

The compounding effect of mandatory GHG emissions disclosure and voluntary ESG disclosure on firm value in Korea

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Abstract

Purpose – This study attempts to examine the effect of greenhouse gas (GHG) emissions disclosure and its compounding effect with environmental, social, and governance (ESG) disclosure on firm value in Korea. This study focuses on the unique institutional setting in Korea that implements mandatory GHG emissions disclosure and voluntary ESG disclosure.

Design/methodology/approach – Using a dataset comprising 25,968 firm-year observations from publicly listed Korean firms from 2000 to 2021, we applied an ordinary least squares (OLS) regression model to test hypotheses.

Findings – The results show that, in a voluntary disclosure regime, ESG disclosure has a positive impact, whereas in a mandatory disclosure regime, GHG emissions disclosure has a negative impact on firm value. The results also indicate that when a firm discloses both its GHG emissions and ESG performance information, the voluntary disclosure of ESG information synergistically mitigates the adverse effects of mandatory disclosure of GHG emissions information. This synergy contributes significantly to enhancing the firm's overall value. The findings indicate that a firm can enhance its value by proactively disclosing ESG information, especially when it is compulsorily required to report GHG emissions data.

Originality/value – This study investigated the effect of corporate non-financial disclosure on firm value by shedding light on the differential attributes between voluntary and mandatory disclosures and between quantitative and qualitative information.

Keywords ESG disclosure, GHG emissions disclosure, Korea, Mandatory disclosure, Voluntary disclosure

Paper type Research paper

1. Introduction

Owing to the recent attention on the climate crisis and greenhouse gas (GHG) emissions, [1] various policies and regulations have been initiated worldwide, including carbon taxation, trading, and reduction (Kolk *et al.*, 2008). The growing interest in GHG emissions has led to a surge in researching GHG emissions related issues (e.g. Chapple *et al.*, 2013; Matsumura *et al.*, 2014), which are specifically related to the environmental element of environmental, social, and governance (ESG) [2]. Particularly, studies on the relationships among GHG emissions, their disclosure, and firm value have rapidly increased in recent times (e.g. Hummel and Jasari, 2022; Sun *et al.*, 2022). Current evidence almost uniformly suggests a negative relationship between GHG emissions and firm value (Baboukardos, 2017; Chapple *et al.*, 2013;



JEL Classification — L10, M10, M48

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Hassel *et al.*, 2005; Salehi *et al.*, 2022), and a positive relationship between disclosure of GHG emissions data and firm value (Matsumura *et al.*, 2014; Saka and Oshika, 2014).

A few studies have explored the impact of changes in corporate social responsibility (CSR) disclosure regimes on firms' CSR activities. Furthermore, regarding the relationship between CSR disclosure and firm value, criticisms have often been raised that most studies were conducted in voluntary disclosure settings, and it is unclear whether the same evidence would also be valid in mandatory disclosure settings (Mittelbach-Hörmanseder *et al.*, 2021). Thus, in order to fill this research gap, we examine whether this relationship persists in mandatory disclosure regimes.

In many countries, while traditional financial reporting is subject to strict regulations and firms are obligated to disclose it, ESG reporting is less strictly regulated, and firms choose to disclose it voluntarily (Christensen *et al.*, 2021). While financial reporting pertains to the financial results of a firm's primary and routine operations, ESG reporting covers a variety of non-financial issues related to a firm's CSR activities (Christensen *et al.*, 2021). However, it is also noticeable that, while both financial reports and GHG emissions reports disclose quantitative information that is measurable and comparable, ESG reports disclose qualitative information that is often non-measurable and non-comparable and thus are not or cannot be included in the former two reports (Jackson *et al.*, 2020).

Currently, ESG disclosure is not compulsory in Korea. However, the disclosure of a governance report will be effective by 2026 and the disclosure of a sustainability report that contains GHG emissions information by 2030. Since 2010, under the GHG and Energy Target Management System (TMS), several selected firms have had to disclose their GHG emissions information. To the best of our knowledge, few studies have explored the interaction between voluntary ESG reporting and mandatory GHG emissions reporting, and their compounding effect on firm value (Einhorn, 2005). Korea is one of the rare countries that concurrently implements policies for voluntary ESG disclosure and mandatory GHG emissions disclosure, which provides an interesting setting for examining our research questions.

