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PAPER

Market Risk in Sustainable and Traditional Exchange-Traded Funds during Global Uncertainty

Deimantė Vasiliauskaitė (✉), Viltė Šabaniauskaitė, Dominyka Šimėnaitė, Kamilė Varžgalytė, Wenting Meng

Vilnius University, Vilnius, Lithuania

deimante.vasiliauskaite@vm.vu.lt

ABSTRACT

Amid global market turbulence triggered by the COVID-19 pandemic and subsequent geopolitical disruptions, investor interest in environmental, social, and governance (ESG) criteria has grown significantly. This study investigates the comparative market risk and performance of traditional and ESG-focused exchange-traded funds (ETFs) in U.S. and European markets from January 2020 to April 2025. The aim was to identify which ETF type delivers superior performance in terms of returns and risk mitigation during periods of heightened volatility. Using daily return data from eight ETFs (four U.S., four European; both ESG and traditional), we applied Value at Risk (VaR), Conditional Value at Risk (CVaR), and Sharpe ratio analysis. The results revealed notable regional differences: traditional U.S. ETFs achieved the highest returns and risk-adjusted performance, while European ESG ETFs demonstrated the lowest downside risk. ESG ETFs in the U.S. performed comparably to traditional funds, suggesting that ESG integration does not necessarily compromise financial outcomes. These findings highlight that ESG-related risk and return profiles vary by region. For investors and portfolio managers, this suggests that ESG allocation decisions should consider regional market dynamics to strike a balance between sustainability goals and financial performance.

KEYWORDS

environmental, social, and governance (ESG), exchange-traded funds (ETFs), global uncertainty, market risk, sustainable investing

1 INTRODUCTION

The increasing prevalence of global uncertainty, driven by events such as the COVID-19 pandemic, geopolitical conflicts, and economic policy uncertainty (EPU), has led to a more complex investment landscape. Investors are now more inclined to explore strategies that can mitigate risk while maintaining returns. Among these strategies, sustainable exchange-traded funds (ETFs) have gained prominence due to their focus on environmental, social, and governance (ESG) criteria. This paper

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examines the market risk differences between sustainable ETFs and traditional ETFs during periods of global uncertainty, with a specific focus on risk measures such as Value at Risk (VaR) and Conditional Value at Risk (CVaR). Usually, investors constantly seek to maximize returns while minimizing risk. Among the various risk factors, market risk, which is linked to price fluctuations driven by macroeconomic and geopolitical events, plays a crucial role in portfolio performance. Recent global disruptions, such as the COVID-19 pandemic, the Russia–Ukraine war, and trade tensions between the U.S. and China, have intensified market instability and increased investor demand for resilient investment instruments. In this context, ETFs have gained prominence as diversified and accessible investments for managing market exposure. At the same time, sustainability has become a growing priority for investors, with ESG criteria shaping a significant portion of investment decisions.

While ESG–focused ETFs continue to attract attention for their ethical orientation and long–term potential, a critical question remains: do these funds provide better protection against market risk compared to traditional ETFs during periods of global uncertainty? This question forms the core of the present research.

The relevance of the study lies in its alignment with shifting investor behavior. According to a 2024 Morgan Stanley Institute survey, 77% of global investors are interested in funds with a positive social or environmental impact, and over half express willingness to pay more for sustainable investments. However, the performance and risk behavior of sustainable ETFs, especially under stress conditions, are not yet fully understood. It remains unclear whether ESG ETFs serve as practical hedging tools or if they may, in fact, be more vulnerable to systemic risks than traditional alternatives.

Although prior research has addressed ESG stock performance, risk characteristics, and recent global crises, there remains a lack of comparative analysis of market risk in traditional versus sustainable ETFs across both U.S. and European markets during global uncertainty [1]. This study aims to fill that gap by providing empirical evidence on how these two ETF categories perform under stress.

The aim of this study, after analyzing the theoretical framework and calculating market risk and return indicators, is to determine which type of ETF (traditional or sustainable) demonstrates lower risk and higher return under volatile market conditions.

2 LITERATURE REVIEW

This part of the study will focus on the theoretical background of market risk -its definition and measurement methods. Moreover, based on existing literature, this part will compare traditional and sustainable investments during normal market conditions and present the impact of global uncertainty on stocks and exchange-traded funds.

