



Does Socially Responsible Investing Outperform Conventional Investing? A Cross-Country Perspective

Iram Hasan¹ · Shveta Singh¹ · Smita Kashiramka¹

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Abstract

Given the growing significance of socially responsible investing (SRI), the study aims to empirically examine the financial performance of socially responsible indices of India, China, the United States (US), and the United Kingdom (UK) vis-à-vis their respective market benchmark indices. The study uses various risk-adjusted performance measures such as Sharpe ratio, Jensen alpha, Treynor ratio, Information ratio, Modified Sharpe ratio, Sortino ratio, and Omega ratio to analyze the performance of SRI indices. The period of analysis extends from January 2018 to December 2021. The study performs various sub-period analyses including a crisis period analysis to assess the impact of the COVID-19 (coronavirus disease) crisis on the performance of select indices. Statistical tests such as the paired t-test and Levene's F test are applied to examine the homogeneity of means and variances of sample indices. Robustness checks involve calculating performance metrics across varying sample sizes using a growing window procedure. The results highlight the outperformance of SRI indices over market benchmarks in India, the US, and the UK, suggesting that investors do not have to forgo financial performance to address their environmental, social, and governance (ESG) concerns. There is no statistically significant outcome observed for SRI performance in China. Empirical evidence from the crisis period analysis indicates that SRI can offer investors a hedge against market volatility. Overall, the findings suggest that there is no homogenous or universal outcome of SRI but rather varies depending on geographic region, study period, current market conditions, and extent of SRI adoption.

Keywords Corporate social responsibility · COVID-19 · ESG · Financial performance · Socially responsible investing · Sustainability

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Extended author information available on the last page of the article

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1 Introduction

The genesis of Socially Responsible Investing (SRI) can be attributed to various religious movements in the mid-nineteenth century, but its prominence didn't really take off until the 1990s, with the last two decades experiencing rapid growth. A series of recent adverse events like financial scams, climate change, and poor corporate governance have underscored the significance of responsible investing. As a consequence, a growing number of investors are now taking into account the company's long-term environmental, social, and governance (ESG) performance when making investment decisions (Vilas et al., 2021; Wu et al., 2022).

Historically, the rise in popularity of ESG is attributed to the 2005 Freshfields Report titled "Fiduciary Duty in the 21st Century". It argued that considering ESG factors is not just a social responsibility, but also a legal and ethical duty for investors (Sandberg, 2011). Building on the momentum created by the Freshfields report, the United Nations Environment Programme Finance Initiative (UNEP-FI) partnered with the Investor Network on Climate Change (INCC) to launch the UN Principles for Responsible Investment (PRI) in 2006. The PRI is a voluntary framework that encourages its signatories, which include investment institutions like asset managers, insurers, and pension funds, to integrate ESG criteria into their investment decision-making. As of April 2024, PRI has over 5,000 signatories from over 80 countries, representing more than \$121 trillion in assets under management. This widespread adoption demonstrates the growing recognition of responsible investment practices within the global financial system (UNPRI, 2024).

In parallel, various international agreements steered towards environmental issues also catalyzed the development of SRI and ESG considerations. Particularly, the late twentieth century witnessed a growing consciousness around environmental issues, with climate change emerging as a pressing global concern. Within climate change, global warming, primarily driven by greenhouse gas (GHG) emissions, has been the most prominent area of focus. To combat the challenges of climate change, the Kyoto Protocol was enacted in 1997 under the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC, 1997). It was the first treaty to set binding emission reduction targets for developed nations, aiming to curb GHG emissions and mitigate global warming. It further laid the groundwork for future agreements like the 2015 Paris Agreement, which established a broader framework for global climate action. This agreement established a more ambitious goal of limiting global warming to well below 2 °C, ideally aiming for 1.5 °C (UNFCCC, 2015). With near-universal participation of both developed and developing nations, it sent a strong message to the business world, highlighting climate change as a serious threat requiring a global response. Building on the Paris Agreement, the 2021 Glasgow Climate Pact further solidified global commitments by calling for a phase-down of coal power and inefficient fossil fuel subsidies, while also urging stakeholders to prioritize sustainability in transitioning to a low-carbon future (UNFCCC, 2021).

These international agreements heightened environmental awareness among investors, who recognized the financial risks associated with climate change,

such as regulatory pressures on carbon-intensive industries and disruptions from extreme weather events (Campiglio et al., 2023). Beyond environmental impacts, these agreements fostered a broader understanding of the interconnectedness of ESG issues. Emphasis on equitable participation and technology transfer resonated with investors focused on social justice and inclusivity. The transparency and accountability demanded from nations to fulfill their commitments mirrored the principles of good governance valued by investors. Companies with strong governance frameworks were seen as better prepared to navigate environmental and social challenges, shaping perceptions of risk and return within sustainability contexts (Albitar et al., 2023; Fahad & Rahman, 2020). Driven by the urgency of climate change and related environmental issues, investors now increasingly recognize that social responsibility is crucial for corporate value creation as well as investment performance.

Following this shift in investor values, socially responsible investors make investment decisions based on a combination of social and financial criteria, ensuring that the investments they select are consistent with their principles and beliefs (Koenigsmarck & Geissdoerfer, 2021). SRI is a strategy for achieving financial goals while being aware of and sensitive to ESG implications. The increasing popularity of SRI is also reflected in the size of its assets. As per the report released by the Global Sustainable Investment Alliance (GSIA), the United States (US) had the largest share of global SRI assets at the start of 2020, accounting for 48.4%, up from 39.1% in 2018. Europe's share, on the other hand, was reported to be 34.0% in 2020. The US and Europe together account for more than 80% of global SRI assets. According to the report, ESG integration emerged as the most popular sustainable investment approach in 2020, with a market share of 43% (GSIA, 2021). In addition, according to the Bloomberg report, global ESG investments are projected to surpass \$53 trillion by 2025, accounting for more than a third of total assets under management (Bloomberg, 2021). As a result, SRI has evolved from a niche investing approach to a prominent investment theme that has gained widespread acceptance among investors.

Overall, the emphasis of SRI remains on ESG. As Gillan et al. (2021) define, responsible investing encompasses how organizations and investors integrate ESG factors into their business strategies and investment decisions. In recent times, ESG investing has become synonymous with SRI, serving as an umbrella term for investments that aim for favorable returns through partnering with ethical businesses (Baklaci et al., 2023; Dimson et al. 2020; Khalid et al. 2021). ESG factors encompass a broad spectrum of criteria that evaluate a company's performance across environmental stewardship, social responsibility, and corporate governance practices (Camilleri, 2021; Leins, 2020). Environmental considerations may include a company's carbon footprint, resource efficiency, and environmental management systems such as waste management and pollution control. Social factors encompass aspects such as labor standards, community engagement, and diversity and inclusion initiatives. Governance factors evaluate the effectiveness of a company's leadership, board structure, transparency, and accountability mechanisms (Sciarelli et al., 2021; Wen et al., 2022). By incorporating ESG criteria into their investment decisions, socially responsible investors aim to mitigate risks associated with environmental

and social controversies while capitalizing on opportunities presented by companies with robust sustainability strategies. Companies that do not fulfill particular ESG requirements are avoided by SRI investors. Chemical firms that pollute the environment excessively, companies with poor labor standards, or companies that are not transparent to their shareholders are all examples of such stocks.

Another reason for the increasing popularity of SRI is the growing awareness of Corporate Social Responsibility (CSR). Although there is no single definition of CSR, many consider it as 'good' corporate behavior wherein businesses integrate social, economic, and environmental responsibilities into their practices (Velte, 2022). CSR also emphasizes transparent business policies and actions that take into account the interests of employees, communities, and the environment. Apart from moral considerations, companies have substantial economic advantages in incorporating CSR into their practices. CSR policies, when effectively applied, are reported to assist organizations improve their reputation, increase their firm value, and minimize unnecessary litigations (Hasan et al., 2022). Furthermore, Hornuf and Yüksel (2024) identify several drivers of corporate sustainability including crisis mitigation, stakeholder pressure, and profit maximization. Over time, opinions attributing social responsibility to businesses have grown stronger and an increasing number of organizations are now committed to developing strategies to manage their CSR/ESG impact. At the same time, investors have begun to factor in social responsibility criteria when making investment decisions (Camilleri, 2021). The significant increase in the amount of SRI assets attests to this trend.

In addition to capital markets, the notion of SRI is gaining traction in academia also. Empirical studies on SRI have grown substantially, particularly in the last 10 years, as sufficient data on the past performance of both SRI and benchmark portfolios has become accessible (Widyawati, 2020). The key point of literary discussion is the financial outcomes of SRI. Theoretically, portfolio theory arguments posit that imposing extra constraints prevents the formation of an optimal portfolio. This means that SRI investors gain less from the prospect of diversification as the universe of investment reduces, resulting in lower risk-adjusted returns compared to an unrestricted portfolio (Pedersen et al., 2021). Moreover, the inclusion of monitoring and screening costs may cause socially responsible portfolios to underperform, making them high-risk investments. Regardless, proponents of SRI argue that socially responsible businesses are relatively cost-effective, innovative, and successful in attracting and retaining competent employees, resulting in higher profitability. Therefore, SRI portfolios are non-penalizing and display superior performance (Tripathi & Kaur, 2020). These conflicting ideas point to mixed findings in the extant literature. As a result, despite the variety of empirical research on SRI, there is no unequivocal response to the issue of SRI performance against conventional or traditional investments.¹ Overall, these findings pave the way for further investigation.

The study breaks new ground by exploring SRI across four distinct economies. In addition to the US and Europe, the SRI industry has expanded in recent years

¹ In this study, we define conventional or traditional investments as those that focus primarily on generating financial returns, without considering environmental, social, and governance (ESG) impact.

to include Asian markets such as India and China. The recent applicability of CSR practices in these emerging markets has resulted in the progressive evolution of SRI but it is still not a mainstream investing approach (Jin & Zhang, 2023; Tripathi & Kaur, 2022; Wang et al., 2021). This, combined with insufficient data, has resulted in limited empirical research on SRI performance concerning these markets. Given the limited literature on SRI performance focusing on emerging countries and the lack of a cross-country perspective, this study aims to fill the gap by empirically evaluating and comparing the performance of SRI indices in India, China, the US, and the UK vis-à-vis their respective market benchmark indices using a variety of risk-adjusted measures. These countries are selected for this study as they have witnessed significant developments in terms of CSR reporting, ESG disclosures, and SRI practices (refer to Sect. 2.3—‘Background on SRI in India, China, US, UK’).

In addition, due to the growing relevance of SRI, there has been a surge in sustainability indices in recent years. The number of ESG indices surged by 13.85% in 2019 and by 40.20% in 2020, according to the survey by the Index Industry Association (IIA) (Vilas et al., 2021). Therefore, in contrast to prior studies, our analysis focuses on SRI indices rather than mutual or investment funds. This offers various advantages such as transaction costs, timing activities, and the fund manager’s expertise are not taken into account and a direct assessment of the performance effects of SRI screens can be investigated (Ballesterio et al., 2012; Piserà & Chiappini, 2024; Schröder, 2007). As SRI indices use screening techniques similar to investment funds, our findings can also be extended to evaluate SRI fund performance. Also, the study employs a comprehensive methodology incorporating both traditional and modern performance metrics, providing a multifaceted assessment of SRI performance. These measures extend beyond traditional return and volatility analyses, providing a more nuanced understanding of the risk-return dynamics inherent in SRI performance. For instance, while metrics like the Sharpe ratio, Jensen alpha, and Treynor ratio evaluate risk-adjusted returns concerning market benchmarks, the Sortino ratio specifically focuses on downside risk, and the Omega ratio sheds light on the probability distribution of returns, offering insights into the likelihood of achieving returns above a specified threshold. Additionally, a limited number of studies have investigated whether SRI adds value during financial turmoil (Brzezyczyński et al., 2022; Lean & Pizzutilo, 2021; Piserà & Chiappini, 2024) Bridging this knowledge gap, our research considers the impact of the COVID-19 (coronavirus) crisis on the performance of SRI indices. This provides valuable insights into how SRI indices respond to market shocks and economic downturns. By conducting various sub-period analyses and robustness tests, the study enhances the credibility and validity of its results, contributing to a deeper understanding of SRI’s performance across different economic landscapes and crisis scenarios. The study offers important implications to investors, policy-makers, and regulators of the sample countries, which can be extrapolated to other developed and emerging markets. Furthermore, the study adds new perspectives to the growing field of sustainable finance and corporate sustainability.

