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The Spillover and Leverage Effects of ESG and Non-ESG Equity Exchange-Traded Funds (ETFs)

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A B S T R A C T

The sustainable finance market is experiencing rapid growth as investors increasingly focus on environmental, social, and governance (ESG) factors in portfolio selection and management. This research utilizes the General Autoregressive Conditional Heteroskedasticity -in Mean-Autoregressive Moving Average (GARCH-M-ARMA) and Exponential GARCH-in Mean-ARMA (EGARCH-M-ARMA) in studying the spillover and leverage effects of returns and returns volatilities of ESG and non-ESG equity exchange-traded Funds (ETFs) and their tracing stock indices. The study finds that there is positive volatility in returns between the two investment vehicles. We have unilateral influence and bilateral relations as well. These results have proven that ESG and non-ESG ETFs positively impact the volatility of their stock index returns. The significant positive findings in this study examined the relationship between risks and returns in daily ETFs and stock prices. The findings evidenced that their positive relationship has a bilateral and unilateral impact. ESG information linked to the Global Reporting Initiative (GRI) standards is provided to the market. The results showed that ESG criteria could be used as a guideline for the management and investment of corporations. Both the GRI standards and the Topic-Specific Standards Report have positively impacted the volatility of ETF and stock index returns.

Keywords: Spillover Effects, Leverage Effect, ESG ETFs, GARCH Models

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1. Introduction

Investing in socially responsible businesses has become more profitable in recent years, with positive returns from investors. Socially Responsible Investments (SRI) involve investing in companies that promote ethical and socially conscious themes, including environmental sustainability, social justice, corporate ethics, and fighting against gender and sexual discrimination. SRI selects corporate assets with an exceptional environmental, social, and governance (ESG) rating and excludes those with a negative social or environmental impact. The SRIs are equivalent to conventional investment strategies with an additional filter in asset selection, the impact of global sustainable investing after the Global Reporting Initiative (GRI) standards launched in October 2016. SRI has made another leap toward a broader investor market by creating Corporate Social Responsibility (CSR) indices. These indices were launched to develop an established framework for companies involved in CSR activities and represent ESG-based investments. Thus, individual companies are eager to be part of these indices to market their companies' reputations, increasing their market performance even more. The study by Kempf and Osthoff (2007) showed that investing in companies with CSR activities results in abnormal returns of 8.7% annually.

ETFs can be defined as open investment funds traded on an equity market, which seek to achieve a certain level of performance relative to a benchmark. ETFs are low-cost, passive financial instruments that offer investors different ways of focusing on particular sectors or countries. ETFs attract investors who, driven by their values, believe that ESG investing will produce a favorable compromise between return and risk. The number of ETFs worldwide has grown an astonishing 3,000 percent since 2003, from 276 in 2003 to almost 8,600 in 2021.[‡]

As an investment strategy, ETFs consider ESG criteria in their portfolio, which have been rising in the last decade, with an ever-increasing number of ETFs explicitly targeting ESG topics. ESG ETFs often select their underlying assets according to sustainability benchmarks, such as the UN Global Compact Principles and UN-supported Principles for Responsible Investment (PRI). The UN Conference on Trade and Development (UNCTAD) makes it clear that ESG ETFs were typical investment portfolios excluded from tobacco, alcohol, weapons, and gambling.

An ESG ETF is labeled with a specific ESG-related theme, such as clean energy or low carbon, and is constructed to invest in a specific sustainability sector or sectors. The largest group of investors in ESG ETFs comprises institutional investors, ranging from sovereign wealth and pension funds to specialized investment firms. These investors have significant funds available to them and are increasingly convinced that long-term financial performance is linked to superior ESG performance.

The volatility of returns and returns impacts investment instruments, including fund and ETF performance. Many research articles on impacts of mean and leverage in related areas dealing with SRI and ethical issues. Previous studies have mainly examined the impact of ESG participation on corporate behavior and its market performance from multiple perspectives, including corporate value, stock market risk, earnings management, idiosyncratic risk, and green innovation. However, there needs to be research based on ESG ETFs to measure impact,

[‡] Statista. " Worldwide ETF assets under management 2003-2021"https://www.statista.com/statistics/224579/worldwide-etf-assets-under management-since-1997/

leverage, and policy issues. This research will explore two types of ETFs that may impact their tracked indices.

The research motivation of this study shows that there is a unilateral and bilateral return on the spillover effects of ESG and non-ESG ETFs linked to their benchmarks. These findings will help investors see opportunities to invest in benchmark or stock index ETFs to assess ETF movements and vice versa. In addition, it reveals the volatility effect of the performance of the GRI Standards reports. The previous research on ETFs has strong linkages in the pricing efficiency of ETFs, and underlying changes in the volatility of security are observed. (Ackert and Tian, 2000) Results can strengthen or weaken the investment strategies of ESG and non-ESG fund managers to engage investors in their portfolios. They supported this behavior of ETFs and found a change in asset allocation and underlying.

As companies invest more in sustainability and social responsibility, it is important to understand whether these investments reflect investor preferences across the market. Some investors will need to find out whether a company is investing in sustainability. While there are examples of these funds or ETFs in the market, it is still being determined whether investing in sustainability is consistent with investor requirements. This paper compares the spillover, average, and leverage effects of ESG and non-ESG ETF returns and volatility on their tracked stock indexes and vice versa. Using the GARCH-M-ARMA and EGARCH-M-ARMA models, this study also examined the relationship between equity indices and ETFs by comparing ESG and non-ESG ETFs. The relationship between risk and ETF returns and stock index tracing was also verified. The Global Reporting Initiative (GRI) provided guidelines to set the world's leading sustainability reporting standards – GRI standards. The GRI and Topic-Specific Standards series is a dummy variable of policy variables to capture the transition period's effect. GARCH models proposed by Engle (1982) and Bollerslev (1990) are ideal for characterizing ETF and stock returns and volatilities because of their usual high peak and fat tails compared to a normal distribution, and these models can capture the presence of time-varying volatility (Liu and Pan, 1997). Bollerslev et al. (1992) indicated that GARCH models and their variations were very useful in modeling the dynamic behavior of investment instruments.

This paper is organized as follows: Section 2 presents the literature review; Section 3 describes the data and explains the models; Section 4 Empirical results and findings; and Section 5 is the conclusion.

2. Literature Review

2.1 Spillover, Mean, and Leverage Effects

This section provides an overview of related studies that have proven the existence of interdependencies through spillover effects on returns and volatility of returns between various investment markets. Karolyi (1995) found that Canadian and American equity markets are embedded in returns and volatility and have some degree of impact on each other. By analyzing the EGARCH–ARMA model, Cheng and Madhavan (2009) explained inverse ETFs, and it is possible for short-term trading for both ETFs and stock index returns with similar patterns of spillover effects of returns. Morales (2008) used EGARCH in Latin American countries and showed that volatility in stock market returns influences exchange rate volatility. Using the GARCH-BEKK models in Eastern European countries, Fedorova and Saleem (2010) found unilateral volatility spillovers from the currency market to the stock market. Krause and Tse (2013) found a bi-directional relationship between the US and Canadian equity markets. Singh, Kumar, and Pandey (2010) revealed that the Japanese financial market more influenced the volatility of Asian markets than the United States.

