability Performance, Sustainability Disclosure, Stock Price Informativeness, Idiosyncratic Volatility, Abnormal Turnover

JEL Classification : G14 ; G18 ; M42.

Data Availability: All data used in this study are available from the public sources identified.

1. INTRODUCTION

The capital market prices value-relevant information pertaining to performance and risk (Grossman and Stiglitz [1976]). Aside from pricing systematic risks (e.g. market risk), the market also prices idiosyncratic risks, mainly because investors do not hold perfectly diversified portfolios and investors are heterogeneous in nature (Merton [1987]; Goyal and Santa-Clara [2003]). Idiosyncratic risks are related to any information being utilized by investors and are commonly used as proxies of stock price informativeness (Durnev et al. [2004], Ferreira and Laux [2007]). Stock price informativeness is applicable to several research settings depending on the type and quality of information that is available to investors. For example, prior studies find that factors like board structure (Ferreira et al. [2011]), board gender diversity (Gul et al. [2011]), corporate governance (Ferreira and Laux [2007]), financial reporting quality (Rajgopal et al. [2011]), product market competition (Gasper and Massa [2006]), quality of stocks (Wang [2017]) and corporate social responsibility (CSR) (Becchetti et al. [2015]) affect stock price informativeness.

A growing number of investors are currently integrating non-financial environmental, social, and governance (ESG) sustainability factors of performance and disclosure into their investment strategies (IRRCi [2018])¹. Indeed, the United States Department of Labor (USDOL) recently issued the Interpretive Bulletin (2015-02) relevant to economically targeted investments (ETIs) by encouraging these investments to be evaluated in terms of both economic and ESG considerations (USDOL, 2018:80 FR 65135, 65136). This shows that the investment community is paying attention to ESG sustainability factors. Regulators require or recommend the disclosure of sustainability factors (EC, 2014; 2018 Delaware Act), an increasing number of global public companies (more than 15,000) issue sustainability reports (Rezaee, 2017), and impact investing with the focus on both financial returns along with social and environmental consideration is gaining momentum with socially-oriented investors (GIIN, 2018). Motivated by the anecdotal evidence and results of prior research, this study examines whether the market prices business

¹ For example, global investors pay attention to business sustainability and start to consider both economic performance and ESG sustainability performance in their investment analyses, as can be seen by increases in socially responsible investing (SRI) by more than 22 percent to \$3.74 trillion in managed assets during the 2010–2012 period (Social Investment Forum (SIF) [2012]). In 2015, almost three quarters of investment professionals use ESG information in making investment decisions (CFA Institute [2015]). The 2016 Sustainability & Innovation Global Executive Study reveals that 75 percent of investment firms have considered sustainability performance in making investment decisions and they believe business sustainability creates tangible value (Unruh et al. [2016]). The 2016 report of the Investor Responsibility Research Center Institute (IRRCi) suggests that portfolio managers “have incorporated their understanding of the value of Environmental, Social and Governance (ESG) issues as fundamental to the investment process...they have incorporated ESG considerations into their valuations of investment opportunities...” (IRRCi [2016]: 3).

sustainability factors of performance and disclosure by investigating their associations with stock price informativeness.

Aligned with prior studies (e.g., Merton [1987], Malkiel and Xu [2002], Xu and Malkiel [2003], Goyal and Santa-Clara [2003], Haw et al. [2012]; Becchetti et al. [2015]), we argue that the main objective of firms is to maximize economic performance, while minimizing the risks associated with ESG sustainability performance and the associated risks. Staub-Bisang [2012] presents theoretical arguments for, and Friedman and Heinle [2016] develop a model proving, a link between a firm's current ESG sustainability performance and its future economic performance, suggesting that stock prices reflect ESG sustainability performance. Following this argument and as depicted in Figure 1, we conjecture that the ESG sustainability factors of performance and disclosure are associated with stock price informativeness. Most importantly, we control for economic performance when investigating the relationship between ESG sustainability performance and stock price informativeness. Following prior studies (Dhaliwal et al. [2011], Kim et al. [2012], Ng and Rezaee [2015]) we construct measures of ESG sustainability performance using provisions included in the MSCI² (formerly KLD) ESG databases. However, we modify the construction of ESG sustainability performance measures commonly used in these studies and use the sums of strengths and concerns in the MSCI ESG database, instead of their differences, to represent ESG sustainability performance. This is a more appropriate measure of sustainability performance, since we are interested in investigating whether the market prices ESG sustainability performance, which could be measured in terms of strengths and/or concerns.

Insert Figure 1 about here

Our hypothesis of ESG sustainability performance is associated with stock price informativeness could be affected by two important factors. First, as economic performance is commonly recognized as the key determinant of firm value, and thus we control for it when

² MSCI (formerly KLD) ESG database is the world's largest provider of ESG data. MSCI ESG Research analyses thousands of companies worldwide to help institutional investors understand how ESG factors can impact the long-term risk and return profile of their investments. It creates tools to help companies incorporate ESG factors into their investment processes. MSCI ESG Research data and ratings are used in the construction of the MSCI ESG Indexes. It includes over 700 equity and fixed income indexes, which are designed to help institutional investors more effectively benchmark ESG investment performance, issue index-based investment products, as well as manage, measure and report on ESG mandates. (refer to https://www.msci.com/documents/1296102/1636401/MSCI_ESG_Research_Factsheet_2018.pdf/e822ce53-7ea6-440e-9af9-e22092160e6f for details)

examining the impacts of ESG sustainability performance on stock price informativeness. In this case, we also investigate the interactive effect of economic performance and ESG sustainability performance on stock price informativeness. Second, we consider the level of disclosure on ESG sustainability performance when testing the relationship, as ESG sustainability performance is not systematically and mandatorily disclosed by all corporations.

We perform our analyses of testing the association between sustainability factors and stock price informativeness in three stages. First, we investigate the link between ESG sustainability performance and stock price informativeness using a full sample of 18,223 firm-year observations during 1992-2015. Using two measures – idiosyncratic volatility ($IDIORISK_t$) and average abnormal annual turnover ($ABTURN_t$) – as proxies for stock price informativeness³, we find that ESG sustainability performance is positively associated with stock price informativeness, after controlling for economic performance. We further investigate the relationship between stock price informativeness and the individual components environmental, social and governance of ESG sustainability performance. We find that the individual components of ESG are all positively and significantly associated with stock price informativeness, although the magnitudes of associations are different for individual components.

We include ESG sustainability disclosure in our second stage of analyses. We use the ESG sustainability disclosure scores developed by Bloomberg⁴ as a measure of ESG sustainability disclosure for a reduced sample of 6,632 firm-year observations in the period spanning 2005-2015⁵. Using this sample, we first show that ESG sustainability disclosure is positively associated with stock price informativeness. Next, we find that the relationship between stock price informativeness and ESG sustainability performance is stronger when firms have higher levels of ESG sustainability disclosure. This result suggests that, although the capital market prices

³ Prior studies show that idiosyncratic volatility and stock price informativeness flows are closely related (Roll [1988], Ross [1989]; Morck et al. [2000]; Durnev et al. [2003]; Durnev et al. [2004]; Chen and Jiang [2006]; Ferreira and Laux [2007]). However, Li, et al. [2014] argue that the R^2 and idiosyncratic risk are not interchangeable and thus we follow their recommendations and develop the measure of as a second proxy for stock price informativeness.

⁴ Bloomberg ESG Disclosure Scores rate companies based on their disclosure of quantitative and policy-related ESG data. Bloomberg provides data on more than 120 indicators for over 10,000 publicly-listed companies globally. (Refer to <http://ratesustainability.org/hub/index.php/search/at-a-glance-product/24/99> for details). Data are collected from annual reports, sustainability reports, press releases and third-party research. The rating scale is between 0 and 100. We use logarithm of this index in this study as a proxy for ESG sustainability disclosure. Over 800 different metrics are tracked and the total number of ESG indicators covered is 120. Examples of data tracked include political donations, employee training costs, employee turnover percentage, percentage of women employees, number of environmental spills, percentage of water recycled, amount of investment in sustainability among others.

⁵ Since ESG sustainability disclosure data only spans the period 2005-2015, we can only test our hypotheses with a reduced sample.

sustainability performance, additional sustainability disclosure still has a positive impact on this association. To the best of our knowledge, this has not been documented by any prior studies.

Finally, we explore the impact of economic performance on the relationship between the ESG sustainability factors of performance and disclosure and stock price informativeness. We find that this relationship is weaker when economic performance is stronger. This result suggests that investors treat economic performance as their primary source of stock price informativeness. When economic performance is strong, the impacts of the ESG sustainability factors of performance and disclosure are not significant. These results are consistent with those [Lys, Naughton, and Wang, 2015], which suggest that firms may commit to CSR/ESG investments to improve CSR performance and disclose CSR information in the current period when they anticipate stronger future financial performance. Overall, these results provide insight on how investors tend to prioritize economic performance and non-financial the ESG sustainability factors of performance and disclosure when pricing stocks. These results suggest that when economic performance is strong, investors pay less attention to the firm's ESG factors of performance and disclosure.

A series of additional analyses are performed to further substantiate our results. First, we perform tests to confirm that the relationship between sustainability performance and price informativeness is not due to correlated omitted variables like future performance, earnings quality and stock returns. Second, we perform Fama-Macbeth [1973] regressions to affirm our results. We also perform a trend analysis on the relationship between business sustainability performance and stock price informativeness and results show that the relationship has strengthened over time. This confirms our conjecture that investors are increasingly paying attention to business sustainability performance. Third, we investigate the relationship between stock price informativeness and ESG sustainability strengths and concerns separately. We find that both sustainability strengths and concerns are positively related to stock price informativeness, with sustainability concerns demonstrating stronger associations. This is not surprising, as concerns are usually more likely to be associated with higher risk and larger impacts. Finally, we conduct additional tests to address possible problems related to endogeneity. We conduct two-stage-least-squares regressions that control for the expected levels of sustainability performance and address endogeneity concerns, which show that our results still hold.

This study complements, yet differs from, prior research and thus contributes to the literature in several ways. First, prior studies (e.g., Merton [1987], Malkiel and Xu [2002], Xu and

Malkiel [2003], Goyal and Santa-Clara [2003], Haw et al. [2012], Becchetti et al. [2015]) commonly examine the relationship between the individual dimensions of sustainability, usually corporate social responsibility (CSR) and financial/market performance in isolated empirical settings, and these studies typically do not control for the primary objective of economic performance. Huang and Watson [2015] therefore conclude that despite more than three decades of more than 100 CSR-related empirical studies, empirical results are still mixed, primarily because these studies tend to narrowly focus on one dimension of sustainability (e.g., CSR) while other dimensions of sustainability performance are generally ignored. Thus, O'Dwyer and Unerman [2016] suggest that future sustainability research provides insight for implications of sustainability that can benefit society and impact policy and practice as presented in this study. Our study investigates the link between stock price informativeness and ESG sustainability performance after controlling for economic performance. Second, we consider ESG sustainability performance in conjunction with the disclosure of sustainability information when analyzing their impact on price informativeness. This joint testing of the sustainability factors of performance and disclosure is often not addressed in prior studies (e.g., Dhaliwal, et al. [2012], Ng and Rezaee [2015], Friedman and Heinle [2016]).

Third, our results have implications for policymakers, regulators, and corporations as they are currently paying attention to all aspects of the sustainability factors of performance and disclosure and their value-relevance to investors. Our results are relevant and support many sustainability initiatives that have been recently taken by national and international organizations such as the Global Reporting Initiative (GRI), the International Integrated Reporting Council (IIRC), the Sustainability Accounting Standards Board (SASB), the Public Company Accounting Oversight Board (PCAOB) and International Auditing and Assurance Standards Board (IAASB) when promoting integrated sustainability reporting and assurance. Our results of the positive relationship between stock price informativeness and the ESG sustainability factors of performance and disclosure should be of abundant interest to the PCAOB and the IAASB in establishing assurance guidelines for auditors in lending more credibility to sustainability reports. Results showing that investors pay more attention to ESG factors when economic performance is weak should be relevant to the PCAOB in establishing auditing standards for auditing/reviewing non-financial information accompanying financial statements. Finally, our results provide support to the recent guidelines released by the United States Department of Labor regarding investment

in ESG by stating that “investment policy statements are permitted to include policies concerning the use of ESG factors to evaluate investments, or on integrating ESG-related tools, metrics, or analyses to evaluate an investment’s risk or return.”

This paper is organized as follows: section 2 describes background information, theoretical framework, and develops testable hypotheses, while section 3 describes sample selection and variable construction. Methodology and results are presented in section 4, additional tests are included in section 5, and section 6 concludes.

2. LITRATURE REVIEW, THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

2.1 Prior Research

2.1.1 Business Sustainability

Business sustainability is defined as the process of achieving financial economic performance by creating shareholder value while protecting the interests of all other stakeholders by addressing the ESG sustainability factors of performance and disclosure (Ng and Rezaee [2015], Rezaee [2016]). The achievement of economic performance is the main goal of all business organizations (Friedman [1970]), and managerial decisions to achieve economic performance should include maximizing operating profit, making investments to ensure future growth and determining the financing of related investments. However, prior studies show that the goal of long-term firm value maximization (Jensen [2001]), and thus long-term shareholder value creation, can only be achieved when the interests of all stakeholders are considered (Rezaee [2017], Hart and Zingales [2017]).

To achieve shared value for all stakeholders, management may be motivated to engage in business sustainability activities, including maximizing long-term profit and firm value (Jensen [2001]), managing corporate governance and image (Gray and Balmer [1998]), improving customer satisfaction (Luo and Bhattacharya [2006]), enhancing corporate reputation (Weber [2008], Rezaee [2016]), fulfilling social responsibilities (Campbell [2007]) and meeting their environmental obligations (Bansal and Roth [2000], Clarkson et al. [2008]). The focus is mainly on long-term shareholder value creation while considering tradeoffs among the other apparently competing, and often conflicting, interests among society, creditors, employees, and the environment. These activities are likely to be considered by investors when making investment decisions, which could be reflected in price informativeness.

Prior studies have demonstrated that the individual components of ESG sustainability are priced by the market. For example, Friedman and Heinle [2016] present a parsimonious model suggesting that the individual social responsibility component can result in strong CSR, which is valued by management and reflected in stock prices. Khan et al. [2016] also provide evidence of the value implications of sustainability investments by finding that firms with good ratings on material (immaterial) sustainability factors significantly outperform (do not outperform) firms with poor ratings on sustainability factors. These studies, however, often consider one aspect of sustainability (CSR) while other ESG sustainability performance and economic performance are not addressed. Controlling for economic performance is important, mainly because conflicts may exist between economic performance and ESG sustainability performance as well as among the different dimensions of ESG sustainability performance.

It is expected that the 2018 Delaware Certification of Adoption of Transparency and Sustainability Standards Act will transform business sustainability from a green washing and branding status to business imperative strategies for public companies and their investors (Delaware Act, 2018). The alignment of investment goals with social and environmental values is better known as “impact investing” and is gaining considerable attention by individual and institutional investors (GIIN, 2018). Anecdotal evidence also suggests that both short-term profitability and long-term value creation can be influenced by economic performance and ESG sustainability performance⁶, and possibly by the interactions between them as well. For example, a study by Standard and Poor (S&P [2016]) shows that sustainable financial economic performance and non-financial ESG sustainability performance help to align investors’ long-term financial interests with those of society and the environment (S&P [2016]). A 2014 survey of institutional investors reveals that the primary reason for investors to consider ESG sustainability performance is to mitigate risk, as about three-quarters of responding investors believe that the consideration of the ESG sustainability factors of performance and disclosure reduces investment risks (PwC [2014]). Thus, these sustainability factors are important to investors and should be priced by the market and reflected in stock price informativeness.

⁶ Anecdotal evidence suggests that these sustainability reports and related ECON and ESG information are integrated into investment decisions as the United Nations Principles for Responsible Investment’s (PRI) have now more than 1,500 signatories with assets amounting to \$60 trillion (UN PRI [2016]). The 2016 PRI encourages system-level sustainability framework in analyzing risks and rewards within environmental, social and financial systems by investment portfolio managers (UN PRI [2016]).