The structure of the paper is as follows: In Sect. 2, existing literature on SRI is reviewed and research hypotheses are formulated. Section 3 outlines the research design. Section 4 examines empirical findings. Section 5 explains robustness tests.

Section 6 concludes the study, while Sect. 7 discusses theoretical and practical implications. Finally, Sect. 8 addresses limitations and suggests areas for future research.

2 Review of Literature and Hypotheses Development

2.1 SRI: Origin and Meaning

The origins of Socially Responsible Investing (SRI) can be traced back to ancient times when people's lives and activities were governed by religious commandments. The Bible and the Torah could be regarded to have set the first ethical investment principles (Renneboog et al., 2008). The Quran and the Hadith (the chronicle of the Prophet Muhammad's traditions) are both extensions of the same thought in the seventh century (Schueth, 2003). Throughout history, the Islamic laws of banking and investment have outlawed unethical and interest-driven activities (Binmahfouz & Kabir Hassan, 2013). The Methodist Church attempted to accomplish the same in the mid-eighteenth century. Following that, in the early 1900s, the stock markets began catering to ethical investors by prohibiting some sectors (sin stocks) from investment portfolios, such as alcohol, tobacco, pork, usury, gambling, and so on (Durand et al., 2013). During the same period, environmental and ethical concerns intensified. In addition, the publication of Howard R. Bowen's seminal book 'Social Responsibilities of the Businessman' in the mid-twentieth century marked the beginning of an era of CSR (Lee, 2008). Meanwhile, investors started to raise their financial stakes in responsible businesses. Gradually, portfolio managers also started to incorporate ESG aspects in their investment analysis, portfolio selection, and decision-making (Nofsinger & Varma, 2014). Following these developments, SRI has now emerged as a popular investment strategy.

The extant literature reports several definitions of SRI. The term "Socially Responsible Investing" is frequently used synonymously with other investment categories like "Green Investing", "Sustainable Investing", "Ethical Investing", "Impact Investing", "Values-based Investing" and "Community Investing" (Koenigsmarck & Geissdoerfer, 2021; Schueth, 2003). Over the years, with the expansion of SRI, new terminologies with new meanings have evolved. They all, however, underline the significance of including ESG considerations in addition to standard financial analysis when undertaking investment valuations. This study aligns with the dominant position in the literature and defines SRI as an investment strategy that incorporates ESG aspects into the selection of portfolios or stocks, in addition to financial concerns. Within the ambit of ESG consideration, the environmental aspect refers to any activity of the company that has a positive or negative impact on the environment (e.g., greenhouse gas emissions, renewable energy sources, waste disposal, and treatment). The social criteria look at how a corporation engages with its stakeholders such as employees, customers, investors, communities, and others. The governance criteria refer to management quality, corporate culture, leadership, executive pay, audits, and internal controls among others (Abdelsalam et al., 2014; Van Duuren et al., 2016; Widyawati, 2020).

2.2 SRI and Financial Performance

A number of studies in the literature have studied the financial implications of SRI. These studies can be broadly categorized into three groups. The first set of studies claims that SRI outperforms conventional investments while another demonstrates that SRI is financially inefficient and comes with costs to investors (Alda, 2020; El Ghouli & Karoui, 2017; Gangi & Varrone, 2018; Joliet & Titova, 2018; Shaik & Rehman, 2023). The third group of studies reports no significant differences in SRI's performance when compared to conventional investments (Humphrey & Lee, 2011; Reddy et al., 2017). While SRI research is broad, we present select studies from the existing literature (extracted from Scopus® and Web of Science®) in Table 1 and summarize some of the major findings on SRI performance.

The advocates of SRI argue that investing with social screening can lead to better financial outcomes. They assert that social screening assists portfolio managers in identifying organizations with better management abilities and increased firm value and, as a result, profit from their superior financial performance (Gillan et al., 2021; Ouchen, 2021). This is in agreement with Freeman's stakeholder theory of CSR, which claims that incorporating stakeholders' interests adds value to businesses and improves stakeholder relationships (Freeman, 1984). Additionally, Derwall et al. (2011) add to the favorable impact of social screening by way of the "errors-in-expectation" hypothesis, arguing that significant CSR developments that financial markets fail to recognize can result in unexpected returns for investors. Furthermore, excluding socially irresponsible or sin stocks minimizes the costs of litigation and uncertainty associated with negative externalities. Nofsinger and Varma (2014) argue that responsible investors, in general, have found the SRI strategy to be non-punitive, as well as a haven during market downturns. Thus, a section of existing literature supports the idea of the "doing well by doing good" theory (Hasan et al., 2023; Talan & Sharma, 2019).

The second premise contends that SRI underperforms traditional investments. The SRI underperformance is explained directly by portfolio theory, which posits that portfolios with a limited number of investment possibilities are mean-variance inefficient. According to the conventional financial model, as represented by portfolio theory and market efficiency requirements, SRI reduces investment opportunities through exclusion criteria, resulting in fewer diversification benefits (Badfa et al., 2020). Derwall et al. (2011) link the underperformance of SRI to the "shunned-stock hypothesis" contending that controversial or irresponsible stocks exhibit greater returns as responsible investors shun these stocks and, as a result, their prices fall below responsible stocks, other things being equal. Additionally, the information and monitoring costs associated with social screening cause SRI portfolios to underperform when compared to traditional investments (Revelli, 2017). This is in line with the traditional perspective of CSR, which holds that there is a negative relationship between CSR and financial performance. According to this viewpoint, which is backed by Friedman (1970), incorporating social considerations into corporate policies consumes resources and imposes additional costs at the expense of shareholders.

Table 1 Studies exploring the financial performance of socially responsible investments. *Source:* Authors' compilation

Study	Geographical coverage	Methodology	Study object	Significant findings
Bauer et al. (2005)	Germany, UK, and US	Carhart multi-factor model	Mutual funds	There is no evidence that SRI and conventional funds have significantly different risk-adjusted returns. SRI mutual funds go through a catching-up phase before generating favorable returns equivalent to those of conventional mutual funds.
Statman (2006)	US	Fama–French three-factor model	Indices	Socially responsible indices outperform the S&P 500 index on average, but alphas aren't statistically significant. The premise that the returns of socially responsible firms are comparable to those of traditional companies cannot be dismissed.
Schröder (2007)	Global	Sharpe, Jensen, and regression tests	Indices	SRI indices do not outperform traditional benchmarks in terms of risk-adjusted return. However, several SRI indices are riskier than their benchmarks.
Cortez et al. (2009)	Europe	CAPM and regression	Mutual funds	European socially responsible funds have a neutral performance when compared to both conventional and socially responsible benchmarks. Investors who want to invest in European funds might include social screening in their portfolios without sacrificing financial returns.

Table 1 (continued)

Study	Geographical coverage	Methodology	Study object	Significant findings
Managi et al. (2012)	Europe, Japan, and Asia-Pacific	MS model	Indices	<p>The features of SRI indices are identical to those of conventional indices. At all times, SRI and non-SRI markets have the same bear and bull market regimes. The means and volatilities obtained by general stock indices and SRI indices do not differ statistically.</p>
Belghitar et al. (2014)	Global, UK, and US	MCSD model	Indices	<p>Considering mean and variance, there are no gains or losses from socially responsible investing, but there is a price to be paid in the higher moments of the return distributions. There is compelling evidence that SRI comes at a financial cost. SRI investors obtain non-financial utility from their investments' responsible nature, which compensates for the loss in financial utility.</p>

Table 1 (continued)

Study	Geographical coverage	Methodology	Study object	Significant findings
Lean et al. (2015)	Europe and North America	Fama–French model and Carhart model	Mutual funds	SRI funds in Europe and North America surpass their market benchmarks. European and North American investors do not have to forgo financial performance to address their ESG concerns. The findings also imply that the lack of diversification in SRI portfolios has no negative impact on their financial performance.
Śliwiński and Łobza (2017)	US, Korea, and Poland	Beta, Sharpe, Treynor, Jensen, and M^2 measures	Indices	In terms of neoclassical risk and return rate, investment in SRI indices does not produce consistently superior returns than investing in conventional indices. This finding also suggests that SRI should be evaluated in terms of behavioral economics, which is concerned with the psycho-social characteristics of investors, rather than the simplified rational choices assumed by neoclassical economics.

Table 1 (continued)

Study	Geographical coverage	Methodology	Study object	Significant findings
Yen et al. (2019)	Asia	Fama–French–Carhart four-factor model	Stock portfolios based on CSR criteria	In emerging Asian markets, SRI portfolios do not perform well because companies are not rewarded for superior CSR activities. This evidence supports the institutional theory and emphasizes the need of taking into account the normative institutional aspects that may influence companies' CSR efforts and SRI outcomes.
Badia et al. (2020)	North America, Japan, and Asia-Pacific	Fama–French model and Carhart model	Stock portfolios based on CSR criteria	The financial impact of SRI varies by geography, timeframe, and the screening dimension considered. As markets grow more aware of the financial aspects of CSR, any mispricing of socially responsible stocks diminishes.
Cunha et al. (2020)	Asia-Pacific, Europe, and US	Jensen, Sharpe, Modified Sharpe, Treynor, Sortino and Omega measures	Indices	SRI performance varies widely across the globe, but there is a strong probability that sustainable investment strategies can help investors in certain countries achieve superior risk-adjusted returns.

Table 1 (continued)

Study	Geographical coverage	Methodology	Study object	Significant findings
Yue et al. (2020)	Europe	CAPM, Fama–French model, and Carhart model	Mutual funds	Sustainable funds are less risky than conventional funds. However, as the demand for socially responsible investments grows, so do the risks. There is no compelling evidence that sustainable funds can outperform standard or benchmark indices in terms of returns.
Broadstock et al. (2021)	China	Event study and multi-factor asset pricing model	Stock portfolios based on ESG criteria	ESG performance reduces financial risk during the financial crisis, as evidenced during COVID-19. Portfolios with a high ESG score outperform portfolios with a low ESG score. Investors can use ESG performance to anticipate future stock success and/or risk mitigation during times of crisis.
Lean and Pizzutillo (2021)	Europe, North America, Japan, and Asia–Pacific	Fama–French model	Indices	There is no conclusive evidence that inequalities in the return distribution between SRI and conventional indices exist during crisis and non-crisis times. Both indices fared nearly identically regardless of financial market conditions. At best, limited evidence supports the claim that SRI provides a hedge during crises in North America only.

Table 1 (continued)

Study	Geographical coverage	Methodology	Study object	Significant findings
Ouchen (2021)	US	GARCH and EGARCH	Stock portfolios based on ESG criteria	There is no agreement on whether ESG investments have a favorable impact on performance. However, as compared to the market benchmark portfolio, the ESG portfolio is less volatile. ESG screening reduces portfolio value by removing stocks with positive risk-return characteristics, resulting in a conservative investment approach that is expensive for both non-ESG and ESG investors. There is an opportunity cost of using ESG screening in emerging economies.
Wang et al. (2021)	China	Sharpe, Information ratio, Fama–French model, and Carhart model	Stock portfolios based on ESG criteria	Under favorable economic conditions, such as periods of high market valuations or increased consumption, stocks with high SRI ratings outperform those with low SRI ratings. However, during adverse economic conditions, such as recessions, high SRI-rated stocks underperform compared to low SRI-rated stocks.
Bansal et al. (2022)	US	Regression and event study	Stock portfolios based on ESG criteria	

Table 1 (continued)

Study	Geographical coverage	Methodology	Study object	Significant findings
Piserà and Chiappini (2024)	China	Multivariate GARCH model	Indices	The findings highlight the superior risk hedging properties of ESG indices when compared to alternative asset classes such as gold or cryptocurrencies in China. The results do not validate the safe haven properties of ESG indices.