Chen and Diaz (2012) found a strong influence of lagged (reverse-leverage) returns on

current equity index returns. Lagged stock index returns have a negative (positive) effect on leverage ETF returns (inverse) due to the addition (reduction) of total return swap exposures. A negative bilateral relationship is evident in the spillover effects of returns, while a positive bilateral relationship of spillover effects of volatilities is also observed from the results. The findings are evident in the higher volatility caused by leveraged ETFs. The relationship between risks and returns is negative for the stock index and inverse leveraged ETF returns. Makhwiting, Lesaoana, and Sigauke (2012) have used GARCH models to model daily returns on the Johannesburg Stock Exchange. The results demonstrate that increased risk does not necessarily imply increased returns. Jorge (2004) modeled volatility in the daily and weekly returns of the Portuguese PSI-20 stock index using the simple GARCH-M, GARCH, Threshold ARCH (TARCH), and EGARCH models. They found critical asymmetric shocks to the volatility of daily equity returns but not weekly equity returns.

The leverage effect has become an extensively studied empirical phenomenon in the form of the negative correlation between current returns and future current volatility (Engle and Ng 1993). Black (1976) and Christie (1982) gave an explanation based on the "leverage effect" hypothesis: A drop in the value of the stock (negative return) increases the financial leverage (debt-to-equity ratio), which makes the stock riskier and increases its volatility. Since then, the leverage effect has been synonymous with asymmetric volatility. Dedi and Yavas (2016) looked at the relationship between stock market returns and the impact of volatility. The author analyzed daily data on country ETFs and discovered volatility and return spillovers in several equity markets, such as Germany, the UK, and Russia. Because of the risk-return trade-off, they also analyzed the effect of the market's volatility on its returns. They found that the market volatility positively affects its future returns: an increase in volatility leads to a rise in future ETF returns in the UK. Chen and Huang (2010) adopted the GARCH-ARMA and EGARCH-ARMA models. They showed bilateral influences between stock indices and ETF returns and asymmetric volatilities when they examined global ETFs and their tracing stock returns.

2.2 Sustainable Finance and ESG Funds

A growing body of academic and sector research indicates that ESG issues can significantly impact business performance. While more and more companies are incorporating ESG performance into their operations, the financial sector is also embracing ESG, leading to a rapid increase in sustainable finance. Financial services and products are based on ESG criteria for the sustainable benefit of clients and society. In general, sustainable finance considers ESG factors in portfolio selection and management. An increasing number of investors are strongly considering ESG criteria because they believe that good sustainability ratings lead to outperformance over the long term. Tschopp and Nastanski (2014) suggest that the Global Reporting Initiative (GRI) would be the best standard for providing relevant information for decision-making. Hedberg and Von (2003) found the CSR report and GRI guidelines more valuable internally than externally.

By allowing nonfinancial attributes to influence investments, SRI offers benefits such as superior return and lower risk during turbulent periods, reputation management, and peace of mind (Bollen, 2007; Riedl and Smeets, 2017; and Umar and Suleman, 2017). Reenebog et al. (2008) found that the SRI funds of European, North American, and Asia-Pacific countries have more robust performance than those with local portfolios. Nevertheless, SRI funds in France, Ireland, Sweden, and Japan are lower than conventional portfolios. Weston and Nnadi (2021) found that SRI companies outperform those that do not adhere to the guidelines. Strignert and Malm (2021) utilized the DCC-M-GARCH model and reported a significant difference in daily volatility between green and non-green ETFs. The analysis is based on five years of daily performance data versus 80 ETFs rated in the United States. The study's outcome is consistent

with the assertion that green and sustainable investments are the future of finance.

ESG criteria are used as guidelines for managing and investing. Nguyen et al. (2022) confirm that investors could assess companies based on ESG practices because of their strong demand for disclosed SRI. Therefore, companies should invest in the ESG factors associated with transparent and public disclosure of information to strengthen stakeholder engagement and thus improve companies' financial performance. In addition, Chen (2011) focused on ethical and non-ethical ETFs relative to their underlying equity indices and showed no significant difference in return spillovers resulting from volatility and leverage. Additionally, lagged ethical ETFs have unilateral and bilateral impacts on their equity index returns.

Based on the above documentation, we can understand well that the effects of returns and volatility impact investment instruments and ETF performance. These studies prove that crucial stock market indices and ESG and non-ESG ETFs can also have this type of relationship and are worth exploring in the literature.

3. Data and methodology

This study uses daily closing prices of ESG and non-ESG ETFs and their corresponding stock indexes from the Yahoo! Finance website and the wall street journal website. The research period involves various ETFs inception dates from January 2017 to June 2022. We selected four ESG ETFs from U.S., Germany, U.K., Japan, and four Non-ESG ETFs for comparison, as shown in Table 1. The New York Stock Exchange (NYSE) Composite Index, DAX PERFORMANCE-INDEX (^GDAXI) Frankfurt, FTSE 100 Index (UKX) London, and NIKKEI 225 Index (^N225) Japan were included as benchmark stock indexes.

The spillover and leverage effects of ETFs and equity index returns, as well as volatility, have been estimated. Returns were measured as the logarithm of returns. The difference between the logarithm of price (ETF and stock index) at time t-1 and t were calculated below.

$$R_{j,t}^{m} = ln\left[\frac{I_j}{I_{j,t-1}}\right] \times 100, \quad (1)$$

$$R_{i,t}^{e} = ln\left[\frac{P_i}{P_{i,t-1}}\right] \times 100, \quad (2)$$

where $R_{j,t}^{m}$ and $R_{i,t}^{e}$ represent *j* is stock index returns , *m* is stock market index and the *e* is ESG or Non-ESG ETFs, and the *i* is ESG or Non-ESG ETFs returns at time *t*, respectively. *I* is stock index and *P* is the ETF price.

By using the GARCH-M-ARMA and EGARCH-M-ARMA models, this study mainly focuses on ESG and non-ESG ETFs because of the lack of research in this field and to further strengthened the determination of spillover, mean, and leverage effects.

The GARCH models were adopted to determine whether GARCH effects exist between stock index returns and ETF returns and verify whether the data have conditional heteroskedasticity. The EGARCH model proposed by Nelson (1991) for stock index and ETF returns was also adopted to analyze asymmetric volatility or leverage effects with non-negativity constraints in the linear GARCH model. The components of the combination of GARCH (p, q)-M-ARMA (g, s) and EGARCH (p, q)-M-ARMA (g, s) have been illustrated. The interdependence between the stock index and ETF returns is affected by market shocks. The spillover and leverage effects are illustrated as follows:

3.1 The Spillover Effect of ETFs Returns and Returns Volatility

This part of the paper explains the spillover effect of ETF from the stock index return. It discusses the possible spillover effects of ETF returns volatilities by examining the influence

of market dynamics. The equations are shown as follows:

$$R_{i,t}^{e} = \alpha_0 \sum_{g=1}^{G} \alpha_g R_{i,t-g}^{e} + wR_{j,t-1}^{m} + \varepsilon_{i,t-1}^{e} + \sum_{s=1}^{S} \theta_s \varepsilon_{i,t-s}^{e} + z\sqrt{h_{i,t}^{e}} \quad , \tag{3}$$

$$h_{i,t}^{e} = \alpha_0 \sum_{q=1}^{Q} \alpha_q \varepsilon_{i,t-q}^{e} + \sum_{p=1}^{P} \psi_p h_{i,t-p}^{e} + v\varepsilon_{j,t-1}^{m^2} + rGRI_t + yG403_t \quad , \tag{4}$$

For GARCH-M

$$\log\left(h_{i,t}^{e^2}\right) = \alpha_0 + \sum_{q=1}^{Q} \left\{ \alpha_q \left| \frac{\varepsilon_{i,t-q}^{e}}{h_{i,t-q}^{e}} \right| + \delta_q \frac{\varepsilon_{i,t-q}^{e}}{h_{i,t-q}^{e}} \right\} + \sum_{p=1}^{p} \varphi_p \cdot \log\left(h_{i,t-p}^{e^2}\right) + v\varepsilon_{j,t-1}^{m^2} + rGRI_t + yG403_t \quad , \tag{5}$$