Systematic risk is also known as “market risk,” which is related to the general market situation [2] and refers to the risk of losses because of fluctuations in overall market price levels [3]. Five categories of market risk were distinguished: equity risks, fixed-income risks, foreign-exchange risks, commodity risks, and miscellaneous risks (including risks associated with catastrophes, weather conditions, or property positions) [4]. According to the source [5], the main causes of market risk are changes in interest rate, investors’ expectations of economic perspectives, and

changes in purchasing power. The Corporate Finance Institute [6] supplements this list by incorporating geopolitical factors. Szylar [2] includes events of national importance. As market risk is a component of financial risk [4], it is crucial to measure losses; therefore, VaR and CVaR have become popular risk measures for measuring downside risks (losses) [7]. VaR is the quantile of the loss distribution [8] and is "defined as the maximum loss expected to be incurred over a certain time horizon at a given probability" [9]. While CVaR, or "expected shortfall" [10], is defined as "the expected loss given that the loss is greater than or equal to the VaR value" [9].

Traditional investing, according to the CFA Institute (2025), involves investing capital in opportunities where the risk level is appropriate to the expected return. Sustainable investing, on the other hand, integrates both traditional investing and ESG information. In other words, according to Morningstar (2023), sustainable investing focuses not only on long-term value creation for investors but also on promoting positive environmental, social, and corporate governance (ESG) outcomes for society. However, there is no consensus in the literature when comparing the risk and return of sustainable and traditional investments [11], [12]. From one perspective, results of some studies coincide on the point that ESG investments (stock portfolios and funds) are less risky compared to traditional investments, as ESG investments have faced lower drawdowns [13], more minor downside deviations [14], or were less volatile [12]. Authors reached a consistent conclusion even though they analyzed different geographical segments: [13] – global market (developed and developing countries), [12] – U.S. market, [14] – U.S. and international markets. However, from the return perspective, according to [13], ESG portfolios tended to exhibit higher average returns; however, research by the Morgan Stanley Institute for Sustainable Investing [14] indicates that there is no significant difference in total return when comparing ESG and traditional funds. Moreover, while comparing risk-adjusted returns, Auer and Schuhmacher's [15] research confirms that the performance of ESG portfolios measured by the Sharpe ratio is similar to their benchmarks in Asia-Pacific and the U.S. But in the European market (in financial and miscellaneous sectors), ESG portfolios had lower risk-adjusted returns than passive benchmarks. In other words, in the Asia-Pacific region and the U.S., investors do not need to sacrifice financial performance if they seek to invest in a socially responsible manner; however, in Europe, pursuing a positive impact while investing may require accepting lower financial returns. Verheyden et al. results [13] are opposite to what the author indicates, that portfolios with an ESG filter had improved risk-adjusted returns compared to the unscreened universe. Overall, results in the literature differ, which may be due to differences in analysis periods, methods, and geographic regions.

The dynamic connectedness between sustainable assets and traditional assets has been a subject of extensive research. Studies have shown that sustainable ETFs exhibit lower volatility spillovers compared to traditional ETFs, making them a more attractive option for risk-averse investors. The use of advanced models such as the TVP-VAR model and wavelet-based VaR analysis has further highlighted the role of green bonds in reducing portfolio risk ratios [16].

Portfolio diversification and hedging strategies are effective in mitigating risks associated with sustainable ETFs. The inclusion of green bonds in a portfolio has been shown to reduce volatility spillovers and enhance risk-adjusted returns.

Additionally, the use of financial derivatives and dynamic portfolio rebalancing can further enhance the risk management capabilities of sustainable ETFs [17].

Investor behavior plays a crucial role in shaping the risk profile of ETFs. Risk-averse investors have shown a preference for sustainable ETFs due to their perceived stability and lower exposure to tail risks. The use of CVaR as a risk measure has been particularly useful in capturing the tail risks associated with sustainable investments. At the same time, providing investors with a more comprehensive view of potential losses [18].

The ESG criteria have also influenced investor decisions during periods of global uncertainty. Investors have increasingly focused on ESG factors when making investment decisions, driven by the belief that these factors can mitigate risks and enhance long-term returns. This shift in investor behavior has been supported by research, which indicates that ESG investments tend to outperform traditional investments during periods of high uncertainty [19].

The comparison of market risk differences between sustainable ETFs and traditional ETFs during periods of global uncertainty highlights the superior risk-adjusted performance of sustainable ETFs. The use of VaR and CVaR as risk measures has provided valuable insights into the risk profiles of these ETFs, with sustainable ETFs exhibiting lower volatility and tail risks. As global uncertainty continues to shape the investment landscape, sustainable ETFs are likely to remain a preferred choice for risk-averse investors seeking to mitigate risks while achieving their investment objectives. In Table 1, the comparison of different ETFs and different risk measures is presented.

