How competitive is SRI in developing financial markets: The case of Central and Eastern Europe

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Abstract: *This study investigates the competitiveness of sustainable and responsible investment (SRI) in Central and Eastern European (CEE) financial markets. Specifically, we examined whether a statistically significant measurable difference in the return and volatility between an SRI index and two conventional benchmark indices in the CEE region exists. To test whether the market volatility may affect the results, we applied a Markov regime-switching model to examine the performance in high and low volatility environments. We also used the Fama-French three-factor model to analyse the potential sources of outperformance and verify the initial analysis results. The analysis covered an eleven-year period (January 2011–December 2021) and was based on monthly returns of indices available on the Vienna Stock Exchange: CECE SRI, CECE Composite and CECE MID. Our findings showed that the SRI phenomenon in developing financial markets of the CEE countries followed performance patterns similar to ones in developed financial markets. Sustainable and responsible investment is competitive with conventional investment in the CEE region. However, the differences in returns between the SRI index and conventional benchmarks were statistically insignificant. Although a statistically significant difference in volatility between the SRI index and the large-cap CECE Composite index was reported, we did not find any evidence of exposure to the SRI factor regarding the analysed returns of the CECE SRI index. Our analysis of SRI returns pointed to the statistical significance of the common risk factors, such as the market and the size, which is similar to the analysed conventional benchmarks, with alpha not being statistically significant.*

Keywords: Sustainable and responsible investment (SRI), performance analysis, risk factor exposures, Central and Eastern Europe (CEE), regime-switching.

JEL classification: M14, G11, G30.

Introduction

In line with the recent regulatory and practical development of sustainable finance, financial investments are under increasing pressure to be sustainable and responsible (i.e., to generate both long-term competitive financial returns and positive societal impact). Different stakeholders, from policy makers, over international bodies to private actors, undertake initiatives to incorporate environmental, social and governance (ESG) criteria into financial decisions, which has been coming to the fore, especially

in recent years. Sustainable and responsible investment (SRI) – implementing corporate social responsibility (CSR) principles in finance – has thus become a new, alternative investment philosophy. At the same time, the SRI performance is an area of interest to institutional and individual investors (Brzeszczynski & McIntosh, 2014) and a research topic of an increasing number of studies. Aggregated evidence indicates no difference in returns between SRI and conventional investment (e.g., Friede et al., 2015; Hartzmark & Sussmann, 2019; Kim, 2019; Revelli & Viviani, 2015), although a consensus on this issue has still not been reached because mixed findings exist regarding the SRI performance (e.g., Bruno et al., 2022; Brzeszczynski & McIntosh, 2014; Rehman et al., 2016). These findings, however, reflect the practice of developed financial markets of Western Europe, the USA, and Australia, thus offering a biased view of the concept of SRI. A comprehensive approach and assessment of SRI should consider that this phenomenon has developed worldwide in various practices shaped by different national legislations, policy frameworks, and cultural landscapes. Different governmental forces, institutional incentives and society's moral criteria either curb or perpetuate specific financial-social considerations (Puaschunder, 2016) and may impact financial decision-making. Therefore, gaining insights from developing markets and seeing whether specific differences or similarities exist between advanced and developing countries regarding SRI is interesting and valuable. However, many insights about SRI remain unavailable within the context of transition and emerging countries. The level and depth of research into SRI are still much lower than in studies on advanced countries.

A lack of empirical research outside financially developed markets motivated us to investigate the topic in developing countries, where we focus on the region of Central and Eastern Europe (CEE). For this purpose we use indices related to the CEE region, which are available on the Vienna Stock Exchange/Wiener Börse AG. We focus on the CECE SRI index, comprised of SRI stocks from the CEE region and compare its performance to two conventional CEE benchmark indices: the CECE Composite and CECE MID. The available indices and data demonstrate that the CEE countries represent a specific case of developing financial markets, following the EU objectives on sustainable

development and CSR. Still, their SRI-related market opportunities are largely ignored.

Our critical evaluation of the existing research in conducting a literature review about SRI in CEE showed that only a few research papers have recently provided region- or country-specific in-depth insights about the current state and developmental potential of SRI practices, mainly focusing on markets of Poland (e.g., Sulik-Gorecka & Rubik, 2017) and Russia (e.g., Atnashev et al., 2015). However, the majority of published studies are descriptive papers, or if empirical, they investigated, for example, investors' attitudes towards SRI or CSR reporting of financial institutions and applied different methodologies (e.g., Czerwonka, 2012; Krasodomska, 2015). On a different note, a more recent study by Kocmanova et al. (2020) offered a sustainable investing model for decision makers, based on research of the manufacturing industry in the Czech Republic. The research direction of Lulewicz-Sas and Kilon (2014) with their SRI performance analysis in investigating operating funds was somewhat closer to ours. The mentioned papers are single-country studies. Regarding the regional approach, Janik and Bartkowiak (2015) researched differences and similarities between the indices of socially responsible companies in CEE. Very few papers have, and only recently, opened an important research direction. For example, Brzeszczynski et al. (2021) and Janik and Bartkowiak (2022) by evaluating the risk of the SRI stocks from the CEE markets. Also, Janik and Bartkowiak (2022) incorporated how the company's qualification for a given index affects its value in its performance of the SRI in CEE countries. However, in both papers there was no attempt to compare the exposure of SRI and conventional stocks to known rewarded risk factors, such as size and value, which could further provide an insight into whether a measurable difference between the examined investments exists. In both papers, only the single market model based on the market index was applied.