This study contributes to the growing body of literature on the effects of corporate social and environmental disclosure on firm value. First, although previous studies have reported mixed results on the relationship between them, we found negative impacts of the mandatory GHG emissions disclosure on firm value. Second, focusing on the different attributes of quantitative and qualitative information, we found that, when a firm discloses both GHG emissions and ESG information, the complementary role of voluntary ESG disclosure significantly weakens the negative effects of mandatory GHG emissions disclosure alone, leading to a substantial enhancement of the firm's value.

2. Related literature and hypotheses development

2.1 ESG disclosure and firm value

The relationship between firms' ESG activities and performance has been explored using various theoretical frameworks from various perspectives. Prior studies have reported heterogeneous results with positive, negative, or no relationship between them (e.g. Chen and Xie, 2022; Duque-Grisales and Aguilera-Caracuel, 2021). Prior research supports either one of these relationships by employing varied operational variables such as ESG score, ESG practices and ESG disclosure as proxies for firms' ESG activities, and various financial performance measures as proxies for firm value (e.g. Duque-Grisales and Aguilera-Caracuel, 2021).

Shareholder theory asserts that the primary goal of a firm is to maximize shareholder value and that the interests of other stakeholders, such as employees, customers and the environment, should be subordinated to this goal (Friedman, 2007; Jensen and Meckling, 1976). From this perspective, a firm's efforts towards ESG may cause unnecessary

expenditures, which can incur a competitive disadvantage and eventually undermine firm value (Aupperle *et al.*, 1985). For example, Barnea and Rubin (2010) found that overinvesting in CSR activities can create conflict among stakeholders because it reduces shareholders' wealth and firm value. Duque-Grisales and Aguilera-Caracuel (2021) provided evidence of a negative relationship between ESG scores and a firm's financial performance, and Richardson and Welker (2001) demonstrated a positive relationship between social disclosure and the cost of capital. Similarly, Cho *et al.* (2015) identified a negative correlation between environmental disclosure and firm value, and Raimo *et al.* (2021) showed a negative relationship between ESG disclosure and the cost of debt financing.

In contrast to shareholder theory, stakeholder theory holds that firms have a broader set of responsibilities towards all stakeholders, including non-shareholders, such as employees, customers, suppliers, communities and the environment (Donaldson and Preston, 1995). These stakeholder groups require firms to provide a variety of information. However, such information is often not included in traditional financial reports (Bernardi and Stark, 2018). In response to stakeholder requests, an increasing number of firms have been disclosing their non-financial information, such as ESG activities and performance (Stubbs and Higgins, 2014). Therefore, from a stakeholder perspective, firms that engage in ESG activities and disclose ESG performance can build positive relationships with stakeholders, which can eventually enhance their reputation and increase firm value (Brammer and Millington, 2005). Fombrun and Shanley (1990) found that firms' CSR performance enhances their reputation, which leads to a decrease in their cost of equity capital and a consequent increase in their firm value. Similarly, Dhaliwal *et al.* (2011) revealed that CSR disclosure is negatively related to the cost of equity capital and this negative relationship is stronger in countries that are more stakeholder-oriented.

Signaling theory suggests that firms can use signals to convey information about their quality, abilities or intentions to stakeholders (Spence, 2002). A firm's ESG activities can signal stakeholders that it is well managed and possesses sufficient slack resources to commit to sustainable practices (Waddock and Graves, 1997). As consumers' positive perceptions of a firm's environmental awareness and sustainable practices are increasingly becoming a basis for competition (Hamel and Prahalad, 1994), investing in environmental activities can create competitive advantages for a firm (Hassel *et al.*, 2005). Overall, a firm's ESG activities and the disclosure of its ESG performance can increase stakeholder confidence, ultimately leading to an increase in firm value (Waddock and Graves, 1997).

Similarly, the legitimacy theory suggests that firms must balance the expectations of various stakeholders to establish and maintain legitimacy in society (Dowling and Pfeffer, 1975). According to this theory, firms that are perceived as meeting the expectations of stakeholders are more likely to be seen as legitimate and enjoy greater support from stakeholders (Haji *et al.*, 2022); therefore, firms tend to disclose their non-financial information to legitimize their activities (Deegan, 2002; Hooghiemstra, 2000).

In summary, adopting various theoretical lenses, extant empirical studies have reported mixed results on the relationships among ESG activities, ESG disclosure, and firm value.