Table 1. Comparison of VaR and CVaR across different ETFs

ETF Type	VaR Insights	CVaR Insights	Citation
Sustainable ETFs	Lower volatility and tail risks	Reduced average losses beyond VaR	[19], [16]
Traditional ETFs	Higher volatility and tail risks	Increased average losses beyond VaR	[17], [20]

Uncertainty is a lack of information [21]; it becomes difficult to estimate what could happen in the future. The importance of uncertainty in financial markets has increased due to new sources of it, including geopolitical tensions, trade disputes, and disease outbreaks [22]. The most recent global events highlighted in literature, which have increased market uncertainty and attracted researchers' attention, include the COVID-19 pandemic, followed by the Russia–Ukraine war and the U.S.–China trade war. According to González-Hermosillo and Hesse [23], during periods of heightened uncertainty, investors with a low tolerance for risk can experience significant effects from even small shocks in global financial markets. For example, Burggraf et al. [24] analyzed the S&P 500 return and found that President Trump's tweets associated with the U.S.–China trade war negatively affected stock prices and increased the VIX index. The impact varied across industries, depending on the extent of trade links with China. Similarly, Wengerek et al. [25] analyzed 1194 U.S. stocks and showed that U.S. announcements of tariffs, regardless of their purpose, caused negative abnormal stock returns. These findings illustrate how global uncertainty events contribute to increased market risk. However, as the interest in sustainable investing increases, it is important to understand how periods of uncertainty affect ESG investments and to compare their resilience during such periods with traditional investments, particularly given that the previously mentioned

authors [12], [13], [14], [15] reported conflicting results when periods of uncertainty and stability were not distinguished.

Roy et al. [24], who analyzed ESG equity portfolios in the US, Japan, China, and India and Beloskar and Rao [1], who analyzed Bombay Stock Exchange stocks, results coincide that ESG stocks experienced lower volatility during COVID-19 than after the pandemic. However, the results of ElBannan, [25] research differ. The author analyzed iShares MSCI ETFs and states that during the pandemic, the volatility of ESG ETFs was higher than before or after the pandemic.

In a comparison of high and low-rated ESG ETFs [26], it was found that during crisis periods–the COVID-19 and Russia–Ukraine war–low ESG ETFs experienced higher price jumps in upward and downward directions and lower returns than high ESG ETFs, which partially confirms Beloskar and Rao's [1] findings that during the pandemic, there was a positive relationship between ESG ratings and returns of stocks.

Particularly, in a comparison of ESG and traditional ETFs, ElBannan [25] states that ESG ETFs experienced lower volatility and higher returns than traditional ETFs during COVID-19. Beloskar and Rao [1] also present the advantage of ESG stocks over traditional stocks, showing that the daily prices of ESG stocks declined less than those of traditional stocks. However, according to [27], results may vary depending on the region, as the Sharpe and Omega ratio values of the ESG-based index in China were not significantly different from those of the market benchmark. In contrast, in India, the U.S., and the U.K., the decline in these ratio values during the pandemic was lower than that of the market benchmarks.

Overall, the study directions of authors, analyzing the impact of global uncertainty on stocks and ETFs included the overall effect of uncertainty on investments without distinguishing between sustainable and traditional investments [25], [27]. The other authors focused on the comparison between ESG and traditional investments during periods of uncertainty [1], [25], [27]. Some others have compared ESG investments before, during, and after such periods [1], [24], [25]. And finally, the other research is concentrated on the comparison of high and low-rated ESG investments [1], [26]. Despite the growing body of research on the impact of global uncertainty on financial markets, several issues remain unsolved. There is no consensus among authors who compared ESG and traditional investments during periods of uncertainty, nor among those who conducted such comparisons without distinguishing between periods of uncertainty and stability. Moreover, most research tends to focus on individual global uncertainty events. It provides limited comparisons of sustainable and traditional ETFs between Europe and the U.S. Therefore, there is a need for a comprehensive analysis over an extended period that includes major recent uncertainty events such as the COVID-19 pandemic, the Russia–Ukraine war, and the U.S.–China trade war.

3 METHODOLOGY

This section presents the key methodological aspects of the study. It outlines the object and aims of the study, formulates the hypothesis, and explains the design adopted to examine the comparative performance of sustainable and traditional ETFs during periods of global uncertainty. The section also describes the process of data collection, the sources used, and the rationale behind the selection of analytical tools.

Furthermore, it details the statistical methods applied, with particular focus on risk and return measures computed using EViews software.

VaR and CVaR are widely used risk management tools that help quantify potential losses in a portfolio over a specific time horizon at a given confidence level. VaR measures the maximum potential loss that a portfolio could face with a given probability. In contrast, CVaR, also known as Expected Shortfall, measures the average of the losses beyond VaR, providing a more comprehensive view of tail risks. These metrics are beneficial during periods of global uncertainty, when market volatility and tail risks are more pronounced.