In order to comprehensively assess the differences in performance between the SRI and conventional stocks in the CEE region we build on the previous papers by including the Fama-French three-factor model in the analysis. Furthermore, based on the research focused on the relationship between risk and return, for instance, Trainor (2012), which showed how important market volatility is in identifying

the statistically significant results, we also test how differences in performance of examined stock indices are affected by market volatility. To that end, we employ a regime-switching model to test for performance differences in different volatility regimes. Many studies have used the regime-switching models, but the analysis has mostly been limited to developed markets (e.g., Managi et al., 2012; Yu, 2013).

The motivation for this paper was twofold. Apart from the recognised and above-presented lack of research findings about SRI in the CEE region, we were also motivated by the seemingly strong outperformance of the SRI index over its conventional benchmarks – our preliminary analysis pointed out that the average return of the analysed SRI index covering CEE markets in the eleven-year period (2011–2021) was positive, unlike the conventional benchmarks, and had a lower variance.

Although SRI in CEE is still emerging in theory and practice, the need for more social responsibility by the financial market participants is getting more pronounced. This has been coming to the fore, especially in recent years, with European Union taking the global lead in developing a regulatory framework for sustainable finance. Therefore, we present and analyse the possibilities of applying SRI in CEE to examine whether SRI might represent a value-creating financial practice in developing markets. Our analysis revealed that although the SRI index outperformed the corresponding major stock market indices in 2011–2021, the differences in returns were statistically insignificant in both cases. The analysis of risk-return characteristics of analysed indices is backed up by factor exposure analysis (obtained by employing the Fama-French three-factor model). The latter analysis pointed out that the statistically significant difference in volatility between the SRI index and the large-cap conventional index can be attributed to the difference in factor exposure.

The paper offers a two-fold contribution to the SRI literature. First, we contribute to the need to open and investigate corporate social responsibility topics in the context of developing countries. Our study represents an attempt to investigate the possibilities of SRI in the CEE financial markets, upgrading the approach of a single country study and comprising the region. Second, by focusing on the less examined CEE financial markets, we pay attention to possible international differences or similarities of SRI options

compared to developed financial markets and extend scarce knowledge about SRI in these countries (Puaschunder, 2016). We strive to contribute to the question of SRI financial competitiveness by providing additional insights that we learnt from examining the CEE markets. We are motivated to determine whether the patterns of SRI in transition countries will resemble or differ from those documented in developed countries and to investigate its financial potential by analysing its performance.

1. Theoretical background and hypotheses development

1.1 From CSR to SRI – The Central and Eastern European perspective

The relationship between corporate social responsibility (CSR) and sustainable and responsible investment (SRI) has evolved. Initially, SRI was limited to a few investment funds of insignificant size. Nowadays, it has the potential of putting certain pressure on the financial markets and companies to consider and implement CSR policies. For instance, fund managers increasingly evaluate corporate social performance for inclusion, hoping that strong CSR practices will have long-term positive consequences on the market value of respective firms (Hill et al., 2007). The relationship between corporate social performance and CSR was later on logically transposed to the performance of SRI, and then followed by the institutionalization of CSR in financial markets and the emergence of ESG data (Revelli, 2017).

CSR and SRI are still in an early phase of development in the CEE region, as responsible business practises in CEE countries are less developed than in other EU countries (Janik & Bartkowiak, 2022). On the other hand, when thinking in EU terms, the CEE countries in particular greatly need sustainable investment. Despite the recognised importance of CSR research in emerging markets, apart from some studies (e.g., Habek, 2017; Ivanisevic Hernaus & Stojanovic, 2015; Rozsa et al., 2021), there is still a lack of empirical findings. Likewise, SRI is neither widely known nor practiced across CEE countries (e.g., Habek, 2017). Part of the underlying reasons is limited demand and supply for responsibility in transition countries. However, others can be also found in the insufficient knowledge about this phenomenon, especially when considering its performance compared to conventional investment.

When transposing the research findings from developed financial markets to transition countries of the CEE region, we should acknowledge the characteristics of CEE financial markets. The available findings are usually not contextual to developing markets which have their unique settings in terms of regulations, stage of market development and ESG coverage (e.g., Beloskar & Rao, 2023). CEE is behind the European average in the importance of securities markets in financing domestic economies. Compared with their Western counterparts, these markets are relatively small, less liquid and still developing. Relatively livelier trading is recently seen on some of the stock exchanges, i.e., the Warsaw Stock Exchange, Bucharest Stock Exchange [the European Think-Tank dedicated to financial services (Eurofi, 2020)]. On the other hand, regarding other characteristics, such as their organisation and listing requirements, the CEE stock exchanges are comparable to Western European exchanges. According to Eurofi (2020), companies listed on the market adhere to higher standards of corporate governance and serve as a role model for other companies.

1.2 (Out)performance of SRI?