This table presents selected studies from the extant literature on the financial performance of SRI

CAPM—Capital Asset Pricing Model; MS-Markov Switching; MCSD—Marginal Conditional Stochastic Dominance; M^2 —Modigliani-Modigliani measure; GARCH—Generalized Auto-Regressive Conditional Heteroskedasticity; EGARCH—Exponential Generalized Auto-Regressive Conditional Heteroskedasticity

Lastly, a section of existing literature claims that there is no substantial difference in the risk-return characteristics of SRI and conventional investing, due to the high sensitivity of the market or ‘mainstreaming’ of responsible investing (Erragragui & Lagoarde-Segot, 2016; Lean & Pizzutilo, 2021). Belghitar et al. (2014) report that any discrepancies in performance can be attributed to differences in the portfolio construction process or fund managers’ abilities instead of the characteristics of the asset class. A comprehensive meta-analysis encompassing over 80 studies conducted by Revelli and Viviani (2015) concludes that SRI neither exhibits inherent weaknesses nor strengths compared to conventional investments. They further elaborate that heterogenous findings across previous studies primarily stem from factors such as thematic area (e.g., environmental vs. social), investment timeframe, and data analysis methods. Similarly, Hornuf and Yüksel (2024) utilize meta-analysis to investigate the performance of SRI, reviewing 153 studies. Their findings indicate that SRI neither demonstrates superior performance nor underperformance compared to the market portfolio. Altogether, there is no conclusive evidence that there is anything to gain or lose from SRI and the findings remain mixed.

2.3 Background on SRI in India, China, US, UK

The growth rate of the Indian SRI market is one-third that of the global SRI market. During 2016–18, responsible investor allocations to India have increased by 6%, compared to global SRI flows, which have increased at a compound annual growth rate (CAGR) of 16% (OXFAM India, 2020). The launch of the S&P BSE Carbonex Index in 2012 marked the country’s initial foray into SRI indices, focusing on companies with strong carbon performance. With the growing recognition of ESG considerations, broader indices emerged such as the S&P BSE ESG Index in 2017 and the NSE Nifty100 ESG Index in 2018 (Kaur & Chaudhary, 2022). Further, the implementation of CSR regulations has significantly contributed to the expansion of SRI in India. The Companies Act 2013, implemented by the Ministry of Corporate Affairs, has made it mandatory for eligible companies to spend on CSR activities. Section 135 of the Act states that eligible companies must spend 2% of their average profits over the last 3 years on a set of social activities (Hasan et al., 2022). Also, India’s market regulator, the Securities and Exchange Board of India (SEBI) has introduced regulations to promote ESG disclosures and effective corporate governance. These include the Listing Obligations and Disclosure Requirements (LODR) Regulations, 2015, which outline principles and standards for transparency, accountability, and ethical conduct among listed companies. These guidelines cover various aspects of corporate governance, including board composition, board independence, audit committees, disclosure requirements, and stakeholder rights, allowing greater visibility into a company’s ESG performance (SEBI, 2015; Suman & Singh, 2022). The Business Responsibility and Sustainability Reporting (BRSR) framework, introduced by SEBI in 2021, mandates the top 1000 listed companies (by market capitalization) to make ESG disclosures, drawing on internationally recognized reporting frameworks like the Global Reporting Initiative (GRI) and the Sustainability

Accounting Standards Board (SASB) (Yadav & Jain, 2023). These developments have steered businesses toward corporate sustainability in India, attracting socially responsible investors.

China's journey with responsible investing has seen a similar rise in recent years. The 2016 guidelines for building green and sustainable financial products and services, provided the groundwork for a sustainable financial system in China (Yin et al., 2019). In 2017, the China Securities Regulatory Commission (CSRC) placed an even greater emphasis on corporate environmental information disclosure (Wang et al., 2021). The introduction of significant indices like the SSE Corporate Governance Index by the Shanghai Stock Exchange (SSE) in 2007 and the CSI 300 ESG Index by the China Securities Index (CSI) in 2021 are significant milestones (Wang & Li, 2023). Additionally, global index providers like Morgan Stanley Capital International (MSCI) offer ESG-focused indices in China, such as the MSCI China ESG Leaders Index and the MSCI China IMI Environment 10/40 Index (Zhao et al., 2024). Despite still being in its infancy, China's SRI market has grown at a rapid pace in recent years. In 2019, the size of ESG mutual funds expanded by more than twofold, marking the highest growth on record. This growth is driven by various factors such as overseas demand, supportive government policies, and active participation by all market players (GSIA, 2021). This focus on SRI considerations has been further amplified by the government's ambitious "3060" Carbon Neutrality Goal, aiming for peak carbon emissions by 2030 and carbon neutrality by 2060 (Yang & Lo, 2024). These policy shifts position China as a key player in the evolving landscape of SRI.

In the United States, the concept of responsible investing gained momentum in the late 1990s with the launch of pioneering indices like the Dow Jones Sustainability Index (DJSI) and the MSCI KLD 400 Social Index. These indices assessed companies based on their environmental and social responsibility practices, catering to investors seeking to align their portfolios with SRI considerations. Building on this foundation, the S&P 500 ESG Index emerged in 2012, tracking the performance of leading US companies with strong ESG scores (Aureli et al., 2020; Ouchen, 2021). Since then, SRI has evolved as a dynamic and rapidly growing part of the financial services industry in the US. The ESG-mandated assets are predicted to increase nearly three times faster than non-ESG-required assets, accounting for nearly half of all professionally managed investments by 2025 (Deloitte, 2020). This trend is fueled by the rise of thematic ESG indices, enabling investors to direct their investments toward specific sustainability goals. For example, the S&P Global Clean Energy Index tracks companies operating in the clean energy sector, while the MSCI USA Climate Change Solutions Index focuses on companies poised to benefit from the transition to a low-carbon economy (Curcio et al., 2023; Kanamura, 2022). Additionally, the US Securities and Exchange Commission (SEC) has introduced policies to enhance disclosures and accountability in the market. In 2022, the SEC proposed rules mandating public companies to disclose their exposure to climate-related risks and opportunities, encompassing aspects such as greenhouse gas emissions, physical climate risks, and climate transition plans. Furthermore, the SEC established the Climate and ESG Task Force in 2022, with a specific focus on identifying and penalizing instances of greenwashing in the ESG investment sector (Karpoff et al.,

2022). These policy initiatives are expected to promote greater accountability and facilitate further expansion of SRI in the US.

The church bodies created some of the first ethical funds in the US and the UK and are still active in investing using ‘ethical’ criteria. The United Kingdom was the first to regulate pension funds and charitable organizations to report their social, environmental, and ethical investment activities (Tularam et al., 2010). A major milestone came in 2001 with the launch of the FTSE4Good Index Series by FTSE Russell. This series served as a pioneer by assessing companies based on their ESG criteria (Belghitar et al., 2014). Over time, the FTSE4Good Index Series expanded its reach to encompass various sectors and industries, providing investors with a comprehensive range of options for aligning their portfolios with responsible practices. The trend continues with thematic ESG indices targeting specific sustainability goals. For instance, the FTSE UK ESG Low Carbon Select Index emphasizes stocks with reduced carbon emissions and fossil fuel reserves, enabling investors to focus on clean energy (Rompotis, 2022). In response to this growing trend, the investment sector is reported to have established 167 sustainable and ESG funds in the UK by 2021. This is an increase of almost 100% from the beginning of 2016 (Fidelity International, 2021). Also, the UK government published a policy document titled “Greening Finance: A Roadmap to Sustainable Investing” in October 2021, outlining the first phase of its objective to position the UK as “the best place in the world for green and sustainable investment” (HM Government, 2021, p. 36). Additionally, the UK is considering mandatory climate-related disclosures for large companies and financial institutions aligning with the Task Force on Climate-Related Financial Disclosures (TCFD) (Ding et al., 2023). These advancements are expected to heighten the relevance of SRI for investors and market participants in the UK.

2.4 Hypotheses Development

The literature on SRI performance remains inconclusive, as evidenced by the theoretical foundations and empirical studies. The study aims to contribute to the existing literature by studying the financial performance of socially responsible indices of India, China, the US, and the UK. As discussed in the literature review, there are broadly three main findings regarding the outcomes of SRI. The first set of studies suggests that SRI outperforms conventional investments while another demonstrates that SRI is financially inefficient and comes with costs to investors. The third group of studies reports no significant differences in the performance of SRI compared to conventional investments. While previous research has yielded mixed results, we consider recent developments in select capital markets and a growing emphasis on responsible investments and opine that the expected returns of SRI portfolios could be higher than the expected returns of conventional portfolios. This is because socially responsible firms have increased firm reputation, better stakeholder relationships, and enhanced firm value. The same argument is underlined in the “stakeholder theory” of CSR, the “errors-in-expectation” hypothesis, and the “doing well by doing good” theory, representing a dominant position in the SRI literature (Belo-skar & Rao, 2023; Derwall et al., 2011; Velte, 2022). While relatively few studies

have examined SRI performance taking into account the impact of COVID-19, we anticipate that the SRI index outperforms the market benchmark during such a crisis period. Palma-Ruiz et al. (2020) and Omura et al. (2021) provide empirical evidence that responsible investments are more resilient during crises like COVID-19 and that market participants reward companies that practice CSR and penalize those that do not. As such, our testable hypotheses are as follows:

Hypothesis 1 The SRI index outperforms the market benchmark index based on various risk-adjusted measures in the case of India, China, the US, and the UK.

Hypothesis 2 The SRI index outperformed the market benchmark index during the COVID-19 downturn in the case of India, China, the US, and the UK.

3 Empirical Methodology

3.1 Sample Selection and Data Sources

The choice of India, China, the US, and the UK for studying SRI is strategic. These countries span emerging (India, China) and developed (US, UK) markets, offering a global perspective on SRI practices. Developed markets provide insights into mature SRI ecosystems while emerging markets showcase their growth potential. Additionally, these countries have readily available data on sustainability-related indices, enabling cross-country comparison and robust analysis. Furthermore, each country has made significant progress in promoting corporate sustainability through policy measures and regulations, reflecting a growing focus on SRI issues, including India's BRSR framework and China's Green finance reforms, rising shareholder activism observed in the US and the UK adopting disclosure frameworks like the TCFD (as discussed in Sect. 2.3). Overall, the selection of India, China, the US, and the UK offers a balanced representation of diverse economies, financial markets, and sustainability initiatives, making them well-suited for studying the financial performance of SRI indices and their implications for investors and stakeholders globally. We further select their respective sustainability-focused index and market benchmark index. The list of the indices employed in the study is provided in Table 2.

Table 2 Country-wise indices included in the study. *Source:* Authors' compilation

Country	SRI indices	Market benchmark indices
India	S&P BSE 100 ESG (SPBSEESG)	S&P BSE 100 (BSE100)
China	Shanghai Stock Exchange Social Responsibility Index (SSRI)	SSE 180 (SSE180)
United States (US)	FTSE4Good US 100 (FT4GDUS100)	S&P 100 (SP100)
United Kingdom (UK)	FTSE4Good UK 50 (FT4GDUK50)	FTSE 100 (FTSE100)

This table depicts the country-wise socially responsible indices and market benchmark indices included in the study

These indices are selected because they are widely acknowledged in theory and practice in the host countries.

As the representation of market benchmark indices, the S&P BSE 100 (BSE100) index is employed for India, Shanghai Stock Exchange 180 (SSE180) for China, S&P 100 (SP100) for the US, and FTSE 100 (FTSE100) index for the UK. The S&P BSE 100 represents the 100 largest and most liquid companies listed on India's Bombay Stock Exchange (BSE). The index accounts for roughly two-thirds of the market capitalization of the BSE listed universe and is widely used as a benchmark for the performance of the Indian stock market (S&P Global, 2022c). The SSE 180 index is the stock index of Shanghai Stock Exchange (SSE), representing the top 180 companies in terms of industry representation, size, and liquidity. The index is widely used as a benchmark for the overall performance of the Chinese stock market (SSE, 2022). The S&P 100 index tracks the performance of the 100 largest publicly traded companies in the US by market capitalization. It is a subset of the larger S&P 500 index, which tracks the performance of the 500 largest publicly traded companies in the US. The index is considered to be a benchmark for the overall performance of the US stock market (S&P Global, 2022a). The FTSE 100 index (short for Financial Times Stock Exchange 100 index) tracks the performance of the 100 largest publicly traded companies in the UK, as measured by market capitalization. The companies in the index are selected by FTSE Russell, a subsidiary of the London Stock Exchange Group. The index is widely followed by investors and analysts and is considered to be a barometer of the UK economy (London Stock Exchange, 2022).