Sustainable ETFs, which focus on ESG criteria, have shown resilience during periods of global uncertainty. Research indicates that ESG investments tend to be more stable under conditions of economic policy uncertainty (EPU) compared to traditional investments. This stability can be attributed to the inherent ESG criteria, which often align with long-term sustainability goals and may reduce exposure to volatile market conditions [19].

The application of VaR and CVaR to sustainable ETFs has revealed fascinating insights. For instance, during the COVID-19 pandemic, the connectedness index between green stocks and green bonds increased significantly, indicating a contagion effect. However, green bonds were found to reduce portfolio risk ratios across various investment horizons, highlighting their role as an effective diversification asset [16].

Traditional ETFs, on the other hand, have shown higher volatility and risk during periods of global uncertainty. The use of VaR and CVaR in traditional ETFs has revealed that these funds are more susceptible to market downturns and tail risks. For example, during the 2008 financial crisis, traditional ETFs experienced significant losses, with VaR estimates failing to capture the true extent of potential losses due to high asset correlations [20].

Research Hypothesis. This study is based on the following hypothesis: ESG-oriented ETFs exhibit significantly lower downside risk and deliver higher risk-adjusted returns than traditional ETFs during periods of global uncertainty. This hypothesis is grounded in modern portfolio theory [28], which states that investors aim to maximize expected return for a given level of risk or minimize risk for a given expected return. A thorough literature review has reinforced this hypothesis, providing deeper insights into how ESG principles contribute to portfolio resilience, especially in uncertain market conditions.

Research Design. The study employs a quantitative, non-experimental, comparative research design. It focuses on evaluating the performance of ESG and traditional ETFs in the U.S. and European markets over a five-year period (2020–2025). The chosen fund tickers are SPY, VOO, ESGV, SUSA, MEUD, XMEU, ESGE, and EDM6.

Data Collection and Sources. Research uses secondary data, specifically daily closing prices and price changes of selected ETFs. The data was collected from the Investing.com website and the Financial Times. The dataset spans from the 2nd of January 2020 to the 30th of April 2025, covering periods of both market stability and uncertainty. ETF selection criteria included:

- Representing either ESG or traditional strategies.
- Belonging to U.S. or European markets.
    - Availability of complete historical data for the target period. Data Analysis Methods. Data analysis was performed using EViews software, which is

well-suited for time series and financial econometrics. The analysis was conducted in two parts:

1. Descriptive Statistics:
- Mean, median, standard deviation, skewness, kurtosis, Jarque-Bera test for normality, minimum and maximum returns, and total return over the period.

2. Risk and Performance Metrics:

1) VaR–estimates potential loss at a given confidence level. In analysis, the following formula will be used for VaR calculation:

$$\text{VaR} = Z \times \sigma \times \text{Portfolio Value} \tag{1}$$

Where:
- Portfolio Value: the total value of the investment.
- Expected Volatility (σ): the standard deviation of investment returns, reflecting the risk level.
- Z (confidence level): The Z-score corresponds to the desired confidence level (e.g., 1.645 for 95%, 2.33 for 99%).

2) CVaR – calculates average loss beyond VaR. In analysis, the following formula will be used for CVaR calculation:

$$\text{CVaR}\alpha = \text{E}[L \mid L \leq \text{VaR}\alpha] \tag{2}$$

Where:
- VaR: The maximum loss threshold at confidence level α, meaning losses are not expected to exceed this amount with probability α.
- L: the random variable representing portfolio losses, which can be modelled using historical returns or statistical distributions.
- E: The mathematical expectation (mean value), used to compute the average loss in the tail distribution beyond VaR.

This formula for CVaR calculates the average of all losses that are worse than VaR.

3) Sharpe Ratio–evaluates risk-adjusted return based on excess return over volatility. In the analysis, the following formula will be used for the Sharpe Ratio calculation:

$$\text{Sharpe ratio} = \frac{R_p - R_f}{\sigma_p} \tag{3}$$

Where:
- Portfolio return (R_p): the overall return generated by the portfolio over the evaluation period.
- Risk-free rate (R_f): the return from an essentially riskless asset, serving as a benchmark for performance evaluation.
- Standard deviation (σ_p): the volatility measure of the portfolio's return above the risk-free rate, reflecting the portfolio's risk level.

As explained by [29], there are generally accepted benchmarks that help investors assess risk-adjusted performance. According to these guidelines, a Sharpe ratio below 1.0 indicates that the portfolio may be generating insufficient returns relative to the risk taken (see Table 2).