Scholars have investigated SRI from various perspectives. Considering the motivation for our research, related primarily to the performance of SRI, we recognised several primary lines of the SRI literature that gave us food for thought. In investigating the financial competitiveness of SRI to conventional investment, that is, examining SRI data to determine whether SRI is profitable and less or more risky than conventional investments, what has been the research question of the vast majority of studies of SRI (Revelli, 2017), the literature takes account of assessing three different research targets: individual stocks, SRI funds and SRI indices (Brzeszczynski & McIntosh, 2014).

The empirical analysis of SRI stocks dates back to the 1970s (e.g., Moskowitz, 1972; Vance, 1975), later forming a direction of literature investigating ESG factors' role in determining stock prices. Friede et al. (2015) gave an exhaustive overview of academic research on this topic, combining the findings of about 2,200 individual studies, starting in 1970 and showing that the business case for ESG investing is empirically very well founded. More recent studies (e.g., Khan, 2019; Miralles-Quirós et al., 2019) also provided exciting insights into

this connection. However, as Torre et al. (2020) emphasized, it is essential to acknowledge that although there was evidence that companies fulfilling sustainability requirements have better market performance, ESG factors may impact differently according to specific businesses and sectors (Khan et al., 2016).

A substantial number of studies in the field focused on the performance of SRI funds (e.g., Ito et al., 2013; Leite et al., 2018; Sanchez & Sotorrio, 2014), some of them investigating specific types of investment funds such as exchange-traded funds (ETFs) (e.g., Sun & Small, 2022). The studies brought mixed results on the financial competitiveness of SRI relative to conventional investment. Chegut et al. (2011) contributed by reviewing the SRI mutual fund performance literature to provide best practices in SRI performance attribution analysis. They pointed out themes that require specific attention in this literature: data quality, social responsibility verification, survivorship bias, benchmarking, and sensitivity and robustness checks.

This line of research has been complemented by a number of studies into the performance of SRI indices (Schroeder, 2007), especially from the late 2000s (e.g., Lean & Pizzutilo, 2021; Tripathi & Kaur, 2020). In these studies, the focus on the indices rather than funds brought certain advantages, since transaction costs of funds, the timing activities and the fund management skills do not have to be considered (e.g., Schroeder, 2007). Obtained research findings regarding SRI performance were mixed. What has to be taken into consideration when discussing the results of all the above studies, however, various research methods are used, different geographical areas and periods analysed, with different prevailing market atmosphere, and the heterogeneity of SRI itself.

We singled out Janik and Bartkowiak's (2015, 2022) studies, on which we later built our approach to SRI research in the CEE region based on the SRI and conventional indices. In terms of applied methodology, however, we added the Fama-French 3-factor model as proposed by Brzeszczynski and McIntosh (2014) and Henriksson et al. (2019). Furthermore, regime switching has been introduced following Managi et al. (2012) and Azmi et al. (2019) who examined conventional Islamic and SRI Islamic investments.

In general, the review of SRI research supports conclusions about mixed findings

regarding the performance of SRI investments (Brzeszczynski et al., 2019). The empirical confusion is additionally increased by different theoretical reasoning.

The modern portfolio theory (Markowitz, 1952), as the conventional investment construction cornerstone, explains how to construct a portfolio with maximized expected return for a given level of risk. It suggests that investors can mitigate the specific risk of portfolios to arbitrarily low levels through diversification (Jin, 2022). The theory states that an efficient portfolio is diversified and creates expectations that SRI should underperform conventional investments (Revelli, 2017) as a result of less investment opportunities (Barnett & Salomon 2006). The modern portfolio theory view is advocated by finance scholars who argue that ESG screening increases total portfolio risk, transaction costs and management fees, thus reducing the performance (e.g., Hickman et al., 1999). However, though modern portfolio theory rightfully assesses the costs to limiting investment choices through the application of SRI strategies, it does not account for the benefits that these strategies may bring (Barnett & Salomon, 2006; Capelle-Blancard & Monjon, 2014; Ivanisevic Hernaus, 2019; Revelli & Viviani, 2015), what is especially related to some of them (positive screening strategy). The essence is summed up in that the financial loss borne by ESG-screened portfolio due to poor diversification is offset as ESG screening intensifies because better-managed and more stable firms are selected into the portfolio (e.g., Barnett & Salomon, 2006). For example, some authors (e.g., Tripathi & Bhandari, 2015) observed evidence in contradiction to the modern portfolio theory, where portfolios of SRI stocks delivered significantly higher risk-adjusted performance compared to broad market benchmark indices in India.

A new narrative is being developed along with the stated traditional financial theory, thus opening space for an opposing theoretical view about SRI performance. By this view, screening assets based on ESG criteria may generate value-relevant information otherwise unavailable to investors, which ultimately translates into favourable and more consistent financial performance (Benlemlih & Girerd-Potin, 2017; Maxfield & Wang, 2020). A novel promising research direction is suggested by some studies (Henke, 2016; Maxfield & Wang, 2020; Nofsinger & Varma, 2014) which offered a more refined view of SRI as a way to mitigate portfolio risk. Evidence that ESG-investing helps manage investment risks is growing in terms that constructing ESG-screened portfolios aims to reduce the aggregate ESG-risk at the portfolio level and such portfolios are expected to be protected against losses by ESG-events (Jin, 2022). Therefore, the proponents of SRI claim that investors might gain returns as high as or equal to conventional investment by applying ESG criteria, despite constraining the range of possible investments. Their argument is based on the social theory of the firm (Coleman, 1990), stakeholder theory (Freeman, 1984) and behavioural portfolio theory (Shefrin & Statman, 2000), putting the benefits of SRI investment upfront. These include integrating the interests of all stakeholders, targeting smaller firms or outperforming organizations with the best CSR reputation, making investment decisions on higher quality information, and being attributable to lower risk of environmental disasters, recovery costs, or penalties related to the environmental regulation violations (Ameer & Othman, 2017; Sanchez & Sotorrio, 2014).