2.2 GHG emissions disclosure and firm value

Issues related to GHG emissions are particularly related to the environment element of ESG, and the recent increase in interest has led to a surge in research on the relationships between the volume of GHG emissions, their disclosure and firm value (Hummel and Jasari, 2022). Both ESG and GHG emissions information can exhibit some common characteristics, as they both provide non-financial information to the public (Jackson *et al.*, 2020; Rossi and Harjoto, 2020). Therefore, the theoretical frameworks employed to explain the relationship between ESG

activities and firm value may also explain the associations between the amount of GHG emissions, the disclosure of GHG emissions information and firm value.

GHG emissions can affect a firm's expected future earnings or cash flows. For firms, it costs to measure, report and manage GHG emissions (Fornaro *et al.*, 2009) and to innovate less carbon-intensive products and processes (Eccles *et al.*, 2013; Matsumura *et al.*, 2014). It may also cause considerable capital expenditure for firms to pay taxes, fees or fines to implement penalties when they fail to meet regulatory requirements. Consequently, Hassel *et al.* (2005) reported a negative impact of environmental investments on firm value, stating that environmental investments cause increased costs, leading to decreased earnings and lower market value. Saka and Oshika (2014) found that GHG emissions volume has a negative impact on a firm's market value of equity. Similarly, Salehi *et al.* (2022) also found a negative effect of GHG emissions on stock prices, returns and market value.

However, empirical studies have reported heterogeneous results regarding the relationship between the disclosure of GHG emissions and firm value. Some of the aforementioned studies also explored the relationship between GHG emissions disclosure and firm value and reported a positive impact on the firm value of firms' voluntary disclosure (Alsaifi *et al.*, 2020; Matsumura *et al.*, 2014) as well as the mandatory disclosure of GHG emissions (Saka and Oshika, 2014).

On the contrary, it has also been reported that voluntary disclosure of GHG emissions has a negative impact on firm value (Choi and Luo, 2021; Lee *et al.*, 2015). It is noticeable that when regulations on the mandatory disclosure of environmental information are enacted, firms are required to disclose improved higher-quality information (Christensen *et al.*, 2021), and firm value decreases in the short run (Elayan *et al.*, 2021; Mittelbach-Hörmanseder *et al.*, 2021) but increases in the long run (Baboukardos, 2017; Gerged *et al.*, 2021; Rossi and Harjoto, 2020). However, to the best of our knowledge, only a few studies have examined the impact of mandatory disclosure of GHG emissions on firm value.

Korea is one of the few countries that have implemented mandatory disclosure policies for GHG emissions information. In support of efforts to reduce GHG emissions, the Korean Government initiated the TMS in 2010. The government selects target organizations based on their GHG emissions and levels of energy consumption and mandates them to measure and report their GHG emissions and energy consumption.

As a regime of mandatory disclosure, the TMS has distinct attributes compared to the voluntary disclosure policy. First, the system forces firms to disclose the amount of their GHG emissions and energy consumption. Second, not only does the system require firms to report the amount in past years but also their targeted reduction amount in upcoming years. Firms must also report detailed managerial and operational action plans to fulfill their reduction targets. Third, the amount of GHG emissions and energy consumption reported by a firm must be verified by a government-appointed verification agency. Finally, firms are given incentives or penalties by the government for their level of reduction fulfillment that they planned in previous years.

Even under the voluntary disclosure scheme, firms incur high costs in measuring, reporting, monitoring, managing, and reducing GHG emissions. Under mandatory TMS, we may expect that much higher costs are incurred for firms to do so more accurately and transparently (Christensen *et al.*, 2021) and additionally to verify, plan, and execute action plans to achieve reduction goals and pay potential penalties for non-fulfillment (Eccles *et al.*, 2013; Fornaro *et al.*, 2009). Consequently, these costs may play as a negative signal that worsens a firm's future financial performance (Aupperle *et al.*, 1985), which may eventually result in the deterioration of firm value. To conclude, we expect a negative relationship under a mandatory disclosure regime.

- H1. There is a negative relationship between mandatory disclosure of GHG emissions and firm value.

