JOURNAL OF ECONOMIC DEVELOPMENT
Volume 50, Number 2, June 2025

ESG FUND PERFORMANCE IN AN EMERGING MARKET: THE CASE OF KOREA BEFORE AND AFTER COVID-19*

HYEJIN PARK [a], JIYOON LEE [b] AND DOJOON PARK [c]

[a] *Hanyang University ERICA Campus, Republic of Korea*
[b] *Yonsei University, Republic of Korea*
[c] *Kongju National University, Republic of Korea*

This study examines the performance of environmental, social, and governance (ESG) funds in emerging markets, using Korean data. We found that ESG fund performance shifted significantly following the onset of the pandemic. While ESG funds did not outperform their matched conventional counterparts in the pre-pandemic years, they significantly outperformed conventional funds during the post-pandemic years. However, we find minimal differences in fund holding characteristics between ESG and conventional funds, which raises concerns about the possibility of ESG washing. This study underscores the differences between the performance patterns of ESG funds in emerging markets and those observed in more developed markets.

Keywords: ESG, SRI, Sustainability, COVID-19, Mutual Funds
JEL Classification: G11, G15, G23, Q56

1. INTRODUCTION

The last decade has witnessed notable growth in sustainable investment markets. With growing global interest in responsible and sustainable investments, environmental, social, and governance (ESG) and socially responsible investment (SRI) funds have experienced markedly expanded into mainstream investment categories. In the United States, the total assets under management (AUM) in ESG funds increased dramatically from $20 billion in 2019 to $300 billion in 2023 (Morningstar, 2024). Similarly, the AUM of sustainable investments outside US markets, including Europe, Japan, Australia,

* This work was supported by the research fund of Hanyang University (HY-2025-1800).

and New Zealand, grew from $18.2 trillion in 2020 to $21.9 trillion in 2022, reflecting 20% growth over the two years (GSIA, 2023).

Investors' growing interest in sustainable and responsible investments has inspired significant academic research on ESG funds. Several studies evaluate ESG fund performance (Bollen, 2007; Hartzmark and Sussman, 2019; Madhavan et al., 2021; Statman, 2000), while others explore the relationship between fund flows and returns within SRI funds (Benson and Humphrey, 2008; Klinkowska and Zhao, 2023; Renneboog et al., 2011). Another line of research examines how ESG funds perform during crisis periods, such as the 2008 global financial crisis and COVID-19 crisis. This line of research highlights that such funds tend to perform better and provide protection against downside risks during such periods (Leite and Cortez, 2015; Munoz et al., 2014; Nofsinger and Varma, 2014; Pastor et al., 2022; Pavlova and de Boyrie, 2022).

Despite extensive ESG fund research, most studies focus on the US or European markets, while emerging markets remain less examined. Furthermore, little is known about how funds in emerging markets differ from those in more developed markets in terms of performance and portfolio characteristics. This study aims to fill this gap in the literature by analyzing the performance and portfolio characteristics of ESG funds in the Korean market. Specifically, we investigate whether fund performance significantly differs before and after the COVID-19 pandemic, an event that heightened investor awareness of sustainability issues.

We hypothesize that ESG fund performance significantly improved in the post-pandemic period, but not before, for two key reasons. First, ESG and sustainable investing have only recently gained traction in Korea, with relatively little interest before the pandemic. Historically, Korea has lagged behind Western developed markets such as those in the United States and Europe in terms of incorporating sustainability and ESG factors into business practices or investment decisions. The nation's primary focus has been on economic growth, which may have overshadowed considerations related to sustainability and other non-financial issues like environmental protection, inclusive growth, and corporate social responsibility (Byeon et al., 2018; KDI School of Public Policy and Management, 2019; Park, 1996).

Second, the prolonged downturn in the Korean mutual fund market over the last decade likely delayed the development of new products, such as ESG funds. The total net asset value (NAV) of all equity funds dropped from around 28 trillion Korean won (KRW) in 2011 to approximately 8 trillion KRW in 2022 (Figure 1)[1]. According to the Korea Financial Investment Association, the net assets of Korean mutual funds, excluding ETFs, fell significantly from 207 trillion KRW at the end of 2009 to 191

[1] Based on the average exchange rate during the sample period, the value of 28 trillion KRW is approximately equivalent to 24.5 billion USD, while 8 trillion KRW is approximately equivalent to 7 billion USD. As of 2022, the total market capitalization of Korea's two major stock exchanges, KOSPI and KOSDAQ, was 2,083 trillion KRW. According to the World Federation of Exchange, this was greater than the market capitalization of Singapore but smaller than that of Australia.

trillion KRW in 2019. This contrasts sharply with the private equity fund market, which more than tripled from 110 trillion KRW to 419 trillion KRW during the same period (Kwon, 2020). This downturn in the overall mutual fund market in Korea likely reduced fund managers' incentives to launch new products like ESG funds.

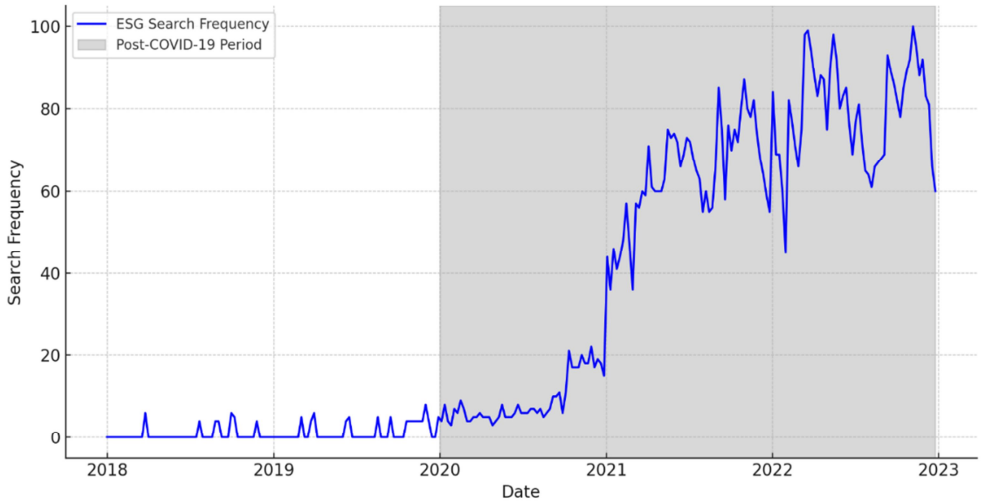
Notes: This figure shows the total net assets of all equity funds (ESG funds and conventional funds) from 2011 to 2022. The data is restricted to actively managed equity funds; index funds, exchange-traded funds, bond or fixed income funds, and funds of funds are excluded.

Figure 1. Total Net Assets of All Equity Funds

Meanwhile, the COVID-19 pandemic served as a catalyst for ESG fund growth, heightening awareness of ESG and climate-related issues among the government, companies, and investors in Korea.[2] Figure 2 presents the 2018 to 2022 timeline of the weekly Google search queries in Korea for the term "ESG." Prior to the COVID-19 outbreak in 2020, the average number of weekly searches for ESG ranged between 7 and 10. However, subsequent to the pandemic's onset, the search frequency surged dramatically, ranging from 50 to 100 searches per week from 2021 onwards. This notable increase in search interest reflects heightened awareness of ESG issues in Korea and indicates a substantial shift in focus toward environmental and social responsibility, possibly driven by the challenges posed by the COVID-19 pandemic. Furthermore, in the aftermath of the COVID-19 crisis, ESG has emerged as a key agenda item for

[2] It has been reported that the COVID-19 crisis has served as a wake-up call among investors and policy makers in Korea regarding the significance of sustainability and climate-related issues (Park, 2020; Shin and Ewing, 2020).

policymakers in promoting sustainable growth in the post-COVID-19 era. The Korean government has taken proactive steps to reinforce ESG principles in the wake of the pandemic. Toward the end of 2021, the government introduced a series of ESG policy measures, including the K-Taxonomy, K-ESG guidelines, and ESG disclosure guidelines.[3] Companies are also increasingly integrating ESG principles into their decisions, strengthening their ESG management to align with this regulatory movement.[4]



Notes: This figure shows the weekly trends in the number of Google search queries for "ESG" in Korea from 2018 to 2022. The shaded area represents the period following the outbreak of COVID-19 in January 2020.

Figure 2. Trends in Google Search Queries for 'ESG' in Korea

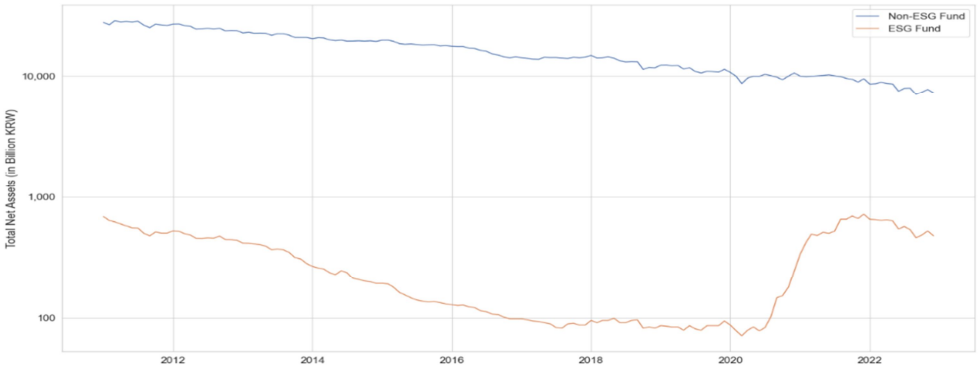
The increasing public awareness of ESG issues, coupled with government policy initiatives, has likely stimulated ESG investing, as evidenced by the rapid proliferation of ESG-focused funds. An analysis of our dataset confirms this expectation. Figure 3 shows the trends of total assets in ESG and conventional equity funds from 2011 to 2022, highlighting the substantial growth in ESG funds in recent years, particularly following the pandemic. Panel A presents the total NAVs of ESG and non-ESG equity

[3] The ESG disclosure guidelines were outlined in a press release by the Ministry of Economy and Finance on October 5, 2021.