How stocks are screened should also be considered (Cortez et al., 2009). The screening is likely to affect the characteristics of assets included in the portfolio. Ivanisevic Hernaus (2019) pointed out the need to differentiate among the SRI strategies used to create such portfolios to understand the different performance implications of SRI.

On the one hand, investors who apply inclusion criteria (positive screening) invest in the best-managed firms in each sector. By the social theory of the firm, the performance of this investment would be higher than that of the rest (Guerard, 1997). The relatively higher ESG performance of these companies, or sectors, is seen as holding a more significant potential of creating value in an investment portfolio. Positive screening indeed results in an increase in returns and reduces risk (Barnett & Salomon, 2006; Humphrey & Tan, 2014). For instance, Kempf and Osthoff (2007) found remarkably high abnormal annual returns for investors employing the best-in-class screening approach. Portfolios of positively-screened SRI stocks in a study by Tripathi and Bhandari (2015) delivered significantly higher risk-adjusted performance compared to broad market benchmark indices.

On the other hand, investors who apply exclusion criteria (negative screening), instead of rewarding particularly exemplary companies, sanction companies for their misconduct (e.g., Diener, 2022) and the investment universe in this case can become substantially constrained (Trinks & Scholtens, 2017). According to the modern portfolio theory, this type of investment would be subject to greater total risk than positively-screened portfolios. Moreover, the return on these investments may be lower since investors cannot capitalize on profitable controversial stocks (Fabozzi et al., 2008; Humphrey & Tan, 2014). However, even when applying negative screening, there are views that, by excluding low ESG-score constituents from the selection universe, constructing ESG-screened portfolios aims to reduce the aggregate ESG-risk at the portfolio level (Jin, 2022).

Substantial theory and extensive research emphasized the outperformance of positively screened portfolios and the underperformance of negatively screened ones. However, several studies did not find evidence of the impact of either positive or negative screening on portfolio risk or returns (e.g., Humphrey et al., 2012; Humphrey & Tan, 2014). Furthermore, Sanchez and Sotorrio (2014) reported that the type of screening used by an SRI fund is not relevant to explain differences in funds' performance since both positive and negative screening is used simultaneously for the majority of European SRI funds. We acknowledge this common practice of mixed screening, and in our analysis use such an SRI portfolio (represented by an SRI market index), formed by both positive and negative screening.

Finally, although restricting the investment universe to SRI may prove optimal and exhibit higher returns than conventional investments if the depth is relatively more profitable than breadth (Gil-Bazo et al., 2010), this might not be the case when, for example, the total number of available stocks is slight, such as in CEE financial markets. Therefore, we expect that a potential positive impact of SRI strategies on performance (supported by the social theory of the firm, the stakeholder theory, and the behavioural portfolio theory) might be neutralised by the mentioned characteristics of the financial markets that take away much of the portfolio diversification effect (presented by the modern portfolio theory), and hypothesize that there is no difference in performance between SRI and conventional investment.

2. Research design and methodology
2.1 Data
This paper examines the presence of the SRI-style premium in stock markets of Central and Eastern Europe. The SRI portfolio used for this research comprises selected stocks from the CEE region. It is represented by the sustainability index CECE Socially Responsible Investment (CECE SRI index) of the Vienna Stock Exchange, launched in 2009 and comprising CSR companies from CEE countries (Croatia, the Czech Republic, Hungary, Poland, Romania and Slovenia). Data regarding the index composition are publicly available for the 2015–2021 period. They show that the index sector breakdown has been dominated by stocks from Pharmaceuticals, Telecommunications and Banking sectors, which have accounted for more than 70% of stocks included in the index on average and no less than 50% of stocks included in the index each year.

The basis for the sustainability research is a sustainability model that considers the ecological, social and economic quality of an analysis object. The model is used to make the sustainability research measurable as precisely as possible, applying comprehensive (positive and negative) screening criteria. The model is one of the most mature tools for the external evaluation of sustainability (Reinhard Friesenbichler Unternehmensberatung, 2021). As the focus of this research is not CSR itself, we do not assess companies' CSR in CEE financial market; instead, their selection is based on the described SRI index. Moreover, considering the combination of positive and negative screening commonly seen in practice in Western financial markets, we found that available SRI indicators at CEE countries in these terms resemble this practice and followed the same approach in our study. By analysing how two basic SRI strategies (i.e., the mentioned positive and negative screening) perform in the CEE financial market, we used indicators addressing a comprehensive screening strategy (Kiymaz, 2019). While positive or best-in-class screening involves the selection or weighting of the best performing or the most improved companies or assets as identified by ESG analysis (Kempf & Osthoff, 2007), within a defined investment universe, negative screening or values-based exclusions systematically a priori excludes from the investment universe companies, sectors, or countries involved in activities deemed unacceptable or controversial (Eurosif, 2019).