2.3 Compounding effect of GHG emissions disclosure and ESG disclosure on firm value

In many countries, while traditional financial reporting is strictly regulated and firms are required to disclose it mandatorily following related regulations, ESG reporting is still less strictly regulated and firms disclose it on a voluntary basis (Christensen *et al.*, 2021) following less well-defined reporting practices (Erkens *et al.*, 2015). ESG reporting differs from financial reporting in that the latter deals with the financial values of firms' core and regular activities, whereas the former reports indirect implications related to firms' operations (Christensen *et al.*, 2021). Furthermore, the voluntary nature allows firms to choose and disclose favorable information based on cost-benefit considerations (Deegan and Rankin, 1997).

While a GHG emissions report provides mostly quantitative information related to GHG emissions only, an ESG report provides a variety of qualitative information not included in a GHG emissions report. Many of these issues can be reported using rich qualitative descriptions with or without quantitative data, targeting particular stakeholder groups and/or providing the expected prospects on a long-term horizon. Therefore, firms' voluntary ESG disclosure allows them to actively reveal detailed information about their corporate activities that may have a direct or indirect impact on their future GHG emissions performance but that cannot be contained in their GHG emissions report.

This valuable information is related to creating, maintaining, and increasing firms' intangible resources such as innovation, human resources, reputation, and organizational culture (Suchman, 1995). According to the legitimacy theory, firms that provide greater disclosure may benefit from increased legitimacy and trust from stakeholders, thus easing their access to valuable resources (Suchman, 1995), including financial resources such as low-cost capital and tax exemptions and intangible resources such as those mentioned above (Waddock and Graves, 1997).

Accordingly, we anticipate that by providing diverse stakeholder groups with rich qualitative information on a wide range of corporate behaviors and performances, voluntarily providing an ESG report can complement a mandatorily disclosed GHG emissions report, which mostly provides quantitative GHG emissions-related information by following strict regulations and guidelines. Putting these together, we expect that, through its complementary role, ESG disclosure will weaken the negative impact of GHG emissions disclosure on firm value.

- H2. ESG disclosure weakens the negative relationship between GHG emissions disclosure and firm value.

3. Methods

3.1 Sample and data

The sample firms were extracted from Korean listed firms for the fiscal years 2012–2021. The data for financial status and market capitalization were collected from the *Data Guide* provided by *FnGuide*, which is similar to *COMPUSTAT* for firms listed in the USA. The data for ESG disclosure were collected from the Korea Corporate Governance Service (KCGS), which has released the corporate ESG grade since 2012. We additionally collected sample firms for the fiscal years of 2005–2010 and their CSR scores for 2005–2011 that the Korea Environmental Industry and Technology Institute (KEJI) released [3]. The data for GHG emissions disclosure were collected from the National GHGs Management System. Finally, we obtained a sample of 25,968 firm-year observations.

The KCGS initiated governance ratings in 2003 based on its code of best practices and added environmental and social ratings in 2011, subsequently conducting ESG-integrated ratings. Utilizing its own ESG rating model, the KCGS conducts ratings across four main areas: environmental (12 sub-categories), social (24 sub-categories), governance (14 sub-categories) for general issuers, and governance for financial institutions. Integrated ESG ratings span from S to D, totaling seven grades.

Concerning GHG data, the Korean Government designates organizations that emit a certain level of GHGs and that consume a certain level of energy as the managed entities, to achieve the national GHG reduction target (a reduction target of 40% below 2018 levels by 2030).

3.2 Regression model

We applied an ordinary least squares (OLS) regression model to test the main hypotheses, as shown in Equation (1).

$$\begin{aligned}
 q = & \beta_0 + \beta_1 ESGD + \beta_2 GHGD + \beta_3 ESGD * GHGD + \beta_4 size + \beta_5 roa + \beta_6 lev + \beta_7 cfo \\
 & + \beta_8 rnd + \beta_9 capex + \beta_{10} adv + \beta_{11} growth + \Sigma year\ fixed\ effect \\
 & + \Sigma industry\ fixed\ effect + \varepsilon
 \end{aligned}
 \tag{1}$$

Where, q = Tobin's Q, which is equal to market capitalization/total equity; $ESGD$ = dummy variable, which takes 1 if a firm discloses its ESG report, 0 otherwise; $GHGD$ = dummy variable, which takes 1 if a firm discloses its GHG emissions report, 0 otherwise; $size$ = natural logarithm of market capitalization; roa = net income/total asset; lev = total liabilities/total equity; cfo = operating cash flow/total asset; rnd = research and development expenditure/sales; $capex$ = capital expenditure/sales; adv = advertising expenditure and/or sales and $growth$ = growth ratio, which is equal to sales/sales of prior year-1.