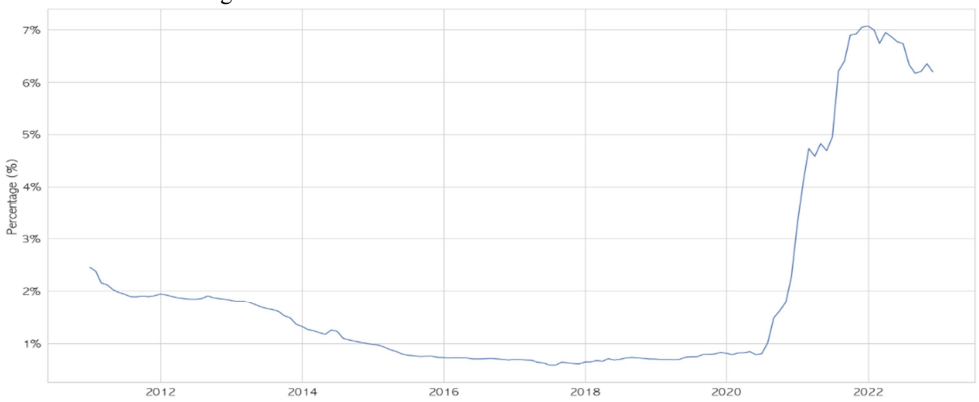
[4] According to a 2022 survey by The Korea Economic Daily of Korea's 100 largest companies, these companies are rapidly embracing ESG standards in management (Nam, 2022).

funds, with the y-axis measured using a logarithmic scale. The total NAVs of both conventional and ESG funds experienced a continuous decline from mid-2016 through 2019. However, starting in 2020, coinciding with the outbreak of COVID-19, the total NAVs of ESG funds increased exponentially. On January 1, 2020, the total NAVs of ESG funds were 87 billion KRW, which grew to 651 billion KRW by January 1, 2022, a growth rate of approximately 648% over the two-year period.

Panel A. Total Net Assets of ESG and Conventional Funds



Panel B. Percentage of Total Net Assets of ESG Funds Relative to Total Net Assets of all Funds



Notes: This figure displays the trends in the total net assets of ESG and conventional equity funds from January 2011 to December 2022, prior to any matching process. Panel A shows the total net assets of ESG funds compared to conventional (non-ESG) funds, with the y-axis on a logarithmic scale. The blue line represents the net assets of non-ESG funds, while the orange line represents the net assets of ESG funds. Panel B displays the percentage of net assets of ESG funds relative to the net assets of all funds over the same period. The analysis is restricted to actively managed equity funds; index funds, exchange-traded funds, bond or fixed income funds, and funds of funds are excluded.

Figure 3. Trends in Total Net Assets of ESG and Conventional Funds

Panel B shows the percentage of the ESG fund NAVs relative to the those of all funds (ESG plus non-ESG funds) over the same period. The graph reveals a pattern of growth in ESG funds similar to that shown in Panel A, with a notable increase in the proportion of ESG funds to all mutual funds, particularly after 2020. The share of ESG funds rose from approximately 2% in 2011 to about 6% in 2022. Despite their relatively small share in the overall market, ESG funds are gaining significant traction and represent a growing segment of Korea's mutual fund market. These figures clearly demonstrate the increasing prominence of ESG funds in Korea, contrasting sharply with the declining trend in the broader mutual fund market.

The performance dynamics of ESG funds in an emerging market such as Korea are expected to differ from the results in previous studies, which primarily focused on developed markets like those in the United States and Europe, where public interest in sustainability and ESG issues has been established for a longer period (Benson and Humphrey, 2008; Bollen, 2007; Hartzmark, and Sussman, 2019; Klinkowska and Zhao, 2023; Madhavan et al., 2021; Renneboog et al., 2011; Statman, 2000). Our research aims to investigate whether ESG funds in an emerging market like Korea display patterns that are distinct from those in developed markets and whether these funds outperform or underperform conventional funds. Specifically, our analysis focuses on fund performance before and after the COVID-19 pandemic, comparing the returns of three types of fund portfolios: ESG, conventional, and ESG-conventional. The ESG and conventional fund portfolios are composed of ESG equity funds and their matched conventional equity funds, respectively. The ESG-conventional fund portfolio, a long-short portfolio, is formed by taking a long position in the ESG fund portfolio and a short position in the conventional fund portfolio.

Our study provides several important findings. First, the analysis of the equal- and value-weighted portfolios of funds during the entire sample period from 2011 to 2022 presents mixed findings. In equal-weighted portfolios, ESG funds exhibit slightly higher average returns, but these differences are not statistically significant. In contrast, the differences in alphas, according to the capital asset pricing model (CAPM), the Fama and French three-factor model, and the Carhart four-factor model, are positive and statistically significant. However, in value-weighted portfolios, ESG fund returns are not statistically significantly different from conventional fund returns. These findings for value-weighted portfolios are consistent with those of Nofsinger and Varma (2014), Renneboog et al. (2008, 2011), and Statman (2000), which suggests that SRI funds do not generally outperform their conventional peers. Thus, the results of examining whether ESG funds consistently outperform their conventional counterparts are indeterminate.

In contrast, the fund portfolio performance analysis for sub-periods reveals that ESG funds outperformed conventional funds in the post-pandemic period. In the pre-COVID-19 period (2011-2019), the average return and alpha estimates for both the equal- and value-weighted fund portfolios also show mixed results, similar to those observed in the analysis of the entire sample period. However, during the

post-COVID-19 period (2020-2022), ESG funds substantially outperformed their conventional counterparts, with positive and significant alpha differences ranging from 0.096% to 0.364% per month, depending on the model used. Furthermore, our analysis of factor loadings reveals that, post-COVID-19, ESG funds had lower loadings on the momentum and value factors compared to those of conventional funds. This suggests that Korean ESG fund portfolios tend to hold lower weights of stocks with higher book-to-market ratios and are less inclined to follow momentum-driven strategies, which typically require frequent portfolio rebalancing. Consequently, ESG funds appear to make fewer portfolio adjustments compared to their conventional counterparts.

Finally, we examine the fund holding characteristics of both ESG and conventional funds to determine whether observable differences exist during the pre- and post-pandemic periods. Using the year-end snapshot of fund holdings, we examine nine firm characteristics and four ESG ratings. The firm characteristics include beta, firm size, book-to-market ratio, operating profitability, investment, leverage, idiosyncratic risk, turnover, and firm age. The ESG ratings, which include environmental, social, governance, and integrated measures, are provided by the Korea Corporate Governance Service (KCGS). Our findings reveal only minimal differences in general firm characteristics between the ESG and conventional funds throughout the entire period, including both the pre- and post-pandemic periods. This result is consistent with recent discussions in Korea about the need to implement standardized ESG fund disclosures to address the potential for ESG fund greenwashing and reduce information asymmetry among investors (Ko, 2022; Won, 2023; Oh, 2023).

In summary, our findings highlight a unique landscape for ESG funds in emerging markets such as Korea, which lags behind developed Western markets in ESG and sustainable investment. Before the COVID-19 pandemic, ESG fund performance did not show significant differences from their conventional peers. However, after the pandemic, ESG funds significantly outperformed conventional funds. The notable improvements in their risk-adjusted returns following the COVID-19 pandemic suggest that the crisis indeed played a critical role in heightening investor attention to ESG and sustainability issues in emerging markets.

The remainder of this paper is organized as follows. Section 2 provides a literature review. Section 3 describes the data and methodology. Section 4 reports the empirical results on fund performance and holding characteristics. Finally, Section 5 concludes the paper.

2. LITERATURE REVIEW

Extensive research has examined whether ESG fund performance differs from that of conventional funds; however, the findings are inconclusive. Some studies, inspired by Markowitz (1952), suggest that ESG criteria may constrain portfolio optimization,

leading to risk-adjusted returns for ESG funds that are inferior to those of conventional funds. For example, Hamilton et al. (1993) compare the returns of socially responsible (SR) mutual funds with those of conventional funds over the 1981-1990 period and find that the risk-adjusted returns (Jensen's alpha) of SR funds are not statistically different from those of conventional mutual funds. Similarly, using a Canadian sample, Bauer et al. (2007) find that ethical mutual fund performance is not statistically different from that of their conventional peers. In line with this, Bauer et al. (2005) use international data and find little evidence of significant differences in the risk-adjusted returns of ethical and conventional funds for 1990 to 2001.

Considering these prior findings, which generally suggest that the performances of socially responsible investment (SRI) and conventional funds do not differ, Benson and Humphrey (2008) examine whether portfolio allocation across industry sectors and SRI managers' stock-picking abilities differ from those of conventional fund managers. They find no significant difference between SRI funds and their conventional counterparts. Meanwhile, employing global data, Renneboog et al. (2008) show that SRI fund performance is not statistically different from that of conventional funds in the United States and the United Kingdom; however, they significantly underperform the benchmark portfolio in most European and Asia-Pacific countries. This suggests that cross-country attributes may significantly influence SRI fund portfolio performance of SRI relative to that of conventional fund portfolios. They interpret their results as reflecting that firms meeting high ethical standards are overpriced by the market; therefore, investors in these companies do not achieve superior financial returns by prioritizing ethical investments.

In contrast, environmental or social screens might indicate better management quality, which could potentially generate superior risk-adjusted returns. For example, Statman (2020) finds that the Domini Social Index (DSI), a socially responsible version of the S&P 500, performed better than the S&P 500. The raw and risk-adjusted returns of the DSI were higher than those of the S&P 500 between 1990 and 1998, albeit the difference was not statistically significant. Statman concludes that socially responsible investing can be just as effective in achieving financial returns as conventional investment strategies focused solely on financial objectives. Bauer et al. (2007) find that socially responsible investing leads to superior portfolio performance. Specifically, based on corporate "eco-efficiency" scores, they find that the high-ranked eco-efficiency portfolio provided substantially higher average returns compared to those of the low-ranked portfolio from 1995 to 2003, supporting the financial viability of socially responsible investing.

ESG investment performance during crisis periods has received considerable scholarly attention. Several studies document that SRI funds exhibited better performance during the 2007-2008 global financial crisis. Notably, Nofsinger and Varma (2014) find that US SRI funds outperformed conventional funds during the crisis. In particular, funds using positive screens or focusing on ESG criteria offered significant protection during these periods. Similarly, Muñoz et al. (2014) and Becchetti et al.

(2015) show that in European markets, SRI funds also play an insurance role during a financial crisis. Lins, Servaes, and Tamayo (2017) demonstrate that stocks with high ESG performance endure market crashes better during crises, suggesting that social responsibility provides insurance benefits during crises of trust, such as financial crises.

More recently, several studies examine whether ESG performance affected stock returns during the COVID-19 pandemic. Albuquerque et al. (2020) show that US firms with high environmental and social ratings exhibited superior performance during the COVID-19 market crash. Ding, Levine, Lin, and Xie (2021), use international data and provide evidence that firms with more corporate social responsibility activities performed better during the pandemic. Garel and Petit-Romec (2021) demonstrate that stocks with high E scores performed better during the crash. However, Bae, El Ghoul, Gong, and Guedhami (2021) and Demers, Hendrikse, Joos, and Lev (2021) find that ES ratings do not significantly affect stock returns.

Despite extensive research on ESG fund performance in the United States and European markets, studies of ESG funds in emerging markets, where ESG and sustainable investing have a relatively short history, remain scarce. Our research contributes to the literature by using Korean mutual fund data to examine ESG funds in emerging markets. By highlighting the unique trends in ESG fund performance in the Korean market, particularly following the COVID-19 pandemic, our study underscores the importance of considering institutional and cultural differences - such as varying degrees of investor awareness about ESG issues, regulatory environments, and market maturity - across emerging and developed markets in ESG and sustainable finance research.