There are two other streams of prior research that are related to this study and they address the relationship between sustainability performance and information quality. The first group consists of studies that relate business sustainability performance/disclosure to financial reporting quality (Dhaliwal et al. [2011, 2012], Kim et al. [2012]). For example, Dhaliwal et al. [2011] find that CSR disclosures are associated with lower analyst forecast errors after controlling for several factors pertaining to financial transparency and institutional attributes. This association is also found to be stronger for firms in countries with opaquer financial disclosures and more stakeholder-oriented focus (Dhaliwal et al. [2012]). Kim et al. [2012] find that socially responsible firms are less likely to manage earnings through either discretionary accruals or operating activities and are more likely to be subjected to SEC investigations against their top executives. The second group of prior studies examines the relationship between the individual factors of ESG business sustainability performance and stock price informativeness and shows that there is a strong relationship between these components individually. For example, Ferreira and Laux [2007] examine the effect of corporate governance – an important dimension of business sustainability, proxied by the lack of anti-takeover provisions – on stock price informativeness, and show that strong corporate governance encourages the collection of and trading on private information and therefore leads to more informative stock prices. However, these studies tend not to control for ECON performance and other dimensions of ESG sustainability performance.

2.1.2 Stock Price Informativeness

Information priced by the market could be related to systematic risk factors, or they could be firm-specific (unsystematic or idiosyncratic). Although asset pricing models commonly treat unsystematic risks as diversifiable risks and thus should not be priced by the market, one stream of research (e.g. Merton [1987]) shows that firm-specific information could still improve the price informativeness of stocks⁷. Investors are likely to trade shares based on private information about the company's financial performance, growth potential, and even non-financial ESG sustainability

⁷ Stock price informativeness is related to firm-specific (mainly idiosyncratic) information reflected by stock price. In an efficient market, stock prices should reflect all relevant financial and non-financial information. Expected stock returns are determined by models of market equilibrium and asset pricing models in general relate expected returns to risk factors. For example, according to the Capital Asset Pricing Model (CAPM) (Fama-French three-factor model), expected stock returns are associated with only one (three) risk factor(s), which capture(s) the co-movement of the stocks and the market portfolio (factor mimicking portfolios). Since the co-movement with the market portfolio captured by model coefficients, is related to systematic (non-diversifiable) risk, investors should be compensated for bearing such risks. Other risks, captured by the error term (ϵ) in models are diversifiable and should not be priced by the market. Returns not captured by these risk factors are related to diversifiable risk or private information.

performance. Based on this argument, Merton [1987] suggests that there should be a premium associated with company-specific risks. Other studies also show that stock price informativeness is priced by the market (e.g. Malkiel and Xu [2002], Xu and Malkiel [2003], Goyal and Santa-Clara [2003]), mainly because investors do not hold perfectly diversified portfolios, or investors are heterogeneous in nature (Goyal and Santa-Clara [2003]).

Stock price informativeness has been investigated by prior studies, which are classified into two main groups. First, prior research shows that stock price informativeness largely depends on company specific information that is priced by the market. For example, prior studies show that price informativeness is related to board structure (Ferreira et al. [2011]), board gender diversity (Gul et al. [2011]), corporate governance (Ferreira and Laux [2007]), financial reporting quality (Rajgopal et al [2011]), product market competition (Gasper and Massa [2006]), quality of stocks (Wang [2017]) and CSR (Becchetti et al. [2015]). Second, the disclosure of information related to sustainability is also an important determinant of stock price informativeness, since regulations related to the systematic and mandatory disclosure of ESG sustainability performance are yet to be established. For example, Plumlee et al. [2015] find that the components of firm value (expected future cash flows and cost of equity) depend on voluntary environmental disclosure quality. Cao et al. [2015] find that companies with higher reputations, measured in terms of the reputation rankings from Fortune's "America's Most Admired Companies", exhibit a lower cost of equity capital. Wang [2017] finds that there is a positive association between stocks' future return and stock idiosyncratic volatility for firms with higher quality measures. Becchetti et al. [2015] explore the relationship between idiosyncratic volatility and CSR and show that there is a positive relationship between the two concepts. Furthermore, Haw et al. [2012] document that higher corporate disclosures in countries with strong investor protections through effective corporate governance measures (enforcement, inside trading laws) are positively associated with stock price informativeness. Our study extends and contributes to the literature by investigating the association between stock price informativeness and business sustainability factors measured in terms of the ESG sustainability factors of performance and disclosure.

2.2 Theoretical Framework

The relationship between business sustainability performance and stock price informativeness can be explained by both the shareholder and stakeholder theories. Asset pricing

models have traditionally been built on shareholder/agency theory suggesting that managers are only responsible to shareholders. For example, capital asset pricing models assume that shareholders and managers are the only two beneficial parties in the agent/principal setting and shareholders' wealth during the next period is the only factor that affects their well-beings. However, investors are also exposed to risks related to society and the environment and their investment horizon could be longer than one period. Shareholders may be willing to invest in business sustainability if the investment promotes long-term profitability for themselves and related beneficiaries. Brest et al. [2018] argue that although most investors are financial return-driven, and thus do not accept a lower financial return for socially-focused investments, a growing number of socially-motivated investors have goals beyond profit maximization. These socially-motivated investors are willing to invest in firms achieving goals that are aligned with their moral and social value. Accordingly, these socially-aligned investments are only attractive to investors where their ESG sustainability performance is prudent and fairly disclosed.

Addressing the problems associated with shareholder theory, stakeholder theory (Freeman [1984], Jensen [2001], Rezaee [2017]) suggests that business decisions should be made by considering business sustainability performance, which creates shared value for all stakeholders (e.g. employees, customers, creditors, society and the environment). Hart and Zingales [2017] also question the traditional shareholders-managers setting and suggest that managers should focus on shareholders' value instead of only wealth when assessing asset pricing models. For example, managers could try to maximize the profit of companies and in the process, their actions could have harmful effects on the environment. Investors who only focus on shareholders' wealth may agree with the actions of managers. However, once the risks associated with the harmful effects against the environment are considered, to which shareholders are also indirectly exposed, then the related actions may not be best for the shareholders. Thus, stakeholder theory may better explain the link between stock price informativeness and sustainability factors than shareholder/agency theory.

2.3 Hypotheses Development

2.3.1 Environmental, Social and Governance (ESG) Sustainability performance

Stakeholders have reciprocal relationships and interactions with firms in the sense that they contribute to firm value creation (stakes) and their well-being is affected by the activities (risks)

of firms. Moser and Martin [2012] argue that it is possible that ESG sustainability performance is driven by both shareholders and non-shareholding stakeholders. Principle 6 of the International Corporate Governance Network (ICGN) states, “Investors should promote the long-term performance and sustainable success of companies and should integrate material environmental, social, and governance (ESG) factors in stewardship activities.” (ICGN [2016]: 10). A recent survey conducted by Ernst and Young (EY) in 2017 reports that: (1) global investors believe that ESG sustainability performance presents risks and opportunities that should be considered by investors; (2) recent social, environmental and ethical scandals have driven investors to consider the ESG sustainability factors of performance and disclosure; and (3) nonfinancial ESG sustainability performance plays an important role in their investment decisions. Rezaee [2016] argues that firms that are managed more effectively in terms of their governance, address their social and environmental initiatives, and run their business more ethically are more financially sustainable in the long-term than other firms. Based on these arguments and as depicted in Figure 1, we posit that investors pay attention to sustainability performance and develop the following hypothesis:

Hypothesis 1: Environmental, social and governance (ESG) sustainability performance is positively associated with stock price informativeness.

2.3.2 Business Sustainability Disclosure

Stakeholders, in recent years, have been increasingly interested in understanding a firm’s total impact on bottom-line financial performance as well as on society and the environment (Rezaee [2017]). As the disclosure of sustainability information is currently not mandatory and regulated, additional disclosure on ESG sustainability would lower information asymmetry between management and investors and thus reduce uncertainty about firm value (Cho et al. [2013], Ng and Rezaee [2015]). Regulators worldwide are recommending and/or requiring the systematic disclosure of ESG sustainability information in addition to the disclosure of financial economic performance measures. For example, over 6,000 European companies are now required to disclose their non-financial ESG sustainability information for their 2017 financial year and onwards (European Commission [2014]). This trend of moving towards sustainability disclosures is expected to have global reach. However, ESG sustainability information is currently not disclosed

in a standardized manner globally and it is difficult for investors to compare sustainability reports from different companies, especially when these companies are from different industries and countries⁸. Prior studies (e.g., Rezaee [2016] and Hummel and Schlick [2016]), in accordance with signaling theory, suggest that managers have more incentives to disclose their good sustainability information rather than disclosing poor ESG sustainability performance. Thus, we hypothesize that ESG sustainability disclosure is related to the price informativeness of the firm as illustrated in Figure 1, and we have the following testable hypothesis:

Hypothesis 2: Business sustainability disclosure is positively associated with stock price informativeness.

2.3.3 Interactive Effects between the Sustainability Factors of Performance and Disclosure

In 2017, the Investor Responsibility Research Center Institute (IRRCi) in collaboration with Sustainalytics took the first step and developed a typology of ESG integration under the three dimensions of management, research, and application that assists investors in incorporating ESG information into their investment decision-making processes (IRRCi [2017]). As a result, the disclosure of sustainability information can have important impacts on the relationship between ESG sustainability performance and stock price informativeness. Given that both sustainability factors of performance and disclosure are associated with higher stock price informativeness as discussed above, we argue that sustainability disclosure can also improve the relationship between ESG sustainability performance and stock price informativeness. As a systematic way to disclose sustainability performance has not yet been established, investors may find the impact of sustainability information on stock price informativeness is more prominent when the firm has higher sustainability disclosure. Prior research (e.g. Goyal and Santa-Clara [2003]; Haggard et al. [2008]) suggests that price informativeness is driven by both mandatory and voluntary information disclosed by firms and information collected by investors as depicted in Figure 1. Therefore, we have the following hypothesis:

⁸ In order to standardize and improve the disclosure of sustainability information, the World Federation of Exchanges (WFE) issued its ESG Guidance and Recommendations (WFE Guidance) in 2015 that provides a basic standard for the adoption of sustainability integration and disclosure of stock exchanges worldwide. In 2010, the SEC issued an “Interpretative Release” on Climate Change Guidance that identifies four main areas of climate-related risk relevant to the environmental dimensions of business sustainability. A survey was conducted by the WFE in 2017, which suggests that institutional and individual investors support WFE Guidance that derives a solid consensus among global exchanges on the integrated ESG reporting and listing rules for sustainability disclosure (WFE, 2017).

Hypothesis 3: Sustainability disclosure improves the relationship between ESG sustainability performance and stock price informativeness.

In this section, we argue that the relationship between stock price informativeness and ESG sustainability performance, can be affected by the economic performance of the firm. Khan et al. (2016) find that firms with a good rating on material (immaterial) sustainability issues outperform (do not outperform) firms with a poor rating. This shows that economic performance and sustainability performance are related. Empirically, economic performance and ESG sustainability performance/disclosure could act as complements or substitutes (e.g. Barnett and Salomon [2006], Margolis and Walsh [2003], Orlitzky et al. [2003]). There are two possible effects that strong economic performance may have on the relationship between stock price informativeness and sustainability performance/disclosure. First, investors may ignore information associated with sustainability performance/disclosure when economic performance is strong, as economic performance is the main determinant of long-term corporate profitability. The impact of sustainability performance on stock price informativeness may therefore be reduced. The effect of ESG sustainability disclosure on this relationship may also be moderated. Second, investors may tend to consider their investment opportunity in holistic manners and pay additional attention to ESG sustainability performance when economic performance is strong. These possibilities introduce tension into our last hypothesis as stated in null form as follows:

Hypothesis 4: Economic performance does not moderate the relationship between ESG sustainability performance/disclosure, and stock price informativeness.

3 SAMPLE SELECTION AND VARIABLE CONSTRUCTION

3.1 Sample Selection

We collect data from Compustat, the Center for Research in Security Prices (CRSP), MSCI ESG and Bloomberg databases. We first start with 36,193 firm-year observations included in the MSCI ESG database between 1992 and 2015, from which we construct proxies of sustainability performance. We construct economic performance measures using data from the Compustat

database. We also calculate our proxies of stock price informativeness ($IDIORISK_t$ and $ABTURN_t$) using data in the CRSP database. The final sample for the first stage of analysis is 18,223 firm-year observations, after we have deleted utilities and financial firms. We also winsorize all continuous variables in our sample at the 1% or 99% level. Finally, we collect ESG sustainability disclosure data from Bloomberg. As data for sustainability disclosure from Bloomberg is only available starting from 2005⁹ onwards, our final sample period for the second stage analysis is from 2005 to 2015 with 6,632 firm-year observations.

3.2 Economic Performance

Economic performance is a multi-dimensional measure that captures managerial decisions as well as market measures relevant to operations and growth and thus reflects both short-term and long-term profitability and investment for future growth. Following Ng and Rezaee [2015], we use Exploratory Principal Component Analysis (EPCA) to construct economic performance variables. We start with eight variables suggested in prior research to be related to economic performance (KPMG [2013], Ng and Rezaee [2015]). These variables are: (1) return on equity for the current year (ROE); (2) sales scaled by total assets (SALES); (3) sales growth scaled by total assets (SALESGR); (4) ratio of market to book value of equity (MVBV); (5) Tobin's Q (TOBINSQ); (6) advertising expenses scaled by total assets (AD); (7) research and development expenses scaled by total assets (RD); and (8) a dummy variable that represents the omission of dividends (DIVIDOMS). These variables capture both short-term operational efficiency and productivity measures (ROE, SALES and SALESGR) and long-term profitability and growth measurements (TOBINSQ, MVBV, RD, AD, and DIVIDOMS). The appendix summarizes these variables and other variables used in this paper along with their definitions.

Consistent with Ng and Rezaee [2015], we construct economic performance using principal component decomposition. Following prior studies (e.g. Larcker et al. [2007], Kanagaretnam et al. [2007], Ng and Rezaee [2015]), we apply EPCA to the eight variables listed above by converting economic performance variables into composite factors. We retain only economic performance variables with the absolute value of component loading higher than 0.40 and eigenvalues greater than 1 (Larcker et al. [2007]). We use a varimax orthogonal rotation to

⁹ Bloomberg disclosure database actually starts from 1999. However, the number of observations for the years between 1999 and 2004 is sparse. Inclusion of these years may create bias for our conclusion and we decide to exclude years before 2005.

manage the number of variables that have high loadings on each factor and assign names based on the information of the indicators that are relevant to the factor. These factors capture three components of economic performance – operation efficiency (OP), growth opportunities (GR), and research efforts (RES) – that are considered important and relevant to investors, and these factors together explain most of the variances in the data (over 70 percent). Following Ng and Rezaee [2015], we group ROE_t , $SALES_t$ and $SALESGR_t$ together as an operation efficiency factor at time t (OP_t), $TOBINSQ_t$ and $MVBV_t$ together as a growth opportunities factor at time t (GR_t), and RD_t and $DIVIDOMS_t$ together as a research effort factor at time t (RES_t). These factors are all scaled to have zero means and standard deviations of one. Note that AD_t is not significantly related to any component and thus it is not included in any of the factors. We then calculate $ECON_t$ as an average of OP_t , GR_t and RES_t .

3.3 Environmental, Social and Governance (ESG) Sustainability Factors

Prior research (e.g., Clarkson et al. [2008], Ng and Rezaee [2015]) addresses ESG sustainability factors in terms of sustainability performance and disclosure as they are different yet interrelated. Sustainability performance determines the achievement of ESG activities and thus pertains to the stakes faced by different stakeholders, and disclosures are related to the precision and efficiency of how sustainability information reaches investors. We conjecture that these sustainability factors are priced by investors as a PricewaterhouseCoopers' (PwC) 2014 survey of institutional investors reveals that about three-quarters of responding investors believe that the consideration of ESG sustainability performance reduces investment risk (PwC [2014]). We also construct a sustainability disclosure index using scores to represent the disclosure of sustainability information.

3.3.1 ESG Sustainability Performance

We construct sustainability performance measures using provisions included in the MSCI ESG database while utilizing the Bloomberg ESG Disclosure Database in constructing the sustainability disclosure index. The MSCI ESG database collects strengths and concerns (positive and negative indicators) ratings using approximately 80 indicators in seven major areas of sustainability: (1) Community, (2) Corporate Governance, (3) Diversity, (4) Employee Relations, (5) Environment, (6) Human Rights, and (7) Products. Following prior research (Dhaliwal et al.