As a benchmark of conventional investment, we used the CECE Composite Index (CECE Composite) in EUR of the Vienna Stock Exchange. The CECE Composite is the composite Eastern European capitalization-weighted price index comprising the large capitalisation stocks included in the Hungarian Traded Index (HTX), Czech Traded Index (CTX) and Polish Traded Index (PTX). This index, therefore, covered a much wider range of sectors – 18 as opposed to only 9, than the CECE SRI in the 2015–2021 period. However, the banking sector (close to 30% of stocks included in the index on average) continuously not only belonged to the top three sectors of the index but held the number one spot being greater in size than the two following sectors combined. Significant sectors not included in the CECE SRI index were most notably Oil and Gas and Electric utilities sectors. Although included in the CECE Composite, the Telecommunications sector played a largely insignificant role, unlike in the CECE SRI index.

We also decided to include the CECE Mid Cap Index (CECE MID) in EUR as one additional conventional benchmark due to its broader geographical coverage and as it should better capture the size risk (premium). CECE MID is a capitalization-weighted price index and is made up of the most liquid stocks of companies of the Eastern-, South- and Central European region, which fulfils the size criterion of the mid cap indices of the Vienna Stock Exchange (Vienna Stock Exchange, 2021). Similar to the CECE Composite, this index includes a relatively large number of sectors – 16. Also resembling the CECE Composite is the share of stocks of the Oil and Gas and Electric utilities sectors which, for each sector, on average stood slightly above 15% of the stocks included in the index in the 2015–2021 period. However, unlike the CECE Composite and similarly to the CECE SRI index, the Telecommunications sector enters the top three sectors on average, while the Banking sector is not as dominant.

As these are conventional investment market indices, they include companies regardless of their CSR and are considered a good benchmark of conventional investment (Schroeder, 2007).

The empirical research used monthly index returns (denominated in EUR) from January 2011 to December 2021 (132 months total). Also, to isolate exposures to the size and value investing factors on index returns, we have quantified the SMB and HML variables (i.e., time-series of monthly factor risk premiums) for the CEE region in the observed period (Dolinar, 2021). For that purpose, our data sample consisted of 50 stocks constituing at least one of the analysed indices as of March 2021: the CECE Composite, the CECE MID and the CECE SRI index (in EUR).

All data needed were downloaded from the Vienna Stock Exchange website (indices' values and compositions) and from the Refinitiv Eikon information system (stocks' total returns, market capitalisations and Price-to-Book values).

2.2 Procedure

The research methodology is based on a two-step approach for identifying SRI-style premium. The first step simply tests whether there is a measurable difference in the performance of the SRI index (portfolio) relative to the conventional indices (portfolios). The statistically significant difference in average return and volatility is in the focus based on the entire analysed period and its subsegments determined by the regime-switching model. The second step considers the possible different exposures to risk factors of the observed indices, i.e., tries to detect SRI-effect on investment returns when exposures to the size and value effect are considered.

In the first step, we compared the performance of the CECE SRI index with the CECE Composite and CECE MID indices as conventional investments. A similar approach has been taken in research studies analysing other markets (e.g., Chegut et al., 2011; Schroeder, 2007). To evaluate the performance of the CECE SRI index, we calculated the time-series of monthly price returns ($R_{p,t}$) and introduced a risk-adjusted performance measure in the form of the modified risk-reward ratio (MRR), a modified version of the Sharpe ratio [Formula 1; Israelsen (2005)]:

$$MRR = \frac{R_p}{\sigma_p^{\frac{R_p}{absolute(R_p)}}} \qquad (1)$$

where: R_p – the monthly average price return of a given index for the observed period (January 2011–December 2021); σ_p – represents the standard deviation of the time-series of its returns. In order to identify statistically significant differences in return performance between observed indices t-tests were per-

formed, while *F*-test was used to test for differences in volatilities.

The simple regime-switching model applied to determine the high and low volatility intervals (two regimes) of the market in the observed period can be specified by Formula 2 as specified by Managi et al. (2012):

$$R_{Mt} = c_M(s_t) + \sigma_M(s_t)\varepsilon_t \qquad (2)$$

where: R_{Mt} – represents the return in the month *t* of an overall CEE equity market for which a proxy explained below (referring to the second step) is used; c_M and σ_M – the state dependent mean (intercept) and volatility of the market; ε_t – *iid* random variable; s_t – the presumed unobservable variable, the regimes. Under the assumption of only two regimes it can only take the value of 1 or 2. We did not find any solid serial correlations and therefore did not include an autoregressive term in the model. It should be noted that regime-switching modelling was not in the focus of this research and that the model in this paper was only used in order to classify observed returns into sub segments according to volatility.