3. DATA AND METHODOLOGY

3.1. Data and Sample

Our sample comprises Korean mutual funds from 2011 to 2022. The dataset was obtained from FnSpectrum, one of Korea's major fund data providers and rating agencies. This dataset contains information about various mutual fund characteristics, including monthly returns, NAV, monthly cash flow, load, expense ratio, inception date, and ESG fund label. It also includes funds that were liquidated during this period, ensuring that the sample is free from survivorship bias.

To be included in the sample, a fund must be an actively managed equity fund. We exclude index funds, exchange-traded funds, bond or fixed income funds, and funds of funds. Our focus is on actively managed equity funds because we link these funds' equity holdings to data in other stock market and accounting databases for stocks listed on the Korea Exchange. We obtain stock market and accounting data from FnGuide, a leading provider of corporate financial information and financial market data in Korea. To address incubation bias, we exclude the returns of funds with less than 12 months old

from their inception date (Evans, 2010). If the dataset contains different classes of the same fund, we choose only the first-established class fund (Statman, 2000). In cases where more than two funds were established simultaneously, we choose the class fund with the greater asset value.

FnSpectrum assigns ESG fund labels to funds that explicitly state in the "Principal Investing Strategies" section of the fund's prospectus that they integrate ESG criteria into portfolio construction.[5] Most ESG funds in Korea fall into the ESG integration category, indicating that they consider ESG factors in their investment decision-making process. However, few funds clearly state whether they adopt positive or negative screening strategies. This may be attributed to the absence of established criteria or official regulations governing ESG fund disclosures, as well as the relatively nascent stage of Korea's ESG investing market (Lee, 2022). Consequently, FnSpectrum does not provide detailed information about specific investment strategies such as positive or negative ESG screening or ESG integration (tilting) for these funds. Instead, it identifies only whether a fund is classified as an ESG fund.

To compare the performance of ESG funds with that of conventional funds, we follow previous studies (Bauer et al., 2005; Bollen, 2007; Climent and Soriano, 2011; Leite and Cortez, 2015; Nofsinger and Varma, 2014; Renneboog et al., 2008; Statman, 2000) and employ matched portfolio methodology. We identify the inception date, fund category, and NAV of each ESG fund. We first look for conventional funds in the same fund category that have inception dates within ±1 year of the ESG fund's inception. Subsequently, we select up to three conventional funds that are closest in NAV to each ESG fund. During this process, we ensure that the same conventional funds are not matched with multiple ESG funds. For some ESG funds, however, finding conventional fund matches proved challenging due to the restrictive nature of the inception date criterion. In such cases, we relaxed the inception date criterion to within two years. Despite these efforts, it was not possible to find matching conventional funds for some ESG funds, and they were excluded from our analysis. Consequently, our final sample consists of 32 ESG funds and 74 matched conventional funds.[6]

Table 1 presents the summary statistics for the ESG and matched conventional

[5] For example, one Korean ESG fund's prospectus explains its ESG strategies as follows: *"This fund (or investment trust) assigns scores to companies based on ESG indicators and weights each category to calculate a comprehensive score. Companies are then evaluated on a seven-grade scale: AA, A, BB, B, C, D, and E. The fund aims to achieve investment returns by investing at least 70% in the top five grades."*

[6] Additionally, we employed an alternative matching procedure by conducting matching routines for each ESG fund every month, allowing the matched pairs of ESG and conventional funds to change monthly. This approach enabled us to include a larger number of ESG funds in our analysis. Although the results from this alternative matching procedure are not tabulated in this paper, they are consistent with our primary findings using the unique matching method (where unique ESG funds are matched with unique conventional funds). Both methods lead us to the same conclusion: that ESG funds outperformed conventional funds in the post-COVID-19 period.

equity funds from 2011 to 2022. The mean NAV for ESG equity funds is 15.59 billion KRW, which is lower than the mean NAV for conventional equity funds of 34.44 billion KRW, indicating that ESG funds are smaller in terms of asset size than conventional funds. The median NAVs follow a similar pattern, with ESG funds at 3.20 billion KRW and conventional funds at 5.59 billion KRW. Both types of funds have mean expense ratios of 0.0013%, with nearly identical median expense ratios. In terms of performance, ESG funds exhibit higher mean (median) fund returns of 0.19% (0.39%) compared to 0.12% (0.34%) for conventional funds. While the difference in monthly mean returns may seem minor, when compounded over an extended period, the performance difference may be significant. The standard deviation of fund returns is slightly higher for ESG funds at 4.80%, compared to 4.54% for conventional funds.

Table 1. Summary Statistics

	ESG funds	**Conventional funds**
Number of funds	32	74
Mean NAV (KRW in billions)	15.59	34.44
Median NAV (KRW in billions)	3.20	5.59
Mean Expense Ratio (%)	0.0013	0.0013
Median Expense Ratio (%)	0.0014	0.0013
Mean Fund Return (%)	0.19	0.12
Median Fund Return (%)	0.39	0.34
Standard Deviation of Fund Return (%)	4.80	4.54

Notes: This table reports the summary statistics (mean, median, and standard deviation) of various characteristics of ESG and conventional funds. The sample consists of 32 ESG funds and 74 matched conventional funds from January 2011 to December 2022. The characteristics include the net asset value (NAV) in billions of Korean won (KRW) and the expense ratio and fund return, both expressed as percentages on a monthly basis. Returns are calculated on a value-weighted basis. Each ESG fund is matched with conventional funds based on fund category, inception date (within one year or two years if necessary), and total net assets. Up to three conventional funds are selected for each ESG fund, ensuring no conventional fund is matched with multiple ESG funds.

3.2. Fund Portfolio Performance Evaluation Model

To evaluate the difference in ESG and conventional fund performance, we examine the returns of three specific fund portfolios: ESG, conventional, and ESG-conventional. The ESG and conventional fund portfolios consist of ESG equity funds and their matched conventional equity counterparts, respectively. The ESG-conventional fund portfolio, a long-short or zero-cost portfolio, is constructed by taking a long position in

the ESG portfolio and short position in the conventional portfolio. We construct both equal- and value-weighted versions of the portfolios and calculate returns for each portfolio.

To estimate the risk-adjusted returns (or alphas) for the fund portfolios, we employ three different factor models: the CAPM, the Fama and French three-factor model (Fama and French, 1993), and the Carhart four-factor model (Carhart, 1997). Specifically, we estimate alphas for the CAPM using the model in Eq. (1):

$$R_t - R_{f,t} = \alpha + \beta_{MKT}(R_{MKT,t} - R_{f,t}) + \varepsilon_t, \quad (1)$$

where R_t is the return on an equal- or value-weighted portfolio of funds in month t. $R_{f,t}$ is the risk-free rate (91-day certificate of deposit rate). $R_{MKT,t}$ is the market return (the Korea Composite Stock Price Index). β_{MKT} measures the portfolio's market-risk exposure, and ε_t is the residual return.

The Fama and French three-factor model (FF3) extends the CAPM by including loadings on size (SMB) and book-to-market (HML) factors as shown in Eq. (2):

$$R_t - R_{f,t} = \alpha + \beta_{MKT}(R_{MKT,t} - R_{f,t}) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \varepsilon_t, \quad (2)$$

where SMB_t represents the return difference between a portfolio of small-cap stocks and a portfolio of large-cap stocks, and HML_t represents the return difference between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks. The Carhart four-factor model (Carhart4) further incorporates the momentum (MOM) factor in Eq. (3):

$$R_t - R_{f,t} = \alpha + \beta_{MKT}(R_{MKT,t} - R_{f,t}) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{MOM}MOM_t + \varepsilon_t, \quad (3)$$

where MOM_t represents the return difference between a portfolio of past winners and a portfolio of past losers. All returns are recorded as percentages in the tables. The standard errors are adjusted using the Newey and West (1987) method to account for potential heteroskedasticity and autocorrelation.

4. RESULTS AND DISCUSSION

4.1. Fund Portfolio Performance

Table 2 presents the empirical results of our analysis of fund portfolio performance. The performance of the ESG, conventional, and ESG-conventional fund portfolios are compared over the entire sample period, spanning from 2011 to 2022. Panel A reports

the average returns and alpha estimates for equal-weighted portfolios; the ESG portfolio has a slightly higher average return of 0.08% per month compared to the conventional portfolio. However, this difference, as represented by the average return of the ESG-conventional portfolio, is not statistically significant. On other hand, the ESG-conventional portfolio has higher alphas based on the CAPM, FF3, and Carhart4. The differences in alpha range from 0.067% to 0.086%, depending on the model. These results are statistically significant at the 1%, 10%, and 5% levels, respectively.

Table 2. Fund Portfolio Performance for the Entire Sample Period (2011-2022)

Panel A. Equal-weighted portfolio of funds

	ESG	Conventional	ESG-Conventional
Average Return	0.220 (0.575)	0.139 (0.383)	0.080 (0.152)
CAPM Alpha	0.034 (1.589)	-0.043** (-2.171)	0.077*** (2.644)
FF3 Alpha	0.002 (0.069)	-0.065*** (-2.716)	0.067* (1.915)
Carhart4 Alpha	-0.026 (-0.973)	-0.113*** (-4.499)	0.086** (2.344)

Panel B. Value-weighted portfolio of funds

	ESG	Conventional	ESG-Conventional
Average Return	0.174 (0.478)	0.124 (0.345)	0.050 (0.098)
CAPM Alpha	-0.047 (-1.457)	-0.072*** (-3.333)	0.025 (0.637)
FF3 Alpha	-0.090*** (-3.073)	-0.065*** (-2.765)	-0.025 (-0.667)
Carhart4 Alpha	-0.120*** (-3.177)	-0.085*** (-3.269)	-0.035 (-0.766)

Notes: This table compares ESG, conventional, and ESG-conventional portfolios from January 2011 to December 2022. The ESG and conventional portfolios are the fund portfolios composed of ESG funds and their matched conventional funds. The ESG-conventional portfolio is created by taking a long position in the ESG portfolio and short position in the conventional portfolio. Our performance measures use a monthly time-series of an equally weighted portfolio of funds in Panel A and a value-weighted portfolio in Panel B. The CAPM alpha is calculated based on the CAPM. The FF3 alpha is calculated based on the Fama and French (1993) three-factor model, which extends the CAPM by adding size and value factors. The Carhart4 alpha is calculated using the Carhart (1997) four-factor model. All returns in our tables are expressed as percentages. The standard errors are corrected for autocorrelation using the Newey and West (1987) procedure. The t-statistics are presented in parentheses. The symbols *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel B of Table 2 presents the average returns and alpha estimates for value-weighted portfolios of funds over the same period. The alpha estimates for the ESG portfolio are negative and statistically significant at the 1% level according to both the FF3 and Carhart4. Similarly, the alpha estimates for the conventional portfolio are negative and statistically significant at the 1% level across the CAPM, FF3, and

Carhart4. However, the alphas for the ESG-conventional portfolio are not statistically significant in any of the three model specifications.