Table 2. Sharpe ratio interpretation guidelines

Sharpe Ratio	Risk-Adjusted Returns
Less than 1.00	Moderate
1.00–1.99	Good
2.00–2.99	Very good
3.00 or above	Excellent

Source: [29].

A ratio below 1.0 suggests that the excess returns do not adequately compensate for the risk incurred, which indicates moderate performance. Ratios between 1.0 and 1.99 are viewed as good, meaning that the investment provides acceptable returns relative to its risk. Ratios from 2.0 to 2.99 are considered very good, reflecting a strong risk-reward balance, while a ratio of 3.0 or above is excellent.

4 RESULTS AND DISCUSSIONS

From 2020 to 2025, global ETF performance was shaped by three significant sources of uncertainty: the COVID-19 pandemic, the Russia–Ukraine war, and the renewed U.S. trade tensions under the Trump administration in 2025. These events triggered sharp market corrections, supply shocks, inflation, and policy shifts that impacted investor sentiment and risk perception.

	EDM6_CHANGE	ESGE_CHANGE	ESGV_CHANGE	MEUD_CHANGE	SPY_CHANGE	SUSA_CHANGE	VOO_CHANGE	XMEU_CHANGE
Mean	0.000321	0.000312	0.000508	0.000345	0.000499	0.000497	0.000500	0.000346
Median	0.000000	0.000831	0.000909	0.000989	0.000906	0.000759	0.000916	0.000801
Maximum	0.079787	0.083283	0.098700	0.085368	0.105019	0.104986	0.095364	0.087930
Minimum	-0.117647	-0.113717	-0.110297	-0.109745	-0.109424	-0.103394	-0.117388	-0.116984
Std. Dev.	0.011316	0.011120	0.014291	0.011343	0.013692	0.013751	0.013705	0.011321
Skewness	-1.073780	-0.937988	-0.241323	-0.909076	-0.257357	-0.070124	-0.320062	-1.100457
Kurtosis	16.43865	15.87488	13.00733	14.78818	15.11126	13.58683	16.04137	17.72819
Jarque-Bera	10194.23	9317.557	5525.063	7830.608	8088.244	6170.209	9383.898	12206.24
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	0.423586	0.412160	0.671164	0.456193	0.658947	0.657151	0.659963	0.456964
Sum Sq. Dev.	0.169037	0.163234	0.269578	0.169828	0.247451	0.249610	0.247942	0.169165
Observations	1321	1321	1321	1321	1321	1321	1321	1321

Fig. 1. Descriptive statistics of the chosen 8 ETFs in the five-year period

Source: Created by authors using Eviews software.

Based on 1,321 daily observations from January 2, 2020, to April 30, 2025, using EViews software, the descriptive statistics (see Figure 1) highlight notable differences among the eight ETFs. U.S. sustainable ETFs, particularly ESGV and SUSA, achieved the highest returns during periods of global uncertainty. ESGV had the highest average daily return of 0.0508% and a cumulative return of 67.12%, although it also exhibited the highest volatility of 1.43%, indicating more pronounced price swings.

In contrast, ESGE, a European sustainable ETF, had the lowest average daily return of 0.0312% and a cumulative return of 41.22%. The most stable ETF, EDM6, had the lowest standard deviation of 1.13%, but also modest returns, with an average daily return of 0.0321%.

All ETFs exhibited negative skewness, indicating a greater downside risk, with XMEU being the most skewed, at –1.10, and ESGV being the least skewed, at –0.24.

Kurtosis values indicated leptokurtic distributions across all funds, pointing to frequent extreme returns. XMEU had the highest kurtosis of 17.73, while ESGV had the lowest of 13.01. High Jarque-Bera values (ranging from 5,525 to 12,206) confirmed significant departures from normality.

Overall, U.S. sustainable ETFs outperformed both European and traditional ETFs, offering higher returns despite higher volatility. Their relative strength suggests growing investor confidence in sustainability–focused funds during periods of economic and geopolitical uncertainty.

Table 3. Sharpe ratio results

United States		Europe	
ETF Ticker	**Sharpe Ratio**	**ETF Ticker**	**Sharpe Ratio**
SPY	0.458	MEUD	0.430
VOO	0.459	XMEU	0.432
ESGV	0.449	ESGE	0.391
SUSA	0.455	EDM6	0.397

Source: Created by authors.

To complement the descriptive statistics, Sharpe ratios were calculated (see Table 3) for all eight ETFs over the 2020–2025 period using annualized returns and standard deviations. U.S. ETFs used the 5-year Treasury yield average of 2.61% (FRED), while European ETFs used the German 5-year bond yield average of 0.95% (Investing.com) for consistency.