The second step further analysed the performance of the CECE SRI index and the two observed benchmark indices by applying the Fama-French (1993) three-factor model (Formula 3), that is, by identifying and comparing exposures to commonly-observed factors (sources) of rewarded risk: the stock market risk, the size risk and the value risk. For this purpose, in order to be able to carry out the analysis (Formula 4), the standard Fama-French (1993) approach had to be slightly adjusted to accommodate the less developed CEE stock market as proposed in Dolinar (2021):

$$E(R_p) = r_f + \widehat{b_p}E(R_M) +$$
$$+ \widehat{s_p}E(SMB) + \widehat{h_p}E(HML) \qquad (3)$$

$$R_{p,t} = \alpha_p + b_p R_{M,t} + s_p SMB_t +$$
$$+ h_p HML_t + \varepsilon_{p,t} \qquad (4)$$

where: $R_{p,t}$ – returns for three observed indices in period *t*; $R_{M,t}$ – the return of an overall CEE equity market in period *t*; SMB_t – the risk premium related to the company size in period *t*; HML_t – the risk premium related to the company valuation in period *t*; b_p, s_p and h_p – sensitives (i.e., exposures or factor betas) to

the corresponding variables (i.e., risk factors); α_p – a unique return associated to an index; $\varepsilon_{p,t}$ – a random error term in period *t*. In this case the $R_{M,t}$ was calculated as a monthly return on the equally-weighted portfolio of 50 stocks constituing at least one of the before mentioned indices.

The definition of *SMB* and *HML* variables also deserves a brief description. We used monthly returns, market capitalisation data and B/M ratios of the previously mentioned 50 companies over an observed eleven-year period. Namely, to capture size and value premium, at the beginning of each year the median was used to split companies into two groups by size – small vs. big (S vs. B), and into two groups by book-to-market value – high vs. low (H vs. L). The time series of monthly returns of the four portfolios were calculated using equal weights. Finally, the *SMB* variable is defined as the difference between the monthly returns on the S and the B portfolio, while the *HML* variable is defined as the difference between the monthly returns on the H and the L portfolio. We encourage the reader to refer to Zoricic et al. (2018) for further specifics on long-short portfolios formation and other methodological details.

3. Research results and discussion
3.1 Findings
Based on the data and procedure described in Research Design and Methodology, the performance of the analysed indices in the overall period (January 2011–December 2021) is presented in Tab. 1.

As presented in Tab. 1, the CECE SRI index seems to clearly outperform both chosen counterparts. Not only does it seem superior regarding the return, but also regarding risk, resulting in a greater risk-reward ratio (especially relative to the Composite index). Regardless of how much in favour of SRI this initial analysis may seem point, unfortunately, the statistical tests do not provide evidence to support it. Namely, the *t*-test did not find any statistically significant difference between the average return, neither between the CECE SRI index and the CECE Composite nor between the CECE SRI index and the CECE MID index. The *F*-test used to test the statistical significance of differences in variances found only the variances of the CECE SRI index and the CECE Composite to be statistically significantly different at the 1% level.

Tab. 1: Performance of the CECE SRI, CECE Composite and CECE MID indices in the overall analysed period (January 2011–December 2021)

	SRI	Composite	MID
Average return (%)	0.31	0.03	0.23
Volatility (%)	4.34	5.91	4.79
Risk-reward ratio	0.071	0.005	0.048

Source: own

Since market volatility can play a role in obscuring the analysed differences, regime switching model described in Research Design and Methodology was used to determine volatility regimes. Two regimes were identified, with 12 out of 132 observations belonging to the high volatility regime and 120 observations belonging to the low volatility regime. The performance of the analysed indices was calculated as presented in Tab. 2.

The results demonstrate the outperformance of the SRI index in both regimes from the risk-return perspective, albeit arguably much more so in the high volatility period considering the greater difference in value of the risk-reward ratio relative to both conventional benchmarks. The greater difference is caused by both greater return and lower volatility of the CECE SRI index. However, in the low volatility period the same is true only when the CECE SRI index performance is compared to the CECE Composite index. The difference in performance of CECE SRI and CECE MID indices is almost hardly noticeable. The slight outperformance of CECE SRI index in this case (indicated by the slightly greater risk-reward ratio) is based on the marginally greater return which is able to compensate for a bit lower volatility of the CECE MID index. However, again

statistical testing produced slim evidence to support the observed differences. In the high volatility regime, not even the difference in volatility between the CECE SRI and CECE Composite indices was found to be statistically significant. In the low volatility regime, however, the difference in volatility between the CECE SRI and CECE Composite indices was detected again and proved to be significant at the 1% level. Nevertheless, other differences in volatilities and returns in both regimes were all found to be statistically insignificant.

In order to further compare returns, we conducted the regression analysis using the Fama-French three-factor model to capture the sources of indices performance that are related to the overall stock market movement, company size and company valuation. Thus, we tested whether our current findings can be backed up by testing the indices' exposure to common risk factors or whether there is evidence of the SRI-tilt in the SRI index. The regression results are presented in Tab. 3.