For EGARCH-M

$$\varepsilon_{i,t}^{e} \mid \varphi_{i-1} \sim N\left(o, h_{i,t}^{e}\right).$$

3.2 The Spillover Effect of Market Returns and Returns Volatility

By looking at the interdependence between equity index returns and ETF returns and the volatility of returns, the equations are presented as follows:

$$R_{j,t}^{m} = \beta_0 \sum_{g=1}^{G} \beta_g R_{i,t-g}^{e} + dR_{j,t-1}^{e} + \varepsilon_{j,t-1}^{m} + \sum_{s=1}^{s} \gamma_s \varepsilon_{j,t-s}^{m} + k\sqrt{h_{j,t}^{m}} \quad , \tag{6}$$

$$h_{j,t}^{m} = \beta_0 \sum_{q=1}^{Q} \beta_q \varepsilon_{j,t-q}^{m} + \sum_{p=1}^{P} \psi_p h_{j,t-p}^{m} + l\varepsilon_{i,t-1}^{e^2} + rGRI_t + yG403_t \quad , \tag{7}$$

For GARCH

$$\log\left(h_{j,t}^{m^2}\right) = b_0 + \sum_{q=1}^{Q} \left\{ b_q \left| \frac{\varepsilon_{j,t-q}^{m}}{h_{j,t-q}^{m}} \right| + \delta_q \frac{\varepsilon_{j,t-q}^{m}}{h_{j,t-q}^{m}} \right\} + \sum_{p=1}^{P} \xi_p \cdot \log\left(h_{j,t-p}^{m^2}\right) + l\varepsilon_{i,t-1}^{e^2} + rGRI_t + yG403_t \quad , \tag{8}$$

For EGARCH-M

$$\varepsilon_{i,t}^{m} \mid \varphi_{i-1} \sim N\left(o, h_{j,t}^{m}\right) .$$

where $R_{i,t}^{e}$ and $R_{j,t}^{m}$ are the ETF and stock index returns, respectively, at period *t*, $\sum_{g=1}^{G} \alpha_g R_{i,t-g}^{e}$ and $\sum_{\mathrm{q}=1}^{Q} \beta_q R_{j,t-q}^{m}$ stand for the ETF and Stock index returns with a higher order of autoregressive AR(g) processes, respectively; $\varepsilon_{i,t-1}^{e}$ and $\varepsilon_{j,t-1}^{m}$ represent the ETF and stock error terms, respectively. The error variance at time *t* is assumed to depend on previous squared error terms. $\sum_{s=1}^{\mathrm{S}} \theta_s \varepsilon_{i,t-s}^{e}$ and $\sum_{s=1}^{\mathrm{S}} \gamma_s \varepsilon_{j,t-s}^{m}$ show the ETF and stock index returns with a higher order of moving average MA(s) processes, respectively. $\sum_{p=1}^{P} \varphi_p \cdot \log\left(h_{i,t-p}^{e^2}\right)$ and $\sum_{p=1}^{P} \xi_p \cdot \log\left(h_{i,t-p}^{m^2}\right)$ reveal the ETF and stock index returns associated with *p* order of conditional heteroscedasticity of GARCH term, respectively.

$\sum_{q=1}^{Q}\left\{\alpha_q\left|\frac{\varepsilon_{i,t-q}^{e}}{h_{i,t-q}^{e}}\right|+\delta_q\frac{\varepsilon_{i,t-q}^{e}}{h_{i,t-q}^{e}}\right\}$ and $\sum_{q=1}^{Q}\left\{b_q\left|\frac{\varepsilon_{j,t-q}^{m}}{h_{j,t-q}^{m}}\right|+\delta_q\frac{\varepsilon_{j,t-q}^{m}}{h_{j,t-q}^{m}}\right\}$ are the ETF and stock index returns associated with q order of conditional heteroscedasticity of ARCH term, respectively. φ_{p-1} represents all information set to period *t-p*; δ_q denotes the leverage term; and θ_s and γ_s are the ETF and stock index returns of unknown parameters, respectively. *r* and *y* are unknown parameters of dummy variables GRI and G403, respectively. The impact of volatility on ESG and non-ESG ETFs returns is measured separately by the GRI and G403 dummy variables.

This study tested the null hypothesis, H0, which stated that the sequence has no spillover effects of returns (w=0 ; d=0), against the alternative hypothesis, H1, which stated that the sequence has the spillover effect of returns (w ≠0 ; d ≠0). The coefficients w and d represent the impact of ETFs and returns on equity indices. If w is significantly different from zero, the lagged returns of the stock index will impact the ETF. If d is markedly uneven from zero, the ETF's lagged returns will affect the stock index's returns. Using GARCH models that integrate the potential for spillovers has allowed us to examine whether ETF and equity index returns in different markets are interdependent.

The potential spillover effects of volatility were considered in testing the cross-market dynamics of equity indexes and ETF returns. The null hypothesis, H0, indicates no spillover effects of return volatility (v =0 ; l =0), against the alternative hypothesis, H1, related to having spillover effects of return volatility (v ≠0 ; l ≠0). If v is significantly higher than zero, then lagged residual stock index will affect ETF volatility. If l is significantly unequal to zero, the shifted residual ETF will influence the volatility of the stock index.

Risk and return relationships in standard deviation are denoted, that is $\sqrt{h_{i,t}^{e}}$ *and* $\sqrt{h_{j,t}^{m}}$ for ETF and stock, based on z and k coefficients. A positive relationship exists in accordance with previous studies that utilized the GARCH-M model (Chou,1987); French, et al., 1987). Therefore, this study can evaluate the connection between risks and returns of stock indexes and ESG and non-ESG ETFs. Chen and Huang (2010) proposed EGARCH-M-ARMA models to estimate inverse and leveraged ETFs' impact and leverage effects on equity indices. Chen (2011) captured the spillover and the asymmetric-volatility effect in ethical ETFs.

In 2016, the Global Reporting Initiative (GRI) moved from guiding to establishing the world's first standards for sustainability reporting–GRI standards. GRI standards are 36 modular standards for preparing a sustainability report based on essential topics. In June 2018, GRI launched a revised reporting Standard. Topic-specific standards series (2018) for GRI 303: Water and Effluents and GRI 403: Occupational Health and Safety effective for reports or other materials published on or after 1 January 2021. They are illustrated in Appendix 1.

The GRI and Topic-Specific Standards series in the conditional variance equation is a dummy variable for GRI Standards, which is meant to capture the transition period effect. When the GRI (2016) standards became effective for reporting after July 1, 2018, we established a dummy variable and zero otherwise. When Topic specific standards series (2018) was practical for reports after 1 January 2021, the dummy variable takes values are one and zero otherwise.

The significance of bilateral performance exists between ETFs and stock indices being tracked. This research can determine the unilateral or bilateral impacts of delayed ETF returns on stock index returns and vice versa. This study can also identify the relationship between risks and returns of stock indices and ESG and non-ESG ETFs.