[2011], Kim et al. [2012]; Ng and Rezaee [2015], Jain et al. [2016]), we first construct an overall MSCI index (MSCI_i) using all strengths and concerns (except for product, which is more relevant to economic performance) in the database to represent overall ESG sustainability performance. Second, we use the sum of numbers of strengths and concerns as our proxy for sustainability performance, rather than using their differences as a proxy for ESG sustainability performance (Dhaliwal et al. [2011], Kim et al. [2012]). Third, instead of only combining all strengths and concerns of different areas to construct an index, we map attributes collected by the MSCI database into ESG dimensions separately to facilitate our investigation of the possible impacts of various dimensions of sustainability performance on price informativeness. Becchetti et al. [2015] also use the relative sum of seven components of CSR concerns from the MSCI ESG database as a proxy for ESG performance. Although the classification of strengths and concerns of different areas into ESG dimensions could be subjective, we conduct sensitivity tests with alternative definitions, and our results are robust to different definitions.

3.3.2 ESG Sustainability Disclosure

Following Jain et al. [2016], we construct ESG sustainability disclosure scores from Bloomberg's ESG disclosure data for 8,704 firms-year observations for the fiscal years of 2005 to 2015. The proprietary composite and component scores range from 1 for firms that disclose the minimum amount of ESG data to 100 for those that disclose every data variable collected by Bloomberg. The list of variables included in the overall components and sub-components are available from the Bloomberg ESG tool database¹⁰. Each data point is weighted in terms of importance, with certain data points such as Greenhouse Gas Emissions carrying greater weight than other disclosures. The score is also customized to different industries enabling a firm's ESG

¹⁰For example, in constructing environment disclosure score Bloomberg uses disclosure information on environmental measures such as water pollution, hazardous wastes, oil spills, radiation, cover emissions, hydraulic fracturing, renewable energy, resource depletion, deforestation, and operational policies around environmental impact. To produce social disclosure score Bloomberg uses disclosure information on variables such as number of part-time employees, number of employees, number of contractors, percentage of minorities in workforce, percentage of women in workforce and management, lost time incident rates, fair remuneration, training, employee CSR, employee fatalities, community spending, policies on health and safety, equal opportunity, human rights, child labor, business ethics, anti-bribery, employee protection, and the UN Global compact signatory. To produce governance disclosure score Bloomberg uses disclosure information on such as board structure and function, number and percentage of non- executive directors, number and corporate governance measures including percentage of independent directors, CEO duality, independent chairperson, independent lead director, presiding director, board and executive activities, shareholder rights, executive compensation, number and percentage of women, number and percentage of female executives, ages of directors, board and executive director duration, number of board meetings, percentage of attendance, size of audit committees, audit committee meetings, audit committee financial experts, nomination committees, compensation committees, compensation committee disclosures, and AGM voting results.

disclosure index to be evaluated in relation to industry peers. We define the disclose index (DISC_t) as the natural logarithm of the Bloomberg disclosure score as a proxy for corporate ESG disclosure.

3.4 Dependent Variable Construction

We use two proxies for stock price informativeness – (1) idiosyncratic volatility (IDIORISK_t) and (2) average abnormal annual turnover (ABTURN_t).

3.4.1 Stock Price Informativeness

Idiosyncratic volatility is a measure of stock return volatility that is not related to the main pricing factors in asset pricing models. Thus, we use the market model (equation 1) to isolate idiosyncratic volatility from the total volatility of stock returns.

$$r_{i,d} = \alpha_i + \beta_i r_{m,d} + \varepsilon_{i,d} \quad (1)$$

where $r_{i,d}$ is the daily excess stock return for firm i and $r_{m,d}$ is the daily excess return of the market portfolio. Model (1) is commonly estimated using OLS regression and we calculate idiosyncratic volatility using equation (2):

$$\sigma_{i,e,d}^2 = \sigma_{i,d}^2 - \frac{\sigma_{i,m,d}^2}{\sigma_{m,d}^2} \quad (2)$$

where $\sigma_{i,d}^2 = \text{Var}(r_{i,d})$.

The ratio of idiosyncratic volatility to total volatility ($\sigma_{i,e,t}^2 / \sigma_{i,t}^2$) for each firm-year t reflects the proportion of volatility that is *not* explained by pricing factors. This ratio also equals $(1-R^2)$ of equation (1). Since $(1-R^2)$ is skewed, we apply a logistic transformation to the variable and define idiosyncratic volatility at time t (IDIORISK_t) as

$$IDIORISK_t = \text{Ln} \left(\frac{1 - R_{i,t}^2}{R_{i,t}^2} \right) = \text{Ln} \left(\frac{\sigma_{i,e,t}^2}{\sigma_{i,t}^2 - \sigma_{i,e,t}^2} \right) \quad (3)$$

3.4.2 Average Abnormal Annual Turnover

In order to confirm our findings, we use the average abnormal annual turnover (ABTURN_t) of stock during the fiscal year as a second proxy for stock price informativeness. Prior research (Chae [2005], Ferreira and Laux [2007]) shows that turnover is another good proxy for information that investors possess when trading stocks, whereas security prices reflect a summary of investors'

beliefs. Investors' activities are induced by information that is new to the market or private information. As a result, abnormal turnover can also be a proxy for price informativeness. We define average abnormal annual turnover as follows:

$$ABTURN_t = \log|TURN_t - INDTURN_t| \quad (4)$$

where $TURN_t$ is the sum of turnover for fiscal year t and $INDTURN_t$ is the industry median¹¹ of $TURN_t$ according to the two-digits SIC industries classification.

4 METHODOLOGY AND RESULTS

4.1 Descriptive Statistics

Table 1 shows the descriptive statistics for all variables. $ECON_{t-1}$ is the variable for economic performance. ENV_{t-1} , SOC_{t-1} and GOV_{t-1} are our main measures of sustainability performance, which are the sum of the individual strengths and concerns in each of the ESG areas. $MSCI_{t-1}$ is the sum of ENV_{t-1} , SOC_{t-1} and GOV_{t-1} , which is the overall ESG sustainability performance measured at time $t-1$. We also provide separate statistics for strengths and concerns of sustainability factors ($ENVSTR_{t-1}$, $SOCSTR_{t-1}$, $GOVSTR_{t-1}$, $MSCISTR_{t-1}$, $ENVCON_{t-1}$, $SOCCON_{t-1}$, $GOVCON_{t-1}$ and $MSCICON_{t-1}$), so that the relative numbers of strengths and concerns are more apparent. We also include statistics for the disclosure index. For our sample, $DISC_t$ ranges from 2.3213 to 3.9813 and it shows that there is significant variability in terms of corporate ESG disclosures. Descriptive statistics for control variables are also reported in this panel. Panel B provides descriptive statistics for key variables for three different sub-samples separated by economic performance during prior period ($ECON_{t-1}$). Univariate statistics¹² of $IDIORISK_t$ and $ABTURN_t$ show that stronger economic performance is associated with higher price informativeness.

Panel C of Table 1 reports the correlations among economic performance as well as between sustainability performance/disclosure and control variables. Correlations between

¹¹ As a robustness test, we also calculate average abnormal annual turnover using industry mean of $TURN_t$ to adjust firm specific turnover and results are qualitatively similar.

¹² Although the mean value of $ABTURN_t$ for the bottom half (17.6245) is higher than that for the top half (17.1878), the difference is not statistically significant.

sustainability performance are relatively low. Therefore, multi-collinearity should not be a problem.

Insert Table 1 about here

4.2 The Basic Tests

4.2.1 ESG Sustainability performance and Stock Price Informativeness

We use IDIORISK_t and ABTURN_t as proxies for price informativeness (PI_t) in equation (5) and investigate the link between the individual components of ESG sustainability performance and stock price informativeness after controlling for ECON_{t-1} and results are reported in Table 2.

$$\begin{aligned}
 PI_t = & \beta_1 ECON_{t-1} + \beta_2 ENV_{t-1} + \beta_3 SOC_{t-1} + \beta_4 GOV_{t-1} + \beta_5 MSCI_{t-1} + \beta_6 DLOSS_{t-1} \\
 & + \beta_7 ROE_{t-1} + \beta_8 VROE_{t-1} + \beta_9 LEV_{t-1} + \beta_{10} MVBV_{t-1} + \beta_{11} LNMVE_{t-1} + \beta_{12} DD_{t-1} \\
 & + \beta_{13} AGE_{t-1} + \beta_{14} DIVER_{t-1} + \beta_{15} BETA_{t-1} + \beta_{16} MERGER_{t-1} \\
 & + \sum \text{Industry Fixed Effect} + \sum \text{Year Fixed Effect} + \varepsilon
 \end{aligned} \tag{5}$$

where

- PI_t = Price informativeness at time t – IDIORISK_t or ABTURN_t
- ENV_t = Environmental Sustainability performance at time t – sum of all environmental sustainability strengths and concerns included in the MSCI ESG database;
- SOC_t = Social Sustainability performance at time t – sum of all social sustainability (community, diversity, humanity, employee relationship) strengths and concerns included in the MSCI ESG database;
- GOV_t = Governance Sustainability performance at time t – sum of all governance sustainability strengths and concerns included in the MSCI ESG database;
- MSCI_t = Summary ESG Sustainability performance at time t – Average of ENV_t, SOC_t, and GOV_t.

Definitions of all other variables are provided in the Appendix.

Insert Table 2 about here

In equation (5), we include control variables that are similar to prior studies in this model. These control variables include profitability (ROE_{t-1}), profit volatility ($VROE_{t-1}$), leverage (LEV_{t-1}), market-to-book ratio ($MVBV_{t-1}$), size ($LN MVE_{t-1}$), dividend payer dummy (DD_{t-1}), firm age (AGE_{t-1}), internal diversification ($DIVER_{t-1}$) systematic risk ($BETA_{t-1}$) and merger activities ($MERGER_{t-1}$). In order to address the possible differences in each fiscal year and in each industry, we include industry (based on Fama-French 49 industries) and year fixed effects. ROE_t is calculated as earnings before extraordinary items (Compustat #18) divided by book value of equity (Compustat #60) at the end of the prior fiscal year, $VROE_t$ is the sample variance of annual ROE_t three years prior, LEV_t is the ratio of long-term debt (Compustat #10) to total assets (Compustat#6), $MVBV_t$ is the logarithm of the market-to-book ratio ($(Compustat \#25 \times Compustat\#199) / Compustat\#60$), $LN MVE_t$ is the market value of equity ($Compustat \#25 \times Compustat\#199$), DD_t is a dummy variable, which equals 1 if the company pays dividends during the fiscal year, AGE_t is defined as the logarithm of the number of years since the stock was included in the CRSP database, $DIVER_t$ is a dummy variable, which equals 1 if a firm operates in multiple segments and 0 otherwise, $BETA_t$ is the coefficient calculated using the market model, $MERGER_t$ is a dummy variable that represents merger activities and equals 1 is if Compustat item AFTNT1 has value of ‘AA’, ‘AB’, ‘AR’, ‘AS’, ‘FA’, ‘FB’, ‘FC’, ‘FD’, ‘FE’, ‘FF’ or ‘FW’, and 0 otherwise. Definitions of all other variables are also provided in the Appendix.

The results presented in Table 2 Panel A show that ESG sustainability performance pertaining to the individual dimensions of ESG sustainability is positively associated with price informativeness. The results of models (1) to (3) show that the market also prices sustainability performance associated with individual dimensions of ESG sustainability performance. However, the results of model (4) show that when individual dimensions of sustainability performance are included in the model simultaneously, the effect related to environmental performance disappears, while the effects related to social and governance performance remain significant and the coefficient for governance performance is the largest in magnitude. These results show that governance performance has the largest impact on stock price informativeness. These results are consistent with those of Seretis and Eastman (2018) that investors pay more attention to risks and opportunities relevance to the governance dimension than the environmental and social factors of performance. One possible explanation for these results is that investors may be especially interested in corporate governance issues, as they are directly related to the benefits of shareholders

in the sense that firms that are managed effectively with strong corporate governance measures are sustainable in the long-term. In general, sustainability performance pertaining to ESG improves stock price informativeness and thus the market prices risk related to ESG business sustainability performance in aggregate, as supported by the results in model (5).

Panel B of Table 2 reports the results of ESG sustainability performance on price informativeness when proxied by $ABTURN_t$. Similar to the results in Panel A, the results show that all dimensions of ESG sustainability performance are positively associated with price informativeness, with governance factors having the most significant effect. Overall, ESG sustainability performance induces higher price informativeness proxied by average abnormal annual turnover, whether they are included individually, collectively, or in aggregate.

4.2.2 Sustainability Disclosure and Stock Price Informativeness

In this subsection, we investigate the link between sustainability disclosure and stock price informativeness using equation (6). Note that equation (6) is applied to a reduced sample, as the coverage of sustainability disclosure only starts in 2005.

$$\begin{aligned}
 PI_t = & \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 DLOSS_{t-1} + \beta_5 ROE_{t-1} \\
 & + \beta_6 VROE_{t-1} + \beta_7 LEV_{t-1} + \beta_8 MVBV_{t-1} + \beta_9 LNMVE_{t-1} + \beta_{10} DD_{t-1} \\
 & + \beta_{11} AGE_{t-1} + \beta_{12} DIVER_{t-1} + \beta_{13} BETA_{t-1} + \beta_{14} MERGER_{t-1} \\
 & + \sum \text{Industry Fixed Effect} + \sum \text{Year Fixed Effect} + \varepsilon
 \end{aligned} \tag{6}$$

where $DISC_t$ = logarithm of Bloomberg ESG sustainability disclosure index at year t ;
 Definitions of all other variables are provided in the Appendix.

Results for equation (6) are given in Table 3. Panel A reports results when stock price informativeness is proxied by $IDIORISK_t$. Column (1) provides results for the base model, which are comparable to those for the full sample (column (1) of Table 2 Panel A). Columns (2) – (4) report results related to $ECON$, the ESG sustainability factors of performance and disclosure, and they are also positively associated with price informativeness when included individually in the model. Columns (5) to (8) report results when different combinations of test variables are included. These results show that the ESG sustainability factors of performance and disclosure may contain similar information and the effect of sustainability factors subsumes the effect of sustainability disclosure that is related to stock price informativeness, when proxied by $IDIORISK_t$. In other words, stock price informativeness depends on the disclosure of sustainability performance but

stock price informativeness is mainly driven by sustainability performance, whereas ESG sustainability disclosure is a channel to promote the relationship between sustainability performance and stock price informativeness. Panel B reports results when stock price informativeness is proxied by $ABTURN_t$, and results are similar to those reported in Panel A, except that both sustainability factors of performance and disclosure are positively associated with price informativeness, even when included in the model simultaneously.

Insert Table 3 about here

4.2.3 Effect of Business Sustainability Disclosure on the Relation between ESG Sustainability Performance and Stock Price Informativeness

We also investigate the interactive effects of sustainability factors on stock price informativeness in addition to examining the effect of economic performance, the ESG sustainability factors of performance and disclosure on stock price informativeness individually. Results in the previous subsection show that both the ESG sustainability factors of performance and disclosure are positively associated with stock price informativeness individually. Based on these results, we can only conclude that ESG sustainability performance has a direct effect on stock price informativeness, whereas ESG sustainability disclosure only has an indirect effect. However, one possible extension of these results is that there may be interactive effects between ESG sustainability disclosure and ESG sustainability performance on stock price informativeness, since ESG sustainability performance is not systematically disclosed to investors in mandatory manners. We posit that more disclosure improves the relationship between ESG sustainability performance and stock price informativeness and we address this question using equation (7):

$$\begin{aligned}
 IDIORISK_t = & \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 MSCI_{t-1} \times DISC_{t-1} \\
 & + \beta_5 DLOSS_{t-1} + \beta_6 ROE_{t-1} + \beta_7 VROE_{t-1} + \beta_8 DEBT_{t-1} + \beta_9 LEV_{t-1} \\
 & + \beta_{10} MVBV_{t-1} + \beta_{11} LNMVE_{t-1} + \beta_{12} DD_{t-1} + \beta_{13} AGE_{t-1} + \beta_{14} DIVER_{t-1} \\
 & + \sum \text{Industry Fixed Effect} + \sum \text{Year Fixed Effect} + \varepsilon
 \end{aligned} \tag{7}$$

All other variable definitions are provided in the Appendix.