Among U.S. ETFs, Sharpe ratios ranged narrowly from 0.449 to 0.459, with VOO achieving the highest risk–adjusted return of 0.459, followed closely by SPY, which resulted in 0.458, and SUSA, which resulted in 0.455. ESGV, despite delivering the highest total and average daily returns, had a slightly lower Sharpe ratio of 0.449 due to its higher volatility. In contrast, European ETFs showed weaker risk–adjusted performance, with MEUD (0.430) and XMEU (0.432) performing moderately. At the same time, sustainable options like EDM6 (0.397) and ESGE (0.391) had the lowest ratios, reflecting their lower returns and greater downside risk.

In conclusion, U.S. ETFs outperformed their European counterparts in terms of Sharpe ratio results during the chosen period. Additionally, U.S. sustainable ETFs performed similarly to traditional ETFs, indicating that ESG–focused investment instruments may also offer financial resilience and competitive returns. In contrast, the weaker performance was shown by European ETFs, especially sustainable ones. It may reflect not only lower returns, but regional differences, as the U.S. is considered to be a more mature market.

Table 4. VaR and CVaR results

United States			Europe		
ETF Ticker	**VaR**	**CVaR**	**ETF Ticker**	**VaR**	**CVaR**
SPY	2,530.64 USD	3,832.03 USD	**MEUD**	1,843.14 EUR	2,884.62 EUR
VOO	2,533.16 USD	3,819.44 USD	**XMEU**	1,839.54 EUR	2,990.67 EUR
ESGV	2,641.30 USD	3,927.46 USD	**ESGE**	1,806.88 EUR	2,752.46 EUR
SUSA	2,541.64 USD	3,871.55 USD	**EDM6**	1,838.74 EUR	2,913.68 EUR

Source: Created by authors.

To evaluate the downside risk of traditional and sustainable ETFs across U.S. and European markets, a VaR and (CVaR) analysis was conducted (refer to Table 4) using a consistent position size of 5,000 USD (4,396.50 EUR for EU ETFs) and a 99% confidence level over a five–year horizon.

Among U.S. ETFs, the traditional funds SPY and VOO had VaRs of around $2,531–$2,533 (about 50.6% of the portfolio) and CVaRs above $3,800, indicating sizable losses in extreme market conditions. ESGV, a sustainable U.S. ETF, showed the highest downside risk with a VaR of 2,641.30 USD and CVaR of 3,927.46 USD, aligning with its high return but also higher volatility. In contrast, European ETFs demonstrated a lower overall risk. Traditional funds MEUD and XMEU had VaRs around 1,840 EUR (about 37% of portfolio value), with XMEU standing out due to its highest CVaR (2,990.67 EUR) in the group, reflecting its left–skewed distribution and heavier tails. European sustainable ETFs ESGE and EDM6 exhibited the lowest downside risk metrics, with VaRs of below 1,840 EUR and CVaRs of under 2,920 EUR, highlighting their conservative profiles.

Interestingly, while U.S. sustainable ETFs carried slightly more risk than traditional ones, the opposite was observed in Europe. These results suggest that sustainable ETFs are not inherently riskier and may offer greater stability, particularly in less volatile markets, such as the EU.

The results of the study align with those of Hasan et al. [27], who also note that the results vary across different regions. Moreover, from one perspective, the results align with ElBannan [25], who suggests that ESG ETFs are more stable, as they exhibit lower volatility. However, from another point, when comparing returns, results differ: while ElBannan [25] states that ESG ETFs outperformed conventional funds, this study found that traditional ETFs outperformed sustainable ones in terms of returns.

This study identified notable cross-regional heterogeneity in the risk and return characteristics of ESG and traditional ETFs, supporting what may be conceptualized as the Regional Divergence Theory of ESG Performance. This theory posits that the observed differences are influenced by variations in institutional quality and market maturity across regions.

According to North's institutional theory, institutions—both formal (e.g., legal systems, regulatory frameworks) and informal (e.g., norms, values, investor behavior)—shape economic performance by influencing incentives and constraints within financial systems [30]. In the case of ESG investing, U.S. markets may benefit from more market-driven institutional environments, characterized by stronger investor protections, transparency, and innovation capacity. These factors enable U.S. ESG ETFs to exhibit higher risk-adjusted returns, as seen in this study. In contrast, European financial systems, while more regulatory-driven and committed to ESG principles, often exhibit a more risk-averse investment culture and institutional conservatism, which may explain their lower returns but more stable performance profiles.