We operationalized our dependent variable, firm value, with Tobin's Q rather than annual financial performance measures such as return on assets (ROA), net income, or operating income. We selected out Tobin's Q considering two factors. First, ESG reporting covers a variety of non-financial issues (Christensen *et al.*, 2021). Second, today's investment in CSR activities can affect future performance over multiple and long-term periods (Hanson, 2013).

4. Results

4.1 Descriptive statistics

Table A1 [4] presents summary statistics for the variables. We winsorized all continuous variables at 1 and 99% of their distributions to mitigate the influence of outliers. The dependent variable q shows a mean value of 1.371, indicating that the market capitalization of equity is 37.1% higher than the book value of total equity, on average.

The mean value of the independent variable $ESGD$ is 0.144, indicating that 14.4% of the whole sample, or 3,730 firms, disclose ESG reports. Another independent variable $GHGD$ shows a mean value of 0.011, indicating that 1.1% of the total sample, or 283 firms, disclose GHG emissions information, which is much smaller than the ratio of ESG-disclosing firms. The control variables show values similar to those in previous studies (e.g., Allayannis and Weston, 2001; Lang and Stulz, 1994).

4.2 Multivariate analyses

Table 1 presents the regression analysis results. The coefficient of *ESGD* in Model 1 is 0.032 and statistically significant at the 10% level (*t*-statistic = 1.729), suggesting that the ESG disclosure enhances firm value. Model 2 reports the results of Hypothesis 1. The coefficient of *GHGD* is -0.160 (*t*-statistics = -6.817), indicating that GHG emissions disclosure reduces firm value.

Model 3 reports our main result testing Hypothesis 2 that mandatory GHG emissions disclosure interacts with the voluntary disclosure of the ESG report and then significantly affects firm value. The coefficients of *ESGD* and *GHGD* are 0.034 (*t*-statistics = 1.762) and -0.325 (*t*-statistics = -13.102), respectively, which are the same tenors as in Models 1 and 2. However, the coefficient of *ESGD * GHGD* is 0.222 (*t*-statistics = 6.077), indicating that additional ESG disclosure positively interacts with the disclosure of GHG emissions and weakens the negative effect of GHG emissions disclosure alone.

In this study, we adopt Tobin's Q as the performance variable, which represents the measure encompassing all variables beyond financial performance over a longer-term horizon. Considering that ROA demonstrates short-term and financial performance by highlighting a difference in performance metrics, in order to compare and present

Dependent =	Model 1	Model 2 <i>q</i> (=Tobin's Q)	Model 3
<i>ESGD</i>	0.032* (1.729)		0.034* (1.762)
<i>GHGD</i>		-0.160*** (-6.817)	-0.325*** (-13.102)
<i>ESGD × GHGD</i>			0.222*** (6.077)
<i>size</i>	0.144*** (22.496)	0.146*** (22.448)	0.146*** (22.529)
<i>roa</i>	-0.376*** (-7.905)	-0.376*** (-7.908)	-0.379*** (-7.978)
<i>lev</i>	0.248*** (8.204)	0.252*** (8.404)	0.250*** (8.276)
<i>cfo</i>	0.148*** (3.327)	0.145*** (3.244)	0.146*** (3.293)
<i>rnd</i>	2.514*** (20.801)	2.497*** (20.709)	2.509*** (20.768)
<i>capex</i>	0.293*** (7.685)	0.290*** (7.604)	0.293*** (7.695)
<i>adv</i>	0.372 (1.045)	0.366 (1.027)	0.368 (1.034)
<i>growth</i>	0.074*** (6.823)	0.074*** (6.800)	0.075*** (6.873)
Constant	-1.690*** (-14.858)	-1.734*** (-14.928)	-1.718*** (-14.966)
Observations	25,968	25,968	25,968
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
SE cluster	Firm	Firm	Firm
Adj <i>R</i> -squared	0.459	0.459	0.460

Table 1. Compounding effect of disclosure of GHG emissions and ESG on firm value

Note(s): For variable definitions, please refer to the note in Equation (1). Figures reported in parentheses are *t*-statistics. ***, ** and * indicate statistical significance at 1, 5 and 10% level, respectively

Source(s): Table created by authors

performance outcomes relative to these differences, we adopt [Nissim and Ziv's \(2001\)](#) model to find that the compounding effect of mandatory GHG emissions disclosure and voluntary ESG disclosure negatively impacts on ROA_{t+1} and ROA_{t+3} , while showing insignificant results for ROA_{t+2} , which is not tabulated. Since [Zellner \(1979\)](#) pointed out the existence of the time-lagged correlations between an event and its financial performance of Tobin's Q, some studies employed one, two or three years of time-lagged Tobin's Q (e.g. [Haslam et al., 2010](#); [Klock et al., 1996](#)).