4. Empirical results

The study illustrates that all major stock indices and ETF indices have positive mean returns in Table 1. Most ETF indices outperform stock market indices. Stock indices have even steadier volatility with a lower standard deviation. The XS8R.L of ESG ETF has the highest volatility among ESG ETFs (0.625). The volatility of ESG ETFs slightly outperforms the returns of the underlying equity index. The study also computed the standardized skewness, kurtosis measures, and the Jarque-Bera statistic for estimating the returns data with the normal distribution. The paper found that all data were skewed negatively and that kurtosis coefficients had leptokurtic distributions. The Jarque-Bera statistic for residual normality demonstrated that the normal distribution assumption of the residual was not accepted and strongly rejects the normality of the unconditional distributions.Table 2 demonstrates that the dataset supports a stationary time series using the Augmented Dickey-Fuller Unit-Root Test (ADF). The minimum value of the Schwarz Criterion (SBC) was applied to determine the lag orders of the ARMA, GARCH, and EGARCH models. The results of the Breusch-Godfrey LM test revealed no serial correlation in the mean equation's residuals, except that DSI, VOO, and SXR7.F. ETFs have a serial correlation in the residuals. The results showed that the null hypothesis could not be rejected for most of the ETFs and stock index returns. The Lagrange Multiplier Test (ARCH-LM) was employed to test the ARCH effect in the model (Engle 1982). The null hypothesis with no ARCH effect for stock and ETF indices was rejected by examination of the relevant statistics of the ARMA model. After applying GARCH (1,1), the null hypothesis of no ARCH effect in the stock and ETFs returns series is accepted except for DXSK.F, SXR7.F, and XS8R. The ARCH-LM test was designed to test the hypothesis of ARCH errors in the residues of the EGARCH-M-ARMA models. There is autoregressive conditional heteroscedasticity for the UKX stock index and XS8R.L and ISF.L ESG ETFs.

4.1 The Spillover Effect of Returns and Returns Volatility

In general, the volatility clustering of stock indices and ETFs shows similar patterns in Figure 1. For example, equity ETFs such as DSI, VOO, and 1398.T are highly volatile with their indices tracked. These suggest that their deviations from the mean move together.

The estimation results of the GARCH-M-ARMA and EGARCH-ARMA show the existence of the leverage effects and estimated spillover effects between stock indices and ETF returns for ESG and non-ESG ETFs, as shown in Table 3. Consistent with previous studies on asymmetric returns of Balaban and Bayar (2005), Chen and Huang (2010), and Chen (2011). This study used the GARCH-M-ARMA and EGARCH-M-ARMA models to examine whether ETFs and stock market indices have a spillover effect on one another concerning returns and volatility of returns. This paper assumes that this divergent trend can be attributed to the investment strategy applied to those ETFs.

Through the GARCH-M–ARMA models, this study analyzes the spillover effect for return. It examines whether the coefficient of lagged stock index returns (d) affects the current ETF returns (w) and vice versa. Under the GARCH-M-ARMA model, the spillover effect of ESG returns and the tracking of equity index returns have a positive and significant bilateral relationship. The 1498.T/^N225 exhibits a strong bilateral positive relationship between the stock index and ESG ETF returns. The coefficient of the SXR7.F (0.1669) and UKX (0.0244), and ^N225 (0.0406) have a positive unilateral impact. It reveals that a rise (fall) of the stock index return for the current period may result in a rise (fall) of the ETF return on the following day, and vice versa. In contrast, the coefficients of 1498.T (0.2624) and 1329.T (0.3627) have a positive unilateral impact relationship based on the EGARCH-M-ARMA model.

Table 1. The Sample Size and Period of ESG ETFs and Non-ESG ETFs and Stock Indexes

Indices	Market	Type	Index	Code	Period	Obs	Mean	SD	Skew	Kurt	J-B
Stock and ESG ETFs Indices	New York	Stock	NYSE COMPOSITE (DJ)	^NYA	2017/01/01-2022/06/30	1383	0.0080	0.523	-1.367	24.54	27161.35***
		ETF	iShares MSCI KLD 400 Social ETF	DSI		1383	0.0170	0.559	-0.917	19.28	15459.28***
	Frankfurt	Stock	DAX PERFORMANCE-INDEX	^GDAXI		1394	0.0030	0.548	-0.732	18.18	13502.21***
		ETF	Xtrackers MSCI Europe Consumer Staples ESG Screened UCITS ETF	DXSK.F		1394	0.0093	0.424	-0.573	12.44	5257.107***
	London	Stock	FTSE 100 Index	UKX		1388	0.0009	0.460	-1.196	20.49	18026.69***
		ETF	Xtrackers MSCI Europe Information Technology ESG Screened UCITS ETF (XS8R.L)	XS8R.L		1388	0.0144	**0.625**	-0.603	6.61	836.21***
	Japan	Stock	NIKKEI 225 Index	^N225	2017/11/24-2022/06/30	1135	0.0060	0.544	-0.122	6.80	685.86***
		ETF	One ETF ESG	1498.T		1135	0.0031	0.612	0.597	15.41	7346.04***
Stock and non-ESG ETFs Indices	New York	Stock	NYSE COMPOSITE (DJ)	^NYA	2017/01/01-2022/06/30	1383	0.0080	0.523	-1.386	24.54	27161.35***
		ETF	Vanguard 500 Index Fund	VOO		1383	0.0170	0.544	-1.004	20.62	18118.65***
	Frankfurt	Stock	DAX PERFORMANCE-INDEX	^GDAXI		1394	0.0030	0.548	-0.732	18.18	13502.21***
		ETF	iShares VII PLC -iShares Core MSCI EMU UCITS ETF EUR (Acc)	SXR7.F		1394	0.0063	0.513	-1.270	19.84	16838.09***
	London	Stock	FTSE 100 Index	UKK		1388	0.0009	0.460	-1.196	20.50	18026.69***
		ETF	iShares Core FTSE 100 UCITS ETF GBP (Dist)	ISF.L		1388	0.0004	0.469	-1.346	21.56	20334.81***
	Japan	Stock	NIKKEI 225 Index	^N225		1388	0.0095	0.513	-0.126	7.26	1034.07***
		ETF	iShares Core Nikkei 225 ETF	1329.T		1388	0.0098	0.513	-0.150	7.34	1074.71***

Source: Yahoo! Finance website and the wall street journal website

Table 2. Summary statistics of unit-root, LM, and ARCH LM tests for stock index and ETF returns

Indices	Market	Type	Code	ADF	ARMA	SBC	LM	ARCH-LM	GARCH	SBC	ARCH-LM	EGARCH	SBC	ARCH-LM
Stock and ESG ETFs Indices	New York	Stock	NYA	-43.301***	（3,2)	1.4604	**12.900****	413.631***	（1,1)	0.8064	0.9108	（1,1)	0.7572	2.638
		ETF	DSI	-45.352***	（2,2)	1.5796	**17.178*****	406.526***	（1,1)	0.9883	3.402	（1,1)	0.9527	3.679
	Frankfurt	Stock	^GDAXI	-38.102***	（3,2)	1.6426	5.3838	201.061***	（1,1)	1.2976	5.707	（1,1)	1.2446	3.2366
		ETF	DXSK.F	-39.417***	（2,2)	1.1351	2.7411	319.644***	（1,1)	0.8241	**9.196***	（1,1)	0.8019	5.973
	London	Stock	UKX	-38.556***	（2,2)	1.2829	3.7016	68.5557***	（1,1)	0.9044	6.534	（1,2)	0.8731	**106.493*****
		ETF	XS8R.L	-37.419***	（2,2)	1.9143	0.3892	136.799***	（1,2)	1.782	**14.101*****	（1,2)	1.7542	**9.510****
	Japan	Stock	^N225	-33.218***	（2,2)	1.6443	6.3668	177385***	（1,1)	1.5022	1.7	（1,1)	1.4637	6.7332
		ETF	1498.T	-15.206***	（3,2)	1.8578	2.5748	-15.205***	（1,1)	1.5022	4.079	（3,2)	1.5387	6.7994
Stock and non-ESG ETFs Indices	New York	Stock	NYA	-43.301***	（3,2)	1.4604	**12.900****	413.631***	（1,1)	0.8064	0.9108	（1,1)	0.7572	2.638
		ETF	VOO	-44.967***	（3,2)	1.5223	**18.102*****	434.395***	（1,1)	0.919	1.7854	（1,1)	0.8828	3.849
	Frankfurt	Stock	^GDAXI	-38.102***	（3,2)	1.6426	5.3838	201.061***	（1,1)	1.2976	5.707	（1,1)	1.2446	3.2366
		ETF	SXR7.F	-36.709***	（3,2)	1.5122	**7.994***	260.896***	（1,1)	1.0989	**4.027*****	（1,1)	1.0523	4.31
	London	Stock	UKX	-38.556***	（2,2)	1.2829	3.7016	68.5557***	（1,1)	0.9044	6.534	（1,2)	0.8731	**106.493*****
		ETF	ISF.L	-37.999***	（2,2)	1.3321	4.3329	52.305***	（1,1)	0.9701	5.947	（1,1)	0.941	**7.936***
	Japan	Stock	^N225	-36.302***	（2,1)	1.5186	0.9935	218.785***	（1,1)	1.3532	4.613	（1,1)	1.3161	2.9141
		ETF	1329.T	-36.045***	（2,1)	1.5174	1.5489	196.232***	（1,1)	1.3602	3.3734	（1,1)	1.3228	2.6764