Results for equation (7) are reported in Column (1) of Table 4 Panel A. To save space, we only report results with respect to $IDIORISK_t$, as results for $ABTURN_t$ are qualitatively similar. Note that we also control for economic performance in our research design, as excluding economic

performance in this research setting may induce bias. The coefficient of the interaction term in model (1) is significantly (at 1% significance) positive, which shows that sustainability disclosure strengthens the relationship between sustainability performance and price informativeness

Insert Table 4 about here

4.2.4 Effect of Economic Performance on the relationship between Sustainability performance and Stock Price Informativeness

In this subsection, we further report results pertaining to the effect of economic performance on the relationship between sustainability performance/disclosure and stock price informativeness. We use equation (8) to test this relationship:

$$\begin{aligned}
 IDIORISK_t = & \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 ECON_{t-1} \times MSCI_{t-1} \\
 & + \beta_5 ECON_{t-1} \times DISC_{t-1} + \beta_6 MSCI_{t-1} \times DISC_{t-1} + \beta_7 ECON_{t-1} \times MSCI_{t-1} \times DISC_{t-1} \\
 & + \beta_8 DLOSS_{t-1} + \beta_9 ROE_{t-1} + \beta_{10} VROE_{t-1} + \beta_{11} DEBT_{t-1} + \beta_{12} LEV_{t-1} + \beta_{13} MVBV_{t-1} \\
 & + \beta_{14} LNMVE_{t-1} + \beta_{15} DD_{t-1} + \beta_{16} AGE_{t-1} + \beta_{17} DIVER_{t-1} \\
 & + \sum \text{Industry Fixed Effects} + \sum \text{Year Fixed Effects} + \varepsilon
 \end{aligned} \tag{8}$$

Results for equation (8) are reported in Column (1) to (3) in Table 4 Panel B. Model (1) shows that the interaction term coefficient (β_4) of $ECON_{t-1}$ and $MSCI_{t-1}$ is negative and significant (at 5% significance level) where coefficients of economic performance and ESG sustainability performance are both positive and significant (at 1% significance level) individually. These results show that although both economic performance and ESG sustainability performance are positively related to stock price informativeness, their interaction reduces the impact of these constructs on stock price informativeness, possibly because they may reflect similar information. Model (2) shows that the relationship between economic performance and sustainability disclosure is similar to the relationship between economic performance and ESG sustainability performance. Although the coefficient for sustainability disclosure is not significant, the similar information between economic performance and ESG sustainability disclosure is still represented by the significantly (at 5% significance level) negative interaction coefficient. Finally, results for Model (3) further confirm that there is similar information in economic performance and ESG sustainability performance, and stronger economic performance weakens (significantly negative coefficient for

the three-way interaction term) the positive relationship between ESG sustainability performance and stock price informativeness reported in section 4.2.1.

We further confirm the effect of economic performance on the relationship between the ESG sustainability factors of performance and disclosure and stock price informativeness using an alternative research design. We investigate this relationship by applying equation (9) to two subsamples of high and low $ECON_{t-1}$:

$$\begin{aligned}
 IDIORISK_t = & \beta_1 MSCI_{t-1} + \beta_2 DISC_{t-1} + \beta_3 MSCI_{t-1} \times DISC_{t-1} + \beta_4 DLOSS_{t-1} \\
 & + \beta_5 ROE_{t-1} + \beta_6 VROE_{t-1} + \beta_7 DEBT_{t-1} + \beta_8 LEV_{t-1} + \beta_9 MVBV_{t-1} \\
 & + \beta_{10} LNMVE_{t-1} + \beta_{11} DD_{t-1} + \beta_{12} AGE_{t-1} + \beta_{13} DIVER_{t-1} \\
 & + \sum \text{Industry Fixed Effect} + \sum \text{Year Fixed Effect} + \varepsilon
 \end{aligned} \tag{9}$$

All other variable definitions are provided in the Appendix.

The results for equation (9) are reported on Table 4 Panel C. The left (right) panel reports the results for the high (low) $ECON_{t-1}$ subsample. Although coefficients for $MSCI_{t-1}$ are significant in both left and right panels for model (1), the coefficient on the right panel is significantly larger than that of the left panel (0.0263 versus 0.0196). This shows that the market is paying less attention to ESG sustainability performance when economic performance is strong. Although the coefficients for $MSCI_{t-1}$ in model (2) in both panels are insignificant, the interaction coefficient is significant only when economic performance is weak, and therefore we can conclude that the ESG sustainability factors of performance and disclosure have minimal effect on stock price informativeness, when the economic performance of the firms is strong. This shows that investors tend to pay more attention to economic performance when it is strong and thus the ESG sustainability factors of performance and disclosure have less impact on stock price informativeness. However, the situation is significantly different when economic performance is weak. The coefficient for the interaction term of Model 2 in the right panel of Table 4 Panel C is significantly positive (0.0143 with 5% significance level), which shows that ESG risks are positively related to stock price informativeness only when disclosure is high and economic performance for the previous year is poor.

Overall, the results in this section confirm our conjecture that economic performance, the ESG sustainability factors of performance and disclosure all have positive associations with stock price informativeness. At the same time, the relationship between sustainability performance and stock price informativeness depends on the disclosure of ESG sustainability information as well

as the economic performance of the firms, which shows that investors not only focus on the quality of disclosed information when making investment decisions, but they also prioritize related information with a keen focus on economic performance information.

5 ADDITIONAL TESTS

In order to further confirm the results presented in the previous sections, we conduct a series of robustness tests. We first conduct tests that control for possible correlated mechanisms that may affect stock price informativeness, to show that there is a direct relation between sustainability performance and stock price informativeness. Second, we use Fama-Macbeth [1973] regressions to substantiate our conclusion and show that the results are not driven by a cross-sectional correlation of standard errors among firms. We also explore the time series pattern of the associations. Third, we confirm our conjecture that both strengths and concerns of ESG sustainability performance are related to stock price informativeness individually, but could be of different magnitudes, by repeating our analyses in section 4 using MSCI ESG provisions strengths and concerns separately as proxies of ESG sustainability performance. Lastly, we address the possible problem of endogeneity in our analyses by running two-stage-least-squares regressions and results show that our conclusions are robust.

5.1 Mechanisms Through Which Business Sustainability Affects Stock Price Informativeness

Results reported in section 4 show that there is an association between economic performance and the ESG sustainability factors of performance and disclosure and stock price informativeness. However, there may not be a direct relation between the constructs and their associations are mainly due to some correlated omitted variables relevant to firm specific characteristics that could possibly be related to stock price informativeness. These factors include future profitability, earnings quality and stock returns. For example, Haw et al. [2012] use cross-country data to explain the extent to which future earnings information is capitalized in current stock returns and show that stock price informativeness is related to future corporate profitability. At the same time, business sustainability performance has also been found to be related to future corporate profitability (Eccles et al. [2014]). Therefore, it would be inappropriate to claim that there is a direct association between business sustainability performance and stock price informativeness without controlling for future profitability. The same argument applies to earnings

quality and stock price informativeness. Prior studies have shown that business sustainability is related to earnings quality (Kim et al, [2012]; Rezaee and Tuo, [2017]) while earnings quality is related to price informativeness (Wild [1992]). Lastly, prior studies have shown that stock returns are also related to private information (e.g. Vega [2006]) and market also prices business sustainability (Cheung [2011]). Therefore, we need to explicitly control for stock returns to demonstrate the robustness of our results.

To address this general problem of omitted correlated variables, we split our sample into subsamples of four quartiles based on future profitability, earnings quality and stock returns, by ranking firms based on average ROA ($FUTROA_t$) of the firms in the coming three years (year $t+1$ to $t+3$), total accruals ($TTLACCL_t$) and annual stock returns ($STKRET_t$) at year t . We then apply regression (5) to the different quartiles. Results are reported in Table 5. Panel A reports the results when we control for future profitability while panel B(C) reports results when we control for earnings quality (stock returns). Coefficients of $ECON_{t-1}$ and $MSCI_{t-1}$ are significantly positive for all quartiles in all panels in Table 6. Although the magnitude of the coefficients may not be similar (coefficients of $ECON_{t-1}$) for the lowest quartiles tend to be smaller than other quartiles, we can still conclude that these factors are moderating variables rather than the omitted correlated variables for the main the relationships between ECON performance and ESG sustainability performance and private information. Most importantly, coefficients of $MSCI_{t-1}$ are of similar magnitudes in all regressions for all panels, which support our arguments about the robust relationship between sustainability performance and stock price informativeness.

Insert Table 5 about here

5.2 Time Trend of The Relationship Between Sustainability Performance and Stock Price Informativeness

In previous sections, we have shown that ECON, ESG sustainability performance all have a positive association with stock price informativeness. However, the association could be driven by specific years in the sample. Although we have controlled for year fixed effects in our models, we attempt to further confirm our results using Fama-Macbeth [1973] regressions by applying equation (10) to the sample annually. Also, we explore possible trends in the relationship between sustainability performance and stock price informativeness over time.

$$\begin{aligned}
IDIORISK_t = & \beta_0 + \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 DLOSS_{t-1} \\
& + \beta_5 ROE_{t-1} + \beta_6 VROE_{t-1} + \beta_7 LEV_{t-1} + \beta_8 MVBV_{t-1} + \beta_9 LNMVE \\
& + \beta_{10} DD_{t-1} + \beta_{11} AGE_{t-1} + \beta_{12} DIVER_{t-1} + \beta_{13} BETA_{t-1} + \beta_{14} MERGER_{t-1} + \varepsilon
\end{aligned} \tag{10}$$

All other variable definitions are provided in the Appendix.

The Fama-Macbeth regression (10) results are reported in Panel A of Table 6 and these results confirm our findings in section 4. Models (1) to (3) show that economic performance, and the ESG sustainability factors of performance and disclosure¹³ are all significantly and positively related to stock price informativeness. The results in models (4) to (7) also show that economic performance, and the ESG sustainability factors of performance and disclosure are positively associated with stock price informativeness when they are included in the model simultaneously, except when both the ESG sustainability factors of performance and disclosure are included simultaneously. These results also confirm our findings that ESG sustainability performance subsumes disclosure and coefficients for ESG sustainability disclosure become insignificant once measures of ESG sustainability performance are included in the model.

Insert Table 6 about here

Panel B of Table 6 reports the results of annual regressions from 1992 to 2015. First, it should be noted that the number of firms are relatively small each year during the early period, as the number of firms being included in the MSCI ESG database is relatively low in earlier years. Second, we exclude the variable $DISC_{t-1}$ from the model to highlight the time trend of the economic performance and ESG sustainability performance and we only report coefficients of the test variables. The results show that the trends of the importance of economic performance and ESG sustainability performance are substantially different. Economic performance did not appear to be of importance in the early period, probably due to the lower number of firms included in the model, while ESG sustainability performance has always been relatively important, as the sample is constructed for firms with available data in the MSCI ESG database. Overall, the results in this subsection show that our conclusions in previous sections are robust.

¹³ Average T-statistics for the coefficient of $DISC_{t-1}$ is 1.61, which is significant at 10% level (one-tailed).

5.3 Testing Sustainability Strengths and Concerns Separately

Sustainability performance measures in prior sections are calculated by summing the strengths and concerns of different provisions in the MSCI ESG database. However, strengths and concerns could be reflecting private information in a different manner, and results could be driven by strengths or concerns separately. To address these possible problems, we estimate regression (6) with ESG sustainability strengths and concerns included in the model separately, and we report the results in Table 7. Table 7 Panel A reports the results with idiosyncratic volatility as a dependent variable when only strengths are included and results for concerns are reported in Panel B.

Insert Table 7 about here

The results in both panels A and B show that both strengths and concerns of ESG sustainability performance induce higher price informativeness, except for the environmental strengths in model 4 of Panel A. These results, however, are logical and justifiable. For example, stock price informativeness is related to governance strengths and concerns, since these attributes directly affect the benefit on primary stakeholders like shareholders and they are likely to perform trading activities when they receive information. Social strengths and concerns should also induce stock price informativeness, although they should be of lower magnitude when compared to governance sustainability information, since social sustainability information is readily observable, and traders may still perform trading activities when they receive information related to social strengths and concerns. However, since the beneficial party related to environmental sustainability is basically the environment, strengths related to environmental sustainability may not induce as much stock price informativeness. Environmentalists, on the other hand, may condemn firms with environmental concerns, and these negative reactions may have more effect on stock price informativeness.

5.4 Endogeneity Tests

Another research issue for the analyses in this study is the problem of endogeneity. Although we have used a lead-lag model as our research methodology to address this issue, it is also necessary to address this issue statistically. We have conducted two-stage-least-square

analyses to control for possible endogeneity by calculating the expected level of economic performance, and the ESG sustainability factors of performance and disclosure in the first stage regressions.

In Table 8, we report the results of our two-stage-least-square analyses. For the first stage regressions (Columns 1, 3 and 5), we include market return (MKTRET) and market return standard deviation (MKTSTD) as instrumental variables¹⁴. Results for the second stage regressions with respect to test variables $ECON_{t-1}$, $MSCI_{t-1}$ and $DISC_{t-1}$ are reported in columns 2, 4 and 6 respectively. Coefficients for the test variables in these columns are all significantly positive in the second stage. In other words, both economic performance and ESG sustainability performance as well as sustainability disclosure are all positively related to stock price informativeness, even after controlling for possible endogeneity between the dependent and independent variables. These results show that conclusions in earlier sections are robust. In summary, additional tests in this section substantiate conclusions in prior sections that both ECON performance and ESG sustainability performance/disclosure are positively related to stock price informativeness, although the magnitudes of association could be different.

Insert Table 8 about here

6 CONCLUSION

Investors, in general, consider the ESG sustainability factors of performance and disclosure when making investment decisions and thus these factors are likely to be linked to stock price informativeness. Despite the global practices of sustainability reporting and increasing attention paid to business sustainability, there is still limited research on the impact of ESG sustainability performance on stock price informativeness. This study examines whether ESG sustainability factors induce more stock price informativeness by investigating their impact on idiosyncratic volatilities and abnormal average annual turnovers. We find that ESG sustainability performance is associated with greater stock price informativeness, after controlling for economic performance. Although the magnitudes of effects of ESG sustainability performance on stock price informativeness is not as strong as economic performance, all individual components of ESG

¹⁴ These variables are selected as instrumental variables because they should be orthogonal to price informativeness theoretically, since they are related to market risk factor in the market model.

sustainability performance are significantly and positively related to stock price informativeness, suggesting that the stock market prices ESG sustainability performance. In addition, this study also investigates whether voluntary ESG sustainability disclosure is associated with stock price informativeness, as sustainability information is not systematically released to investors. The results show that higher ESG sustainability disclosure is associated with higher stock price informativeness and it also strengthens the relationship between ESG sustainability performance and stock price informativeness. Finally, we investigate the impact of economic performance on the relationship between ESG sustainability performance and stock price informativeness and find that the relationship is stronger when economic performance is weaker.

The findings of this study provide policy and research implications. Economic performance is the key driver of stock price informativeness and currently there are regulations and standards with respect to the disclosure of financial information, as supported by the recent SEC initiatives in modernizing corporate financial disclosures (SEC, 2016). The disclosure of ESG sustainability performance, however, is less structural, even though several global organizations are trying to standardize the disclosure of ESG sustainability information across firms in recent years (Waddock, 2008; Schooley and English, 2015; Rezaee, 2016). Our results pertaining to the positive association between the ESG sustainability factors of performance and disclosure and stock price informativeness suggest that the disclosure of non-financial ESG dimensions of sustainability should be standardized, regulated and integrated into corporate reporting.

Conceptually, it is also important to highlight that the results in this study should be interpreted with care. There are at least two limitations for this study. First, we have only tried to control for four dimensions of business sustainability performance with economic performance being the primary one, while there could be other important firm-specific and industry-specific sustainability performance (e.g., ethics) that could be relevant but not included in our analyses. Including additional sustainability performance dimensions may affect the relationship between the ESG sustainability factors of performance and disclosure and stock price informativeness. Second, there could be different definitions of ESG sustainability performance and this study only measures ESG sustainability performance in terms of the strengths and concerns of sustainability provisions included in the MSCI ESG database. Including other related sustainability performance measures that are not included in this database may affect our conclusion. For example, common corporate governance factors like board composition, independence, and their activities are not

considered when defining corporate governance sustainability by the MSCI ESG database. Once these corporate governance measures are included, the impact of governance sustainability factors on stock price informativeness may change. Unfortunately, it seems impossible to incorporate all kinds of sustainability performance measures into our analysis, unless there are regulations regarding all types of standardized and systematic disclosures of sustainability information.