The determination coefficient is high for all the three indices, implying that the tested set of factors captures index performance well. As expected, the variable R_M as the market factor is statistically significant for all the three

Tab. 2: Performance of the CECE SRI, CECE Composite and CECE MID indices in high and low volatility regimes

		SRI	Composite	MID
High volatility period	Average return (%)	−2.59	−3.27	−3.30
	Volatility (%)	9.29	13.57	11.45
	Risk-reward ratio	−0.0024	−0.0044	−0.0038
Low volatility period	Average return (%)	0.60	0.36	0.59
	Volatility (%)	3.44	4.50	3.43
	Risk-reward ratio	0.173	0.080	0.171

Source: own

Tab. 3: Fama-French three-factor model risk exposures of the CECE SRI, CECE Composite and CECE MID indices

Variables	SRI	Composite	MID
R_M	0.896***	1.293***	1.070***
	(0.0473)	(0.0494)	(0.0295)
SMB	−0.229***	−0.507***	−0.025
	(0.0508)	(0.0625)	(0.0552)
HML	−0.063	−0.095	0.160**
	(0.0565)	(0.0669)	(0.0699)
Constant	−0.003	−0.006***	−0.006***
	(0.0022)	(0.0021)	(0.0017)
R-squared	0.744	0.887	0.850
Observations	132		

Source: own

Note: ***$P < 0.01$; **$p < 0.05$; robust standard errors in parentheses.

indices. The variable SMB related to company size seems statistically significant for the CECE Composite and CECE SRI index, while the HML variable related to company valuation seems statistically significant only for the CECE MID index. In the observed period, the CECE SRI index presents an investment opportunity that is, relative to the both benchmark indices (the CECE Composite and CECE MID), less exposed (tilted) to the overall stock market movements [parameter b_p less than 1; Brzeszczynski et al. (2021) reported similar findings]. Also, concerning size premium (variable SMB), the CECE SRI is in between the two benchmarks, i.e., it is more exposed to the size risk (i.e., tilted toward relatively smaller companies) relative to the CECE Composite index and slightly less exposed to the size risk relative to the CECE MID index. Although, same findings could apply to exposures to the HML variable, it is statistically significant only in the case of the CECE MID index.

If we observe the Fama-French three-factor model as a valid pricing model for the CEE stock market (i.e., no additional significant systematic risks and market anomalies present) then, based on the analysed sample and this paper's research objective, the parameter $α_p$ (constant term) could be seen as a proof of risk-adjusted excess return associated to the SRI-tilt. Bruno et al. (2022) took a similar approach when examining ESG strategies. In that sense, the CECE SRI index has the highest relative value of the constant term (although not statistically different from zero) since two other benchmark indices have constant terms which are negative and statistically different from zero. Nevertheless, since the SRI alpha is not statistically significant, we do not find evidence of SRI-style or another factor that could explain the CECE SRI index returns.

Overall findings related to factor exposure support the findings of the initial analysis of the risk-return characteristics, given that the value of coefficients related to the exposure to market, size and valuation factors of the CECE SRI and CECE MID indices are relatively close (with the CECE MID index providing a bit stronger exposure toward smaller companies with lower P/B multiples). Furthermore, based on the applied Fama-French three-factor model, the statistically significant difference in volatilities between the CECE SRI and CECE Composite indices seems to be related to much more pronounced exposure of the CECE Composite index to the market factor and much less pronounced exposure to the size factor. The t-tests and F-tests for differences between expected return and volatilities between the CECE Composite index and CECE MID have also been conducted. The results match those already reported for the CECE SRI and CECE Composite indices corroborating the findings. Therefore, it seems

that the main differences captured in the analysis can be traced back to the composition of the CECE Composite index. Being a large-cap index, it focuses on a geographically narrower region and to the banking sector. However, more importantly, it also seems to offer a lower degree of diversification to systematic risks (regardless of the broad range of sectors covered), which is a well-documented phenomenon (e.g., Amenc et al., 2014).

3.2 Theoretical and practical implications

The theoretical contribution of our study emerges from raising awareness of SRI in CEE markets. To date, this region has been unexplored in research on SRI. A lack of empirical insights does not enable a clear view of whether current SRI trends and practices from developed financial markets are also reflected in less developed counterparts. In particular, we found that SRI does not outperform the conventional benchmark indices. Although, as the measurable difference in performance between SRI and conventional investment is not statistically significant, the research does not eliminate SRI as a viable option in the financial market. Our comparative performance results of SRI and conventional investment align with our underlying theoretical rationale and other research studies. As such, they do not differ from those documented in developed countries. They are similar, for example, to the meta-analytic findings, provided by Revelli and Viviani (2015) and Kim (2019), who suggested that SRI performance was not different from conventional investment. It can also be noted that Henriksson et al. (2019) claimed that statistically insignificant difference in returns could be explained by investors' expectations of similar returns regardless of the ESG criteria. In this regard, Bruno et al. (2022) also pointed out that there should be no information advantage in a competitive market. Therefore, even if the corporate performance of the SRI stocks is better, it should not lead to higher returns if investors know about it.

Furthermore, our findings for the CEE region corroborate those of Brzeszczynski et al. (2021) and Janik and Bartkowiak (2022). They also complement them by providing further evidence supporting the view that the rewarded SRI risk factor, i.e., SRI-style premium, does not exist. Based on the Fama-French three-factor model, our findings point out that although

the SRI screening does make a difference, such a difference is only statistically significant relative to the traditional large-cap benchmark (CECE Composite index). The mid-cap index, such as the analysed CECE MID index, seems to offer an alternative to the large-cap investment quite similar to the SRI investment, albeit with even more pronounced factor exposure to the common systematic risk factors.