Note: ADF is the t-statistic for the Augmented Dickey-Fuller test with a constant and trend at the level LM is Breusch-Godfrey serial correlation test, and we use Lag (4) to be the best lag period. SBC is Schwarz Criterion. *, **, and *** are significant at 10, 5, and 1% levels, respectively; p-values are in parentheses.

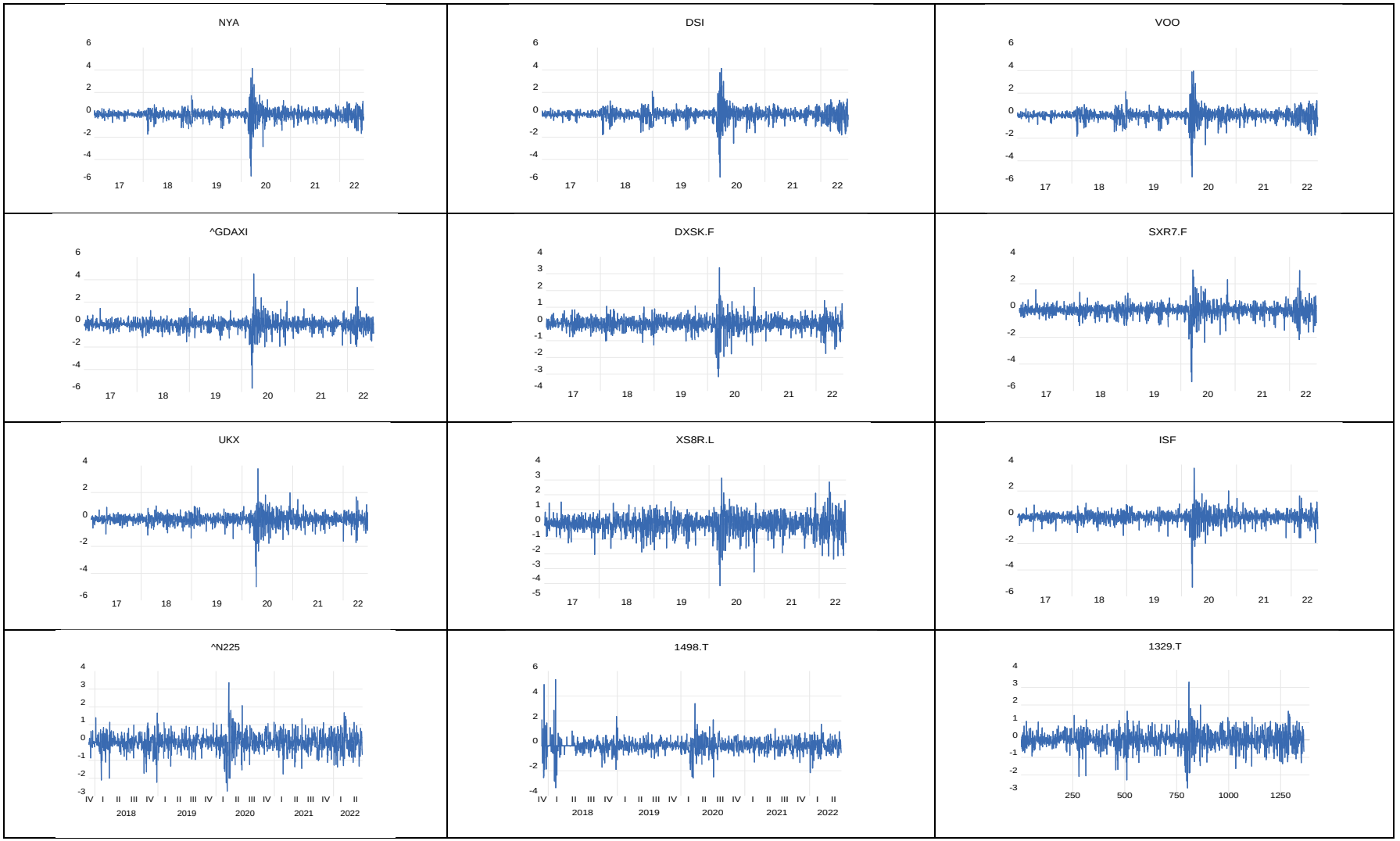

Figure 1. Daily returns of equity ETFs and stock indices

Table 3. Spillover effects of returns and volatilities for ESG and Non-ESG ETFs

Panel A: Spillover Effects

ETFs & indices	Code	Spillover Effects of Returns				Meam				Spillover Effects of Return Volatilities			
		GARCH		EGARCH		GARCH		EGARCH		GARCH		EGARCH	
		Stock	ETF	Stock	ETF	Stock	ETF	Stock	ETF	Stock	ETF	Stock	ETF
		1(d)	*2(w)*	*3(d)*	*4(w)*	*5(k)*	*6(z)*	*7(k)*	*8(z)*	*9(l)*	*10(v)*	*11(ı)*	*12(v)*
ESG ETFs	DSI/	-0.0254	-0.0275	-0.0358	0.0432	0.0001	0.09	0.039	0.0401	**1.1257**	**-0.1475**	0.1316	0.0219
	NYA	(0.2027)	(0.4403)	(0.3548)	(0.4298)	(0.9967)	(0.1033)	(0.5543)	(0.5083)	(0.0000)***	(0.0001)***	(0.3298)	(0.2581)
	DXSK.F/	-0.0059	0.0181	0.0502	0.0265	**0.1063**	0.0505	-0.0017	0.0325	**0.8962**	**0.0498**	**0.0564**	**0.0415**
	^GDAXI	(0.4407)	(0.5299)	(0.1695)	(0.2960)	(0.0000)***	(0.6264)	(0.9828)	(0.7345)	(0.0000)***	(0.0000)***	(0.0001)***	(0.0032)***
	XS8R.L/	0.0217	**0.0224**	0.021	0.0101	-0.0058	**-0.2421**	-0.0055	-0.032	**0.0118**	**0.3142**	**0.0752**	**0.0408**
	UKX	(0.2383)	(0.0836)*	(0.2412)	(0.7658)	(0.9302)	(0.0000)***	(0.9469)	(0.7804)	(0.0000)***	(0.0000)***	(0.0000)***	(0.0486)**
	1498.T/	**0.0473**	**0.1561**	0.0084	**0.2624**	0.107	**-0.2086**	0.1379	0.0341	-0.0192	**0.5552**	**0.0169**	**0.0386**
	^N225	(0.0000)***	(0.0000)***	(0.8320)	(0.0000)***	(0.5115)	(0.0165)**	(0.3586)	(0.7262)	(0.0287)	(0.0000)***	(0.0301)**	(0.0677)**
Non-ESG ETFs	VOO/	0.0078	0.0266	-0.0431	0.0449	0.0577	-0.0408	0.0156	0.0447	**0.0603**	**1.395**	0.0098	0.0224
	NYA	(0.9021)	(0.1349)	(0.4295)	(0.4581)	(0.4021)	(0.1371)	(0.8101)	(0.4896)	(0.0124)**	(0.0000)***	(0.4814)	(0.1344)
	SXR7.F/	**0.1669**	-0.0089	0.1412	0.05	0.1387	**0.1353**	0.0323	0.0483	**0.8962**	**-0.6017**	0.0678	0.0429
	^GDAXI	(0.0072)***	(0.5688)	(0.0127)	(0.0672)	(0.7302)	(0.0000)***	(0.6947)	(0.5335)	(0.0000)***	(0.0000)***	(0.0000(***	(0.0069)***
	ISF.L	0.0673	-0.0119	0.0189	-0.0021	0.2065	**0.1966**	**0.0762**	0.0844	-0.0127	**-0.541**	**0.0562**	**0.0395**
	UKX	(0.0201)	(0.2404)	(0.4458)	(0.9346)	(0.0974)*	(0.0000)***	(0.0365)**	(0.3467)	(0.2713)	(0.0000)***	(0.0000)***	(0.0055)***
	1329.T/	0.0721	**0.0406**	-0.0438	**0.3627**	0.1082	**0.0939**	-0.297	-0.0356	**-0.2959**	**0.7668**	**0.0951**	**0.1037**
	^N225	(0.4437)	(0.0029)***	(0.8006)	(0.0280) **	(0.1030)	(0.0213)**	(0.7989)	(0.6831)	(0.0000)***	(0.0000)***	(0.0001)***	(0.0001)***