The SRI indices used in the study are S&P BSE 100 ESG index (SPBSEESG), SSE Social Responsibility index (SSESRI), FTSE4Good US 100 index (FT4GDUS100), FTSE4Good UK50 index (FT4GDUK50) for India, China, the US, and the UK, respectively. The S&P BSE 100 ESG index tracks equities that fulfill sustainability investment requirements while maintaining comparable levels of risk and performance to the S&P BSE 100 (the "underlying index"). The index uses an ESG score as the defining characteristic to capture 75% of the float-adjusted market capitalization of each Global Industry Classification Standard (GICS®) Industry Group within the underlying index. Companies that engage in certain business practices, such as cigarettes or controversial weaponry, are not eligible for inclusion (S&P Global, 2022b). The members of the SSE Social Responsibility Index are 100 equities rated by social contribution value per share from the SSE Corporate Governance Index. SSE launched the SSE Social Responsibility Index in 2009 to encourage companies to participate in CSR (Zhang et al., 2020). The FTSE4GOOD index family includes the FTSE4Good US 100 and FTSE4Good UK 50. The FTSE-4Good Index Series was launched in 2001. The index criteria for evaluating the firms are created through market engagement and then approved by a committee. The advisory group for the FTSE4Good index series determines whether a company is suitably "responsible" to be included in the index series based on topics like CSR, non-discriminatory labor rights, stakeholder practices, transparent management, and environmental sustainability to name a few (Gok et al., 2019). The key indicators for all sample indices including launch year, number of constituents, market cap coverage, dividend yield, and P/E ratio are depicted in Table 3.

Table 3 Profile of sample indices included in the study. *Source:* Bloomberg® (as of December 21, 2021)

Indices	Launch year	Number of constituents	Currency	Market cap coverage (trillion)	Weight top 10 constituents (%)	Dividend yield (%)	P/E
SPBSEESG	2017	56	INR	64.42	66.10	1.21	22.48
BSE100	1989	101	INR	91.52	49.80	1.40	20.52
SSRI	2009	100	CNY	3.61	52.36	4.14	8.49
SSE180	2002	180	CNY	23.87	43.25	2.91	11.47
FT4GDU100	2001	100	USD	20.16	37.48	1.63	21.61
SP100	1983	101	USD	25.32	38.90	1.73	18.46
FT4GDUK50	2001	50	GBP	1.52	56.62	3.57	12.54
FTSE100	1984	100	GBP	2.05	50.81	3.75	13.87

An overview of the sample indices included in the study is provided in this table

INR—Indian Rupee, CNY—Chinese Yuan Renminbi, USD—United States Dollar, GBP—Great British Pound

Table 4 illustrates the sector exposure of the sample indices. To identify index components, the study uses the Global Industry Classification Standard® (GICS) developed by Morgan Stanley Capital International (MSCI) and Standard & Poor's (S&P). As can be observed from Table 4, sustainability indices are exposed more to financial firms as well as to IT and consumer goods firms. Sectors like utilities, real estate, and telecommunications contribute marginally. Although the sector-wise representation of sustainable indices is not significantly different from the market benchmark indices, some variation persists. Contrary to popular belief, the sample indices indicate that applying sustainability criteria does not necessarily result in a restricted investment portfolio. This could also be due to screening and selection criteria that result in the inclusion of top-performing firms in each industry. For instance, in the case of India, the sample sustainability index captures 75% of the market cap of each sector from the parent index. This leads to the question of whether sustainability screening would have a significant impact on investment characteristics and performance. To answer this question, the study employs the following methodology.

The study uses daily closing prices for all sample indices (expressed in local currency). There are several advantages of using daily closing prices when analyzing financial markets. Closing prices are typically more stable and less volatile than other indicators which makes it easier to compare returns over time (Mazur et al., 2021). Also, many financial databases provide daily closing prices, so it is convenient and readily available. In addition, the closing price is often seen as a good representation of market sentiment, as it reflects the final buying and selling activity for the day (Khajenouri & Schmidt, 2021). For all four countries, the implicit yield on 91-day T-bills is used as a measure of the risk-free rate of return. The secondary data is obtained from Bloomberg® and Investing.com from January 2018 to December 2021 (the total number of observations across four countries is 7,920). The four-year period is chosen to account for differences in

Table 4 Sector exposure of sample indices. *Source: Bloomberg® (as of December 21, 2021)*

Sector	SPSEES (%)	BSE100 (%)	SSRI (%)	SSE180 (%)	FT4G-DUS100 (%)	SP100 (%)	FT4GDUK50 (%)	FTSE100 (%)
Health care	4.10	6.93	5.81	6.06	12.83	15.10	15.13	12.32
Information technology	10.70	7.92	2.50	10.17	38.05	31.60	0.00	0.98
Basic materials	7.60	11.88	6.49	9.64	2.50	0.90	8.04	12.30
Energy	14.80	8.91	2.86	3.32	2.78	4.30	9.97	13.17
Industrials	1.40	9.90	20.89	12.29	12.30	5.50	8.67	10.02
Consumer goods	8.10	9.90	7.60	17.42	5.97	7.90	17.54	19.39
Consumer services	8.50	12.87	6.70	5.38	8.30	11.50	11.30	6.11
Real estate	0.40	2.97	4.05	1.45	1.37	0.60	0.72	1.04
Telecommunication	3.40	1.98	2.37	1.77	2.87	10.40	2.40	3.26
Utilities	1.50	3.96	0.85	3.88	1.52	1.60	4.20	3.82
Financials	39.60	21.78	39.73	28.56	11.51	10.50	22.02	16.53
Others	-	-	-	-	-	-	-	1.08
Total	100	100	100	100	100	100	100	100

This table reports the sector-wise classification of constituents for all sample indices following the GICS® framework

the introduction of SRI indices in the sample countries. While SRI indices in the US and the UK were established in the early 2000s, they were launched in India and China much later. Therefore, considering the availability of comparable data for all four countries the time period selected is 4 years.

3.2 Disaggregation Process

We undertake comprehensive disaggregation analyses for our study. This is to ensure that the results are accurate and can be applied to a variety of sub-periods and sample sizes. To that end, we first undertake the analysis of each index for the entire sample period, i.e., from 2018 to 2021 (208 weeks). The sample is then divided into two equal sub-periods, sub-period I (January 2018–December 2019; 104 weeks) and sub-period II (January 2020–December 2021; 104 weeks) for each index. Additionally, we conduct disaggregate analysis to account for the market-wide financial crisis that was sparked by the COVID-19 pandemic. For that, we identify the structural breaks in the return series of each index. We plotted the daily returns of all selected indices with time and discovered the structural breaks corresponding to the COVID-19 outbreak. The breaks occurred concurrently in all sample indices of India, China, the US, and the UK (Fig. 1). Based on identified structural breaks, we divide our sample into three periods: pre-crisis (January 2018–December 2019; 104 weeks), crisis (January 2020–March 2020; 15 weeks), and post-crisis period (April 2020–December 2021; 86 weeks). Similar crisis period intervals are identified and reported in studies including Brzeszczyński et al. (2022), He et al. (2020), and Khan et al. (2020).

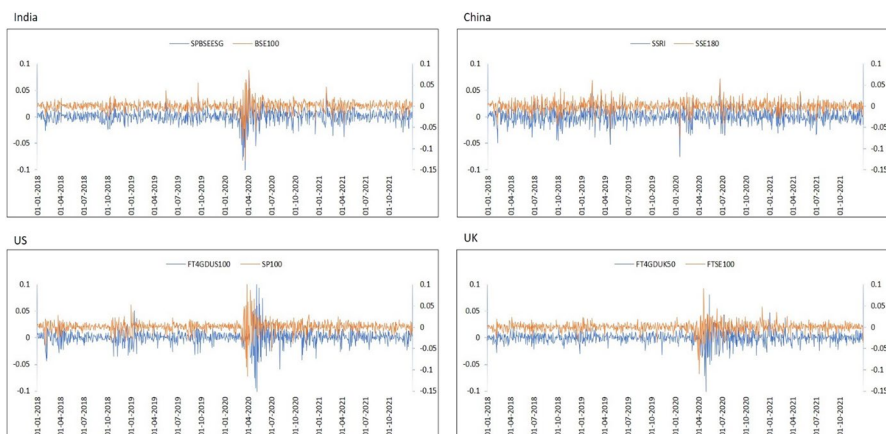


Fig. 1 Daily return series of sample indices as part of structural break analysis from 2018 to 2021. *Source:* Authors' illustration

3.3 Risk-Adjusted Measures of Performance Evaluation

Our study employs a well-recognized methodology used in various empirical studies (Collison et al., 2008; Cunha et al., 2020; Schröder, 2007; Sherwood & Pollard, 2018; Śliwiński & Łobza, 2017). We employ seven widely used risk-adjusted return measures, including Sharpe ratio, Jensen alpha, Treynor ratio, Information ratio, Modified Sharpe ratio, Sortino ratio, and Omega ratio. These measures are selected for five major reasons. First, they present key fundamentals regarding portfolio performance and explore varied assumptions concerning return probabilities. Second, they take into account diverse portfolio theories, offering an objective evaluation of investment returns. Third, the select measures employ a number of risk indicators to analyze portfolio returns, which can be valuable for investors with varying levels of risk aversion. In addition, the chosen collection of metrics incorporates both common financial market ratios like Jensen and Sharpe, as well as more advanced measures like Sortino and Omega. Finally, these measures are selected for the methodological rigor with which they can be calculated and compared for cross-country analyses.

For performance evaluation, we first compute descriptive statistics. Then we calculate index returns, beta, and other risk-adjusted measures. The formula equation for each variable and measure is presented in Table 5.

The daily closing index prices are transformed into simple percentage returns ($R_{i,T}$), calculated as the ratio of the difference between the previous day's index value from the current day's index value divided by the previous day's index value. Beta (β) is a metric used in fundamental analysis to determine how volatile an asset or portfolio is in comparison to the overall market. The formula for determining beta is the covariance of the return of the portfolio with the return of the market, divided by the variance of the return of the market over the period (Sherwood & Pollard, 2018). Typically, a higher beta means greater exposure to the market premium.

The Sharpe ratio was introduced by Nobel laureate William F. Sharpe and is commonly used by investors to analyze an investment's return in relation to its risk (Sharpe, 1966). We construct the Sharpe ratio by dividing each index's excess return by the standard deviation of its overall risk. Sharpe ratio does not presume that the portfolio is widely diversified as it employs standard deviation as an indicator of risk. A portfolio with a greater Sharpe ratio is thought to be superior to its counterparts. Jensen's alpha (α) determines the abnormal return of a portfolio over the theoretical expected return (Jensen, 1968). A market model, most often the Capital Assets Pricing Model (CAPM), is used to calculate the theoretical return. A portfolio that consistently generates a positive excess return given its β and the average market return will generate a positive α and vice-versa (Śliwiński & Łobza, 2017). The Treynor ratio is determined as the excess return per unit of portfolio systematic risk, measured by β (Treynor, 1965). A sound Treynor ratio is one that supports the greater value. Since the Sharpe and Treynor metrics use distinct risk measurements, the two can rank performance in different ways. For a completely diversified portfolio, both metrics produce comparable rankings, as total risk becomes synonymous with systematic risk. Conversely, when the portfolio is not sufficiently diversified, a high Treynor score but a low Sharpe ranking is probable. This discrepancy is

Table 5 Equations for portfolio performance measures. *Source:* Authors' compilation

Measures	Equation
Return ($R_{i,T}$)	$R_{i,T} = \frac{P_i - P_{i-1}}{P_{i-1}}$
Beta (β)	$\beta = \frac{\text{Covariance}(R_i, R_m)}{\text{Variance}(R_m)}$
Sharpe ratio (SR)	$SR = \frac{R_i - R_f}{\sigma_i}$
Jensen's α (α)	$\alpha = R_i - [R_f + \beta(R_m - R_f)]$
Treynor ratio (TR)	$TR = \frac{R_i - R_f}{\beta}$
Information ratio (IR)	$IR = \frac{R_i - R_m}{S_{m-i}}$
Modified Sharpe ratio (MSR)	$MSR = \frac{R_i - R_f}{\text{VAR}_i}$
Sortino ratio (SoR)	$\text{SoR} = \frac{R_i - R_f}{\sigma_{\text{downside risk}}}$
Omega ratio (Ω)	$\Omega = \frac{\int_{r-\infty}^{\infty} [1 - F(x)] dx}{\int_r^{\infty} F(x) dx}$

This table lists the formulae used to determine index returns, beta, and other risk-adjusted metrics. $R_{i,T}$ is the return of index i at time T ; $P_{i,t}$ is the current week's closing index value of index i ; $P_{i,t-1}$ is the previous week's closing index value of index i ; R_i denotes weekly portfolio returns; R_m is the return of the market benchmark index; R_f is the risk-free rate; β is the systematic risk of the portfolio; $R_i - R_f$ is the risk premium; σ_i is the standard deviation of the portfolio; S_{m-i} is the standard deviation of the difference between the returns of the portfolio with the returns of the benchmark; VAR_i is the portfolio historical value at risk; $\sigma_{\text{downside risk}}$ is the downside risk of the portfolio return which is the standard deviation of portfolio returns less than the minimum acceptable return; $F(x)$ is the cumulative distribution function of the portfolio returns defined by the interval $-\infty, +\infty$, r is the threshold return defining what is considered a gain versus a loss. In our estimates, the minimum acceptable return, as well as the threshold return, was equal to the risk-free rate

attributed to the portfolio's low level of diversification (Collison et al., 2008). The Information ratio is defined as the predicted active return divided by tracking error, where the active return is the difference between the portfolio's return and the return of the benchmark index and the tracking error is the standard deviation of the active return (Goodwin, 1998; Wang et al., 2021). The Information ratio is similar to the Sharpe ratio, but instead of comparing the return on investment to a risk-free rate, it compares it to a benchmark. It measures how well the portfolio has outperformed its benchmark. A higher Information ratio indicates a preferred level of consistency, while a low Information ratio implies the opposite.