Regarding the practical implications of this study, we attempted to move SRI closer to investors, by investigating its financial competitiveness with conventional investment. In this regard, based on the statistically insignificant alpha parameter in the Fama-French model, the results of our study support the view that there are no statistically significant risk-adjusted differences in the returns of SRI strategies. This corroborates the findings of Brzeszczynski and McIntosh (2014) and Bruno et al. (2022) for the developed markets and Naffa and Fain (2022) for a portfolio of companies belonging to both developed and emerging markets. Therefore, according to Bruno et al. (2022), such findings help explain that the value added of the SRI investments might not lie in their outperformance potential but rather in their contribution to reducing the climate risk, improving the investment norms, and positive effects on society – the risks they are inherently designed to mitigate. SRI index providers serve a valuable purpose to this end by offering a portfolio of SRI companies to investors, which encourages implementation of ESG norms in the companies and fosters development of SRI. However, as shown in this study, investors should seek further information on particular SRI portfolios of their interest to better understand the differences related to other conventional benchmarks and the systematic risk exposures they face.

3.3 Limitations and future research

We should know potential research limitations when deriving conclusions from results obtained. A limitation of this study is using an SRI index for defining the available SRI universe in the CEE financial market. Daily index calculation and dissemination are effected by the Vienna Stock Exchange, whereas Mag. Friesenbichler Unternehmensberatung is responsible for the sustainability research. We cannot verify information from different sources. However, the construction of this index is based on similar methodologies of renowned indices

globally, is the only available measure of CSR of companies at the CEE regional level, and is used in research and has been recognised as a benchmark of CSR in CEE. Considering that the aim of this paper is not to investigate CSR itself but to investigate performance of SRI and to position SRI in a financial market, the SRI Index can be seen as a total available SRI universe in CEE. These arguments stand behind a broad acceptance of using CSR ratings for SRI performance analysis in the literature (e.g., Brzeszczynski & McIntosh, 2014). However, it should also be pointed out that a relatively small number of 46 stocks were available for the analysis to represent the overall CEE market and define the market, size and value factors in the Fama-French three-factor model. To this end, except for counting on market development, future research could attempt to apply the classification method (Henriksson, 2019) to increase the number of sampled companies while still preserving the characteristics and return patterns of the examined companies. If successful, such an approach would even enable the application of more complex modifications of the original Fama-French multi-factor model, such as the five-factor model applied in Naffa and Fain (2022). In addition, as current research of SRI in the CEE region has offered dominantly single-country studies, the literature would welcome more studies comprising the whole region and a cross-national approach. This might bring additional insights into possible differences among the CEE countries and compared to developed markets, and provide more possibilities for generalisation of the findings about SRI.

Conclusions

The present study explores the financial competitiveness of SRI compared to its conventional benchmarks. The SRI portfolio, represented by the CEE SRI index which is constructed using mixed screening investment strategies, has been compared to two conventional investment benchmarks, CECE Composite and CECE MID. Our analysis covering an eleven-year period (2011–2021) revealed statistically insignificant differences in returns between SRI and both conventional investment benchmarks for the whole analysed period and two subperiods related to different volatility regimes. The statistically significant difference was only detected in the volatility

of CECE SRI and CECE Composite indices. In capturing the sources of the performance related to the overall stock market exposure, company size, and value exposure, we found that the SRI index and the conventional indices are exposed to the same factors – market and size. Furthermore, the SRI index presents investment opportunities which are, relative to the large cap CECE Composite index, slightly less exposed to the overall stock market movements and slightly more tilted towards the size risk. Compared to the mid-cap index (CECE MID), the exposure differences are even less pronounced, supporting the initial analysis of risk-return characteristics. Most importantly, the factor exposure analysis did not yield significant alpha of the SRI investment, corroborating other research suggesting that the benefits of SRI investing do not (at least yet) translate into a measurable difference in performance. However, the obtained results also indicate that SRI practices are financially not notably less attractive than conventional investment from a performance-based perspective.

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Appendix

Tab. A1 presents the overall performance of the analysed indices along with the descriptive statistics, to provide a broader context regarding the assessment of the results discussed in the research findings. The descriptive statistics in the analysed period show that returns of the CECE Composite index do not deviate significantly from the normal distribution based on the values for kurtosis and skewness since the values for normally distributed data would be 3 and 0 respectively. Returns of the SRI and MID indices again exhibit more similarity by being slightly skewed to the left. Also, the distribution of returns of CEE MID index is slightly more leptokurtic than the one of the CECE Composite index, while the distribution of returns of CEE SRI index is significantly platykurtic.

Tab. A1:	Performance of the CECE SRI, CECE Composite and CECE MID indices in the overall analysed period (January 2011–December 2021) with descriptive statistics		
	SRI	**Composite**	**MID**
Average return (%)	0.31	0.03	0.23
Volatility (%)	4.34	5.91	4.79
Risk-reward ratio	0.071	0.005	0.048
Variance (%)	0.19	0.35	0.23
Kurtosis	1.722	3.217	3.411
Skewness	−0.387	−0.096	−0.425
Median (%)	0.43	−0.06	0.22
Minimum (%)	−15.09	−23.83	−20.12
Maximum (%)	14.70	24.18	18.72
No. of observations	132	132	132