Panel B: GRI Standards and Topic-Specific Standards

ETFs & indices	Code	Leverage Effect		GARCH				EGARCH			
				Stock		ETF		Stock		ETF	
		Stock	ETF	GRI SD	Spec Top	GRI SD	Spec Top	GRI SD	Spec Top	GRI SD	Spec Top
		13(δ)	*14(h)*	*15(r)*	*16(y)*	*17(r)*	*18(y)*	*19(r)*	*20(y)*	*21(r)*	*22(y)*
ESG ETFs	**DSI/**	**-0.1948**	**-0.1667**	**0.002**	**-0.0024**	**0.0056**	**0.0044**	**0.0423**	-0.0036	**0.0628**	0.0058
	NYA	(0.0000)***	(0.0000)***	(0.0216)**	(0.0921)*	(0.0001)***	(0.0309)**	(0.0034)***	(0.7686)	(0.0001)***	(0.6796)
	DXSK.F/	**-0.2136**	**-0.1279**	**0.0042**	-0.0012	0.0016	-0.0017	**0.0485**	**-0.0274**	**0.0229**	-0.0199
	^GDAXI	(0.0000)***	(0.0000)***	(0.0008)***	(0.3799)	(0.2131)	(0.1984)	(0.0001)***	(0.0129)**	(0.0092)***	(0.0583)
	XS8R.L/	**-0.0933**	**-0.0841**	0.0002	0.0002	**0.4055**	0.0738	0.0016	-0.0019	**0.0294**	0.0036
	UKX	(0.0000)***	(0.0000)***	(0.7155)	(0.7585)	(0.0000)***	(0.1299)	(0.7161)	(0.5524)	(0.0121)**	(0.5523)
	1498.T/	**-0.1561**	**-0.1432**	**-0.0821**	**0.0252**	-0.0032	0.007	**0.0184**	0.0065	-0.0065	0.0097
	^N225	(0.0000)***	(0.0000)***	(0.0001)***	(0.0161)**	(0.4077)	(0.1257)	(0.0580)*	(0.3865)	(0.6854)	(0.4450)
Non-ESG ETFs	**VOO/**	**-0.1774**	**-0.1665**	**0.0034**	**-0.0037**	**0.0018**	**0.0017**	**0.0045**	-0.0093	**0.0603**	-0.0071
	NYA	(0.0000)***	(0.0000)***	(0.0030)***	(0.0759)*	(0.0033)***	(0.0533)*	(0.0016)***	(0.4595)	(0.0002)***	(0.6106)
	SXR7.F/	**-0.2107**	**-0.2144**	**0.0092**	-0.0034	**0.0053**	-0.0025	**0.0547**	-0.028	**0.0487**	-0.007
	^GDAXI	(0.0000)***	(0.0000)***	(0.0008)***	(0.1902)	(0.0000)***	(0.1984)	(0.0000)***	(0.0860)*	(0.0001)***	(0.2914)
	ISF.L	**-0.1022**	**-0.1339**	-0.224	**-0.1031**	**0.0031**	0.0008	0.0006	**0.008**	**0.0277**	0.0034
	UKX	(0.0000)***	(0.0000)***	(0.2996)	(0.0000)***	(0.0009)***	(0.3593)	(0.6551)	(0.0000)***	(0.0060)***	(0.6000)
	1329.T/	-0.0125	0.0074	**0.0061**	**0.0091**	**0.0068**	**0.0079**	**0.0233**	0.0078	**0.0257**	0.006
	^N225	(0.7069)	(0.8254)	(0.0006)***	(0.0136)**	(0.0001)***	(0.0220)**	(0.0007)***	(0.3177)	(0.0001)***	(0.4351)

Note: *, **, and *** are significant at 10, 5, and 1% levels, respectively; p-values are in parentheses.

This study analyses the volatility transmission between ETF performance and equity indices. The result shows that DXSK.F/^GDAXI, XS8R.L/UKX, and VOO/NYA exhibit a strong positive bilateral relationship between the stock index and ETF. However, ISF.L/UKX shows strong adverse bilateral effects of ESG ETF. These findings indicate that the spillover effects of return volatilities positively affect stock indices and ETFs. The result shows that DSI/NYA, SXR7.F/^GDAXI, and 1329.T/^N225 were found to have mixed results on the stock index and ETF. The spillover effect of returns for ESG and the tracing stock index returns were found to have a positive significant bilateral relationship based on the EGARCH-M-ARMA model. Most of the ETFs and stock index exhibit a strong bilateral positive relationship between stock index and ESG ETF returns, except for DSI/NYA and VOO/NYA.

These findings proved that the volatility of ESG and non-ESG ETFs return affect the volatility of their stock index volatility returns, and vice versa. Thus, active trading from these ETFs' investments also significantly affects market index movements. The results from the volatility spillover effects are consistent with the founds of Lin, Shih, Ma, Chiang, Yang, and Ko (2005) about the heightened volatility of component stocks following the establishment of an ETF. These results are also consistent with the findings of Chen and Huang (2010) and Chen (2011) on ETFs having bilateral relationships with the spillover effect of volatilities. This additional evidence strengthens the economic significance of the buying and selling strategies of the investing public, especially ESG-based investors, in increasing the liquidity of assets.

4.2 Return and Risk

This study examined the relationship between risk and performance in daily ETFs and stock prices and provided evidence of their positive relationship. The significant positive findings in the section on standard deviation revealed that the number of returns (risks) gained in ETF or stock index could cause the rise (fall) of the other. The SXR7.F, DXSK.F/^GDAXI, and ISF.L/UKX exhibit a positive unilateral impact. However, ESG ETFs like XS8R.L and 1498.T have a significant negative unilateral impact, indicating that as returns increase, risk decreases. However, UKX has a positive unilateral impact base on the EGARCH model. Kovačić (2007) used Macedonian Stock Exchange daily data from 2005 to 2007 and found that the risk premium effect has a negative relationship between returns and risk. This finding is consistent with Lanne, and Saikkonen (2004) and Karanasos and Kim (2006) found a positive relationship between the risks and returns of six equity indexes, respectively.