La Porta et al.'s legal origin framework further enriches this explanation by classifying financial systems based on legal traditions—common law (e.g., U.S.) and civil law (e.g., most European countries)—and linking them to investor protections and financial development [31]. Their findings suggest that common law countries tend to support stronger capital markets, greater financial disclosure, and a more vibrant investment environment—factors that contribute to more efficient ESG integration and superior fund performance. Civil law systems, by contrast, often rely on state intervention and exhibit less dynamic capital market behavior, potentially limiting the competitiveness of ESG funds despite strong policy support.

Market maturity also plays a critical role. U.S. markets are deeper, more liquid, and offer more advanced ESG data infrastructures and diversified investment vehicles, allowing ESG strategies to compete on both ethical and financial grounds. Meanwhile, European markets, though leaders in sustainable finance regulation, may be constrained by fragmented ESG methodologies, smaller ETF scale, and limited retail investor engagement.

Overall, this theoretical framing helps explain why ESG investment outcomes are not uniform across regions and emphasizes the importance of aligning ESG strategies with institutional and market-specific conditions.

Research on the Regional Divergence Theory of ESG performance has emerged as a critical area of inquiry due to its implications for sustainable investment, corporate governance, and economic development across diverse markets [32], [33]. Since the coining of ESG in 2004, the field has evolved from focusing on corporate social responsibility to encompassing comprehensive ESG criteria that influence firm valuation and stakeholder engagement [34], [35]. The increasing global emphasis on ESG is reflected in the growing adoption of ESG reporting standards and investment strategies, with evidence showing significant regional disparities in ESG integration and financial impacts [36], [37]. For instance, ESG practices have been shown to enhance firm value in developed markets, while emerging markets exhibit heterogeneous outcomes influenced by institutional and market maturity factors [38], [39].

Despite extensive research, a specific problem persists in understanding the cross-regional heterogeneity of ESG performance and its determinants [40], [41]. Existing studies highlight the influence of institutional quality, governance frameworks, and market development on ESG outcomes but often treat emerging and developed markets as homogeneous groups [42], [43]. Moreover, conflicting findings exist regarding the financial benefits of ESG practices across regions, with some studies reporting positive effects in mature markets and mixed or negative effects in emerging economies [44], [45]. This controversy underscores a knowledge gap in integrating institutional theory with market maturity frameworks to explain why ESG performance diverges regionally [46]–[48]. The consequences of this gap include challenges for investors and policymakers in designing effective ESG strategies tailored to regional contexts [49].

5 CONCLUSION AND RECOMMENDATIONS

This study aimed to compare the market risks of traditional and sustainable ETFs in European and U.S. markets during a period of global uncertainty, evaluating which ETFs offer safer options in volatile conditions. The hypothesis was partially supported: U.S. ESG ETFs showed risk–adjusted returns similar to traditional U.S. ETFs, while European ESG funds prioritized stability over performance. Overall, ESG ETFs did not consistently deliver lower risk or higher returns during global uncertainty.

Market risk primarily arises from changes in interest rates, economic outlook, fluctuations in purchasing power, geopolitical factors, and national events. Measuring expected losses with VaR and CVaR is important, as it helps to determine possible financial losses. Literature comparing sustainable and traditional investments, both with and without considering periods of global uncertainty, presents mixed evidence on whether sustainable or traditional funds outperform in terms of return, risk, and risk-adjusted returns, often depending on the region.

The study applied descriptive statistics, Sharpe ratios, VaR, and CVaR calculations on ETF data from the 2nd of January 2020 to the 30th of April 2025, ensuring a structured and reliable analysis framework.

U.S. ETFs delivered higher average returns but also greater volatility compared to European ETFs. Sharpe ratios confirmed better risk-adjusted returns for U.S. ETFs, whereas European sustainable ETFs exhibited lower downside risk as indicated by VaR and CVaR. U.S. sustainable ETFs effectively balance return and risk, showing resilience in uncertain markets. European sustainable ETFs emphasized stability over maximizing returns.

Across risk metrics, U.S. ETFs exhibited more substantial returns with higher volatility, whereas European ETFs, particularly those focused on sustainability, prioritized downside protection during periods of global uncertainty. Traditional U.S. ETFs demonstrated the most substantial risk–adjusted returns, while European ESG ETFs offered a better defensive profile.