Table 3. Fund Portfolio Performance for the Sub-Periods: Pre- and Post-COVID-19

Panel A. Equal-weighted portfolio of funds

Period	ESG	Conventional	ESG-Conventional
Pre-COVID-19 (2011-2019)			
Average Return	0.112 (0.314)	0.051 (0.148)	0.061 (0.123)
CAPM Alpha	-0.026 (-1.153)	-0.093*** (-4.024)	0.066** (2.039)
FF3 Alpha	-0.087*** (-3.485)	-0.144*** (-5.313)	0.058 (1.568)
Carhart4 Alpha	-0.134*** (-5.301)	-0.216*** (-8.511)	0.082** (2.300)
Post-COVID-19 (2020-2022)			
Average Return	0.543 (0.492)	0.405 (0.390)	0.139 (0.092)
CAPM Alpha	0.214*** (6.004)	0.106*** (3.854)	0.109** (2.413)
FF3 Alpha	0.267*** (5.565)	0.171*** (7.059)	0.096* (1.780)
Carhart4 Alpha	0.297*** (6.404)	0.198*** (7.711)	0.099* (1.860)

Panel B. Value-weighted portfolio of funds

Period	ESG	Conventional	ESG-Conventional
Pre-COVID-19 (2011-2019)			
Average Return	-0.046 (-0.130)	0.023 (0.067)	-0.069 (-0.139)
CAPM Alpha	-0.226*** (-9.404)	-0.138*** (-5.646)	-0.088** (-2.575)
FF3 Alpha	-0.244*** (-10.742)	-0.165*** (-7.120)	-0.078** (-2.419)
Carhart4 Alpha	-0.301*** (-8.931)	-0.203*** (-8.107)	-0.098** (-2.337)
Post-COVID-19 (2020-2022)			
Average Return	0.835 (0.827)	0.428 (0.425)	0.406 (0.285)
CAPM Alpha	0.488*** (14.90)	0.124*** (4.497)	0.364*** (8.499)
FF3 Alpha	0.371*** (10.986)	0.236*** (9.622)	0.135*** (3.241)
Carhart4 Alpha	0.422*** (9.823)	0.268*** (11.159)	0.154*** (3.119)

Notes: This table presents the average returns and various alpha measures for the ESG, conventional, and ESG-conventional portfolios for the sub-periods: pre-COVID-19 (2011-2019) and post-COVID-19 (2020-2022). The ESG and conventional portfolios are the fund portfolios composed of ESG funds and their matched conventional funds. The ESG-conventional portfolio is created by taking a long position in the ESG portfolio and short position in the conventional portfolio. Our performance measures use a monthly time series of an equal-weighted portfolio of funds in Panel A and a value-weighted portfolio in Panel B. The CAPM alpha is calculated based on the CAPM. The FF3 Alpha is calculated based on Fama and French (1993)'s three-factor model, which extends the CAPM by adding size and book-to-market factors. The Carhart4 alpha is calculated using the Carhart (1997) four-factor model. All returns in our tables are expressed as percentages. The standard errors are corrected for autocorrelation using the Newey and West (1987) procedure. The t-statistics are presented in parentheses. The symbols *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Taken together, these results suggest that over the entire sample period, the differences in returns between ESG and conventional funds are positive and statistically significant for the equal-weighted portfolio of funds. However, for the value-weighted portfolio of funds, the differences are inconclusive and not statistically significant. This result aligns with the findings of earlier studies by Nofsinger and Varma (2014), Renneboog et al. (2008, 2011), and Statman (2000), which found that SRI funds do not outperform their conventional counterparts.

Table 3 reports the average returns and alpha estimates for the periods preceding and following the COVID-19 pandemic. Panel A of Table 3 shows the average returns and alpha estimates for the equal-weighted portfolios. The ESG fund portfolio outperforms the conventional fund portfolio in terms of risk-adjusted returns both before and after the COVID-19 pandemic, although the statistical significance varies depending on the asset pricing model used. Notably, in the post-pandemic period, the ESG portfolio outperforms the conventional portfolio by 0.096% to 0.109% per month, depending on the model. For the pre-pandemic period, while the alpha estimates for the ESG portfolio are higher than those for the conventional portfolio, the differences are smaller, ranging from 0.058% to 0.082% per month.

Panel B of Table 3 presents the average returns and alpha estimates for the value-weighted portfolios. In the pre-COVID-19 period, the alpha estimates for the ESG portfolio are negative and statistically significant at the 1% level across all models. Meanwhile, the alphas for the conventional portfolio are also negative but less negative than those for the ESG portfolio. The alphas for the ESG-conventional portfolio are negative, ranging from -0.098% to -0.088% per month, and statistically significant at the 1% level, suggesting that ESG funds underperform conventional funds during this earlier period.

In contrast, the post-COVID-19 picture is different. The alpha estimates for both the ESG and conventional portfolios are positive and statistically significant at the 1% level across all models. Furthermore, the alphas for the ESG-conventional portfolio are positive, ranging from 0.135% to 0.364% per month, also statistically significant at the 1% level. These findings suggest that ESG funds significantly outperform their conventional counterparts after the pandemic.

We next examine the Sharpe ratios. Table 4 presents the Sharpe ratios for both the ESG and conventional fund portfolios, along with the differences between the Sharpe ratios of the two portfolios. For the equal-weighted portfolios, during the entire sample period, the Sharpe ratio for the ESG portfolio is 0.029, compared to 0.012 for the conventional portfolio. This difference of 0.017 is statistically significant at the 10% level. In the pre-COVID-19 period, the Sharpe ratio for the ESG portfolio is 0.004, while that of the conventional portfolio is -0.013. Although the ESG portfolio has a higher Sharpe ratio, the difference of 0.017 is not statistically significant. In the post-COVID-19 period, the Sharpe ratio for the ESG portfolio improves to 0.072, compared to 0.055 for the conventional portfolio, but the difference of 0.018 remains statistically non-significant at the conventional levels.

For the value-weighted portfolios, the trend is slightly different. Over the entire sample period, the Sharpe ratio for the ESG portfolio is 0.020, compared to 0.008 for the conventional portfolio, with the difference of 0.011 not statistically significant. In the pre-COVID-19 period, the Sharpe ratio for the ESG portfolio is -0.039, while that of the conventional portfolio is -0.020. This difference of -0.018 is also not statistically significant. However, in the post-COVID-19 period, the Sharpe ratio for the ESG portfolio improves significantly to 0.127, compared to 0.060 for the conventional portfolio. This difference of 0.067 is statistically significant at the 5% level, indicating that ESG funds notably outperform their conventional counterparts after the pandemic.

Table 4. Sharpe Ratio Test

	Equal-weighted portfolio			**Value-weighted portfolio**		
	ESG	**Con**	**Diff**	**ESG**	**Con**	**Diff**
Entire Sample						
Sharpe Ratio	0.029	0.012	0.017 *	0.020	0.008	0.011
			(1.78)			(0.66)
Pre-COVID-19 (2011-2019)						
Sharpe Ratio	0.004	-0.013	0.017	-0.039	-0.020	-0.018
			(1.30)			(-0.95)
Post-COVID-19 (2020-2022)						
Sharpe Ratio	0.072	0.055	0.018	0.127	0.060	0.067 **
			(1.28)			(2.01)

Notes: This table presents the Sharpe ratios for the ESG and conventional (Con) portfolios, along with the differences (Diff) for the entire sample period and sub-periods: pre-COVID-19 (2011-2019) and post-COVID-19 (2020-2022). The Sharpe ratio is measured as the mean portfolio returns in excess of the risk-free rate divided by the standard deviation of returns. *, **, and *** indicate statistical significance according to Ledoit and Wolf (2008) heteroskedasticity- and autocorrelation-robust standard errors, at the 10%, 5%, and 1% levels, respectively. The t-statistics are presented in parentheses.

The results from the Sharpe ratio analysis, combined with our earlier findings regarding alpha in Panel B of Table 3, highlight a substantial turnaround in ESG fund performance. Specifically, the CAPM alpha for the value-weighted ESG portfolio dramatically improved from -0.226% pre-COVID-19 to 0.488% post-COVID-19. Similarly, the alpha for the ESG-conventional portfolio shifted to a positive 0.364%, a stark contrast from the pre-pandemic value of -0.088%. Similar trends are observed in the FF3 and Carhart4, indicating a shift from pre-pandemic underperformance to notable outperformance thereafter. Consistent with this, the Sharpe ratios for the value-weighted

ESG portfolio also improved significantly, increasing from -0.018 pre-COVID-19 to 0.067 during the post-COVID-19 period. This result indicates a substantial turnaround in ESG fund performance relative to their conventional counterparts in the aftermath of the pandemic. The pandemic's systemic shock may have catalyzed heightened awareness of ESG and sustainability issues among investors, leading to a more deliberate integration of these concerns into investment decisions. The increase in Google search queries for the term ESG provides supporting evidence for this.

Next, to capture the dynamic nature of fund performance, we use 12-month rolling windows and conduct a time-series regression to derive a measure of time-varying abnormal returns using value-weighted portfolios of funds.[7] Figure 4 illustrates the evolution of dynamic alphas for both the ESG and conventional portfolios. Initially, the ESG portfolio lags behind the conventional portfolio. However, beginning in 2013, the performance gap narrows, and the ESG portfolio starts to show comparable performance. Notably, following the COVID-19 pandemic outbreak in 2020, the ESG portfolio exhibits superior performance relative to that of the conventional portfolio. This shift for ESG funds from relative underperformance to outperformance compared to their conventional peers further suggests investors' increasing focus on ESG and sustainability factors in investment decisions, particularly in the wake of the COVID-19 pandemic.