4.3 Leverage Effect

The objective of this study is to measure leverage on ESG ETFs, non-ESG ETFs, and stock indexes. The leverage effect indicates that the stock (ETF) relationship between volatility negatively correlates to current stock (ETF) return variance. Leverage implies that a negative shock on conditional variance tends to push volatility higher than a positive shock of the same magnitude. The EGARCH-M–ARMA model findings were tabulated based on the coefficients of the leverage term (δ) and (h). They illustrated a strong negative asymmetric volatility effect in all the stock indices and ETFs. Findings show that a leverage effect exists on all ETFs and stock indexes to have a significant adverse effect on conditional variance (volatility), except the 1329.T/^N225 stock index.

4.4 GRI Standards (GRI) and Topic Specific Standards (Topic)

This research consistently discovered positive effects for GRI Standards and Topic Specific Standards report on the return volatility of ETFs and stock index returns. The estimated coefficients of GRI are positive and significantly more than the Topic-Specific Standards report. The results indicate that the announcement of the GRI policy increases the volatility of the equity index and ETFs. In addition, the results show a statistically significant difference

between ESG and non-ESG ETFs. Non-ESG corporations can assess their impacts as transparent, credible, and comparable by using the GRI Standards, which enhances their contribution to sustainable development. To ascertain the effect of the GRI Standards reports on sustainability. LaGore, Mahone, and Thorne (2015) found that companies voluntarily issuing Corporate Social Responsibility (CSR) reports have a stronger association between CSR strengths and subsequent stock returns. Bodhanwala and Bodhanwala (2019) observe that SRI portfolios outperform benchmark indexes but only in developed nations. Our findings indicate that these effects influence the performance of the index. Results can strengthen or weaken the investment strategies of ESG and non-ESG fund managers to engage investors in their portfolios. Kanuri (2020) stated that investors can allocate some investment portfolios toward meeting the desired Environmental, Social, and Governance (ESG) criteria. Diversification and risk reduction would be achieved through this investment. Investors are relying on global standards for sustainability reporting – the GRI Standards reports because firms can obtain a better reward based on CSR performance than those without issuing GRI Standards reports.

5. Conclusions

This research analyzed the relationship between equity indices and ETFs by comparing ESG and non-ESG ETFs. The GARCH-M-ARMA and EGARCH-M-ARMA models are applied to determine spillover and leverage effects of returns and returns volatilities. The relationship between the risks and returns of ETFs and the tracking of stock indices was also verified.

ESG ETFs have a positive bilateral relationship with the current volatility in equity index returns. Only minimal evidence was found that ESG ETFs negatively impact the returns of equity indices. This study tested the idea of volatility in return transfers between ETFs and equity index returns. These findings showed that both ESG and non-ESG ETFs positively affect the volatility of their stock index returns and vice versa. These again provide evidence that their volatility transmissions exist on both assets. ESG ETFs in the Japanese stock market exhibit a strong bilateral positive correlation between stock index and ESG ETF returns, while non-ESG ETFs have only a positive unilateral impact.

This study provides a measure of the leverage effect on ESG ETFs and non-ESG ETFs associated with the tracking of stock indices. The findings from EGARCH–M-ARMA model based on the coefficients of the leverage term illustrated a strong negative asymmetric volatility effect in all the stock indices and ETFs.

This study reviewed the relationship between risk and daily ETF returns and stock prices and provided evidence of their positive relationship. ETFs have significant adverse outcomes, suggesting that as returns increase, risk decreases. ESG ETFs in the UK and Japanese stock markets have a significant negative unilateral impact. However, non-ESG ETFs in the UK have a strong positive bilateral impact.

This study discovered consistent positive effects for GRI Standards and Topic-Sspecific Standards report on the volatility of ETFs and stock index returns. The estimated coefficients of GRI (2016) are more significantly positive than Special-Topics (2018). The results indicate that the announcement of the GRI policy increases the volatility of the equity index and ETFs. The sustainability report targets crucial stakeholders (such as investors, regulators, and stock exchanges) to facilitate responsible investment, promote financial market transparency and promote sustainability. Additionally, non-ESG ETFs have a larger impact than ESG ETFs. Outcomes can help ESG, and other fund managers convince investors of their portfolios.

The paper highlights the presence of unilateral and bilateral performance influences and asymmetrical volatility effects caused by major indices on ESG and non-ESG ETFs and vice versa. As a result, this paper provides empirical evidence on the impact of ETFs or their indexes

on one-way or two-way returns. These effects influence the performance of stock index returns, and thus they are valuable indicators for investors. Our results bring greater economic importance to the investment community as they can provide a strategic basis for traders and fund managers in creating market prospects and excess returns. These effects affect the return of the stock index. The results can help reinforce or weaken the investment strategies of ESG and non-ESG fund managers to convince investors of their portfolios.

The main limitation of this study is only two types of ETFs, namely ESG and other ETF types. The sample period is limited by the effective date of the new GRI standard (2016) and the Topic Specific Standard series (2018). A possible extension can consider other types of ETFs in a future study. Moreover, a huge potential area for future studies is comparing the performance comparison of ETFs with fellow exchange-traded products and finding similarities and differences in their behavior when subjected to used GARCH family model in the study.

ESG ETFs investors can derive financial and non-financial utilities from exercising their Investment Strategy in the money market. ESG ETFs can have a significant positive relationship with their stock indices and thus become viable instruments for investment and diversification. This study revealed consistent results on the positive impact of the lagged stock index on ETF returns.

Appendix 1.

The GRI Standards main contents

Series		Effective date
Universal Standards 100 series	GRI 101: Foundation 2016	2018/07/01
	GRI 102: General Disclosures 2016	
	GR/ 103: Management Approach 2016	
Topic-Specific Standards GRI 200: Economic	GRI 201: Economic Performance 2016	
	GRI 202: Market Presence 2016	
	GRI 203: Indirect Economic lmpacts2016	
	GRI 204: Procurement Practices 2016	
	GRI 205: Anti-corruption2016	
	GRI 206: Anti-competitive Behavior 2016	
	GRI 207: Tax 2019	**2021/01/01**
Topic-Specific Standards GRI 300: Environmental	GRI 301: Materials2016	2018/07/01
	GRI 302: Energy 2016	
	GRI 303: Water and Effluents 2018	**2021/01/01**
	GRI 304: Biodiversity 2016	2018/07/01
	GRI 305: Emissions2016	
	GRI 306: Waste 2020	**2022/01/01**
	GRI 307: Environmental Compliance 2016	2018/07/01
	GRI 308: Supplier Environmental Assessment 2016	
Topic-Specific Standards GRI 400: Social	GRI 401: Employment 2016	
	GRI 402: Labor/Management Relations 2016	
	GRI 403: Occupational Health and Safety 2018	**2021/01/01**
	GRI 404: Training and Education 2016	2018/07/01
	GRI 405: Diversity and Equal Opportunity 2016	
	GRI 406: Non-discrimination 2016	

	GRI 407: Freedom of Association and Collective Bargaining 2016	
	GRI 408: Child Labor 2016	
	GRI 409: Forced or Compulsory Labor 2016	
	GRI 410: Security Practices 2016	
	GRI 411: Rights of Indigenous Peoples 2016	
	GRI 412: Human Rights Assessment 2016	
	GRI 413: Local Communities 2016	
	GRI 414: Supplier Social Assessment 2016	
	GRI 415: Public Policy 2016	
	GRI 416: Customer Health and Safety 2016	
	GRI 417: Marketing and Labeling 2016	
	GRI 418: Customer Privacy2016	
	GRI 419: Socioeconomic Compliance 2016	

Source: GRI (Global Reporting Initiative). 2021. Consolidate Set of GRI Sustainability

Reference

Ackert, L. F. and Tian, Y. S. (2000). Evidence of the efficiency of index options markets. *Federal Research Bank of Atlanta Economic Review*, 85, 40-51

Balaban, E. and Bayar, A. (2005). Stock returns and volatility: empirical evidence from fourteen countries. *Applied Economics Letters,* 12(10), 603-611.