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Appendix
Definitions of Variables
Exploratory Principal Component Analysis

<i>TOBINSQ_t</i>	Tobin's Q
<i>ROE_t</i>	Return on equity;
<i>SALES_t</i>	Sales scaled by total assets
<i>SALESGR_t</i>	Sales growth scaled by total assets
<i>MVBV_t</i>	Market to Book Value of Equity
<i>RD_t</i>	Research and development expenses scaled by total assets
<i>AD_t</i>	Advertising expenses scaled by total assets
<i>DIVIDOMS_t</i>	Dummy variable that represents omission of dividend: 1 if dividend payment is zero; 0 otherwise;

Price Informativeness

<i>IDIORISK_t</i>	Annual logistic transformed relative idiosyncratic volatility estimated from the market model;
<i>ABTURN_t</i>	Abnormal Turnover estimated as the difference between firm's average monthly dollar turnover during fiscal year t and average dollar turnover of firms in the same industry (with the same two digit SIC codes);

Sustainability Performance Variables

<i>GR_t</i>	Economic Performance - Growth Factor
<i>OP_t</i>	Economic Performance - Operation Factor
<i>RES_t</i>	Economic Performance - Research Factor
<i>ECON_t</i>	Summary Economic Performance – Average of <i>GR_t</i> , <i>OP_t</i> , and <i>RES_t</i> .
<i>ENV_t</i>	Environmental dimension of Sustainability Performance: Number of Environmental strengths plus number of Environmental concerns;
<i>SOC_t</i>	Social dimension of Sustainability Performance: Number of Social strengths plus number of Social concerns;
<i>GOV_t</i>	Governance dimension of Sustainability Performance: Number of Governance strengths plus number of Governance concerns;
<i>MSCI_t</i>	Summary ESG Sustainability Performance: Number of strengths plus number of concerns in the MSCI database;
<i>ENVSTR_t</i>	Number of Environmental strengths;
<i>SOCSTR_t</i>	Number of Social strengths under community, diversity, humanity, employee relationship;
<i>GOVSTR_t</i>	Number of Governance strengths;
<i>MSCISTR_t</i>	Number of strengths MSCI database under community, diversity, humanity, employee relationship, environmental and corporate governance;
<i>ENVCON_t</i>	Number of Environmental concerns;
<i>SOCCON_t</i>	Number of Social concerns under community, diversity, humanity, employee relationship;
<i>GOVCON_t</i>	Number of Governance concerns;
<i>MSCICON_t</i>	Number of concerns MSCI database under community, diversity, humanity, employee relationship, environmental and corporate governance;
<i>DISC_t</i>	Natural logarithm of Bloomberg ESG sustainability disclosure index

Control Variables

<i>DLOSS_t</i>	Annual Loss variable that equals 1 when a firm reports negative income at year t, and 0 otherwise
<i>ROE_t</i>	Return on equity calculated as earnings before extraordinary items (COMPUSTAT #18) divided by book value of equity (COMPUSTAT #60) by the end of prior year
<i>VROE_t</i>	Sample variance of annual ROE over the last 3 years
<i>DEBT_t</i>	The ratio of long-term debt (COMPUSTAT #10) to total assets (COMPUSTAT #6)
<i>MVBV_t</i>	Log of the market-to-book ratio (COMPUSTAT #25 × COMPUSTAT #199) / (COMPUSTAT #60)
<i>LN MVE_t</i>	Annual Market capitalization (COMPUSTAT #25 × COMPUSTAT #199)
<i>BETA_t</i>	Annual dividend dummy, which equals 1 if the firms pays dividends, and 0 otherwise (COMPUSTAT #201 > 0)
<i>AGE_t</i>	Log age defined as the number of years since the stock was included in the CRSP database
<i>DD_t</i>	Annual dummy variable that equals 1 when a firm operates in multiple segments, and 0 otherwise
<i>BETA_t</i>	Beta calculated using market model for the fiscal year;
<i>MERGER_t</i>	Dummy variable which equals 1 if Compustat item AFTNT1= 'AA', 'AB', 'AR', 'AS', 'FA', 'FB', 'FC', 'FD', 'FE', 'FF', or 'FW', and 0 otherwise
<i>FUTROA_t</i>	Average ROA for year t+1, t+2 and t+3
<i>TTLACCL_t</i>	Total Accruals at time t
<i>STKRET_t</i>	Fiscal year Annual Stock Return at time t

Table 1
Descriptive Statistics

Panel A: Full Sample

	Mean	P1	Q1	Median	Q3	P99	StdDev	N
IDIORISK_t	1.1269	-0.8380	0.4346	1.0512	1.6812	4.0704	1.0542	18223
ABTURN_t	16.9533	12.4093	15.6187	16.9285	18.3276	21.0756	1.8995	15986
ECON_{t-1}	0.0484	-0.8105	-0.4091	-0.0005	0.3863	1.7326	0.5744	18223
GR_{t-1}	0.1578	-0.7188	-0.3958	-0.1326	0.3525	3.7730	0.9066	18223
OP_{t-1}	0.0332	-1.4793	-0.5421	-0.1221	0.4092	2.8257	0.8378	18223
RES_{t-1}	-0.0462	-0.9504	-0.9504	-0.8567	0.9390	1.7743	0.9940	18223
MSCI_{t-1}	2.9279	0	1	2	4	15	2.9696	18223
SOC_{t-1}	0.4492	0	0	0	0	5	1.0363	18223
GOV_{t-1}	1.9708	0	1	2	2	10	2.0142	18223
ENV_{t-1}	0.5080	0	0	0	1	2	0.6492	18223
DISC_{t-1}	2.7342	2.2943	2.4121	2.5820	2.8539	4.0066	0.4305	6632
MSCISTR_{t-1}	1.3919	0	0	1	2	11	2.2073	18223
SOCSTR_{t-1}	0.2293	0	0	0	0	3	0.6318	18223
GOVSTR_{t-1}	1.0220	0	0	0	1	8	1.7195	18223
ENVSTR_{t-1}	0.1406	0	0	0	0	1	0.3657	18223
MSCICON_{t-1}	1.5360	0	1	1	2	7	1.4811	18223
SOCCON_{t-1}	0.2199	0	0	0	0	3	0.6515	18223
GOVCON_{t-1}	0.9487	0	0	1	2	4	0.9447	18223
ENVCON_{t-1}	0.3673	0	0	0	1	2	0.5572	18223
DLOSS_{t-1}	0.1756	0	0	0	0	1	0.3805	18223
ROE_{t-1}	0.0644	-1.2860	0.0374	0.1058	0.1706	0.5658	0.2899	18223
VROE_{t-1}	0.1596	0.0000	0.0006	0.0027	0.0147	4.9100	1.0040	18223
LEV_{t-1}	0.2041	0.0000	0.0239	0.1803	0.3244	0.7207	0.1844	18223
MVBV_{t-1}	3.2341	0.5908	1.5313	2.3058	3.7128	16.4729	3.0089	18223
LNMVE_{t-1}	7.4001	4.4787	6.2613	7.2533	8.3517	11.2714	1.5217	18223
DD_{t-1}	0.5563	0	0	1	1	1	0.4968	18223
AGE_{t-1}	22.3638	1.3333	8.5833	16.4167	31.5833	81.6667	18.6907	18223
DIVER_{t-1}	0.5618	0	0	1	1	1	0.4962	18223
MERGER_{t-1}	0.2066	0	0	0	0	1	0.4049	18223
MK_RET_{t-1}	1.1860	0.2405	0.8471	1.1315	1.4729	2.5679	0.4980	18223
STK_RET_{t-1}	0.1850	-0.7047	-0.1053	0.1272	0.3779	1.9799	0.5133	18223

Panel B: Subsample based on $ECON_{t-1}$

Panel B1: High $ECON_{t-1}$

	Mean	P1	Q1	Median	Q3	P99	StdDev	N
IDIORISK_t	1.2890	-0.6418	0.6801	1.2353	1.8088	3.7304	0.9270	6074
ABTURN_t	2.1374	-2.0378	1.4183	2.2619	3.0522	4.6121	1.3256	5280
ECON_{t-1}	0.6964	0.2469	0.3863	0.5685	0.8883	1.9404	0.4110	6074
DISC_{t-1}	2.6285	2.2943	2.4121	2.5502	2.6467	3.8954	0.3539	2211
GR_{t-1}	0.8151	-0.6262	-0.0627	0.4401	1.3584	4.6435	1.2182	6074
OP_{t-1}	0.5497	-1.6919	-0.1038	0.3833	1.0716	3.2355	1.0237	6074
RES_{t-1}	0.7244	-0.9504	0.9178	0.9247	1.1286	1.8506	0.7925	6074
MSCI_{t-1}	2.4078	0	1	2	3	10	2.0739	6074
SOC_{t-1}	1.7351	0	1	1	2	8	1.5791	6074
GOV_{t-1}	0.4908	0	0	0	1	2	0.5919	6074
ENV_{t-1}	0.1819	0	0	0	0	3	0.5701	6074

Panel B2: Medium $ECON_{t-1}$

	Mean	P1	Q1	Median	Q3	P99	StdDev	N
IDIORISK_t	1.1377	-0.8259	0.4597	1.0466	1.6750	4.0296	1.0291	6075
ABTURN_t	1.8287	-2.2237	1.1999	1.9748	2.6585	4.2818	1.2856	5285
ECON_{t-1}	-0.0067	-0.2674	-0.1339	-0.0005	0.1222	0.2361	0.1477	6075
DISC_{t-1}	2.7308	2.2943	2.4121	2.5587	2.8647	3.9990	0.4247	2211
GR_{t-1}	-0.0361	-0.7132	-0.4076	-0.1413	0.2365	1.3902	0.4800	6075
OP_{t-1}	-0.0377	-1.4279	-0.5125	-0.1221	0.4037	1.7197	0.6673	6075
RES_{t-1}	0.0556	-0.9504	-0.9486	-0.4743	0.9527	1.5174	0.9708	6075
MSCI_{t-1}	2.9473	0	1	2	4	16	3.0349	6075
SOC_{t-1}	1.9924	0	1	2	2	10	2.0471	6075
GOV_{t-1}	0.5279	0	0	0	1	3	0.6741	6075
ENV_{t-1}	0.4270	0	0	0	0	5	1.0156	6075

Panel B3: Low $ECON_{t-1}$

	Mean	P1	Q1	Median	Q3	P99	StdDev	N
IDIORISK_t	0.9539	-0.9690	0.1910	0.8170	1.5011	4.7570	1.1661	6074
ABTURN_t	1.7485	-2.2799	1.1010	1.9283	2.5785	4.1940	1.2896	5266
ECON_{t-1}	-0.5447	-0.8481	-0.6732	-0.5506	-0.4091	-0.2785	0.1558	6074
DISC_{t-1}	2.8434	2.2943	2.4717	2.6426	3.1052	4.1134	0.4769	2210
GR_{t-1}	-0.3054	-0.7465	-0.4861	-0.3468	-0.1641	0.4483	0.2596	6074
OP_{t-1}	-0.4125	-1.2702	-0.7007	-0.4673	-0.1368	0.4619	0.3771	6074
RES_{t-1}	-0.9188	-0.9504	-0.9504	-0.9504	-0.9383	-0.6113	0.1675	6074
MSCI_{t-1}	3.4287	0	1	2	4	17	3.5250	6074
SOC_{t-1}	2.1847	0	1	2	3	11	2.3210	6074
GOV_{t-1}	0.5053	0	0	0	1	3	0.6776	6074
ENV_{t-1}	0.7387	0	0	0	1	6	1.3076	6074

Panel C: Pearson (Spearman) Correlation Above (Below) diagonal

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)IDIORISK _t	N/A	0.14***	-0.13***	0.07***	-0.07***	0.03***	-0.06***	0.06***	-0.19***	-0.09***	-0.08***	-0.14***	0.01	-0.22***	-0.01*	-0.17***
(2)ECON _{t-1}	0.19***	N/A	-0.13***	0.01	0.06***	0.15***	-0.3***	0.65***	-0.06***	-0.62***	-0.3***	-0.26***	0.07***	0.15***	0.23***	-0.21***
(3)MSCI _{t-1}	-0.13***	-0.09***	N/A	-0.08***	0.1***	-0.03***	0.07***	0.01	0.53***	0.2***	0.41***	0.16***	0	-0.09***	-0.05***	0.67***
(4)DLOSS _{t-1}	0.08***	0.01	-0.05***	N/A	-0.64***	0.13***	0.02***	0.03***	-0.28***	-0.25***	-0.17***	-0.11***	-0.03***	0.24***	-0.09***	-0.17***
(5)ROE _{t-1}	-0.05***	0.22***	0.11***	-0.66***	N/A	-0.22***	-0.04***	0	0.31***	0.22***	0.16***	0.1***	0.02***	-0.19***	0.11***	0.18***
(6)VROE _{t-1}	0.07***	0.24***	0.02**	0.42***	-0.2***	N/A	0.06***	0.23***	-0.09***	-0.09***	-0.08***	-0.06***	-0.01	0.08***	0.04***	-0.06***
(7)LEV _{t-1}	-0.07***	-0.35***	0.07***	-0.01	-0.01**	0	N/A	-0.03***	0.12***	0.22***	0.12***	0.12***	0.03***	-0.08***	-0.05***	0.08***
(8)MVBV _{t-1}	0.09***	0.57***	0.02**	-0.08***	0.43***	0.12***	-0.13***	N/A	0.22***	-0.08***	-0.06***	-0.16***	-0.02**	0.03***	0.24***	-0.03***
(9)LNMVE _{t-1}	-0.19***	-0.11***	0.39***	-0.29***	0.39***	-0.22***	0.2***	0.3***	N/A	0.33***	0.41***	0.19***	0.06***	-0.17***	0.09***	0.66***
(10)DD _{t-1}	-0.13***	-0.68***	0.14***	-0.25***	0.25***	-0.28***	0.26***	-0.07***	0.33***	N/A	0.44***	0.25***	-0.06***	-0.25***	-0.05***	0.3***
(11)AGE _{t-1}	-0.14***	-0.32***	0.24***	-0.19***	0.19***	-0.24***	0.16***	-0.07***	0.36***	0.45***	N/A	0.31***	-0.01*	-0.21***	-0.04***	0.45***
(12)DIVER _{t-1}	-0.15***	-0.25***	0.12***	-0.11***	0.07**	-0.12***	0.17***	-0.15***	0.19***	0.25***	0.32***	N/A	0.08***	-0.08***	-0.03***	0.21***
(13)MERGER _{t-1}	0.01	0.09***	0	-0.03***	0	-0.03***	0.05***	0.01**	0.06***	-0.06***	-0.02***	0.08***	N/A	-0.01	-0.01*	-0.01***
(14)MK_RET _{t-1}	-0.2***	0.16***	-0.04***	0.22***	-0.2***	0.28***	-0.12***	0	-0.19***	-0.25***	-0.19***	-0.07***	-0.01	N/A	0.06***	-0.19***
(15)STK_RET _{t-1}	-0.02**	0.15***	-0.06***	-0.16***	0.18***	-0.04***	-0.02***	0.32***	0.16***	0.02***	0	0.01	0	0.02**	N/A	-0.02***
(16)DISC _{t-1}	-0.23***	-0.23***	0.49	-0.2	0.24***	-0.16***	0.15***	0.04***	0.66***	0.3***	0.38***	0.2***	0***	-0.18***	0.01***	N/A

N=18223 for all columns and rows except N= 6623 for Column and Row (16).-Refer to Appendix for variable definitions. ***, **, * indicate significance at a p-value of less than the 1% level, 5% level, and 10% level, respectively.