The Modified Sharpe ratio is often used to assess the risk-adjusted performance of non-normal return investments. In contrast to the conventional Sharpe ratio, the Modified Sharpe ratio considers value at risk (VaR) as a risk indicator (Chuang et al., 2008; Dowd, 1999). Using VaR, particularly historical VaR has significant advantages compared to standard risk measures. For instance, it assesses downside risk, which is appealing to risk-averse investors. Also, it is applied to assets that are non-normally distributed, which is common in most financial markets. The Sortino

ratio is named after Frank A. Sortino (Sortino & Price, 1994). Unlike the Sharpe ratio, which penalizes both upside and downside volatility equally, this ratio penalizes only those returns that fall below a user-specified target return (Sherwood & Pollard, 2018). Downside volatility is more concerning to investors since they want to escape investments that have significant and recurrent losses below their targeted return. Therefore, the Sortino ratio quantifies the differential return of a portfolio per unit of downside risk (measured by semi-standard deviation), taking into account the possibility of the portfolio earning a return less than the investor's acceptable rate of return. A rational investor prefers a greater Sortino ratio since it indicates that the investment is yielding a greater return per unit of bad risk. The Omega Ratio was introduced by Con Keating and William F. Shadwick in 2002 (Keating & Shadwick, 2002). The metric divides predicted returns into gains and losses, or returns above the expected rate (the upside) and returns below the expected rate (the downside). In particular, it is calculated using an integral function around a specified threshold return level and compares the portfolio's weighted profits to weighted losses. Unlike, the Sharpe ratio, the Omega ratio considers all moments of the distribution.

4 Results and Discussion

4.1 Descriptive Statistics and Performance Analysis

Table 6 reports the descriptive statistics of the daily return series of the sample indices. Panel A depicts the results for the overall study period, from January 2018 to December 2021, whereas Panel B and C report summary statistics for sub-periods I and II, respectively. The mean return and standard deviation values indicate the return and risk of the indices, respectively. Overall, the SRI indices of India, the US, and the UK outperformed their market benchmark indices in terms of raw mean return values. The US had the highest daily mean return for the SRI index, followed by India and the UK. China reports an inferior return for the SRI index compared to its market benchmark. For all sample countries, the risk of the SRI index is slightly higher than the market benchmark. In terms of risk and return, similar trends are observed in sub-periods I and II (Panel B and Panel C).

The descriptive statistics gauging the impact of COVID-19 are depicted in Panel D (pre-crisis period), Panel E (crisis period), and Panel F (post-crisis period). The trend observed in the pre-crisis period is similar, with SRI indices reporting superior mean return values compared to market benchmarks in all four countries. In Panel E, depicting the COVID-19 crisis period, both SRI and market indices yield negative mean return values. It is interesting to observe that SRI indices report lesser negative mean return values than the market indices for all sample countries except for China. During the crisis period, the performance of the US, India, and the UK reflects the same pattern observed for the overall period. In the post-crisis period (Panel F) returns are favorable, but the trend is reversed. The market benchmarks outperform SRI indices based on mean return values except for the US. We attribute this observation to the fact that immediately after the crisis the capital markets go

Table 6 Descriptive statistics of daily index return series. *Source:* Authors' calculations

Panel A: Overall period (Jan 2018–Dec 2021)								
	SRI indices			Benchmark indices				
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI00	FTSE100
Mean	0.00064	0.00009	0.00073	0.00003	0.00056	0.00018	0.00066	-0.00002
Standard deviation	0.01264	0.01291	0.01392	0.01112	0.01240	0.01242	0.01346	0.01150
Kurtosis	17.96460	19.30232	15.33239	14.58156	19.61162	18.43253	16.52130	15.17406
Skewness	-1.22489	-1.00250	-0.48358	-0.99932	-1.38076	-1.17936	-0.54296	-0.93685
Minimum	-0.12723	-0.07476	-0.12216	-0.10719	-0.12960	-0.07350	-0.11569	-0.10874
Maximum	0.08639	0.07076	0.10579	0.08047	0.08483	0.06429	0.10127	0.09053
Panel B: Sub-period I (Jan 2018–Dec 2019)								
	SRI indices			Benchmark indices				
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI00	FTSE100
Mean	0.00033	0.00009	0.00047	0.00003	0.00026	0.00012	0.00039	-0.00008
Standard deviation	0.00857	0.01323	0.01012	0.00738	0.00848	0.01251	0.00986	0.00772
Kurtosis	3.17529	2.41509	3.36935	1.43475	4.04477	2.69350	3.63339	1.68283
Skewness	0.56688	0.04767	-0.50058	-0.44907	0.43767	0.01312	-0.50685	-0.37660
Minimum	-0.02550	-0.05169	-0.04302	-0.03209	-0.02593	-0.05309	-0.04315	-0.03231
Maximum	0.05368	0.06670	0.05071	0.02331	0.05527	0.06135	0.05196	0.02353
Panel C: Sub-period II (Jan 2020–Dec 2021)								
	SRI Indices			Benchmark indices				
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI00	FTSE100
Mean	0.00095	0.00009	0.00097	0.00005	0.00085	0.00025	0.00092	0.00003

Table 6 (continued)

Panel C: Sub-period II (Jan 2020-Dec 2021)									
	SRI Indices					Benchmark indices			
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI100	FTSE100	FTSE100
Standard deviation	0.01564	0.01260	0.01684	0.01384	0.01531	0.01234	0.01624	0.01428	0.01428
Kurtosis	14.41011	14.37852	13.19629	11.19883	15.90629	14.25246	14.55951	11.89211	11.89211
Skewness	-1.40299	-0.04888	-0.46451	-0.96175	-1.59406	-0.37632	-0.53366	-0.92413	-0.92413
Minimum	-0.12723	-0.07476	-0.12216	-0.10719	-0.12960	-0.07350	-0.11569	-0.10874	-0.10874
Maximum	0.08639	0.07076	0.10579	0.08047	0.08483	0.06429	0.10127	0.09053	0.09053
Panel D: Pre-crisis period (Jan 2018-Dec 2019)									
	SRI indices					Benchmark indices			
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI100	FTSE100	FTSE100
Mean	0.00033	0.00009	0.00047	0.00003	0.00026	0.00012	0.00039	-0.00008	-0.00008
Standard deviation	0.00857	0.01323	0.01012	0.00738	0.00848	0.01251	0.00986	0.00772	0.00772
Kurtosis	3.17529	2.41509	3.36935	1.43475	4.04477	2.69350	3.63339	1.68283	1.68283
Skewness	0.56688	0.04767	-0.50058	-0.44907	0.43767	0.01312	-0.50685	-0.37660	-0.37660
Minimum	-0.02550	-0.05169	-0.04302	-0.03209	-0.02593	-0.05309	-0.04315	-0.03231	-0.03231
Maximum	0.05368	0.06670	0.05071	0.02331	0.05527	0.06135	0.05196	0.02353	0.02353
Panel E: Crisis period (Jan 2020-Mar 2020)									
	SRI indices					Benchmark indices			
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI100	FTSE100	FTSE100
Mean	0.00033	0.00009	0.00047	0.00003	0.00026	0.00012	0.00039	-0.00008	-0.00008
Standard deviation	0.00857	0.01323	0.01012	0.00738	0.00848	0.01251	0.00986	0.00772	0.00772

Table 6 (continued)

Panel E: Crisis period (Jan 2020-Mar 2020)									
	SRI indices					Benchmark indices			
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI00	FTSE100	
Kurtosis	3.17529	3.41509	3.36935	1.43475	4.04477	2.69350	3.63339	1.68783	
Skewness	0.46688	-0.04767	-0.50058	-0.44907	0.56767	-0.01312	-0.50685	-0.37660	
Minimum	-0.02550	-0.05169	-0.04302	-0.03209	-0.02593	-0.05309	-0.04315	-0.03231	
Maximum	0.05368	0.06670	0.05071	0.02331	0.05527	0.06135	0.05196	0.02353	
Panel F: Post-crisis period (Apr 2020-Dec 2021)									
	SRI indices					Benchmark indices			
	SPBSEESG	SSRI	FT4GDUS100	FT4GDUK50	BSE100	SSE180	SPI00	FTSE100	
Mean	0.00165	0.00041	0.00161	0.00073	0.00156	0.00046	0.00126	0.00069	
Standard deviation	0.01037	0.01179	0.01596	0.01279	0.01009	0.01150	0.01053	0.01126	
Kurtosis	1.79677	3.33721	16.91946	5.26195	2.07956	2.99166	3.04864	2.07464	
Skewness	-0.48751	-0.56340	0.03015	0.38627	-0.55967	-0.15692	-0.83001	-0.04062	
Minimum	-0.03767	-0.03450	-0.12216	-0.04980	-0.03779	-0.04539	-0.05685	-0.03988	
Maximum	0.04483	0.07076	0.10579	0.08047	0.04548	0.06429	0.03207	0.04675	

This table depicts the summary statistics of the daily return series for all the indices used in the study for the overall period, sub-period I, sub-period II, pre-crisis period, crisis period, and post-crisis period

through a market correction phase along with increased turbulence. Figure 2 depicts the graphical representation of the daily performance of the sample indices.

We also calculate and report the third and fourth moments of distribution as investors like to take them into account. In general, higher skewness is favored as it means fewer chances of extreme negative returns, and lower kurtosis is preferred as it indicates predictable returns (Belghitar et al., 2014; Elyasiani et al., 2021). This preference may vary considering investors have varying risk-return tolerance. For the sample data, we observe similar trends in the third and fourth moments as reflected by the mean return and variance.