Black, B. (1976). Studies of stock price volatility changes, in Proceedings of the 176 Meetings of the American Statistical Association, *Business and Economic Statistics*, 177–181.

Bodhanwala, S., and Bodhanwala, R. (2019). Relationship between sustainable and responsible investing and returns: A global evidence. *Social Responsibility Journal*, 16(4), 579-594.

Bollen, N. P. (2007). Mutual fund attributes and investor behavior. *Journal of Financial and Quantitative Analysis*, 42(3), 683-708.

Bollerslev, T. (1990). Modeling the coherence in short-run nominal exchange rates: A multivariate generalized ARCH model. *Review of Economics and Statistics*, 72, 498–505.

Bollerslev, Chou. T. R. Y. and Kroner, K. F. (1992). ARCH modeling in finance: A review of the theory and empirical evidence. *Journal of econometrics*, 52(1-2), 5-59.

Chen, J. and Huang, C. (2010). An analysis of the spillover effects of exchange traded funds. Applied Economics, 42, 1155–1168.

Chen, J. H. (2011). The spillover and leverage effects of ethical exchange traded fund. *Applied Economics Letters*, 18(10), 983-987.

Chen, J. H. and Diaz, J. F. (2012). Spillover and asymmetric-volatility effects of leveraged and inverse leveraged exchange traded funds. *Journal of Business and Policy Research,* 7(3), 1-10.

Cheng, M. and Madhavan, A. (2009). The dynamics of leveraged and inverse exchange-traded funds. *Journal of Investment Management*, 7(4), 43-62.

Chou, R. (1987). Volatility persistence and stock valuations; Some empirical evidence using GARCH. *Journal of Applied Econometrics*, 3 (4), 279-294.

Christie, A. A. (1982). The stochastic behavior of common stock variances: Value, Leverage and interest rate effects, *Journal of Financial Economics*, 10, 407–432.

Dedi, L. and Yavas, B. F. (2016). Return and volatility spillovers in equity markets: An investigation using various GARCH methodologies. *Cogent Economics and Finance*, 4(1), 1266788.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica: Journal of the econometric society,*

987-1007.
Engle, R. F. and Ng, V. K. (1991). Measuring and testing the impact of news on volatility. *Journal of Finance*, 48 (5), 1749-1778.
Engle, R. F. and Ng, V. K. (1993). Measuring and testing the impact of news on volatility. *The journal of finance*, 48(5), 1749-1778.
Fedorova, E. and Saleem, K. (2010). Volatility spillovers between stock and currency markets: Evidence from emerging Eastern Europe, *Czech Journal of Economics and Finance*, 60(4), 519–533.
French, K., Schwert, G. and Stambaugh, R. (1987). Expected stock returns and volatility, *Journal of Financial Economics*, 19 (1), 3-29.
GRI (Global Reporting Initiative). 2021. Consolidate Set of GRI Sustainability Reporting Standards. Available online: https://www.globalreporting.org/standards/gri-standards-download-center/ (accessed on 1 September 2022).
Hedberg, C. J. and Von Malmborg, F. (2003). The global reporting initiative and corporate sustainability reporting in swedish companies. *Corporate Social Responsibility and Environmental Management*, 10(3), 153-164.
Jorge C. (2004). Modelling and Forecasting Volatility of the Portuguese Stock Index PSI-20, *Portuguese Journal of Management Studies*, 9(1): 3-21.
Kanuri, S. (2020). Risk and return characteristics of environmental, social, and governance (ESG) equity ETFs. *The Journal of Beta Investment Strategies*, 11(2), 66-75.
Karanasos, M. and Kim, J. (2006). A re-examination of the asymmetric power ARCH model. *Journal of Empirical Finance*, 13(1), 113-128.
Karolyi, G. (1995). A multivariate GARCH model for international transmissions of stock returns and volatilities: The case of the US and Canada, *Journal of Business and Economic Statistics*, 13, 1-25.
Kempf, A. and Osthoff, P. (2007). The effect of socially responsible investing on portfolio performance. *European financial management*, 13(5), 908-922.
Kovačić, Z. (2007). Forecasting volatility: Evidence from the Macedonian stock exchange. MPRA Paper 5319, University Library of Munich, Germany.
Krause, T. and Tse, Y. (2013). Volatility and return spillovers in Canadian and U.S. industry ETFs. *International Review of Economics and Finance*, 25 (January), 244-259.
LaGore, W., Mahoney, L., and Thorne, L. (2015). Standalone corporate social responsibility reports and stock market returns. *In Research on Professional Responsibility and Ethics in Accounting* , 19, 1-26).
Lanne, M. and Saikkonen, P. (2004). A skewed GARCH-in-mean model: An application to US stock returns. University of Jyvaskyla, Jyvaskyla.
Lin, C. H., Shih, F. Y., Ma, M. M., Chiang, W. C., Yang, C. W., and Ko, P. I. (2005). Should bleeding tendency deter abdominal paracentesis?. *Digestive and Liver Disease*, 37(12), 946-951.
Liu, Y. A. and Pan, M. S. (1997). Mean and volatility spillover effects in the U.S. and Pacific-Basin stock markets. *Multinational Finance Journal*, 1, 47-62.
Makhwiting, M. R. (2014). Modelling volatility and financial market risks of shares on the Johannesburg stock exchange, Doctoral dissertation, Department of Science and Agriculture Limpopo University.
Makhwiting, M.R., Lesaoana, M. and Sigauke, C. (2012). Modelling Volatility and Financial Market Risk of Shares on the Johannesburg stock exchange. *African Journal of Business Management*, 6(27), 8065-8070.
Morales, L. (2008). Volatility spillovers between equity and currency markets: Evidence from major Latin American countries. *Cuadernos de Economia*, 45, 185–215.
Nelson, D. B. (1991). Conditional heteroskedasticity in asset returns: A new approach.

Econometrica: Journal of the Econometric Society, 59(2) , 347-370.

Nguyen, D. T., Hoang, T. G., and Tran, H. G. (2022). Help or Hurt? The Impact of ESG on Firm Performance in S&P 500 Non-Financial Firms. *Australasian Accounting, Business and Finance Journal*, 16(2), 91-102.

Renneboog, Luc, Ter Horst, Jenke and Zhang, Chendi, (2008). The price of ethics and stakeholder governance: The performance of socially responsible mutual funds. *Journal of Corporate Finance*, 14 (3), 302-322.

Riedl, A. and Smeets, P. (2017). Why do investors hold socially responsible mutual funds?. *The Journal of Finance*, 72(6), 2505-2550.

Singh, P. Kumar, B. and Pandey, A. (2010). Price and volatility spillovers across North American, European and Asian stock markets. *International Review of Financial Analysis*, 19(1), 55-64.

Strignert, A. and Malm, E. (2021). ESG Investing through ETFs-An effective way to circumvent volatility? Lund University.

Tschopp, D. and Nastanski, M. (2014). The harmonization and convergence of corporate social responsibility reporting standards. *Journal of Business Ethics*, 125(1), 147-162.

Umar, Z. and Suleman, T. (2017). Asymmetric return and volatility transmission in conventional and Islamic equities. Risks, 5(2), 22.

Weston, P. and Nnadi, M. (2021). Evaluation of strategic and financial variables of corporate sustainability and ESG policies on corporate finance performance. *Journal of Sustainable Finance & Investment*,1-1.