Table 2

Effect of ESG Sustainability performance on Price Informativeness

$$PI_t = \beta_1 ECON_{t-1} + \beta_2 ENV_{t-1} + \beta_3 SOC_{t-1} + \beta_4 GOV_{t-1} + \beta_5 MSCI_{t-1} + \beta_6 DLOSS_{t-1} + \beta_7 ROE_{t-1} + \beta_8 VROE_{t-1} + \beta_9 LEV_{t-1} + \beta_{10} MVBV_{t-1} + \beta_{11} LNMVE + \beta_{12} DD_{t-1} + \beta_{13} AGE_{t-1} + \beta_{14} DIVER_{t-1} + \beta_{15} BETA_{t-1} + \beta_{16} MERGER_{t-1} + \sum \text{Industry Dummies} + \sum \text{Year Dummies} + \varepsilon$$

Panel A: The impact of MSCI_{t-1} on stock price informativeness (PI_t= IDIORISK_t) (N=18223)

Variable	(1)	(2)	(3)	(4)	(5)
ECON _{t-1}	0.2996*** (12.0)	0.3009*** (12.1)	0.3029*** (12.1)	0.3031*** (12.2)	0.3021*** (12.1)
ENV _{t-1}	0.0366*** (5.60)			0.0076 (1.09)	
SOC _{t-1}		0.0380*** (12.3)		0.0331*** (9.91)	
GOV _{t-1}			0.0739*** (8.01)	0.0509*** (5.38)	
MSCI _{t-1}					0.0295*** (13.0)
DLOSS _{t-1}	0.1599*** (8.73)	0.1499*** (8.21)	0.1589*** (8.69)	0.1474*** (8.08)	0.1478*** (8.09)
ROE _{t-1}	-0.1759*** (-7.0)	-0.1709*** (-6.8)	-0.1765*** (-7.0)	-0.1699*** (-6.8)	-0.1696*** (-6.8)
VROE _{t-1}	0.0205*** (3.77)	0.0183*** (3.39)	0.0208*** (3.84)	0.0184*** (3.40)	0.0184*** (3.40)
LEV _{t-1}	-0.0128 (-0.37)	0.0014 (0.04)	0.0021 (0.06)	0.0034 (0.10)	-0.0040 (-0.12)
MVBV _{t-1}	-0.0256*** (-7.3)	-0.0243*** (-6.9)	-0.0260*** (-7.4)	-0.0241*** (-6.9)	-0.0240*** (-6.8)
LNMVE _{t-1}	-0.1912*** (-41)	-0.2076*** (-43)	-0.1931*** (-42)	-0.2139*** (-43)	-0.2138*** (-43)
DD _{t-1}	0.0220 (1.06)	0.0205 (0.99)	0.0266 (1.28)	0.0240 (1.16)	0.0229 (1.10)
AGE _{t-1}	-0.0034*** (-8.8)	-0.0036*** (-9.5)	-0.0030*** (-8.1)	-0.0037*** (-9.6)	-0.0038*** (-10)
DIVER _{t-1}	-0.0858*** (-7.3)	-0.0819*** (-7.0)	-0.0884*** (-7.5)	-0.0850*** (-7.2)	-0.0849*** (-7.2)
BETA _{t-1}	-0.4673*** (-35)	-0.4662*** (-35)	-0.4665*** (-35)	-0.4643*** (-35)	-0.4643*** (-35)
MERGER _{t-1}	-0.0013 (-0.10)	0.0058 (0.44)	-0.0005 (-0.04)	0.0061 (0.46)	0.0053 (0.41)
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.6169	0.6195	0.6176	0.6202	0.6199
F-Stat	26.14***	26.44***	26.23***	26.46***	26.48***

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel B: The impact of MSCI_{t-1} on stock price informativeness (PI_t=ABTURN_t) (N=15986)

Variable	(1)	(2)	(3)	(4)	(5)
ECON _{t-1}	0.0837** (2.02)	0.0868** (2.09)	0.0908** (2.19)	0.0895** (2.16)	0.0860** (2.07)
ENV _{t-1}	0.0552*** (5.03)			0.0258** (2.19)	
SOC _{t-1}		0.0391*** (7.24)		0.0287*** (4.89)	
GOV _{t-1}			0.1058*** (6.77)	0.0840*** (5.26)	
MSCI _{t-1}					0.0296*** (8.30)
DLOSS _{t-1}	0.1109*** (3.71)	0.1050*** (3.51)	0.1110*** (3.72)	0.1001*** (3.35)	0.1005*** (3.36)
ROE _{t-1}	-0.1141*** (-2.79)	-0.1103*** (-2.71)	-0.1166*** (-2.86)	-0.1094*** (-2.68)	-0.1097*** (-2.69)
VROE _{t-1}	0.0149* (1.89)	0.0134* (1.70)	0.0150* (1.90)	0.0132* (1.68)	0.0132* (1.67)
LEV _{t-1}	0.3973*** (7.26)	0.4177*** (7.65)	0.4202*** (7.69)	0.4182*** (7.65)	0.4089*** (7.49)
MVBV _{t-1}	-0.0056 (-0.99)	-0.0051 (-0.90)	-0.0061 (-1.08)	-0.0044 (-0.78)	-0.0042 (-0.74)
LNMVE _{t-1}	1.0900*** (136.7)	1.0797*** (132.2)	1.0889*** (140.5)	1.0662*** (125.0)	1.0679*** (123.7)
DD _{t-1}	-0.1456*** (-4.27)	-0.1445*** (-4.24)	-0.1359*** (-3.99)	-0.1399*** (-4.11)	-0.1439*** (-4.23)
AGE _{t-1}	-0.0037*** (-5.57)	-0.0036*** (-5.55)	-0.0031*** (-4.93)	-0.0040*** (-6.08)	-0.0041*** (-6.21)
DIVER _{t-1}	-0.0574*** (-2.93)	-0.0558*** (-2.85)	-0.0625*** (-3.19)	-0.0610*** (-3.12)	-0.0590*** (-3.02)
BETA _{t-1}	0.1518*** (6.51)	0.1522*** (6.53)	0.1533*** (6.58)	0.1527*** (6.56)	0.1533*** (6.58)
MERGER _{t-1}	-0.0766*** (-3.41)	-0.0726*** (-3.23)	-0.0760*** (-3.39)	-0.0720*** (-3.21)	-0.0721*** (-3.21)
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.6916	0.6921	0.6920	0.6928	0.6925
F-Stat	64.26***	64.43***	64.39***	64.39***	64.53***

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Table 3

Effect of Sustainability Disclosure on Price Informativeness

$$PI_t = \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 DLOSS_{t-1} + \beta_5 ROE_{t-1} + \beta_6 VROE_{t-1} + \beta_7 LEV_{t-1} + \beta_8 MVBV_{t-1} + \beta_9 LNMVE + \beta_{10} DD_{t-1} + \beta_{11} AGE_{t-1} + \beta_{12} DIVER_{t-1} + \beta_{13} BETA_{t-1} + \beta_{14} MERGER_{t-1} + \sum \text{Industry Dummies} + \sum \text{Year Dummies} + \varepsilon$$

Panel A: The impact of ECON_{t-1}, MSCI_{t-1} and DISC_{t-1} on IDIORISK_t (N=6632)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ECON _{t-1}		0.3363*** (8.79)			0.3408*** (8.96)	0.3409*** (8.92)		0.3412*** (8.97)
MSCI _{t-1}			0.0249*** (8.16)		0.0253*** (8.34)		0.0249*** (7.38)	0.0249*** (7.43)
DISC _{t-1}				0.0900*** (3.46)		0.0974*** (3.77)	0.0015 (0.05)	0.0088 (0.31)
DLOSS _{t-1}	0.1505*** (5.51)	0.1680*** (6.17)	0.1367*** (5.02)	0.1464*** (5.36)	0.1542*** (5.69)	0.1638*** (6.02)	0.1367*** (5.02)	0.1541*** (5.68)
ROE _{t-1}	-0.0720* (-2.0)	-0.1900*** (-4.9)	-0.0616* (-1.7)	-0.0697* (-1.9)	-0.1810*** (-4.7)	-0.1891*** (-4.9)	-0.0616* (-1.7)	-0.1811*** (-4.7)
VROE _{t-1}	0.0210*** (2.94)	0.0211*** (2.98)	0.0192*** (2.71)	0.0199*** (2.79)	0.0193*** (2.75)	0.0199*** (2.82)	0.0192*** (2.71)	0.0193*** (2.73)
LEV _{t-1}	-0.0753 (-1.6)	0.0359 (0.72)	-0.0829* (-1.7)	-0.0756 (-1.6)	0.0297 (0.60)	0.0371 (0.75)	-0.0829* (-1.7)	0.0299 (0.60)
MVBV _{t-1}	0.0096*** (3.29)	-0.0279*** (-5.4)	0.0121*** (4.14)	0.0114*** (3.84)	-0.0259*** (-5.0)	-0.0265*** (-5.1)	0.0121*** (4.11)	-0.0258*** (-5.0)
LNMVE _{t-1}	-0.1630*** (-25)	-0.1577*** (-24)	-0.1959*** (-26)	-0.1799*** (-22)	-0.1910*** (-25)	-0.1758*** (-22)	-0.1961*** (-23)	-0.1921*** (-23)
DD _{t-1}	-0.2079*** (-11)	0.0052 (0.17)	-0.2113*** (-11)	-0.2120*** (-11)	0.0047 (0.15)	0.0037 (0.12)	-0.2113*** (-11)	0.0046 (0.15)
AGE _{t-1}	-0.0034*** (-6.3)	-0.0030*** (-5.6)	-0.0044*** (-8.1)	-0.0036*** (-6.7)	-0.0040*** (-7.4)	-0.0032*** (-6.1)	-0.0044*** (-8.1)	-0.0040*** (-7.4)
DIVER _{t-1}	-0.0971*** (-5.5)	-0.1011*** (-5.8)	-0.1024*** (-5.9)	-0.0991*** (-5.6)	-0.1066*** (-6.1)	-0.1033*** (-5.9)	-0.1024*** (-5.9)	-0.1067*** (-6.1)
BETA _{t-1}	-0.4336*** (-18)	-0.4346*** (-18)	-0.4290*** (-18)	-0.4335*** (-18)	-0.4299*** (-18)	-0.4345*** (-18)	-0.4290*** (-18)	-0.4299*** (-18)
MERGER _{t-1}	-0.0157 (-0.78)	-0.0291 (-1.5)	-0.0074 (-0.37)	-0.0117 (-0.58)	-0.0209 (-1.0)	-0.0250 (-1.3)	-0.0074 (-0.37)	-0.0206 (-1.0)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.5969	0.6018	0.6011	0.5976	0.6062	0.6027	0.6011	0.6062
F-Stat	22.70***	23.11***	23.05***	22.71***	23.48***	23.14***	22.99***	23.42***

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel B: The impact of $ECON_{t-1}$, $MSCI_{t-1}$ and $DISC_{t-1}$ on $ABTURN_t$ (N=8501)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ECON_{t-1}$		0.0996* (1.75)			0.1017* (1.79)	0.1128** (1.99)		0.1120** (1.98)
$MSCI_{t-1}$			0.0254*** (6.05)		0.0255*** (6.06)		0.0140*** (3.08)	0.0139*** (3.07)
$DISC_{t-1}$				0.3093*** (8.33)		0.3113*** (8.38)	0.2612*** (6.49)	0.2634*** (6.54)
$DLOSS_{t-1}$	0.1254*** (3.10)	0.1304*** (3.21)	0.1087*** (2.69)	0.1117*** (2.77)	0.1138*** (2.81)	0.1173*** (2.90)	0.1047*** (2.59)	0.1102*** (2.73)
ROE_{t-1}	-0.0507 (-0.88)	-0.0854 (-1.41)	-0.0446 (-0.78)	-0.0457 (-0.80)	-0.0800 (-1.32)	-0.0850 (-1.41)	-0.0432 (-0.76)	-0.0821 (-1.36)
$VROE_{t-1}$	0.0214** (2.31)	0.0216** (2.33)	0.0198** (2.14)	0.0187** (2.03)	0.0200** (2.16)	0.0189** (2.04)	0.0182** (1.98)	0.0184** (2.00)
LEV_{t-1}	0.3601*** (5.12)	0.3943*** (5.40)	0.3521*** (5.02)	0.3549*** (5.07)	0.3871*** (5.32)	0.3937*** (5.42)	0.3513*** (5.02)	0.3898*** (5.37)
$MVBV_{t-1}$	-0.0010 (-0.24)	-0.0118 (-1.60)	0.0016 (0.40)	0.0043 (1.06)	-0.0094 (-1.28)	-0.0079 (-1.08)	0.0049 (1.20)	-0.0072 (-0.98)
$LN MVE_{t-1}$	1.1097*** (116.9)	1.1112*** (116.5)	1.0736*** (95.86)	1.0520*** (89.76)	1.0751*** (95.73)	1.0534*** (89.74)	1.0411*** (85.05)	1.0425*** (85.04)
DD_{t-1}	-0.1484*** (-5.19)	-0.0854* (-1.86)	-0.1516*** (-5.31)	-0.1639*** (-5.74)	-0.0872* (-1.90)	-0.0926** (-2.02)	-0.1632*** (-5.72)	-0.0924** (-2.02)
AGE_{t-1}	-0.0033*** (-4.20)	-0.0031*** (-4.03)	-0.0044*** (-5.49)	-0.0042*** (-5.35)	-0.0042*** (-5.32)	-0.0040*** (-5.17)	-0.0046*** (-5.84)	-0.0045*** (-5.66)
$DIVER_{t-1}$	-0.0789*** (-3.07)	-0.0794*** (-3.08)	-0.0842*** (-3.27)	-0.0849*** (-3.31)	-0.0847*** (-3.29)	-0.0855*** (-3.33)	-0.0869*** (-3.39)	-0.0875*** (-3.41)
$BETA_{t-1}$	0.2969*** (8.53)	0.2956*** (8.49)	0.3000*** (8.63)	0.2991*** (8.63)	0.2987*** (8.60)	0.2978*** (8.59)	0.3005*** (8.67)	0.2991*** (8.63)
$MERGER_{t-1}$	-0.0752** (-2.57)	-0.0795*** (-2.71)	-0.0668** (-2.28)	-0.0589** (-2.02)	-0.0711** (-2.42)	-0.0636** (-2.17)	-0.0568* (-1.94)	-0.0615** (-2.10)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.7341	0.7342	0.7353	0.7364	0.7354	0.7365	0.7367	0.7368
F-Stat	49.75***	49.66***	49.94***	50.21***	49.85***	50.13***	50.18***	50.09***

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Table 4
Impact of Economic Performance on the
relationship between ESG factors of performance and disclosure
and stock price informativeness

Panel A: Interaction between MSCI_{t-1} and DISC_{t-1} on Stock Price Informativeness

$$\begin{aligned}
 IDIORISK_t = & \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 MSCI_{t-1} \times DISC_{t-1} \\
 & + \beta_5 DLOSS_{t-1} + \beta_6 ROE_{t-1} + \beta_7 VROE_{t-1} + \beta_8 DEBT_{t-1} + \beta_9 LEV_{t-1} + \beta_{10} MVBV \\
 & + \beta_{11} LNMVE_{t-1} + \beta_{12} DD_{t-1} + \beta_{13} AGE_{t-1} + \beta_{14} DIVER_{t-1} + \beta_{15} BETA_{t-1} \\
 & + \beta_{16} MERGER_{t-1} + \sum \text{Industry Fixed Effect} + \sum \text{Year Fixed Effect} + \varepsilon
 \end{aligned}$$

Variables	(1)
ECON _{t-1}	0.3424*** (9.00)
MSCI _{t-1}	-0.0186 (-1.2)
DISC _{t-1}	-0.0501 (-1.4)
MSCI _{t-1} × DISC _{t-1}	0.0128*** (2.75)
DLOSS_{t-1}	0.1547*** (5.71)
ROE_{t-1}	-0.1837*** (-4.7)
VROE_{t-1}	0.0195*** (2.76)
LEV_{t-1}	0.0282 (0.57)
MVBV_{t-1}	-0.0264*** (-5.1)
LNMVE_{t-1}	-0.1874*** ((-22)
DD_{t-1}	0.0056 (0.18)
AGE_{t-1}	-0.0041*** (-7.6)
DIVER_{t-1}	-0.1065*** (-6.1)
BETA_{t-1}	-0.4273*** ((-18)
MERGER_{t-1}	-0.0213 (-1.1)
Industry Dummies	Yes
Year Dummies	Yes
Adj. R ²	0.6067
F-Stat	23.40***
N	6632

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel B: Interaction between ECON_{t-1}, MSCI_{t-1}, DISC_{t-1} on Stock Price Informativeness

$$\begin{aligned}
 IDIORISK_t = & \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 ECON_{t-1} \times MSCI_{t-1} + \beta_5 ECON_{t-1} \times DISC_{t-1} \\
 & + \beta_6 MSCI_{t-1} \times DISC_{t-1} + \beta_7 ECON_{t-1} \times MSCI_{t-1} \times DISC_{t-1} + \beta_8 DLOSS_{t-1} + \beta_9 ROE_{t-1} + \beta_{10} VROE_{t-1} \\
 & + \beta_{11} DEBT_{t-1} + \beta_{12} LEV_{t-1} + \beta_{13} MVBV + \beta_{14} LNMVE_{t-1} + \beta_{15} DD_{t-1} + \beta_{16} AGE_{t-1} \\
 & + \beta_{17} DIVER_{t-1} + \beta_{18} BETA_{t-1} + \beta_{19} MERGER_{t-1} + \sum \text{Industry Dummies} + \sum \text{Year Dummies} + \varepsilon
 \end{aligned}$$