Panel A. The CAPM

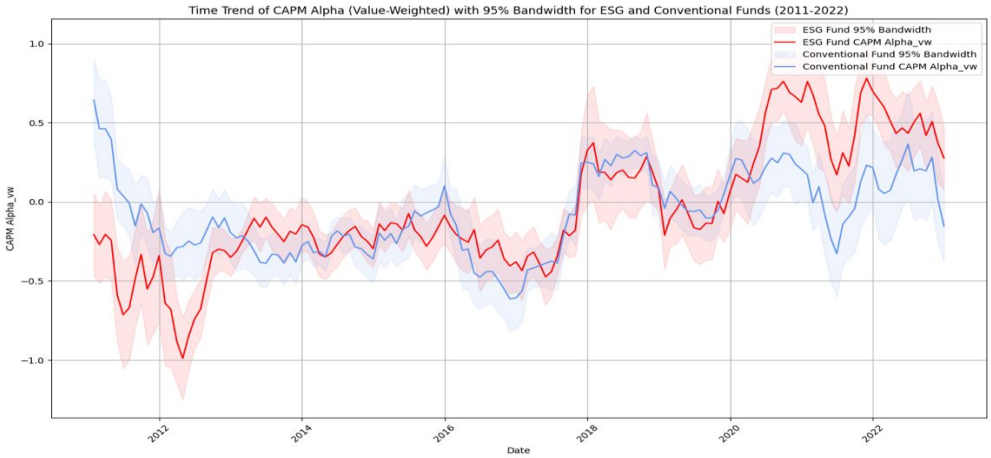
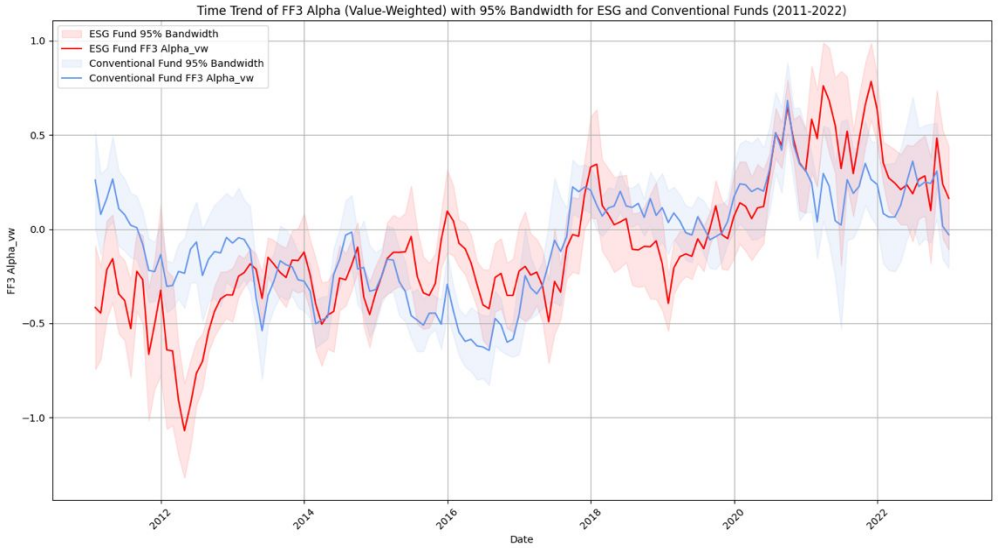


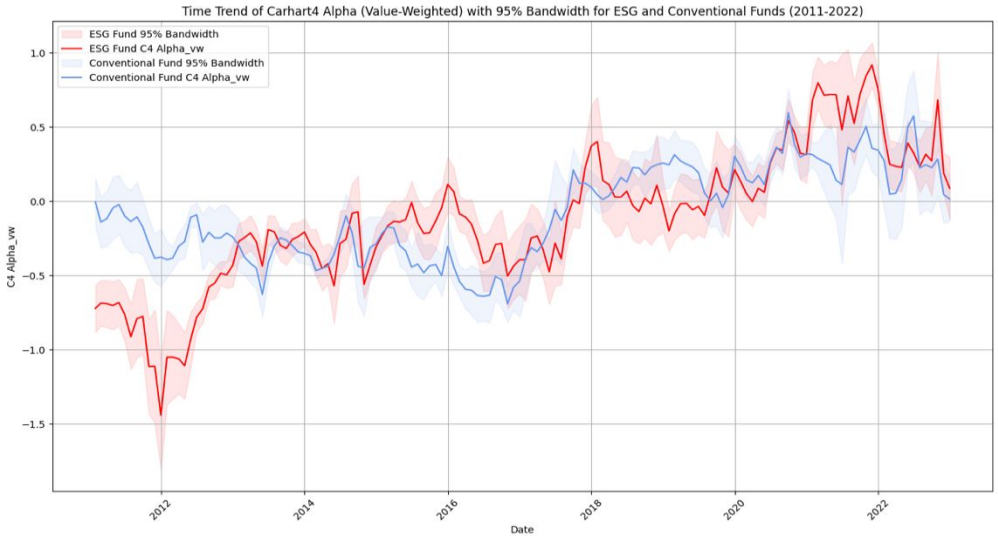
Figure 4. Performance Dynamics of the ESG and Conventional Portfolios

[7] We focus on value-weighted portfolios for presentation. The results for the equal-weighted portfolios are qualitatively similar to those presented, though the magnitude of alpha differences between ESG and conventional fund portfolios is slightly smaller compared to the difference with value-weighted portfolios. The results for equal-weighted portfolios are available from the authors upon request.

Panel B. The Fama and French three-factor model



Panel C. The Carhart four-factor model

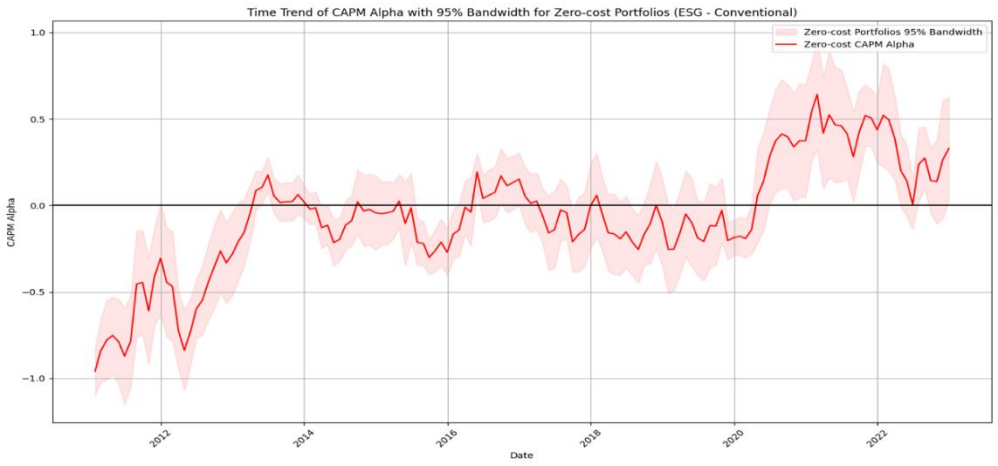


Notes: This figure displays alphas for the ESG and conventional portfolios, which are composed by ESG funds and their matched conventional funds, respectively. The alphas are estimated from 12-month rolling window time-series regressions using value-weighted portfolio of funds, based on the CAPM, the Fama and French three-factor model, and the Carhart four-factor model. The figure includes the 95% confidence interval band, adjusted using Newey and West standard errors. The data spans the period from January 2011 to December 2022.

Figure 4. Performance Dynamics of the ESG and Conventional Portfolios (cont')

In addition, we estimate dynamic alphas for the zero-cost portfolio. Using the value-weighted return of the ESG-conventional portfolio, we perform a time-series regression with 12-month rolling windows. Figure 5 shows that the alphas for the ESG-conventional portfolio were initially mostly negative, indicating the underperformance of ESG funds relative to conventional funds. However, the trend shifts over time, with the zero-cost portfolios gradually yielding positive abnormal returns, particularly following the COVID-19 outbreak in 2020. These results corroborate our previous findings from the comparative performance analysis of the two types of funds.

Panel A. The CAPM



Panel B. The Fama and French three-factor model

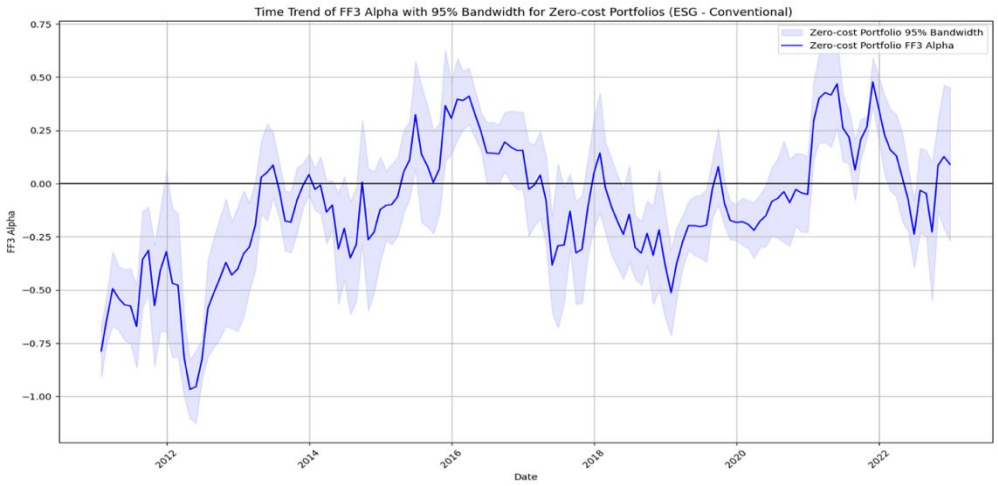
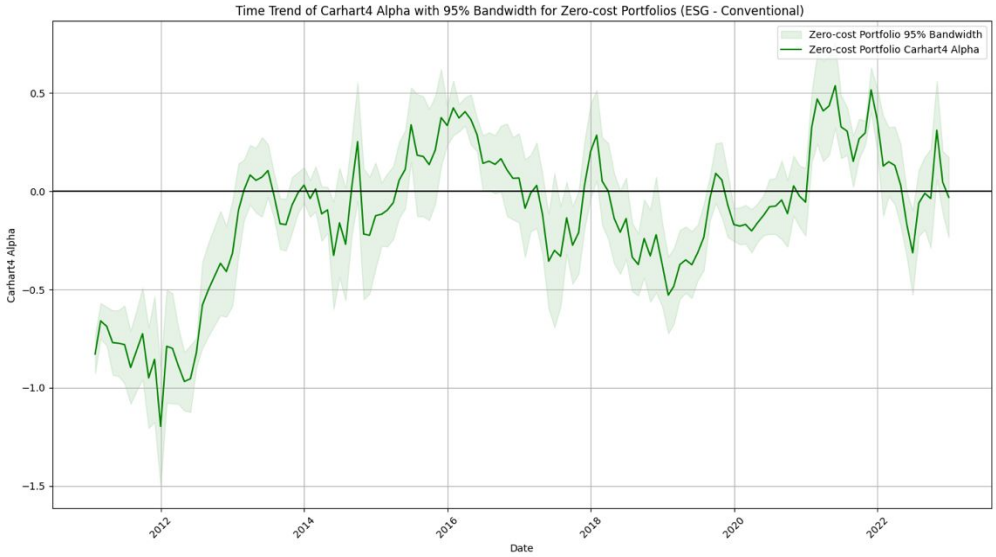


Figure 5. Performance Dynamics of the ESG-conventional Portfolio

Panel C. The Carhart four-factor model



Notes: This figure displays alphas for the ESG-conventional portfolio, which is constructed by taking a long position in the ESG portfolio and a short position in the conventional portfolio. The alphas are estimated from 12-month rolling window time-series regressions using value-weighted portfolio of funds based on the CAPM, the Fama and French three-factor model, and the Carhart four-factor model. The figure includes the 95% confidence interval band, adjusted using Newey and West standard errors. The data spans the period from January 2011 to December 2022.