4.3 Subsample analyses

We conducted additional analyses to investigate how the relationship between $ESGD * GHGD$ and q varied among the subgroups. [Table A2 \[1\]](#) presents the results of subsample analyses.

Panel A shows the test results with subsamples of firms operating in high- and non-high-technology industries. Using Korean two-digit Standard Industrial Classification (SIC) codes, we classified firms following [Francis and Schipper \(1999\)](#). The coefficient of $ESGD * GHGD$ is 0.280 (t -statistics = 6.887) for non-high-technology firms in Model 2 but is not significant for high-technology firms in Model 1, indicating that the compounding impact of ESG and GHG emissions disclosures is effective only for non-high-technology firms. We also presented the results of a difference test, which confirmed that the two groups are significantly different, as the coefficient of $HitechD * ESGD * GHGD$ is -0.347 (p -value = 0.009).

Panel B shows another result of a subsample test in a setting in which a firm is classified into either a chaebol or non-chaebol group. Chaebols are Korean-specific, family-oriented conglomerate groups such as Samsung and Hyundai. The results show that the compounding coefficient of $ESGD * GHGD$ is significantly positive at 0.325 (t -statistics = 6.758) only for the non-chaebol subgroup in Model 2. The result of a difference test confirmed that the groups are significantly different, as the coefficient of $ChaebolD * ESGD * GHGD$ is -0.439 (p -value = 0.003).

Although not tabulated, we conducted a robustness test using a time-lagged model where Tobin's Q_{t+1} is the dependent variable. We identified results similar to those presented in [Table A2 \[1\]](#).

4.4 Endogeneity check

The coefficient of $ESGD * GHGD$ in [Table A2 \[4\]](#) is 0.140, which represents that firm value (q) increases when a firm discloses both ESG and GHG emissions information. However, one may argue that the positive effect may reflect not only the compounding effect, but also the general increase in firm value for all the listed firms over time. Thus, we established [Equation \(2\)](#) to check the endogeneity by implementing the difference-in-difference (DiD) approach.

$$q = \beta_0 + \beta_1 post_GHG + \beta_2 treat_GHG + \beta_3 post_GHG * treat_GHG + \text{controls} \\ + \sum year\ fixed\ effect + \sum firm\ fixed\ effect + \varepsilon \quad (2)$$

Where, $post_GHG$ = dummy variable that takes 1 if it is after 2011 when the TMS was introduced, and 0 otherwise; $treat_GHG$ = dummy variable that takes 1 if a firm has disclosed GHG emissions information at least once during 2000–2021, and 0 otherwise.

[Table A3 \[4\]](#) shows the results of the DiD test for the subgroups. The variables of $post_GHG$ and $treat_GHG$ are dropped due to the collinearity in Model 2. The coefficient of $post_GHG * treat_GHG$ is positive and significant at 0.085 (t -statistics = 2.213) in Model 2 where $ESDG = 1$, while not significant in Model 1 where $ESDG = 0$. The result indicates that the

introduction of the TMS in 2011 increased the value of the firms that disclosed both GHG emissions and ESG information. We confirm that the compounding effect of ESG and GHG emissions disclosures is still effective when excluding the time-relevant effect.

5. Concluding discussion

This study resulted in the following conclusions. First, ESG emission disclosure alone had a positive impact on firm value in a voluntary disclosure regime. Second, GHG emissions disclosure alone had a negative impact in a mandatory disclosure regime. Lastly, our findings also suggest that the joint disclosure of both GHG emissions and ESG information mitigates the negative effects of GHG emissions disclosure alone.

5.1 Contributions and implications

This study contributes to the existing literature in several ways. First, it complements the existing literature on the relationship between corporate social and environmental disclosures and firm value. Among multiple theoretical frameworks (Seow, 2024), two contrasting theories have frequently been used to explain the relationship between the disclosure of corporate social and environmental information and firm value: the stakeholder and the stakeholder theories.