Variables	(1)	(2)	(3)
ECON _{t-1}	0.3741*** (9.30)	0.5782*** (5.34)	0.3642*** (9.25)
MSCI _{t-1}	0.0221*** (6.26)	0.0236*** (6.95)	-0.0105 (-0.64)
DISC _{t-1}	0.0067 (0.23)	0.0021 (0.07)	-0.0387 (-1.1)
MSCI _{t-1} × DISC _{t-1}			0.0096** (1.98)
ECON _{t-1} × MSCI _{t-1}	-0.0128** (-2.5)		
ECON _{t-1} × DISC _{t-1}		-0.0913** (-2.3)	
ECON _{t-1} × MSCI _{t-1} × DISC _{t-1}			-0.0032** (-2.1)
DLOSS _{t-1}	0.1559*** (5.75)	0.1562*** (5.76)	0.1566*** (5.77)
ROE _{t-1}	-0.1724*** (-4.4)	-0.1716*** (-4.4)	-0.1748*** (-4.5)
VROE _{t-1}	0.0194*** (2.76)	0.0192*** (2.73)	0.0195*** (2.77)
LEV _{t-1}	0.0343 (0.69)	0.0343 (0.69)	0.0319 (0.64)
MVBV _{t-1}	-0.0255*** (-5.0)	-0.0256*** (-5.0)	-0.0259*** (-5.0)
LNMVE _{t-1}	-0.1916*** (-23)	-0.1918*** (-23)	-0.1880*** (-22)
DD _{t-1}	0.0051 (0.17)	0.0019 (0.06)	0.0054 (0.18)
AGE _{t-1}	-0.0040*** (-7.5)	-0.0040*** (-7.4)	-0.0041*** (-7.6)
DIVER _{t-1}	-0.1057*** (-6.1)	-0.1062*** (-6.1)	-0.1056*** (-6.1)
BETA _{t-1}	-0.4310*** (-18)	-0.4321*** (-18)	-0.4291*** (-18)
MERGER _{t-1}	-0.0201 (-1.0)	-0.0201 (-1.0)	-0.0204 (-1.0)
Industry Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Adj. R ²	0.6066	0.6066	0.6070
F-Stat	23.40***	23.39***	23.37***
N	6632	6632	6632

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel C: The impact of High versus Low ECON_{t-1} on the relationship between MSCI_{t-1} and DISC_{t-1} on stock price informativeness

$$IDIORISK_t = \beta_1 MSCI_{t-1} + \beta_2 DISC_{t-1} + \beta_3 MSCI_{t-1} \times DISC_{t-1} + \beta_4 DLOSS_{t-1} + \beta_5 ROE_{t-1} + \beta_6 VROE_{t-1} + \beta_7 DEBT_{t-1} + \beta_8 LEV_{t-1} + \beta_9 MVBV + \beta_{10} LNMVE_{t-1} + \beta_{11} DD_{t-1} + \beta_{12} AGE_{t-1} + \beta_{13} DIVER_{t-1} + \beta_{13} BETA_{t-1} + \beta_{13} MERGER_{t-1} + \sum \text{Industry Dummies} + \sum \text{Year Dummies} + \varepsilon$$

Parameter	High ECON _{t-1}		Low ECON _{t-1}	
	(1)	(2)	(1)	(2)
MSCI _{t-1}	0.0196*** (3.51)	0.0265 (0.97)	0.0263*** (5.92)	-0.0236 (-1.09)
DISC _{t-1}	-0.0237 (-0.54)	-0.0147 (-0.26)	0.0229 (0.59)	-0.0441 (-0.91)
MSCI _{t-1} × DISC _{t-1}		-0.0021 (-0.26)		0.0143** (2.35)
DLOSS _{t-1}	0.1273*** (3.39)	0.1275*** (3.39)	0.1200*** (2.85)	0.1220*** (2.90)
ROE _{t-1}	-0.0453 (-1.03)	-0.0449 (-1.02)	-0.3014*** (-3.63)	-0.3043*** (-3.66)
VROE _{t-1}	0.0080 (0.92)	0.0080 (0.92)	0.0584*** (4.14)	0.0587*** (4.16)
LEV _{t-1}	-0.2916*** (-4.04)	-0.2918*** (-4.04)	0.1193* (1.72)	0.1155* (1.67)
MVBV _{t-1}	0.0144*** (3.96)	0.0145*** (3.96)	-0.0090 (-1.00)	-0.0092 (-1.03)
LNMVE _{t-1}	-0.1987*** (-16.6)	-0.1992*** (-16.4)	-0.1915*** (-15.6)	-0.1846*** (-14.6)
DD _{t-1}	-0.1588*** (-4.85)	-0.1585*** (-4.84)	-0.2093*** (-5.77)	-0.2094*** (-5.78)
AGE _{t-1}	-0.0048*** (-4.92)	-0.0047*** (-4.84)	-0.0042*** (-6.10)	-0.0042*** (-6.18)
DIVER _{t-1}	-0.0895*** (-3.59)	-0.0896*** (-3.59)	-0.1103*** (-4.34)	-0.1119*** (-4.40)
BETA _{t-1}	-0.3696*** (-10.5)	-0.3698*** (-10.5)	-0.4911*** (-14.5)	-0.4862*** (-14.3)
MERGER _{t-1}	-0.0122 (-0.44)	-0.0118 (-0.42)	0.0077 (0.26)	0.0098 (0.33)
Industry Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Adj. R ²	0.5802	0.5802	0.6299	0.6306
F-Stat	11.71***	11.68***	14.01***	14.01***
N	3317	3317	3315	3315

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Table 5

The Relationship between ESG factors of performance and disclosure and stock price informativeness after controlling for possible intermediate effects

$$\begin{aligned}
 IDIORISK_t = & \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DLOSS_{t-1} \\
 & + \beta_4 ROE_{t-1} + \beta_5 VROE_{t-1} + \beta_6 LEV_{t-1} + \beta_7 MVBV_{t-1} + \beta_8 LNMVE + \beta_9 DD_{t-1} \\
 & + \beta_{10} AGE_{t-1} + \beta_{11} DIVER_{t-1} + \beta_{12} BETA_{t-1} + \beta_{13} MERGER_{t-1} \\
 & + \sum \text{Industry Dummies} + \sum \text{Year Dummies} + \varepsilon
 \end{aligned}$$

Panel A: Controlling for Future Profitability

Variable	FUTROAQ1	FUTROAQ2	FUTROAQ3	FUTROAQ4
ECON_{t-1}	0.1783*** (3.15)	0.3290*** (5.86)	0.3740*** (5.41)	0.4485*** (7.06)
MSCI_{t-1}	0.0172*** (3.62)	0.0231*** (4.89)	0.0283*** (5.33)	0.0227*** (3.63)
DLOSS_{t-1}	0.1437** (2.05)	0.2102*** (3.87)	0.0449 (0.89)	0.0926*** (2.84)
ROE_{t-1}	-0.0659 (-0.81)	-0.0978 (-1.3)	-0.1505* (-1.8)	-0.2754*** (-5.8)
VROE_{t-1}	-0.0276** (-2.3)	0.0110 (0.65)	0.0503*** (3.00)	0.0194* (1.87)
LEV_{t-1}	-0.1298 (-1.2)	-0.0611 (-0.71)	-0.0873 (-1.0)	0.1025 (1.40)
MVBV_{t-1}	-0.0054 (-0.68)	-0.0145* (-1.7)	-0.0222** (-2.0)	-0.0522*** (-5.8)
LNMVE_{t-1}	-0.1976*** (-19)	-0.1780*** (-15)	-0.1613*** (-13)	-0.1568*** (-12)
DD_{t-1}	-0.0913** (-2.0)	0.0562 (1.19)	0.0873 (1.58)	0.1702*** (3.25)
AGE_{t-1}	-0.0031*** (-3.3)	-0.0045*** (-5.8)	-0.0040*** (-4.5)	-0.0042*** (-4.1)
DIVER_{t-1}	-0.0587** (-2.2)	-0.0794*** (-3.1)	-0.0204 (-0.69)	-0.0721*** (-2.7)
BETA_{t-1}	-0.4843*** (-15)	-0.4002*** (-13)	-0.5863*** (-17)	-0.3773*** (-14)
MERGER_{t-1}	-0.0222 (-0.69)	0.0215 (0.78)	0.0779** (2.40)	0.0274 (0.89)
Industry Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Adj. R²	0.7236	0.7523	0.7348	0.7047
F-Stat	10.69***	10.88***	11.13***	11.78***
N	3533	3534	3534	3533

FUTROAQ1 to FUTROAQ4 are the lowest to highest quartile of the sample ranked based on future average ROA in year t. Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel B: Controlling for Total Accruals

Variable	TTLACCLQ1	TTLACCLQ2	TTLACCLQ3	TTLACCLQ4
ECON_{t-1}	0.1951*** (3.76)	0.3645*** (6.68)	0.3267*** (5.76)	0.2706*** (5.52)
MSCI_{t-1}	0.0273*** (5.27)	0.0235*** (5.51)	0.0342*** (7.38)	0.0187*** (3.59)
DLOSS_{t-1}	0.1172*** (2.68)	0.1810*** (4.46)	0.1685*** (4.34)	0.1126*** (3.56)
ROE_{t-1}	-0.0727 (-1.2)	-0.1948*** (-2.8)	-0.1328** (-2.4)	-0.2131*** (-5.4)
VROE_{t-1}	0.0197* (1.93)	0.0150 (1.24)	0.0167 (1.36)	0.0137 (1.32)
LEV_{t-1}	0.0326 (0.46)	0.1231* (1.68)	-0.1010 (-1.4)	0.0126 (0.18)
MVBV_{t-1}	-0.0083 (-1.1)	-0.0386*** (-4.9)	-0.0294*** (-3.8)	-0.0265*** (-4.1)
LNME_{t-1}	-0.2401*** (-22)	-0.1898*** (-18)	-0.1914*** (-18)	-0.1837*** (-17)
DD_{t-1}	-0.0416 (-0.93)	0.0567 (1.29)	-0.0210 (-0.46)	0.0513 (1.26)
AGE_{t-1}	-0.0029*** (-3.7)	-0.0030*** (-4.1)	-0.0043*** (-5.4)	-0.0054*** (-5.6)
DIVER_{t-1}	-0.0623** (-2.4)	-0.0799*** (-3.3)	-0.0500** (-2.1)	-0.1159*** (-5.0)
BETA_{t-1}	-0.4911*** (-18)	-0.4675*** (-16)	-0.4502*** (-16)	-0.3621*** (-14)
MERGER_{t-1}	0.0185 (0.63)	0.0485* (1.82)	-0.0232 (-0.84)	-0.0046 (-0.18)
Industry Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Adj. R²	0.6753	0.7070	0.6930	0.6474
F-Stat	9.787***	11.19***	10.39***	9.524***
N	4554	4555	4555	4554

TTLACCLQ1 to TTLACCLQ4 are the lowest to highest quartile of the sample ranked based on total accruals in year t. Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel C: Controlling for Stock Return

Variable	STKRETQ1	STKRETQ2	STKRETQ3	STKRETQ4
ECON_{t-1}	0.1316*** (2.65)	0.3185*** (5.77)	0.2773*** (5.32)	0.3279*** (6.78)
MSCI_{t-1}	0.0236*** (4.75)	0.0261*** (5.92)	0.0251*** (5.58)	0.0235*** (4.79)
DLOSS_{t-1}	0.1175*** (3.46)	0.1272*** (3.15)	0.1310*** (3.16)	0.1303*** (3.75)
ROE_{t-1}	-0.0905** (-2.2)	-0.2726*** (-4.4)	-0.1149* (-1.8)	-0.2056*** (-3.9)
VROE_{t-1}	0.0232** (2.31)	0.0077 (0.64)	0.0199 (1.53)	0.0183* (1.88)
LEV_{t-1}	-0.0286 (-0.42)	0.1081 (1.51)	0.0038 (0.05)	0.0712 (1.07)
MVBV_{t-1}	-0.0102 (-1.5)	-0.0283*** (-3.7)	-0.0231*** (-3.2)	-0.0238*** (-3.4)
LN MVE_{t-1}	-0.2355*** (-23)	-0.1820*** (-18)	-0.1870*** (-18)	-0.1852*** (-18)
DD_{t-1}	-0.0427 (-1.0)	0.0120 (0.27)	-0.0430 (-1.0)	0.0895** (2.20)
AGE_{t-1}	-0.0039*** (-5.0)	-0.0025*** (-3.3)	-0.0043*** (-5.6)	-0.0054*** (-6.6)
DIVER_{t-1}	-0.0921*** (-3.9)	-0.1075*** (-4.4)	-0.0683*** (-2.9)	-0.0290 (-1.2)
BETA_{t-1}	-0.4007*** (-15)	-0.5175*** (-17)	-0.5550*** (-19)	-0.3567*** (-14)
MERGER_{t-1}	-0.0014 (-0.05)	-0.0055 (-0.20)	0.0449* (1.66)	0.0075 (0.29)
Industry Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Adj. R²	0.6538	0.6765	0.7155	0.7113
F-Stat	9.833***	10.01***	11.58***	13.45***
N	4556	4556	4556	4555

STKRETQ1 to STKRETQ4 are the lowest to highest quartile of the sample ranked based on stock returns in year t. Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Table 6
Effect of Sustainability factors of factors of performance and disclosure on stock price informativeness - Fama-Macbeth Regressions

$$IDIORISK_t = \beta_0 + \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 DLOSS_{t-1} + \beta_5 ROE_{t-1} + \beta_6 VROE_{t-1} + \beta_7 LEV_{t-1} + \beta_8 MVBV_{t-1} + \beta_9 LNMVE + \beta_{10} DD_{t-1} + \beta_{11} AGE_{t-1} + \beta_{12} DIVER_{t-1} + \beta_{13} BETA_{t-1} + \beta_{14} MERGER_{t-1} + \varepsilon$$

Panel A: Fama-Macbeth Regressions

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	2.8712*** (14.5)	3.0460*** (15.0)	2.7869*** (12.1)	2.9823*** (14.5)	2.7383*** (11.7)	2.9331*** (11.4)	2.8835*** (11.0)
ECON_{t-1}	0.2304** (3.58)			0.2284** (3.57)	0.2207** (3.59)		0.2193** (3.57)
MSCI_{t-1}		0.0196** (2.56)		0.0189** (2.50)		0.0167** (2.02)	0.0161* (1.94)
DISC_{t-1}			0.1073 (1.61)		0.0992 (1.61)	0.0555 (0.59)	0.0495 (0.63)
DLOSS_{t-1}	0.1899** (2.42)	0.1748* (1.97)	0.1853** (2.12)	0.1774** (2.23)	0.1878** (2.37)	0.1777 (2.00)	0.1809 (2.25)
ROE_{t-1}	-0.1405 (-1.8)	-0.0784 (-0.71)	-0.0935 (-0.76)	-0.1275 (-1.8)	-0.1359 (-1.8)	-0.0774 (-0.71)	-0.1226 (-1.7)
VROE_{t-1}	0.0816 (1.11)	0.1292 (0.86)	0.0997 (0.88)	0.0995 (1.00)	0.0780 (1.02)	0.1104 (0.82)	0.0917 (0.97)
LEV_{t-1}	-0.2753 (-0.02)	-0.3741 (-1.2)	-0.3793 (-1.3)	-0.2701 (0.01)	-0.2817 (-0.02)	-0.3755 (-1.2)	-0.2783 (0.01)
MVBV_{t-1}	-0.0115 (-1.7)	0.0143 (1.84)	0.0157 (1.84)	-0.0104 (-1.5)	-0.0082 (-1.5)	0.0153 (1.89)	-0.0083 (-1.5)
LNMVE_{t-1}	-0.1416** (-6.8)	-0.1683* (-7.5)	-0.1647** (-6.8)	-0.1635* (-7.1)	-0.1595** (-6.5)	-0.1722* (-7.1)	-0.1672* (-6.8)
DD_{t-1}	-0.1272 (-0.27)	-0.2663* (-4.5)	-0.2749* (-4.6)	-0.1214 (-0.23)	-0.1334 (-0.29)	-0.2669* (-4.5)	-0.1274 (-0.24)
AGE_{t-1}	-0.0029 (-1.9)	-0.0038** (-2.6)	-0.0035** (-2.3)	-0.0036** (-2.5)	-0.0033** (-2.2)	-0.0039** (-2.6)	-0.0037** (-2.5)
DIVER_{t-1}	-0.1299** (-2.7)	-0.1374** (-2.8)	-0.1351** (-2.8)	-0.1344** (-2.8)	-0.1322** (-2.7)	-0.1380** (-2.8)	-0.1347** (-2.8)
BETA_{t-1}	-0.5864*** (-8.4)	-0.5831** (-8.4)	-0.5812** (-8.3)	-0.5850*** (-8.4)	-0.5834*** (-8.4)	-0.5809** (-8.3)	-0.5826*** (-8.4)
MERGER_{t-1}	-0.0527 (-0.84)	-0.0296 (-0.43)	-0.0275 (-0.41)	-0.0490 (-0.76)	-0.0481 (-0.74)	-0.0259 (-0.39)	-0.0466 (-0.72)
Average Adj. R²	0.3106	0.2939	0.2894	0.3155	0.3120	0.2940	0.3160