Despite offering valuable insights into the comparative risk and return characteristics of sustainable and traditional ETFs during periods of global uncertainty, this study is subject to several limitations. First, the sample is restricted to only eight ETFs—four from the U.S. and four from Europe, which, while representative, may not fully capture the diversity of the broader ETF landscape. The regional focus excludes key markets such as Asia-Pacific and Latin America, thereby limiting the global generalizability of the findings. Additionally, the analysis does not account for sector-specific variations within ETFs, which may influence risk-return profiles. The risk assessment relies primarily on traditional measures such as VaR, CVaR, and the Sharpe ratio, without incorporating more advanced econometric models that could provide deeper insights into extreme market behavior. The assumption of a static buy-and-hold investment strategy over the five-year period overlooks the impact of active management or dynamic portfolio rebalancing. Moreover, the classification of ETFs into ESG and traditional categories is not underpinned by a detailed discussion of ESG rating methodologies, which can vary significantly across providers. The study also does not control for broader macroeconomic variables such as interest rates, inflation, or policy shifts that could affect ETF performance. While return distributions were shown to deviate significantly from normality, the risk metrics applied still largely rely on assumptions of distributional regularity, potentially underestimating tail risks. Finally, as the dataset concludes in April 2025, the findings reflect a specific historical context and may not fully anticipate the evolving dynamics of ESG investing or future market developments.

Recommendations for Investors: Diversify between ESG and traditional ETFs. If there is no strict preference or personal value for choosing an ETF type, it is recommended to diversify, as ESG ETFs have not consistently outperformed traditional ETFs during volatile market conditions.

Diversify between regions. In general, U.S. ETFs tended to outperform their European counterparts during the analyzed period. Investors, focused on performance, may choose to invest in the U.S. market; however, regional diversification should be considered to balance risk and return accordingly. Based on the research results, we can see that market risk, as measured by VaR and CVar, is lower in Europe. However, investors should also diversify their portfolios across regions, focusing not only on risk profile but also on returns. Based on the results, we suggest a green portfolio that includes the SUSA ETF from the US, with a Sharpe ratio of 0.455, and the EDM6 ETF from Europe, with a Sharpe ratio of 0.397.

Evaluate risk preferences. ESG ETFs did not always offer lower downside risk; therefore, investors should look beyond the ESG label and do an analysis of risk

indicators, such as volatility, VaR, CVaR, and Sharpe ratio, before making investing decisions.

Future studies could expand the ETF sample to include a broader range of funds across more diverse geographic regions, such as Asia-Pacific, Latin America, or emerging markets, to evaluate whether regional ESG performance differences hold globally. A more granular approach could also examine sector-specific ESG ETFs (e.g., clean energy, technology, healthcare) to assess how sustainability considerations impact risk and return within individual industries.

Moreover, there is space to apply advanced econometric models—such as GARCH, DCC-GARCH, or machine learning techniques—to capture time-varying volatility, tail dependencies, and nonlinear relationships that are not fully addressed by traditional risk metrics. Exploring the use of dynamic portfolio strategies, including rebalancing rules or momentum-based ESG tilts, would also reflect more realistic investor behavior.

Another avenue is to integrate macroeconomic and policy variables—such as interest rate changes, inflation, or green finance regulations—into risk-return modelling to better understand how systemic factors affect ETF performance. Future research could also focus on ESG scoring methodologies, comparing how different ESG data providers or rating agencies influence fund categorization and investment outcomes.

Additionally, given the rise of social and environmental impact metrics, researchers may explore dual-objective performance frameworks that balance financial return with sustainability outcomes. Lastly, a longitudinal study examining post-2025 market behavior—particularly under evolving climate policies, technological transitions, or new geopolitical shocks—could provide timely insights into the resilience and effectiveness of ESG investing in a rapidly changing world.

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8 AUTHORS

Deimantė Vasiliauskaitė is a Professor at Vilnius University Business School in Lithuania. She is teaching and doing research in the field of sustainable investments, climate risk management, the banking sector, monetary policy and related fields (E-mail: deimante.vasiliauskaite@vm.vu.lt).

Viltė Šabaniauskaitė is a bachelor student of the Business Finance program at Vilnius University, Business School in Lithuania (E-mail: vilte.sabaniauskaite@vm.stud.vu.lt).

Dominyka Šimėnaitė is a bachelor student of the Business Finance program at Vilnius University, Business School in Lithuania (E-mail: dominyka.simenaite@vm.stud.vu.lt).

Kamilė Varžgalytė is a bachelor student of the Business Finance program at Vilnius University, Business School in Lithuania (E-mail: kamile.varzgalyte@vm.stud.vu.lt).

Wenting Meng is a postdoctoral fellow at Vilnius University, Business School in Lithuania. She is doing research on the topic "Climate change, economic challenges and peacebuilding: valuation of synergistic potential" (E-mail: wenting.meng@vm.vu.lt).