For the overall period, all sample indices exhibit higher kurtosis, with values exceeding 15. However, SRI indices display lower kurtosis compared to their market benchmarks, except for China. This indicates that SRI indices have a more stable distribution with less likelihood of extreme returns compared to the broader market. China displays the highest kurtosis for both market and SRI indices, followed by India, the US, and the UK. This trend remains consistent across sub-periods I and II, as well as during the crisis and post-crisis periods. In terms of skewness, all sample indices exhibit negative skewness values in the overall period, with SRI indices displaying comparatively greater negative skewness. This implies that the returns are likely to have a longer left tail than a normal distribution, indicating a higher probability of negative returns. Across the board, the skewness values for all sample indices range from -0.4 to -1.4 . This unique characteristic of SRI indices, characterized by lower kurtosis and negative skewness suggests a higher frequency of losses, although the magnitude of losses might be smaller compared to the potential gains compared to the market indices

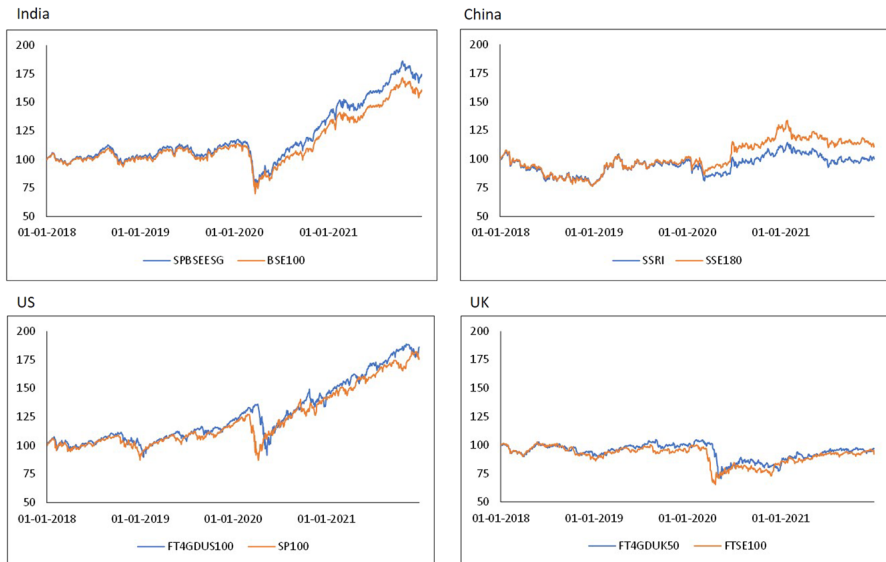


Fig. 2 Daily performance of sample indices from 2018 to 2021. Bases adjusted for 100 points on January 1st, 2018. *Source:* Authors' illustration

(Olofsson et al., 2021; Zhang et al., 2023). However, the magnitude of both losses and gains vary depending on the specific SRI index, sector exposure, and market conditions. Only the US and the UK display positive skewness values for their SRI indices in the post-crisis period, indicating a right-skewed distribution, potentially suggesting higher positive returns or price movements. Overall, the analysis of skewness and kurtosis within countries suggests significant variations in the risk-return profiles of SRI and benchmark indices. However, these metrics only capture the shape of the return distribution, not the overall performance. For a more comprehensive comparison, these findings are considered alongside other factors like mean return, volatility, and risk-adjusted measures.

We also examine the homogeneity of means and variances of the sample indices for each country for all periods of analysis. To compare means, paired t-test is used and to compare variances, Levene's F test is employed. These two statistical tests are widely reported in the empirical literature (Ates, 2020; Yilmaz et al., 2020). A t-test is a statistical hypothesis test that is used to determine whether there is a significant difference between the means of two groups. Similarly, Levene's F test is a statistical test used to determine whether there is a significant difference between the variances of two or more groups. Table 7 lists the results of the comparison of means and variances tests. In the case of India, the US, and the UK, the results indicate that there is a statistically significant difference between the means of the SRI and market benchmark indices return series for the overall period, sub-period II, crisis, and post-crisis periods at the 5% significance level. Further, there exists a statistically significant difference at the 5% level between the variances of the SRI and market benchmark indices return series for all periods of analysis.

Furthermore, we calculate the annualized and total return and standard deviation of all sample indices. Table 8 depicts the results based on these classic return and risk indicators for each year of the analysis period and for the overall study period, i.e., from 2018 to 2021. In terms of annualized and total return, the sustainability indices outperform their market benchmark indices in the case of India, the US, and the UK. The volatility as depicted by the annualized and total standard deviation of the sustainability indices is slightly higher than the benchmark indices for all sample countries. The highest total return is exhibited by the US (17.79%), followed by India (14.94%) and the UK (7.72%). In the case of China, the sustainability index underperforms the market benchmark index (1.07% vs. 3.70%). Similar trends are reported by Su (2021) highlighting that sustainable investments in China underperform conventional investments and offer less protection against market downside risk. In the case of India and the US, the annualized returns of the sustainability index are positive and outperform the market index consistently from 2018 to 2021. This could be attributed to strong economic growth, a diversified economy, positive investor sentiments, and increased focus on SRI in both countries (Cunha et al., 2020; Umar et al., 2020). In the case of the UK, the sustainability index outperforms the market index, however, the annualized returns of sample indices are negative in 2018 which could correspond to Brexit uncertainty, economic slowdown, and interest rate hikes, and in 2020 due to the market-wide financial crisis sparked by the COVID-19 outbreak. These findings and observations are similar to Davies and Studnicka (2018) and Zhang et al., (2022a, 2022b).

Table 7 Results of the mean and variance homogeneity tests. *Source:* Authors' calculations

Index	Overall period		Sub-period I		Sub-period II		Pre-crisis period		Crisis period		Post-crisis period	
	t-test	Levene's F test	t-test	Levene's F test	t-test	Levene's F test	t-test	Levene's F test	t-test	Levene's F test	t-test	Levene's F test
<i>India</i>												
SPB-SEESG and BSE100	1.673 (0.047)	1.038 (0.002)	1.553 (0.057)	1.022 (0.004)	1.654 (0.045)	1.044 (0.003)	1.551 (0.067)	1.022 (0.004)	1.829 (0.037)	2.433 (0.000)	1.685 (0.049)	2.895 (0.000)
<i>China</i>												
SSRI and SSE180	-0.765 (0.062)	1.079 (0.001)	-0.885 (0.077)	1.118 (0.010)	-0.703 (0.006)	1.042 (0.003)	-0.801 (0.082)	1.118 (0.010)	-0.608 (0.052)	0.632 (0.003)	-0.715 (0.064)	1.892 (0.003)
<i>US</i>												
FT4G-DUS100 and SPI100	2.109 (0.049)	1.069 (0.001)	2.124 (0.059)	1.054 (0.002)	2.091 (0.047)	1.075 (0.002)	1.984 (0.069)	1.054 (0.002)	2.265 (0.036)	2.402 (0.000)	2.154 (0.051)	2.299 (0.000)
FT4G-DUK50 and FTSE100	2.099 (0.046)	0.934 (0.013)	2.231 (0.072)	0.914 (0.036)	2.084 (0.044)	0.940 (0.024)	1.977 (0.066)	0.914 (0.036)	2.255 (0.039)	0.548 (0.004)	2.186 (0.048)	1.291 (0.005)

This table reports results for statistical tests employed in the study. Paired t-test is used to compare means and Levene's F test is used to compare variances of the indices for each country. The *p*-values are in parentheses. All values are significant at a 5% significance level

Table 8 Return and standard deviation of sample indices from 2018 to 2021 (per annum and total). *Source:* Authors' calculations

Index	2018		2019		2020		2021		Total	
	Return (%)	Standard deviation (%)	Return (%)	Standard deviation (%)	Return (%)	Standard deviation (%)	Return (%)	Standard deviation (%)	Return (%)	Standard deviation (%)
<i>India</i>										
SPBSESG	4.08	13.08	12.69	13.77	24.52	31.33	29.44	15.54	14.94	34.77
BSE100	2.66	12.80	10.66	14.76	20.85	30.60	26.47	15.33	12.61	34.02
<i>China</i>										
SSRI	-19.72	21.64	29.17	19.64	14.88	22.24	-8.61	17.26	1.07	37.61
SSE 180	-20.00	20.31	31.77	18.69	27.94	21.89	-11.00	16.74	3.70	37.08
<i>US</i>										
FT4GDUS100	1.86	16.65	32.04	15.01	27.05	35.34	32.25	12.99	17.79	33.79
SP100	-8.98	17.66	23.52	14.02	23.09	34.05	25.78	12.67	15.11	32.36
<i>UK</i>										
FT4GDUK50	-8.82	11.92	11.09	11.15	-5.83	27.88	19.74	13.38	7.72	34.98
FTSE 100	-11.71	12.34	7.24	11.72	-18.04	29.34	9.40	12.64	4.04	36.18

This table depicts annualized and total return (%) and standard deviation (%) of sample indices for each country from 2018 to 2021

We also calculate and report holding period return (HPR) for sub-period I, sub-period II, pre-crisis period, crisis period, and post-crisis period. This allows a comprehensive assessment of risk-return profiles of sample indices at different periods. HPR is the percentage change in an investment's value from the beginning to the end of a holding period and is useful for comparing the performance of different investments or portfolios held for different periods of time (Durand et al., 2019). Table 9 depicts the holding period return and standard deviation of sample indices for select periods. Overall, the trend remains consistent across all periods of analysis, with the sustainability index outperforming the market benchmark index in India, the US, and the UK.

4.2 Performance Evaluation Using Risk-Adjusted Measures

Table 10 provides the results based on the risk-adjusted performance measures for the overall period as well as for sub-periods I and II. The beta (β) measures the sensitivity of the SRI index with respect to the market index. For the overall period, as well as for the sub-period I and sub-period II, beta values for the SRI indices remain less than 1 for India (0.95) and the UK (0.94). This indicates the SRI indices do not impose greater volatility than the market benchmarks. In the case of China, the beta value is greater than 1 in the overall period as well as in sub-period I and sub-period II. This indicates that the SRI index in China offers greater volatility than the market index. For the US SRI index, the beta value is slightly higher (1.08) in sub-period I which also corresponds to the pre-crisis period. This could be due to heightened market turbulence right before the crisis, reflecting an increase in beta value.

Based on the Sharpe ratio results, we observe that SRI indices display superior performance compared to market indices for India, the US, and the UK in the overall period as well as in sub-period I. In the case of sub-period II, only the US SRI index displays superior performance compared to the market benchmark. Sub-period II coincides with the occurrence of the COVID-19 crisis and hence varying return patterns are observed. In the case of China, no discernible trend is apparent. Although the Sharpe measure does not take into account systematic risk, primary evidence reveals that the SRI index performs better in India, the US, and the UK in the overall period and sub-period I. We document significant positive Jensen alpha values for the SRI index in the overall period as well as in sub-period I and II for India, the US, and the UK. For China, the alpha is negative in the overall period, sub-period I, and sub-period II. The positive alpha values indicate the possibility of earning greater risk-adjusted returns by investing in SRI indices in India, the US, and the UK.

Treynor ratio, unlike the Sharpe ratio, considers systematic risk. For India and the US, the Treynor ratio displays superior performance for SRI indices in the overall period as well as in sub-period I and II. For China, there is no consistent pattern. For the UK, the SRI index performance is superior in the overall period and sub-period I. The UK SRI index underperforms the market index in sub-period II, which also corresponds to the COVID-19 crisis. Except for China, the Information ratio displays superior SRI performance for India, the US, and the UK in the overall period. For the US, the ratio is favorable across all periods. A higher Information ratio

Table 9 Holding period return and standard deviation of sample indices for select periods. *Source:* Authors' calculations

Index	Sub-period I		Sub-period II		Pre-crisis period		Crisis period		Post-crisis period	
	Holding period return (%)	Standard deviation (%)	Holding period return (%)	Standard deviation (%)	Holding period return (%)	Standard deviation (%)	Holding period return (%)	Standard deviation (%)	Holding period return (%)	Standard deviation (%)
<i>India</i>										
SPBSEESG	7.33	18.98	23.03	34.62	7.33	18.98	-32.71	27.53	39.39	21.15
BSE100	5.66	18.78	19.94	33.88	5.66	18.78	-36.75	27.02	36.10	20.59
<i>China</i>										
SSRI	-0.31	29.28	0.16	27.88	-0.31	29.28	-31.88	14.47	9.02	24.04
SSE180	0.74	27.69	4.38	27.32	0.74	27.69	-18.05	14.41	10.28	23.45
<i>US</i>										
FT4GDUS100	10.77	22.41	23.07	37.25	10.77	22.41	-24.35	18.50	35.13	32.55
SP100	8.34	21.83	21.79	35.96	8.34	21.83	-27.35	29.16	25.43	21.47
<i>UK</i>										
FT4GDUK50	-0.03	16.33	1.53	30.65	-0.03	16.33	-37.86	16.17	17.70	26.09
FTSE100	-3.39	17.08	1.36	31.60	-3.39	17.08	-39.99	21.84	16.16	22.97

This table reports the holding period return (%) and standard deviation (%) for all sample indices corresponding to sub-period I, sub-period II, pre-crisis period, crisis period, and post-crisis period