There are nine regressions and the average number of observations per regression is 734.8. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel B: Annual regressions

$$IDIORISK_t = \beta_0 + \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DLOSS_{t-1} + \beta_4 ROE_{t-1} + \beta_5 VROE_{t-1} + \beta_6 LEV_{t-1} + \beta_7 MVBV_{t-1} + \beta_8 LNMVE + \beta_9 DD_{t-1} + \beta_{10} AGE_{t-1} + \beta_{11} DIVER_{t-1} + \beta_{12} BETA_{t-1} + \beta_{13} MERGER_{t-1} + \varepsilon$$

Year		ECON _{t-1}	MSCI _{t-1}	Adj. R ²	N
1992	Coef	-0.4197*	0.0473*	0.5138	242
	T-Stat	(-1.68)	(1.74)		
1993	Coef	0.1103	0.0955***	0.3852	252
	T-Stat	(0.42)	(3.52)		
1994	Coef	-0.2406	0.0693***	0.3968	251
	T-Stat	(-0.88)	(2.54)		
1995	Coef	0.3099	0.1827***	0.3616	199
	T-Stat	(0.57)	(3.59)		
1996	Coef	-0.0450	0.0840***	0.4422	218
	T-Stat	(-0.17)	(3.40)		
1997	Coef	0.1653	0.0629***	0.5149	225
	T-Stat	(0.69)	(2.88)		
1998	Coef	-0.1713	0.0353	0.3497	247
	T-Stat	(-0.76)	(1.60)		
1999	Coef	-0.1145	0.0485**	0.5645	233
	T-Stat	(-0.49)	(2.17)		
2000	Coef	0.4016	0.0869***	0.3636	212
	T-Stat	(1.07)	(2.38)		
2001	Coef	-0.0042	-0.0209	0.2343	269
	T-Stat	(-0.01)	(-0.60)		
2002	Coef	0.3883***	0.0144	0.3055	455
	T-Stat	(2.97)	(1.11)		
2003	Coef	0.0260	0.0257***	0.1993	568
	T-Stat	(0.20)	(2.04)		
2004	Coef	0.2210***	0.0213***	0.2518	1292
	T-Stat	(3.35)	(2.64)		
2005	Coef	0.3419***	0.0314***	0.2558	1191
	T-Stat	(4.56)	(3.29)		
2006	Coef	0.4011***	0.0130	0.1989	1215
	T-Stat	(5.42)	(1.58)		
2007	Coef	0.5094***	0.0059	0.3304	1214
	T-Stat	(7.96)	(0.80)		
2008	Coef	0.4465***	0.0186***	0.3070	1299
	T-Stat	(6.72)	(2.54)		
2009	Coef	0.2857***	0.0303***	0.3600	1403
	T-Stat	(3.69)	(3.78)		
2010	Coef	0.6438***	0.0304***	0.4836	1424
	T-Stat	(8.30)	(4.48)		
2011	Coef	0.3426***	0.0503***	0.4254	1426
	T-Stat	(5.01)	(7.83)		
2012	Coef	0.2475***	0.0155*	0.3345	1426
	T-Stat	(3.06)	(1.89)		
2013	Coef	0.4517***	0.0411***	0.3696	1301
	T-Stat	(6.24)	(5.14)		
2014	Coef	0.2995***	0.0451***	0.2905	1294
	T-Stat	(3.82)	(5.53)		
2015	Coef	0.3404***	0.0202	0.4622	367
	T-Stat	(2.31)	(1.43)		

***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Table 7
Effect of ESG Sustainability Strengths and
Concerns on Price Informativeness

Panel A: Strengths only (N=18223)

$$IDIORISK_t = \beta_1 ECON_{t-1} + \beta_2 ENVSTR_{t-1} + \beta_3 SOCSTR_{t-1} + \beta_4 GOVSTR_{t-1} + \beta_5 MSCISTR_{t-1} + \beta_6 DLOSS_{t-1} \\ + \beta_7 ROE_{t-1} + \beta_8 VROE_{t-1} + \beta_9 LEV_{t-1} + \beta_{10} MVBV_{t-1} + \beta_{11} LNMVE + \beta_{12} DD_{t-1} + \beta_{13} AGE_{t-1} \\ + \beta_{14} DIVER_{t-1} + \beta_{15} BETA_{t-1} + \beta_{16} MERGER_{t-1} + \sum \text{Industry Dummies} + \sum \text{Year Dummies} + \varepsilon$$

Variable	(1)	(2)	(3)	(4)	(5)
ECON_{t-1}	0.3007*** (12.0)	0.3044*** (12.2)	0.3021*** (12.1)	0.3054*** (12.3)	0.3055*** (12.3)
ENVSTR_{t-1}	0.0317*** (3.30)			-0.0174* (-1.7)	
SOCSTR_{t-1}		0.0429*** (11.7)		0.0431*** (10.8)	
GOVSTR_{t-1}			0.0729*** (5.03)	0.0444*** (2.96)	
MSCISTR_{t-1}					0.0317*** (11.1)
DLOSS_{t-1}	0.1628*** (8.89)	0.1529*** (8.37)	0.1640*** (8.96)	0.1535*** (8.41)	0.1546*** (8.46)
ROE_{t-1}	-0.1778*** (-7.1)	-0.1742*** (-6.9)	-0.1799*** (-7.1)	-0.1754*** (-7.0)	-0.1752*** (-7.0)
VROE_{t-1}	0.0209*** (3.84)	0.0188*** (3.46)	0.0213*** (3.92)	0.0190*** (3.51)	0.0193*** (3.56)
LEV_{t-1}	-0.0071 (-0.21)	0.0067 (0.20)	0.0059 (0.17)	0.0146 (0.43)	0.0057 (0.17)
MVBV_{t-1}	-0.0261*** (-7.4)	-0.0248*** (-7.1)	-0.0268*** (-7.6)	-0.0252*** (-7.2)	-0.0251*** (-7.1)
LNMVE_{t-1}	-0.1868*** (-40)	-0.2082*** (-42)	-0.1817*** (-41)	-0.2055*** (-41)	-0.2062*** (-42)
DD_{t-1}	0.0220 (1.06)	0.0220 (1.06)	0.0216 (1.04)	0.0218 (1.05)	0.0220 (1.06)
AGE_{t-1}	-0.0030*** (-8.1)	-0.0034*** (-9.1)	-0.0030*** (-8.0)	-0.0034*** (-9.0)	-0.0035*** (-9.2)
DIVER_{t-1}	-0.0852*** (-7.2)	-0.0830*** (-7.1)	-0.0852*** (-7.2)	-0.0830*** (-7.1)	-0.0842*** (-7.2)
BETA_{t-1}	-0.4676*** (-35)	-0.4650*** (-35)	-0.4680*** (-35)	-0.4651*** (-35)	-0.4639*** (-35)
MERGER_{t-1}	-0.0017 (-0.13)	0.0051 (0.39)	-0.0014 (-0.10)	0.0054 (0.41)	0.0040 (0.31)
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Adj. R²	0.6164	0.6192	0.6167	0.6194	0.6189
F-Stat	26.09***	26.40***	26.13***	26.37***	26.37***

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Panel B: Concerns only (N=18223)

$$IDIORISK_t = \beta_1 ECON_{t-1} + \beta_2 ENVCON_{t-1} + \beta_3 SOCCON_{t-1} + \beta_4 GOVCON_{t-1} + \beta_5 MSCICON_{t-1} + \beta_6 DLOSS_{t-1} \\ + \beta_7 ROE_{t-1} + \beta_8 VROE_{t-1} + \beta_9 LEV_{t-1} + \beta_{10} MVBV_{t-1} + \beta_{11} LNMVE + \beta_{12} DD_{t-1} + \beta_{13} AGE_{t-1} \\ + \beta_{14} DIVER_{t-1} + \beta_{15} BETA_{t-1} + \beta_{16} MERGER_{t-1} + \sum \text{Industry Dummies} + \sum \text{Year Dummies} + \varepsilon$$

Variable	(1)	(2)	(3)	(4)	(5)
ECON_{t-1}	0.2976*** (11.9)	0.2972*** (11.9)	0.3000*** (12.0)	0.2969*** (11.9)	0.2961*** (11.9)
ENVCON_{t-1}	0.0526*** (5.20)			0.0432*** (4.20)	
SOCCON_{t-1}		0.0285*** (4.76)		0.0209*** (3.43)	
GOVCON_{t-1}			0.0641*** (5.76)	0.0573*** (5.12)	
MSCICON_{t-1}					0.0328*** (7.75)
DLOSS_{t-1}	0.1601*** (8.74)	0.1608*** (8.78)	0.1596*** (8.72)	0.1545*** (8.44)	0.1557*** (8.50)
ROE_{t-1}	-0.1759*** (-7.0)	-0.1757*** (-7.0)	-0.1756*** (-7.0)	-0.1716*** (-6.8)	-0.1721*** (-6.8)
VROE_{t-1}	0.0205*** (3.79)	0.0206*** (3.79)	0.0207*** (3.81)	0.0199*** (3.67)	0.0200*** (3.68)
LEV_{t-1}	-0.0120 (-0.35)	-0.0075 (-0.22)	-0.0079 (-0.23)	-0.0160 (-0.47)	-0.0145 (-0.42)
MVBV_{t-1}	-0.0258*** (-7.3)	-0.0259*** (-7.3)	-0.0257*** (-7.3)	-0.0248*** (-7.0)	-0.0250*** (-7.1)
LNMVE_{t-1}	-0.1870*** (-42)	-0.1836*** (-42)	-0.1916*** (-41)	-0.1962*** (-41)	-0.1922*** (-42)
DD_{t-1}	0.0218 (1.05)	0.0208 (1.00)	0.0262 (1.26)	0.0249 (1.19)	0.0228 (1.09)
AGE_{t-1}	-0.0033*** (-8.6)	-0.0030*** (-8.1)	-0.0029*** (-7.8)	-0.0034*** (-8.8)	-0.0033*** (-8.8)
DIVER_{t-1}	-0.0854*** (-7.2)	-0.0837*** (-7.1)	-0.0874*** (-7.4)	-0.0869*** (-7.4)	-0.0854*** (-7.3)
BETA_{t-1}	-0.4692*** (-35)	-0.4698*** (-35)	-0.4680*** (-35)	-0.4685*** (-35)	-0.4692*** (-35)
MERGER_{t-1}	-0.0017 (-0.13)	-0.0011 (-0.08)	-0.0015 (-0.11)	-0.0004 (-0.03)	-0.0003 (-0.02)
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Adj. R²	0.6168	0.6167	0.6169	0.6177	0.6175
F-Stat	26.13***	26.12***	26.15***	26.18***	26.22***

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Table 8
Endogeneity Test – Two Stage Least Square Regressions

First Stage:

$$ECON_{t-1} / MSCI_{t-1} / DISC_{t-1} = \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 MKTRET_{t-1} + \beta_4 MKTSTD_{t-1} + \beta_4 DLOSS_{t-1} + \beta_5 ROE_{t-1} + \beta_6 VROE_{t-1} + \beta_7 LEV_{t-1} + \beta_8 MVBV_{t-1} + \beta_9 LNMVE + \beta_{10} DD_{t-1} + \beta_{11} AGE_{t-1} + \beta_{12} DIVER_{t-1} + \beta_{13} BETA_{t-1} + \beta_{14} MERGER_{t-1} + \sum \text{Year Fixed Effect} + \varepsilon$$

Second Stage:

$$IDIORISK_t = \beta_1 ECON_{t-1} + \beta_2 MSCI_{t-1} + \beta_3 DISC_{t-1} + \beta_4 DLOSS_{t-1} + \beta_5 ROE_{t-1} + \beta_6 VROE_{t-1} + \beta_7 LEV_{t-1} + \beta_8 MVBV_{t-1} + \beta_9 LNMVE + \beta_{10} DD_{t-1} + \beta_{11} AGE_{t-1} + \beta_{12} DIVER_{t-1} + \beta_{13} BETA_{t-1} + \beta_{14} MERGER_{t-1} + \sum \text{Year Fixed Effect} + \varepsilon$$

Variables	First Stage	Second Stage	First Stage	Second Stage	First Stage	Second Stage
	Dependent Variables					
	ECON _{t-1}	IDIORISK _t	MSCI _{t-1}	IDIORISK _t	DISC _{t-1}	IDIORISK _t
Intercept	.2764*** (5.54)	2.572*** (3.67)	-9.46*** (-19.49)	4.199*** (33.96)	1.343*** (24.04)	3.392*** (24.48)
ECON_{t-1}		6.139** (2.21)			-0.018 (-1.24)	
MSCI_{t-1}	0.0026** (2.10)			.0360*** (4.96)	0.0492*** (37.76)	
DISC_{t-1}	-0.013 (-1.24)		3.623*** (37.74)			0.5543*** (8.71)
MKTRET_{t-1}	-0.012 (-0.24)		-0.147 (-0.29)		0.0202 (0.35)	
MKTSTD_{t-1}	-0.522 (-0.76)		-1.41 (-0.20)		1.019 (1.27)	
DLOSS_{t-1}	-0.074*** (-7.17)	0.6330*** (2.98)	0.4716*** (4.57)	0.1625*** (5.68)	0.0114 (0.95)	0.1609*** (5.55)
ROE_{t-1}	0.3777*** (27.35)	-2.42** (-2.30)	-0.196 (-1.42)	-0.089** (-2.35)	0.0022 (0.13)	-0.088** (-2.28)
VROE_{t-1}	0.0027 (0.97)	0.0095 (0.50)	0.0323 (1.18)	0.0233*** (3.10)	0.0084*** (2.63)	0.0193** (2.50)
LEV_{t-1}	-0.452*** (-27.83)	2.652** (2.11)	-0.05 (-0.31)	-0.117*** (-2.63)	-0.03 (-1.51)	-0.106** (-2.33)
MVBV_{t-1}	0.1139*** (106.21)	-0.682** (-2.16)	-0.019* (-1.74)	0.0203*** (6.88)	-0.010*** (-4.93)	0.0264*** (8.41)
LNMVE_{t-1}	-0.022*** (-7.18)	-0.029 (-0.48)	0.6825*** (23.00)	-0.206*** (-17.59)	0.1150*** (34.67)	-0.259*** (-19.37)
DD_{t-1}	-0.654*** (-95.06)	3.734** (2.06)	-0.188*** (-2.73)	-0.280*** (-14.86)	0.012 (0.97)	-0.294*** (-15.24)
AGE_{t-1}	-0.001*** (-2.77)	0.0001 (0.06)	0.0299*** (16.14)	-0.004*** (-7.31)	0.0018*** (8.42)	-0.005*** (-8.72)
DIVER_{t-1}	-0.004 (-0.67)	-0.131*** (-3.09)	0.1069* (1.67)	-0.165*** (-9.39)	0.0221*** (2.96)	-0.176*** (-9.73)
BETA_{t-1}	0.0098 (1.29)	-0.633*** (-11.34)	0.0103 (0.14)	0.569*** (-27.41)	-0.021** (-2.39)	-0.557*** (-26.18)
MERGER_{t-1}	0.0602*** (8.07)	-0.408** (-2.35)	-0.063 (-0.84)	-0.03 (-1.45)	-0.034*** (-3.93)	-0.012 (-0.56)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R²	0.82436	0.8244	0.57632	.5763	0.59288	.5929
F-Stat	1347.02***	1347***	408.84***	408.8***	418.64***	418.6***
N	6597	6597	6597	6597	6597	6597

Refer to Appendix for variable definitions. White-adjusted T-statistics are in parentheses below each variable. ***, ** and * indicate significance at a p-value of less than the 1% level (2-tailed), 5% level (2-tailed), and 10% level (2-tailed), respectively

Figure 1
Stock Price Informativeness and Sustainability Factors