Figure 5. Performance Dynamics of the ESG-conventional Portfolio (cont')

4.2. Fund Portfolio Factor Loadings

So far, our analysis has mainly focused on comparing the risk-adjusted performance, or alpha, of ESG, conventional, and ESG-conventional fund portfolios. However, the portfolios' risk factor loadings can also provide valuable insights into the investment style differences between ESG and conventional funds. Table 5 reports summary statistics for the monthly returns of the ESG and conventional value-weighted portfolios, as well as the returns of the four risk factors: market (R_{MKT}), size (SMB), book-to-market (HML), and momentum (MOM).

All returns are reported in percentages. Panel A shows the average returns and standard deviations for the portfolios over the full sample period and subperiods, and Panel B shows the correlations between the factors used in the analysis. All four factors have positive average returns over the entire sample period, with SML showing the highest average return. Both the ESG and conventional portfolios have the highest correlation with the market factor.

Table 5. Summary Portfolio Statistics

Panel A. Average Returns of Portfolios

	ESG	Con	R_{MKT}	SMB	HML	MOM
Entire Sample						
Mean	0.174	0.124	0.165	0.700	0.368	0.277
Std. Dev	0.365	0.360	0.381	0.300	0.281	0.323
Pre-COVID-19 (2011-2019)						
Mean	-0.046	0.023	0.133	0.730	0.446	0.533
Std. Dev	0.352	0.346	0.356	0.344	0.282	0.379
Post-COVID-19 (2020-2022)						
Mean	0.835	0.428	0.263	0.611	0.136	-0.491
Std. Dev	1.009	1.008	1.099	0.622	0.745	0.605

Panel B. Correlations

	ESG	Con	R_{MKT}	SMB	HML	MOM
ESG	1	0.979	0.974	0.098	-0.051	0.002
Con		1	0.983	0.083	-0.047	0.027
R_{MKT}			1	0.099	-0.008	-0.038
SMB				1	0.039	0.000
HML					1	-0.251
MOM						1

Notes: This table reports the average, standard deviation, and correlations of the monthly returns for the ESG and conventional (Con) value-weighted portfolios, as well as the returns of the four risk factors. All returns are recorded as percentages. R_{MKT} denotes the Korea Composite Stock Price Index (KOSPI) return. SMB (small minus big), HML (high minus low), and MOM (momentum) are the size, book-to-market, and momentum factors, respectively. The sample period is from January 2011 to December 2022.

In Table 6, we present the factor loadings for the value-weighted portfolio based on the Carhart4 across different periods over the entire sample period (2011-2022). Both the ESG and conventional portfolios exhibit significant exposure to the excess market return. Compared to the conventional portfolio, the ESG portfolio has a higher factor loading on the size factor, while the ESG portfolio has a lower loading on the book-to-market and momentum factors. These results suggest that the ESG portfolio is more heavily weighted toward small and value firms relative to the conventional portfolio. The lower factor loading on momentum is consistent with the previous literature (Nofsinger and Varma, 2014; Leite and Cortez, 2015). One possible interpretation for the lower momentum bias is that ESG funds are constrained by ESG criteria, which prevents them from making frequent adjustments to their portfolios.

Table 6. Factor Loadings for the Carhart4 Model over the Entire Sample Period

Fund portfolio coefficients	Intercept (α)	MKT (β_{MKT})	SMB (β_{SMB})	HML (β_{HML})	MOM (β_{MOM})	Adjusted R-squared
ESG	0.018	0.934***	0.004	-0.047*	0.034	0.951
	(0.218)	(31.867)	(0.166)	(-1.746)	(1.482)	
Conventional	-0.032	0.934***	-0.016	-0.032	0.065***	0.971
	(-0.498)	(51.167)	(-0.937)	(-1.387)	(4.600)	
ESG-conventional	0.050	0.000	0.020	-0.015	-0.031	-0.005
	(0.687)	(0.013)	(0.863)	(-0.451)	(-1.240)	

Notes: This This table presents the factor loadings for the value-weighted portfolio for the Carhart (1997) four-factor model over the entire sample period from January 2011 to December 2022. The ESG and conventional portfolios are the fund portfolios composed of ESG funds and their matched conventional funds. The ESG-conventional portfolio is created by taking a long position in the ESG portfolio and a short position in the conventional portfolio. The coefficients of β_{MKI}, β_{SMB}, β_{HML}, and β_{MOM} represent loadings on the excess market return (MKT), size (SMB), book-to-market (HML), and momentum (MOM) factors, respectively. Standard errors are corrected for autocorrelation using the Newey and West (1987) procedure. The t-statistics are presented in brackets. The symbols *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 7 shows the factor loadings by sub-period, with before the COVID-19 outbreak (2011-2019) in Panel A and after the COVID-19 outbreak (2020-2022) in Panel B. Panel A shows that before the COVID-19 pandemic, the ESG portfolio exhibited a negative loading on the HML factor (-0.057), which was statistically significant. This suggests that ESG funds favored growth stocks over value stocks during this period. Additionally, the ESG portfolio had a positive loading on the MOM factor (0.069), indicating a preference for momentum-driven strategies. Panel B shows that after the COVID-19 pandemic, the loadings for both the HML and MOM factors changed. The HML loading for the ESG portfolio became less negative (-0.032) and statistically insignificant, reflecting a reduced preference for growth stocks relative to that in the pre-pandemic period. Simultaneously, the MOM factor loading became negative (-0.025), suggesting that ESG funds moved away from momentum strategies in the post-pandemic period, although this result was not statistically significant.

The ESG-conventional portfolio comparison further underscores these shifts. In the pre-COVID-19 period, the ESG portfolio exhibited higher loadings on the HML and MOM factors compared to those of the conventional portfolio, although these differences are not statistically significant at conventional levels. In the post-COVID-19 period, however, the ESG portfolio displayed a significantly lower loading on the HML and MOM factors compared to those of the conventional portfolio, and these differences are statistically significant. This implies that ESG funds moved further away from stocks with high book-to-market ratio and reduced their momentum exposure relative to that of their conventional counterparts.

Table 7. Factor Loadings for the Carhart4 Model by Sub-period

Panel A. Pre-COVID-19 period (2011-2019)

Fund portfolio coefficients	Intercept (α)	MKT (β_{MKT})	SMB (β_{SMB})	HML (β_{HML})	MOM (β_{MOM})	Adjusted R-squared
ESG	-0.180**	0.963***	-0.013	-0.057**	0.069***	0.953
	(-2.276)	(35.094)	(-0.599)	(-2.335)	(3.580)	
Conventional	-0.097	0.954***	-0.014	-0.076***	0.059***	0.970
	(-1.607)	(51.458)	(-0.778)	(-3.516)	(4.619)	
ESG-conventional	-0.083	0.009	0.000	0.019	0.010	-0.031
	(-1.176)	(0.318)	(0.014)	(0.718)	(0.436)	

Panel B. Post-COVID-19 period (2020-2022)

Fund portfolio coefficients	Intercept (α)	MKT (β_{MKT})	SMB (β_{SMB})	HML (β_{HML})	MOM (β_{MOM})	Adjusted R-squared
ESG	0.569***	0.900***	0.023	-0.032	-0.025	0.964
	(3.185)	(22.571)	(0.465)	(-0.755)	(-0.338)	
Conventional	0.245*	0.911***	-0.019	0.049*	0.117**	0.978
	(1.78)	(33.572)	(-0.349)	(1.853)	(2.483)	
ESG-conventional	0.325**	-0.011	0.042	-0.081**	-0.142***	0.169
	(2.386)	(-0.298)	(1.219)	(-2.043)	(-2.744)	

Notes: This The table presents the factor loadings for the value-weighted portfolio based on the Carhart (1997) four-factor model by sub-period. The ESG and conventional portfolios are the fund portfolios composed of ESG funds and their matched conventional funds. The ESG-conventional portfolio is created by taking a long position in the ESG portfolio and short position in the conventional portfolio. The coefficients β_{MKI}, β_{SMB}, β_{HML}, and β_{MOM} represent loadings on the excess market return (MKT), size (SMB), book-to-market (HML), and momentum (MOM) factors, respectively. Standard errors are corrected for autocorrelation using the Newey and West (1987) procedure. The t-statistics are presented in brackets. The symbols *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.3. Fund Holding Characteristics

Thus far, we have shown that, prior to the pandemic, ESG fund performance was not significantly different from that of their conventional peers; however, they have outperformed their conventional peers in the post-pandemic period. In this section, we investigate whether ESG and conventional funds have notable differences in fund holding characteristics. We use the funds' year-end holdings snapshot to compute the variables for fund holding characteristics. We choose nine firm characteristics for our analysis: beta, firm size, book-to-market ratio, operating profitability, investment, leverage, idiosyncratic risk, turnover, and firm age. Beta is measured based on the CAPM, using monthly excess returns for three years. Similar to Fama and French (2015), size is calculated as the firm's market capitalization (in billions KRW) at the end of the previous June. The book-to-market ratio is computed as the book value of equity, which is the sum of common stock, deferred taxes, and investment credits at the end of

the previous fiscal year divided by the firm's market capitalization. Operating profitability is calculated as the ratio of revenues minus cost of goods sold, selling, general, and administrative expenses, and interest expense to book equity. Investment is the annual growth in total assets, while leverage is defined as the firm's debt-to-equity ratio. Idiosyncratic risk is calculated as the standard deviation of the residuals from the beta estimation. Following Datar et al. (1998), turnover for each stock is calculated as the average daily turnover over the last calendar year, where daily turnover is defined as trading volume divided by shares outstanding. Age refers to the number of years since a firm was first listed on the Korean exchange.

In addition, we examine four ESG ratings: environmental, social, governance, and integrated. These ratings use a seven-grade system (S, A+, A, B+, B, C, D) and are provided by KCGS, which publishes ESG ratings every year across these four ESG areas We assign point values to ESG ratings as follows: grade S (7 points), grade A+ (6 points), grade A (5 points), grade B+ (4 points), grade B (3 points), grade C (2 points), and grade D (1 point).

Fund holding characteristics are evaluated in two ways. First, for each individual fund, we calculate the value-weighted averages of the variables for the nine firm characteristics and four ESG ratings of the fund constituents. Second, we calculate the mean values of these fund characteristic variables for the ESG, conventional, and ESG-conventional fund portfolios, which are constructed using either an equal- or value-weighted sum of funds, as outlined in the previous section.