Table 10 Portfolio performance measures. *Source:* Authors' calculations

Indices	Beta	Sharpe ratio	Jensen alpha	Treynor ratio	Information ratio	Modified Sharpe ratio	Sortino ratio	Omega ratio
Overall period								
<i>India</i>								
SPBSEESG	0.950 (35.94)	0.078	0.052 (1.77)	0.222	0.043	0.055	0.122	1.315
BSE100	1	0.064	0.000	0.167	–	0.039	0.105	1.270
<i>China</i>								
SSRI	1.027 (34.50)	–0.010	–0.034 (–1.46)	–0.028	–0.032	–0.007	0.000	1.000
SSE180	1	0.002	0.000	0.005	–	0.001	0.019	1.036
<i>US</i>								
FT4GDUS100	0.992 (91.27)	0.115	0.057 (2.03)	0.322	0.139	0.080	0.137	1.409
SP100	1	0.095	0.000	0.264	–	0.069	0.113	1.341
<i>UK</i>								
FT4GDUK50	0.946 (74.72)	0.004	0.004 (1.93)	0.010	0.008	0.003	0.006	1.016
FTSE100	1	0.002	0.000	0.005	–	0.002	0.004	1.011
Sub-period I								
<i>India</i>								
SPBSEESG	0.968 (96.46)	0.015	0.090 (1.44)	0.027	0.224	0.008	0.079	1.150
BSE100	1	–0.037	0.000	–0.066	–	–0.021	0.002	1.004
<i>China</i>								
SSRI	1.052 (119.00)	–0.019	–0.08 (–1.35)	–0.051	0.080	–0.021	–0.010	0.987
SSE180	1	–0.050	0.000	–0.130	–	–0.040	–0.050	0.907
<i>US</i>								
FT4GDUS100	1.027 (98.23)	0.086	0.055 (1.98)	0.182	0.190	0.060	0.120	1.305
SP100	1	0.061	0.000	0.128	–	0.048	0.089	1.222

Table 10 (continued)

Indices	Beta	Sharpe ratio	Jensen alpha	Treynor ratio	Information ratio	Modified Sharpe ratio	Sortino ratio	Omega ratio
<i>UK</i>								
FT4GDUK50	0.979 (93.46)	0.019	0.037 (1.08)	0.030	0.106	0.009	0.035	1.074
FTSE100	1	-0.005	0.000	-0.008	-	-0.006	0.001	1.002
Sub-period II								
<i>India</i>								
SPBSEEG	0.946 (96.46)	0.118	0.401 (2.04)	0.419	-0.004	0.072	0.155	1.428
BSE100	1	0.123	0.000	0.402	-	0.078	0.169	1.475
<i>China</i>								
SSRI	1.001 (96.20)	-0.001	-0.143 (-1.35)	-0.003	-0.127	-0.001	0.013	1.019
SSE180	1	0.061	0.000	0.142	-	0.035	0.103	1.208
<i>US</i>								
FT4GDUS100	0.978 (88.36)	0.137	0.462 (1.25)	0.463	0.109	0.099	0.154	1.493
SP100	1	0.121	0.000	0.402	-	0.088	0.133	1.434
<i>UK</i>								
FT4GDUK50	0.938 (97.23)	-0.004	0.039 (2.08)	-0.012	-0.051	-0.002	-0.005	0.987
FTSE100	1	0.006	0.000	0.018	-	0.003	0.006	1.017

This table summarizes the performance of the indices based on Beta, Sharpe ratio, Jensen alpha, Treynor ratio, Information ratio, Modified Sharpe ratio, Sortino ratio, and Omega ratio for the overall period, sub-period I, and sub-period II analyses. The t-values in parenthesis are derived from ordinary least squares (OLS) regression using the Capital Assets Pricing Model (CAPM), $R_t - R_f = \alpha + \beta(R_m - R_f) + \epsilon_t$, with values significant at the 5% significance level

indicates that the SRI index has consistently outperformed the benchmark index on a risk-adjusted basis.

The modified Sharpe ratio was calculated using 99% historical VaR. This threshold was chosen primarily to be consistent with previous studies, in which the majority of inferences were drawn using the same VaR level. The modified Sharpe ratios confirm the inferences derived previously from the classical Sharpe ratio. SRI indices continue to have a higher modified Sharpe ratio than market benchmarks in India, the US, and the UK in the overall period and sub-period I. In terms of Sortino performance, SRI indices outperform market benchmarks in India, the US, and the UK in the overall period as well as in sub-period I. In sub-period II, only the US SRI index delivers superior performance. For China, there appears to be no clear trend. Finally, the Omega ratio reports superior performance of the SRI index throughout all periods for the US. Following the trend with other ratios, we find inconsistent outcomes for China in the case of the Omega ratio as well. The SRI indices of India and the UK display superior performance in the overall period and sub-period I, similar to trends observed with other ratios. A greater omega ratio indicates that the SRI index provides more gains relative to losses for the given threshold and is favorable for SRI investors. Overall, these findings support acceptance of our research Hypothesis 1 that the SRI index outperforms the market benchmark index based on various risk-adjusted measures for the distinct periods in the case of India, the US, and the UK.

4.3 Performance Evaluation Using Risk-Adjusted Measures: Impact of COVID-19

We report risk-adjust measures taking into account the identified structural breaks in the return series corresponding to the outbreak of the COVID-19 pandemic in Table 11. The trend for beta values remains the same during the crisis period. For India, it remains less than one, but slightly higher during the crisis period (0.98) compared to pre-and post-crisis periods (0.96 and 0.91, respectively). For China, the beta values remain greater than one during pre-crisis, crisis, and post-crisis period. For the US, it is greater than one in pre-crisis period but less than one during crisis and post-crisis periods, alluding to increased volatility before the onset of the crisis. For the UK, the beta values are less than one during pre-crisis, crisis, and post-crisis periods. Considering Sharpe measure results, only for the US, the SRI index displays superior performance than the market benchmark in all periods. In the pre-crisis period, the Jensen alpha values are positive for all SRI indices. During the crisis period, only the US displays positive alpha while India, China, and the UK report negative alpha values. In the post-crisis period, India and the US report positive alphas, and China and the UK continue to report negative alpha for SRI indices. These results point to variations in the risk-adjusted returns due to COVID-19 in all four countries. The results for the pre-crisis period are similar to sub-period I. In the crisis period, all indices yield negative returns but the returns of SRI indices for India, the US, and the UK are lesser negative than the market benchmarks, implying that SRI indices incur lower losses (a hedge) than the market benchmark. The modified Sharpe ratio was not valid for the crisis period due to negative abnormal

Table 11 Portfolio performance measures: Impact of COVID-19. *Source:* Authors' calculations

Indices	Beta	Sharpe ratio	Jensen alpha	Treynor ratio	Information ratio	Modified Sharpe ratio	Sortino ratio	Omega ratio
Pre-crisis period								
<i>India</i>								
SPBSEESG	0.968 (96.46)	0.015	0.090 (1.44)	0.027	0.224	0.008	0.079	1.150
BSE100	1	-0.037	0.000	-0.066	-	-0.021	0.002	1.004
<i>China</i>								
SSRI	1.052 (119.00)	-0.019	-0.081 (-1.35)	-0.051	0.080	-0.021	-0.010	0.987
SSE180	1	-0.050	0.000	-0.130	-	-0.040	-0.050	0.907
<i>US</i>								
FT4GDUS100	1.027 (98.23)	0.086	0.055 (1.98)	0.182	0.190	0.060	0.120	1.305
SP100	1	0.061	0.000	0.128	-	0.048	0.089	1.222
<i>UK</i>								
FT4GDUK50	0.979 (93.46)	0.019	0.037 (1.88)	0.030	0.106	0.009	0.035	1.074
FTSE100	1	-0.005	0.000	-0.008	-	-0.006	0.001	1.002
Crisis period								
<i>India</i>								
SPBSEESG	0.998 (115.92)	-0.544	-0.061 (1.87)	-2.590	-0.115	-	-0.771	0.119
BSE100	1	-0.557	0.000	-2.628	-	-	-0.805	0.134
<i>China</i>								
SSRI	0.962 (45.95)	-0.276	-0.405 (-2.29)	-0.995	-0.455	-	-0.523	0.476
SSE180	1	-0.174	0.000	-0.605	-	-	-0.618	0.625
<i>US</i>								
FT4GDUS100	0.969 (93.29)	-0.248	0.088 (1.03)	-1.653	0.191	-	-0.277	0.764
SP100	1	-0.273	0.000	-1.807	-	-	-0.314	0.731

Table 11 (continued)

Indices	Beta	Sharpe ratio	Jensen alpha	Treynor ratio	Information ratio	Modified Sharpe ratio	Sortino ratio	Omega ratio
<i>UK</i>								
FT4GDUK50	0.919 (86.26)	-0.421	-0.127 (-0.98)	-2.556	0.052	-	-0.380	0.419
FTSE100	1	-0.429	0.000	-2.557	-	-	-0.417	0.447
Post-crisis period								
<i>India</i>								
SPBSEEG	0.918 (94.06)	0.285	0.102 (1.83)	0.889	-0.009	0.162	0.579	2.502
BSE100	1	0.305	0.000	0.845	-	0.147	0.480	2.245
<i>China</i>								
SSRI	1.010 (39.64)	0.056	-0.107 (0.99)	0.151	-0.098	0.041	0.112	1.174
SSE180	1	0.118	0.000	0.251	-	0.074	0.199	1.413
<i>US</i>								
FT4GDUS100	0.993 (88.26)	0.305	0.028 (1.72)	0.731	0.064	0.167	0.525	2.272
SP100	1	0.297	0.000	0.725	-	0.156	0.509	2.250
<i>UK</i>								
FT4GDUK50	0.959 (93.5)	0.140	0.041 (1.04)	0.308	-0.148	0.047	0.247	1.476
FTSE100	1	0.163	0.000	0.395	-	0.069	0.286	1.584

This table summarizes the performance of the indices based on Beta, Sharpe ratio, Jensen alpha, Treynor ratio, Information ratio, Modified Sharpe ratio, Sortino ratio, and Omega ratio for the pre-crisis, crisis, and post-crisis period analyses. The modified Sharpe ratio was not valid for the crisis period due to negative excess returns relative to the risk-free rate of return, both for sustainability indices and market benchmarks. The t-values in parenthesis are derived from ordinary least squares (OLS) regression using the Capital Assets Pricing Model (CAPM), $R_i - R_f = \alpha + \beta(R_m - R_f) + \epsilon_i$, with values significant at the 5% significance level

returns relative to the risk-free rate of return, both for sustainability indices and market benchmarks.

For India and the UK, in the post-crisis period, most of the risk-adjusted measures dictate the underperformance of SRI indices compared to market benchmarks. This could be related to the market turbulence due to the COVID-19 pandemic. In the post-crisis period, we observe that the US SRI index consistently displays superior performance compared to the market benchmark for all risk-adjusted measures. This finding could be attributed to the fact that the US market is the most mature SRI market and is fundamentally stronger compared to other sample SRI markets. Overall, our findings are consistent with those of He et al. (2020), Khan et al. (2020), and Omura et al. (2021) and provide empirical evidence that the COVID-19 crisis impacted the performance of SRI indices along with market benchmark indices of the sample countries. Only in the case of the US SRI market, do our findings lend credence to our research Hypothesis 2 that the SRI index outperformed the market benchmark index during the COVID-19 downturn.

5 Robustness Test

As part of our robustness checks, we calculate risk-adjusted performance metrics across varying sample sizes. To achieve this, we employ the “growing window” procedure, similar to the approach adopted by Sherwood and Pollard (2018) and Cunha et al. (2020). Under this approach, we re-estimated all the metrics utilized in our study by progressively increasing the sample sizes. Particularly, we begin the calculation of all metrics for the period January 1st, 2018 to May 28th, 2018. This initial period comprises 100 observations, which provides an adequate starting point for the analysis. In the subsequent phase, we progressively add one observation at a time, gradually expanding the sample size until we encompass the entire analysis period, which extends until December 31st, 2021. We perform robustness tests for all the metrics employed in the study. However, due to space constraints, we present the results of the robustness checks for the Sharpe and Omega measures only. This is because the Sharpe measure is a classical and widely used performance metric while the Omega measure is a more advanced metric taking into account the entire distribution of returns. So, both measures help understand the persistence of performance measured by these metrics throughout the sample period. Similar to results reported and discussed as part of empirical analysis, both measures demonstrate superior performance for SRI indices in India, the US, and the UK with similar structural breaks and variations observed during the crisis period. The results of the robustness tests are presented in Figs. 3 and 4, illustrating the Sharpe measure and Omega measure, respectively.