Although previous studies have reported mixed results, our findings support the stakeholder theory, which posits that firms have broader responsibilities toward all stakeholders (Donaldson and Preston, 1995), rather than the shareholder theory, which posits that the primary goal of firms is to maximize shareholder value (Friedman, 2007; Jensen and Meckling, 1976).

Second, this study provides new evidence of the interplay between the two types of non-financial reports. We may attempt to explain this positive compounding effect by adopting the complementary role of ESG reports, which can provide additional information that GHG emissions reports cannot, because, as an important form of non-financial disclosure, a typical ESG report contains a great amount of information that has significant implications for assessing firm value (Amel-Zadeh and Serafeim, 2018) but is typically not reported in financial statements (Dhaliwal *et al.*, 2014) or GHG emissions reports. For instance, the negative impact of GHG emissions disclosure on firm value is significantly reduced by good corporate governance, which includes more diversified and independent boards (Choi and Luo, 2021), and frequent media reporting on environmental activities mitigates the negative impact of GHG emissions disclosure on capital market returns (Lee *et al.*, 2015). These studies support the complementary role of ESG disclosures, which can provide various stakeholder groups with a wide range of corporate behaviors and rich qualitative information.

This study also yields significant practical implications. The results suggest that companies can augment their overall value through proactive dissemination of ESG information, particularly in instances where there is a compulsory requirement for disclosing GHG emissions data. This underscores the importance of integrating ESG considerations into corporate strategies and disclosure practices. The findings resonate with prior research (Brammer and Millington, 2005; Chen and Xie, 2022; Dhaliwal *et al.*, 2014; Waddock and Graves, 1997), which highlights the positive impact of ESG disclosure on firm performance.

By extension, this study provides insights for executives, policymakers, and international business leaders operating in Korea. This underscores the strategic imperative for actively advancing ESG-related initiatives, as they have the potential to significantly enhance firm value, especially in scenarios where GHG emissions reporting is either mandatory or anticipated to become so in the foreseeable future. For example, the environmental

assessment of KCGS provides questions in six categories: climate change, resource circulation, water/soil/biodiversity, pollutants/chemicals, eco-friendly supply chain and eco-friendly products and services. Among these, climate change questions mostly elicit qualitative responses and do not delve into detailed information on GHG emissions, which are arguably a central factor in the climate crisis. Therefore, disclosing GHG emissions, which complements ESG items confined to qualitative questions, is interpreted as a significant tool to provide investors with more accurate data for corporate analysis and thus eventually enhance firm value.

5.2 Limitations and further research

This study has several limitations. First, there is a constraint related to the sample. The generalizability of the empirical findings is limited, given that not all listed companies in Korea disclose GHG emissions. This lack of disclosure hinders the broader application and interpretation of the empirical results. Second, there are doubts about the representativeness of ESG data. In contrast to recent developments in the USA, where the SEC is establishing and enforcing ESG disclosure standards (McGowan, 2023), Korea currently lacks official ESG reporting standards from government agencies, and the available data are not sufficiently diverse.

For future research related to this study, there are two important areas to consider. First, if mandatory ESG disclosure is implemented in Korea in the future, there will be a need to directly compare the effects of voluntary versus mandatory ESG disclosure on GHG emissions. Understanding this comparison could provide valuable insights into the effectiveness and impact of different disclosure approaches. Second, as all listed companies in Korea will potentially begin to disclose GHG emissions, there will be a need for more generalized studies on the relationship between ESG and GHG disclosure. Insights gained from such studies could inform policymakers with various factors to consider regarding the adoption of ESG and GHG disclosure systems, providing guidance on what data to use and how to apply them effectively.

Notes

1. We employ the term GHG emissions as a comprehensive one that includes carbon emissions and CO₂ emissions.
2. We employ the term ESG as a comprehensive one that includes CSR and Sustainability.
3. To avoid the perfect multicollinearity between the variables of *post_GHG* and *treat_GHG*, we needed to collect other ESG-related data for the fiscal years of 2005–2011. Since KCGS released its ESG data from 2012, we resorted to KEJI's CSR index that includes environmental, social, and governance attributes for Korean listed firms.
4. Please see it on the [Online Appendix](#).

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Appendix

Supplementary material for this article can be found online.

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