The first column of Table 8 reports the results based on individual funds, including the mean values of the fund holding characteristic variables for the ESG and conventional funds over the entire sample period. It also reports the mean differences between the ESG and conventional funds for all variables, along with their respective t-statistics. In terms of general firm characteristics, ESG funds exhibit minimal differences from their conventional peers, except for an average beta higher by 0.02 and a lower leverage by 0.08. Regarding ESG characteristics, although ESG funds have higher average ESG ratings than conventional funds, these differences are not statistically significant.

The second and third columns of Table 8 present an annual times series of the mean values of equal- and value-weighted portfolios, respectively. The standard errors for the difference are corrected for autocorrelation using the Newey and West (1987) procedure. In the equal-weighted portfolio, the ESG and conventional portfolios' firm characteristics are very similar, except for higher beta values and lower leverage. Regarding ESG characteristics, the ESG portfolio displays higher E, S, G, and integrated ESG ratings that are statistically significant at the 1% to 5% levels. Similarly, for the value-weighted portfolio, the differences between the ESG and conventional portfolios are minor, including lower values for size, leverage, and age and a higher book-to-market ratio. In terms of ESG characteristics, the G rating of the ESG portfolio is higher than that of the conventional portfolio; this difference is statistically significant at the 5% level.

Table 8. Fund Holding Characteristics over the Entire Sample Period

Variables	Individual fund			Equal-weighted portfolio			Value-weighted portfolio		
	ESG	Con	Diff	ESG	Con	Diff	ESG	Con	Diff
Beta	1.04	1.03	0.02 ***	1.04	1.03	0.02 ***	1.02	1.03	-0.01
			(2.69)			(5.08)			(-1.06)
Size	56,144	54,660	1,485	57,306	57,186	121	50,713	60,172	-9,459 **
			(0.62)			(0.08)			(-2.13)
Book-to	0.72	0.71	0.01	0.73	0.71	0.01	0.74	0.69	0.05 ***
-market			(0.75)			(0.94)			(4.36)
Operating	0.11	0.11	0.00	0.11	0.11	0.00	0.12	0.11	0.00
profitability			(-0.32)			(-0.03)			(1.04)
Investment	0.13	0.13	0.00	0.13	0.13	0.00	0.13	0.13	0.00
			(-0.10)			(-0.33)			(-0.23)
Leverage	1.02	1.10	-0.08 ***	1.01	1.09	-0.08 ***	1.04	1.17	-0.13 **
			(-3.24)			(-3.24)			(-2.48)
Idiosyncratic	0.10	0.10	0.00	0.10	0.10	0.00	0.10	0.10	0.00
risk			(0.14)			(-0.33)			(1.30)
Turnover	0.60	0.60	0.00	0.60	0.61	-0.01	0.59	0.57	0.01
			(-0.16)			(-0.81)			(0.41)
Age	24.17	24.13	0.03	24.31	24.31	0.00	24.22	25.21	-0.99 ***
			(0.13)			(-0.01)			(-3.04)
E rating	3.47	3.41	0.06	3.55	3.48	0.07 ***	3.55	3.55	0.00
			(0.48)			(3.47)			(0.09)
S rating	3.93	3.87	0.06	4.03	3.98	0.05 **	4.03	4.04	-0.01
			(0.45)			(2.20)			(-0.21)
G rating	3.37	3.33	0.03	3.45	3.40	0.05 ***	3.54	3.43	0.11 **
			(0.29)			(2.88)			(2.49)
ESG rating	3.58	3.53	0.04	3.66	3.61	0.05 ***	3.69	3.67	0.02
			(0.34)			(4.36)			(0.64)

Notes: This table presents the mean values of the holding characteristics for the ESG and conventional (Con) funds over the entire sample period from January 2011 to December 2022. The first column shows the mean values for the individual funds and mean differences (Diff) between the ESG and conventional funds for all variables, along with their respective t-statistics. The second and third columns show the mean values over an annual time series of equal- and value-weighted portfolios. The standard errors for the differences are corrected for autocorrelation using the Newey and West (1987) procedure. Beta is measured based on the CAPM. Size is calculated as the market capitalization (in billions KRW). The book-to-market ratio is calculated as the book value of equity divided by the firm's market capitalization. Operating profitability is measured as the ratio of revenues minus cost of goods sold, selling, general, and administrative expenses, and interest expense to book equity. Investment is the annual growth in total assets. Leverage is defined as the firm's debt-to-equity ratio. Idiosyncratic risk is calculated as the standard deviation of the residuals from the beta estimation. Turnover for each stock is calculated as the average daily turnover over the last calendar year. Age refers to the number of years since the firm was first listed on a Korean exchange. ESG ratings are assigned point values as follows: grade S (7 points), grade A+ (6 points), grade A (5 points), grade B+ (4 points), grade B (3 points), grade C (2 points), and grade D (1 point). The t-statistics are presented in brackets. The symbols *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 9. Fund Holding Characteristics by Sub-period

Variables	Pre-COVID-19 period (2011-2019)			Post-COVID-19 period (2020-2022)		
	ESG	Con	Diff	ESG	Con	Diff
Beta	1.05	1.03	0.02 **	1.04	1.03	0.01
			(2.39)			(1.49)
Size	45,134	42,425	2,709	94,197	100,114	-5,917
			(1.54)			(-1.23)
Book-to	0.70	0.71	-0.01	0.78	0.72	0.06 *
-market			(-0.47)			(1.71)
Operating	0.12	0.12	0.00	0.08	0.09	-0.01 **
profitability			(1.04)			(-2.42)
Investment	0.13	0.13	0.00	0.12	0.13	0.00
			(0.12)			(-0.38)
Leverage	1.07	1.17	-0.10 ***	0.84	0.84	0.00
			(-3.56)			(-0.04)
Idiosyncratic	0.09	0.09	0.00	0.15	0.15	0.00
risk			(-0.02)			(0.07)
Turnover	0.55	0.56	-0.01	0.77	0.77	0.00
			(-0.42)			(0.07)
Age	23.29	23.21	0.08	27.20	27.57	-0.37
			(0.32)			(-0.83)
E rating	3.19	3.15	0.04	4.43	4.38	0.04
			(0.28)			(0.89)
S rating	3.52	3.47	0.05	5.37	5.36	0.01
			(0.30)			(0.15)
G rating	3.07	3.07	0.00	4.40	4.31	0.09 ***
			(-0.02)			(3.75)
ESG rating	3.28	3.26	0.02	4.60	4.54	0.06 *
			(0.11)			(1.83)

Notes: This table presents the mean values of the holding characteristics for the ESG and conventional (Con) funds by sub-period. Both columns show the mean values for the individual funds and mean differences (Diff) between the ESG and conventional funds for all variables, along with their respective t-statistics. Beta is measured based on the CAPM. Size is calculated as market capitalization (in billions KRW). The book-to-market ratio is calculated as the book value of equity divided by the firm's market capitalization. Operating profitability is calculated as the ratio of revenues minus cost of goods sold, selling, general, and administrative expenses, and interest expense to book equity. Investment is the annual growth in total assets. Leverage is defined as the firm's debt-to-equity ratio. Idiosyncratic risk is measured as the standard deviation of the residuals from the beta estimation. Turnover for each stock is calculated as the average daily turnover over the last calendar year. Age refers to the number of years since the firm was first listed on a Korean exchange. ESG ratings are assigned point values as follows: grade S (7 points), grade A+ (6 points), grade A (5 points), grade B+ (4 points), grade B (3 points), grade C (2 points), and grade D (1 point). The t-statistics are presented in brackets. The symbols *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Next, we examine fund holding characteristics by sub-period. As holding characteristics are annual data, to ensure a sufficient number of observations for a robust analysis, we use panel data for individual funds, rather than time-series data for the portfolio of funds. Table 9 presents the mean values of ESG and conventional funds' holding characteristics by sub-period. The first column of Table 9 shows the mean values of the fund holding characteristics before the COVID-19 outbreak (2011-2019). The ESG funds exhibit few differences from their conventional peers in most firm characteristics except for higher beta and lower leverage. Similarly, during the post-COVID-19 period, ESG funds show no significant differences in most firm characteristics, except for higher book-to-market ratio and lower operating profitability. Regarding ESG characteristics, the ESG ratings of both the ESG and conventional funds improve over time. However, in the post-COVID-19 period, compared to their conventional counterparts, the ESG funds have significantly higher G (governance) and weakly higher integrated ESG ratings.

Collectively, these results indicate that few differences exist between the fund holding characteristics of ESG and conventional funds in Korea. This observation supports recent criticisms regarding the absence of official disclosure rules or guidelines for ESG funds in Korea, leading to "ESG washing." ESG washing refers to funds that label themselves as ESG or claim in their fund prospectuses to consider ESG issues in their portfolio management while, in reality, they do not differ from non-ESG funds (Ko, 2022; Won, 2023; Oh, 2023).

5. CONCLUSION

Sustainable investments have experienced significant growth over recent decades, as more investors and firms consider ESG and sustainability issues such as climate change, biodiversity loss, and pollution problems in their decision-making. Existing research extensively covers ESG fund performance and characteristics, particularly in developed markets like those in the United States and Europe. However, limited research focuses on emerging markets, which have a relatively shorter history of sustainable investment. Our research addresses this gap by using Korean mutual fund data to investigate ESG fund performance. We find a distinct shift in performance between pre- and post-COVID-19: ESG funds did not outperform their conventional counterparts before the pandemic, but did significantly outperform them following the pandemic.

Our analysis highlights the unique performance dynamics of ESG funds in emerging markets compared to those in developed markets. The COVID-19 pandemic intensified interest in ESG investing in Korea, potentially transforming the country's performance landscape for ESG funds. We provide new insights into the evolving dynamics of ESG fund performance in an emerging market, contributing to the broader discourse on sustainable investing. This study not only sheds light on how global crises impact investment strategies but also underscores the increasing importance of ESG factors in

emerging markets like Korea, which have traditionally been slower to adopt such practices.

Finally, this research offers valuable insights for investors, fund managers, and policymakers. Our findings highlight the growing importance of ESG considerations in Korea, especially following the COVID-19 pandemic. However, the absence of official disclosure rules or guidelines for ESG funds in Korea has raised concerns about greenwashing by ESG fund managers and information asymmetry among investors. In light of these concerns, Korea's Financial Services Commission (FSS) announced that starting from December 2023, funds labeled as ESG or claiming to incorporate ESG into their investment processes will face new disclosure standards (FSS, 2023). These standards mandate that ESG-themed funds specify their investment goals and strategies, investment risks, selection criteria, and ESG evaluation methodology. They must also demonstrate how their investment approaches relate to ESG and the resources they have for implementing their ESG strategies, with regular disclosure of investment progress and performance.