Similar to the results presented in Sect. 4, both Sharpe and Omega ratios demonstrate superior performance for SRI indices in India, the US, and the UK. Graphically, a higher Sharpe ratio is observed for SRI indices across India, the US, and the UK, indicating higher returns per unit of risk. Similarly, the Omega ratio for SRI indices is consistently higher than that of market indices across the sample period for India, the US, and the UK. A superior omega ratio indicates that the SRI index

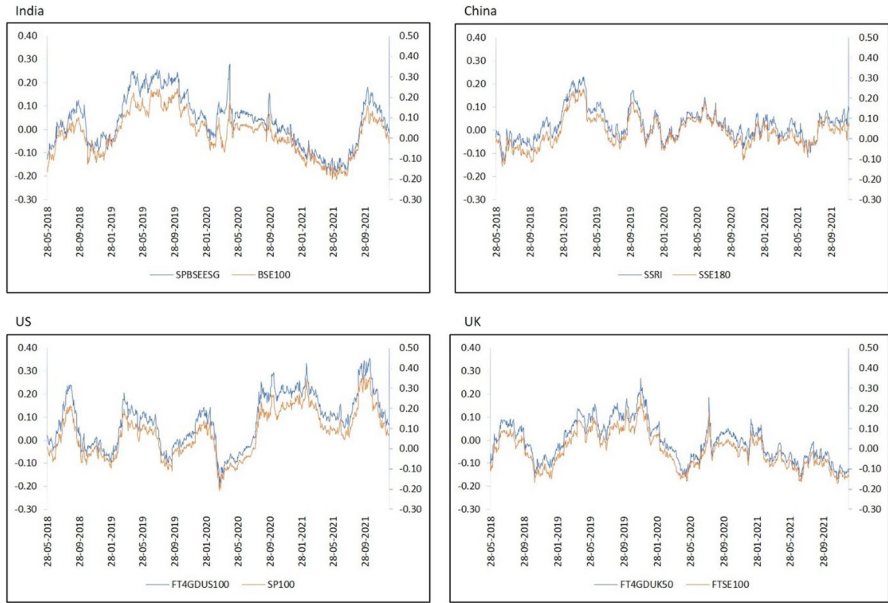


Fig. 3 Robustness test with the Sharpe measure. Source: Authors' illustration

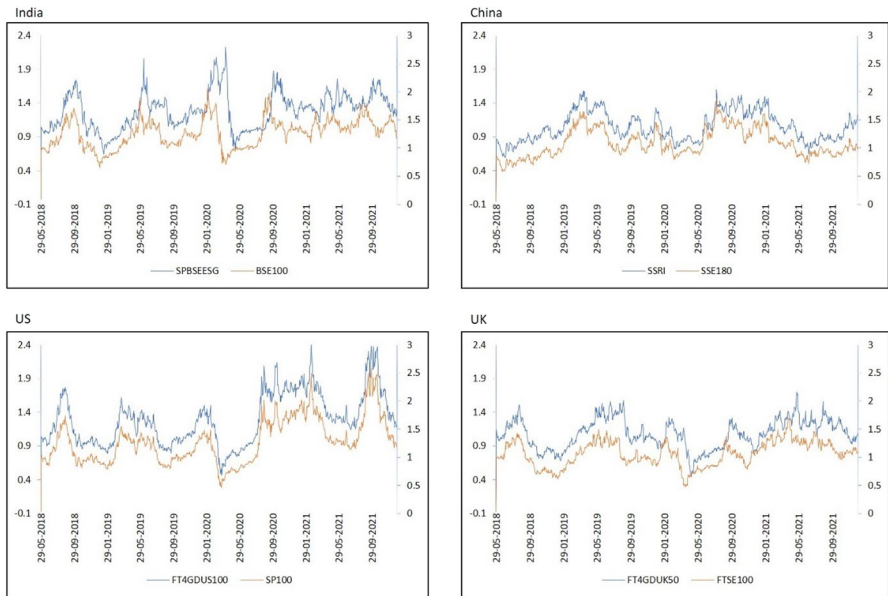


Fig. 4 Robustness test with the Omega measure. Source: Authors' illustration

provides more gains relative to losses for the given threshold and is favorable for investors. These observations also suggest that the outperformance of SRI strategies may become more persistent over time in these capital markets. In terms of the crisis period (Jan 2020–Mar 2020), both indicators report a decline in ratio values. However, the decrease in ratio values for SRI indices is less pronounced compared to the market benchmarks. This suggests that SRI indices experience lower losses, acting as a hedge against market downturns, for India, the US, and the UK. In the post-crisis period (Apr 2020–Dec 2021), both indicators continue to report lower values compared to the pre-crisis period, indicating that the COVID-19 crisis affected the performance of SRI indices and market indices in the sample countries. In the post-crisis period, only in the case of the US, the SRI index exhibits superior performance. In the case of China, there are no significant differences observed in the performance between the SRI index and the market index. Overall, these findings align with the results presented in Sect. 4 and validate the acceptance of our research Hypothesis 1, which states that SRI indices outperform market benchmark indices based on various risk-adjusted measures during distinct periods in India, the US, and the UK. Additionally, Hypothesis 2, which proposes that SRI indices outperformed market benchmarks during the COVID-19 downturn is validated only for the US market.

6 Conclusion

The empirical analysis of SRI indices is relatively unexplored, particularly in the context of developing economies. The study investigated the performance of SRI indices vis-à-vis their conventional benchmarks using various risk-adjusted performance measures in the case of India and China thus covering major emerging markets, and also the US and the UK, the leading SRI markets in the developed world. Our study employed classical measures such as Sharpe ratio, Jensen alpha, Treynor ratio, and Information ratio as well as modern metrics like Modified Sharpe ratio, Sortino ratio, and Omega ratio. The use of various risk-adjusted measures serves two purposes well. Firstly, the inferences can be drawn for broad types of investors depending on the type of indicator and measure of risk they wish to incorporate. Secondly, this decreases the chances of reporting spurious relationships as findings are corroborated with different types of indicators.

Our study contributes to the literary discussion on SRI. The findings reveal that for the overall period, SRI indices in India, the US, and the UK outperform market benchmarks based on all moments of distribution analysis. The risk-adjusted performance measures indicate that the SRI indices outperform market benchmarks in the case of India, the US, and the UK in the overall period, sub-period I, and pre-crisis period. In the case of China, the results point to varied trends, and no conclusive result can be drawn. The study interestingly reveals that SRI indices are less exposed to market risk than their market benchmarks. This demonstrates that SRI indices do not penalize investors with SRI concerns seeking financial rewards. Only in the post-crisis period, do we observe that SRI indices in India and the UK perform inferior to the market benchmarks. This emphasizes the importance of considering

disaggregate or sub-period analysis to fully comprehend the investment outcomes. Also, similar to Giese et al. (2019), Cunha et al. (2020), and Badía et al. (2020), the heterogenous findings of our study point to the importance of considering geographical region, study period, present market conditions, and level of SRI penetration when assessing SRI performance. Very clearly, the developed markets of the US and the UK show that investors can obtain financial gains by opting for SRI. In terms of developing economies, we observe that India despite having SRI in its nascent stage has shown favorable results for investors seeking responsible investing.

Our study points to unique results for China, where the SRI index does not surpass the market benchmark. This observation finds support in existing literature. For instance, Su (2021) highlights that green companies prioritize long-term financial profitability and actively engage in innovative technologies to bring about sustainable operations. Due to high production costs and the nascent stage of their innovative technologies, they accept short to medium-term losses. Su's findings indicates that green investments in China yield lower returns compared to conventional stocks and provide less protection during market downturns. Additionally, the literature highlights that the performance of SRI in China is intricately linked to sector and industry allocation. Zhang et al., (2022a, 2022b) emphasize that the impact of a company's ESG practices on its future stock returns depends on both the specific ESG pillar (environmental, social, or governance) and the industry it operates in. Their research reveals that strong ESG performance may result in reduced excess returns for companies in secondary sectors like manufacturing, but yield higher excess returns for those in tertiary sectors such as services. Similarly, Jin and Han (2018) shed light on the significant influence of industry allocation on the performance of SRI funds, implying that the sectors in which these funds invest play a crucial role in determining their overall performance. Thus, the sector-wise allocation of companies within the SRI index could contribute to the underperformance of the SRI index in China.

Furthermore, investors may prioritize social and environmental impact over short-term gains, potentially leading to lower returns compared to conventional stocks. Martí-Ballester (2021) examines the financial performance of SRI-themed mutual funds in China using various financial metrics and reports that these funds exhibit performance similar to the Chinese market index over the medium term. The study argues that SRI investors can attain favorable financial outcomes over the long term while fulfilling their non-financial preferences, indicating a willingness among SRI investors to sacrifice short-term financial gains. Therefore, our findings align with existing research, suggesting that SRI in China may not consistently outperform the market. This, however, doesn't diminish the potential of SRI as a growing investment theme in the region.

Overall, we contribute to the literature that SRI does not come with a major financial cost in select capital markets (India, the US, and the UK) and investors do not have to forgo financial performance to address their environmental, ethical, or social concerns. These findings are consistent with the "doing well by doing good" theory, which is prevalent in the SRI literature. Also, similar to Managi et al. (2012), we propose that SRI and non-SRI markets share the same bear and bull market regimes at all times, as demonstrated by structural breaks. Our findings indicate that SRI

indices mitigate greater risk during the financial crisis, as observed in the analysis of the COVID-19 crisis in India, the US, and the UK. Similar to Lean and Pizzutolo (2021), we reinforce the notion that SRI can serve as a hedge in times of market crisis. Lastly, these results are robust to various sub-period analyses employed in the study.

7 Implications for Theory and Practice

Our research holds significant implications for academia, particularly for finance scholars investigating SRI or ESG investments. The findings shed light on the diverse factors that can influence SRI returns, offering a deeper understanding for future research. Moreover, our study offers empirical evidence of the impact of COVID-19 on SRI performance, indicating that SRI can serve as a necessary hedge against potential downside risks compared to the traditional style of investing. These findings can be used in conjunction with other research to further develop the theoretical underpinning of SRI. Additionally, our study offers important implications for broad types of investors. Investors focusing on SRI or even traditional investors can leverage our findings to diversify their portfolios and potentially improve returns. For business managers, our findings suggest an increasing market emphasis on sustainability issues, urging them to integrate such considerations into their business valuations. Lastly, our study presents pertinent implications for regulators and policymakers. In light of our findings, government entities can play a pivotal role in fostering sustainable investment models through the implementation of guidelines and regulations.

The unique findings of our study regarding China necessitate specific implications for policymakers and investors in the country. Firstly, to promote SRI, policymakers should establish a stable, long-term regulatory framework to alleviate uncertainty and investment risk. Secondly, a broader range of economic incentives, such as subsidies and tax credits, can stimulate both the supply and demand for SRI. This would enhance the risk-return balance for both companies and investors. Thirdly, increased public investment in research and development is vital to offset the substantial costs associated with innovative sustainable technologies. Additionally, investors should maintain confidence in the long-term potential of responsible investments and reassess risk management strategies to better accommodate SRI considerations.

8 Limitations and Future Scope of Work

The findings of the study must be considered in light of the select sample size, time period, and secondary data sources, which can have their own limitations. Additionally, the study focuses on four major economies (India, China, the US, and the UK) and SRI performance might differ in regions with contrasting economic structures, regulations, or cultural norms. Therefore, generalizing these findings to global SRI trends requires prudence. The study considers the impact of the COVID-19 crisis on the performance of select indices, the analysis may not fully capture the long-term

effects or the resilience of SRI strategies in the face of future crises or unforeseen events. Although the study provides valuable insights into the financial performance of SRI indices across different countries, it may not comprehensively address all factors influencing SRI outcomes, such as specific sectoral differences or the depth of SRI adoption within each market. Future studies employing alternative methods are needed to assess the performance of SRI indices to bring unanimity to the findings. Future studies can conduct a longer-term analysis spanning multiple economic cycles to provide a more comprehensive view of the performance of socially responsible indices and their resilience to market fluctuations over time. To further establish the case for SRI, performance comparisons of socially responsible and irresponsible investments can be explored under different institutional settings and economic conditions. Qualitative research can help gain deeper insights into the motivations behind SRI adoption, the implementation challenges faced by companies, and the perceptions of investors and stakeholders.

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Authors and Affiliations

Iram Hasan¹  · Shveta Singh¹ · Smita Kashiramka¹

✉ Iram Hasan
iram.10shines@gmail.com

Shveta Singh
shveta.singh@dms.iitd.ac.in

Smita Kashiramka
smitak@dms.iitd.ac.in

¹ Department of Management Studies, Indian Institute of Technology (IIT) Delhi, New Delhi 110016, India