These regulatory developments are expected to alleviate information asymmetry and enhance investors' ability to identify genuine ESG funds, thereby promoting sustainable investment growth in Korea. Future research could explore whether ESG fund performance is influenced by these specific ESG characteristics post-regulation, potentially leading to findings that differ from our current results.

REFERENCES

Albuquerque, R., Y. Koskinen, S. Yang and C. Zhang (2020), "Resiliency of Environmental and Social Stocks: An Analysis of the Exogenous COVID-19 Market Crash," *Review of Corporate Finance Studies*, 9(3), 593-621.

Albuquerque, R.A., Koskinen, Y. and R. Santioni (2023), "Mutual Fund Trading and ESG Clientele During the COVID-19 Stock Market Crash," ECGI Working Paper Series in Finance.

Bae, K.H., S. El Ghoul, Z.J. Gong and O. Guedhami (2021), "Does CSR Matter in Times of Crisis? Evidence from the COVID-19 Pandemic," *Journal of Corporate Finance*, 67, 101876.

Bauer, R., K. Koedijk, and R. Otten (2005), "International Evidence on Ethical Mutual Fund Performance and Investment Style," *Journal of Banking and Finance*, 29(7), 1751-1767.

Bauer, R., J. Derwall and R. Otten (2007), "The Ethical Mutual Fund Performance Debate: New Evidence from Canada," *Journal of Business Ethics*, 70, 111-124.

Becchetti, L., R. Ciciretti, A. Dalò and S. Herzel (2015), "Socially Responsible and

Conventional Investment Funds: Performance Comparison and the Global Financial Crisis," *Applied Economics*, 47(25), 2541-2562.

Benson, K.L., and J.E. Humphrey (2008), "Socially Responsible Investment Funds: Investor Reaction to Current and Past Returns," *Journal of Banking and Finance*, 32(9), 1850-1859.

Bloomberg (2021), "ESG Assets May Hit $53 Trillion by 2025, A Third of Global AUM," Bloomberg.

Bollen, N.P. (2007), "Mutual Fund Attributes and Investor Behavior," *Journal of Financial and Quantitative Analysis*, 42(3), 683-708.

Borghesi, R., J.F. Houston and A. Naranjo (2014), "Corporate Socially Responsible Investments: CEO Altruism, Reputation, and Shareholder Interests," *Journal of Corporate Finance*, 26, 164-181.

Byeon, Y., K. Choi, H. Choi and J. Kim (2018), "Korea's Paradigm Shift for Sustainable and Inclusive Growth: A Proposal," IMF Working Paper No. 17/260, 2018.

Campello, M., J.R. Graham, and C.R. Harvey (2010), "The Real Effects of Financial Constraints: Evidence from a Financial Crisis," *Journal of Financial Economics*, 97(3), 470-487.

Carhart, M.M. (1997), "On Persistence in Mutual Fund Performance," *Journal of Finance*, 52(1), 57-82.

Climent, F. and P. Soriano (2011), "Green and Good? The Investment Performance of US Environmental Mutual Funds," *Journal of Business Ethics*, 103, 275-287.

Datar, V.T., N.Y. Naik and R. Radcliffe (1998), "Liquidity and Stock Returns: An Alternative Test," *Journal of Financial Markets*, 1(2), 203-219.

Ding, W., R. Levine, C. Lin, and W. Xie (2021), "Corporate Immunity to the COVID-19 Pandemic," *Journal of Financial Economics*, 141(2), 802-830.

Demers, E., J. Hendrikse, P. Joos, and B. Lev (2021), "ESG Did Not Immunize Stocks During the COVID-19 Crisis, But Investments in Intangible Assets Did," *Journal of Business Finance and Accounting*, 48(3-4), 433-462.

Drempetic, S., C. Klein and B. Zwergel (2020), "The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review," *Journal of Business Ethics*, 167(2), 333-360.

Evans, R.B. (2010), "Mutual Fund Incubation," *Journal of Finance*, 65(4), 1581-1611.

Fama, E. F. and K.R. French (1993), "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics*, 33(1), 3-56.

Fama, E.F. and K.R. French (2015), "A Five-Factor Asset Pricing Model," *Journal of Financial Economics*, 116(1), 1-22.

FSS (2023), "Introduction of Disclosure Standards for ESG Funds," Press release on October 5, 2023.

Gallo, P.J. and L.J. Christensen (2011), "Firm Size Matters: An Empirical Investigation of Organizational Size and Ownership on Sustainability-Related Behaviors," *Business and Society*, 50(2), 315-349.

Gantchev, N., M. Giannetti and R. Li (2024), "Sustainability or Performance? Ratings

and Fund Managers' Incentives," *Journal of Financial Economics*, 155, 103831.
Garel, A. and A. Petit-Romec (2021), "Investor Rewards to Environmental Responsibility: Evidence from the COVID-19 Crisis," *Journal of Corporate Finance*, 68, 101948.
GSIA (2023), "Global Sustainable Investment Review 2022," Global Sustainable Investment Alliance.
Hartzmark, S.M. and A.B. Sussman (2019), "Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows" *Journal of Finance*, 74(6), 2789-2837.
KDIS (2019), "Secrets of an Economic Miracle: Lessons for Sustainable Development from South Korea," KDI School of Public Policy and Management.
Klinkowska, O. and Y. Zhao (2023), "Fund Flows and Performance: New Evidence From Retail and Institutional SRI Mutual Funds," *International Review of Financial Analysis*, 87, 102596.
Ko, J. (2022), "Will 'ESG Funds in Name Only Be Filtered Out? NH·Woori Asset Management Received Official ESG Fund Certification," Hankyung, Retrieved from https://www.hankyung.com/article/202206279286i (Original article written in Korean).
Kwon, M.K. (2020), "A Slowdown in Mutual Funds: Causes and Challenges Ahead," *Korea Capital Market Institute*.
Ledoit, O. and M. Wolf (2008), "Robust Performance Hypothesis Testing with the Sharpe Ratio," *Journal of Empirical Finance*, 15(5), 850-859.
Lee, I., (2022), "Need for Sustainability Disclosure by Funds," *Korea Capital Market Institute*.
Leite, P. and M.C. Cortez (2015), "Performance of European Socially Responsible Funds During Market Crises: Evidence from France," *International Review of Financial Analysis*, 40, 132-141.
Lins, K.V., H. Servaes and A. Tamayo (2017), "Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility During the Financial Crisis," *Journal of Finance*, 72(4), 1785-1824.
Liu, N., C. Nemoto and C. Lu (2023), "The Effect of ESG Performance on the Stock Market During the COVID-19 Pandemic - Evidence from Japan," *Economic Analysis and Policy*, 79, 702-712.
Madhavan, A., A. Sobczyk and A. Ang (2021), "Toward ESG Alpha: Analyzing ESG Exposures Through a Factor Lens," *Financial Analysts Journal*, 77(1), 69-88.
Markowitz, H. (1952), "Portfolio Selection," *Journal of Finance*, 7(1), 77-91.
Matos, P. (2020), "ESG and Responsible Institutional Investing Around the World: A Critical Review," *CFA Institute Research Foundation Literature Reviews*.
Morningstar (2024), "What Are Sustainable Funds and How Have They Performed?" Morningstar.
Muñoz, F., M. Vargas and I. Marco (2014), "Environmental Mutual Funds: Financial Performance and Managerial Abilities," *Journal of Business Ethics*, 124, 551-569.

Nam, J.M. (2022.5.23), "Korean Companies Rapidly Embrace ESG in Management Standards," Korean Economic Daily Global Edition, Retrieved from https://www.kedglobal.com/esg/newsView/ked202205230007

Newey, W.K. and K.D. West (1987), "Hypothesis Testing with Efficient Method of Moments Estimation," *International Economic Review*, 28(3), 777-787.

Nofsinger, J. and A. Varma (2014), "Socially Responsible Funds and Market Crises," *Journal of Banking and Finance*, 48, 180-193.

Oh, J. (2023), "The Financial Supervisory Service Forms a Task Force to Establish Disclosure Standards for ESG Funds," Yonhap News, Retrieved from https://www.yna.co.kr/view/AKR20230328128000002 (Original article written in Korean).

Omura, A., E. Roca and M. Nakai (2021), "Does Responsible Investing Pay During Economic Downturns: Evidence from the COVID-19 Pandemic," *Finance Research Letters*, 42, 101914.

Park, A.J. (2020), "ESG Investing Gaining Traction in Korea," Korea Times, Retrieved from https://www.koreatimes.co.kr/www/biz/2025/01/175_291636.html

Park, W.A. (1996), *Financial liberalization: The Korean experience. In Financial deregulation and integration in East Asia*, 247-276*,* University of Chicago Press.

Pástor, Ľ., R.F. Stambaugh and L.A. Taylor (2022), "Dissecting Green Returns," *Journal of Financial Economics*, 146(2), 403-424.

Pavlova, I. and M.E. de Boyrie (2022), "ESG ETFs and the COVID-19 Stock Market Crash of 2020: Did Clean Funds Fare Better?" *Finance Research Letters*, 44, 102051.

Renneboog, L., J. Ter Horst and C. Zhang (2008), "The Price of Ethics and Stakeholder Governance: The Performance of Socially Responsible Mutual Funds," *Journal of Corporate Finance*, 14(3), 302-322.

Renneboog, L., J. Ter Horst and C. Zhang (2011), "Is Ethical Money Financially Smart? Nonfinancial Attributes and Money Flows of Socially Responsible Investment Funds," *Journal of Financial Intermediation*, 20(4), 562-588.

Seth, M. (2017), "South Korea's Economic Development, 1948–1996," Oxford Research Encyclopedia of Asian History.

Shin, M. and J. Ewing (2020.10.5), "South Korea Paves the Way for an Eco-Friendly Asia," East Asia Forum, Retrieved from https://eastasiaforum.org/2020/10/05/south-korea-paves-the-way-for-an-eco-friendly-asia/

Statman, M. (2000)., "Socially Responsible Mutual Funds," *Financial Analysts Journal*, 56(3), 30-39.

Won, H. (2023), "ESG Funds? Turns out They Are Funds with a High Concentration of Large Firms. Financial Supervisory Service Steps in to Establish Fund Disclosure Standards," Maeil Business News, Retrieved from https://www.mk.co.kr/news/stock/10699219 (Original article written in Korean).

Xu, N., J. Chen, F. Zhou, Q. Dong, and Z. He (2023), "Corporate ESG and Resilience of Stock Prices in the Context of the COVID-19 Pandemic in China," *Pacific-Basin*

Finance Journal, 79, 102040.

Mailing Address: Dojoon Park, Kongju National University, Division of International Studies, 56 Gongjudeahak-ro, Gongju-si, Chungcheongnam-do 32588, Korea, Email: dojoon@kongju.ac.kr

Received May 01, 2025, Accepted Jun 19, 2025.