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CONFERENCE PAPER

Performance Differences between ESG Indices and Conventional Market Indices: a Multivariate Analysis of Indices

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Abstract: This paper aims to identify performance differences between conventional European equity indices and ESG indices. Conventional European equity indices are tools both institutional and retail investors use to understand the overall state of the market, as well as a benchmark for comparing investment decisions. ESG indices or sustainability indices are different from conventional market indices and can provide information to investors about the firm's sustainability performance, they are new and constantly developing stock market indices taking into account environmental, social, and governance considerations. The indices were analysed by multivariate analysis. Since we could collect data by country only for conventional indices, cluster analysis based only on those indices was performed. The following variables of conventional indices were analysed: year-to-date price return, annualized 3-year price return, annualized 5-year price return, and annualized 10-year price return. The paper also compares ESG indices and conventional indices, and in most cases, they have no significant performance differences.

Keywords: cluster analysis; multivariate analysis; ESG indices; conventional indices; the European Union member countries

JEL Classification: C38, G11, O31

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Introduction

Sustainable investing is a means of investing taking into account environmental, social and corporate governance considerations. The literature refers to two related but slightly different concepts: Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) performance. ESG concept has wider scope because encompasses the environmental and social impact of the firm and combines it with Corporate Governance performance. While CSR encompasses only the first two elements of ESG the environmental and the social conduct of the firm (Gerard, 2018).

The importance of ESG factors in investment decisions has increased in recent years, due to the growing interest of both investors and regulators in socially responsible investments and impact finance (La Tore et al., 2020). Although, the concept of sustainable development goes way back to the Brundtland Report of 1987. titled "Our Common Future". In that Report, created by UN World Commission on Environment and Development (WCED), Sustainable Development Goals (SDG) were constructed. SDG consists of 17 goals and 169 targets divided into various categories such as social development, environmental sustainability, economic growth, poverty, and global partnership. ESG efforts are connected with various incentives but The UN is still the biggest force in the legislation of ESG disclosure and corporate ESG adoption. (WCED, 1987)

The concept of sustainable investing is taking root not only in corporations and the public equities market but across asset classes as well – from clean technology venture capital to sustainable fixed income, to green real estate development (Krosinsky and Robins, 2008). European Green Deal, a set of policy initiatives to make the European Union climate neutral by 2050, marked an important milestone for sustainable investing. With the introduction of the European Green Deal Investment Plan EU will mobilize at least one trillion euros toward sustainable investments. In March 2018. European Commission also adopted an action plan on sustainable finance that aims to 1) reorient capital flows towards sustainable investment, to achieve sustainable and inclusive growth, 2) manage financial risks stemming from climate change, resource depletion, environmental degradation, and social issues and 3) foster transparency and long-termism in financial and economic activity (European Commission, 2018).

Sustainable investing is on a constant rise globally, at the start of 2020, global investment reached USD 35.3 trillion, a 55% increase from 2016-2020 (Global Sustainable Investment Alliance, 2020).

Stock market indices are indices that measure a stock market or subset of the stock market. Retail and institutional investors use indices as benchmarks while making investment decisions. Investors can't invest in market indices directly so they invest in index funds which are structured as mutual funds or exchange-traded funds that track market indices and are trying to replicate their performance. ESG indices

are on the contrary indices taking into account environmental, social and corporate governance considerations. ESG indices can vary by region, and types of underlying securities, and they can also be thematic meaning that they can focus on certain areas like clean power, green real estate, or fintech. ESG equity indices are based on a parent index and they measure the performance of securities meeting sustainability criteria from the parent index while also usually maintaining similar overall industry group weights as a parent index.

For that reason, it is important to identify how ESG elements influenced investment decisions, and whether are investors searching for companies that fit ESG criteria.

Of course, in different countries adoption of ESG criteria and the enforcement of ESG law, are connected with different practices. The European Commission has proposed the Corporate Sustainability Reporting Directive (CSRD) which will help in the adoption of sustainability reporting standards and in the future require all large and listed companies to disclose their ESG reports.

The remainder of the paper is organized as follows. Section 2 provides a review of the literature on ESG and traditional conventional indices. Section 3 states the data and the methodological framework of the study, Section 4 reports the results of the analysis, and Section 5 concludes with implications.

Literature Review

Even though sustainable investing is a relatively new investment strategy, there is no shortage of literature available. It is common sense that the integration of environmental, social, and fair governance practices makes a company less vulnerable to reputation, political, and regulatory risk and thus leading to lower volatility of cash flows and profitability (Aswin et al., 2016). With the popularization of sustainable finance, a question arose whether investing more capital to incorporate ESG issues into financial decision-making would positively or negatively affect companies' performance. In the existing literature, we can find evidence to support the positive relationship between ESG and investment performance. Derwall et al., (2005) found that portfolios with a higher eco-efficiency score provide better investment returns. Moreover, Friede et al. (2015), by aggregating evidence from more than 2000 empirical studies, showed that the business case for ESG investing is empirically very well founded and that roughly 90% of studies find nonnegative ESG and corporate financial performance, but rather a large majority of studies report positive findings.

Stellner et al., (2015) proved the relationship between corporate bond spreads and corporate social performance in Eurozone areas. And in one earlier work from Menz (2010) which was focused on the European corporate bond market, it was found that socially responsible firms incur a greater credit spread than non-socially responsible companies.

By conducting a meta-analysis of 85 studies and 190 experiments, Revelli and Viviani (2015) concluded that the consideration of corporate social responsibility in stock market portfolios is neither a weakness nor a strength compared with conventional investments. Brooks and Oikoomou (2015), Hübel et al. (2020), and La Torre et al. (2020) investigate the impacts of ESG investing on portfolio performance, while Glossner (2021) examines the price of ignoring ESG risks on portfolio performance. A research report by Hong Kong Exchanges and Clearing Limited (2020) having looked at 23 pairs of ESG equity indices and their parent indices, found that the investment return and return volatility of ESG indices in many cases were found to be similar to those of their parent indices for different investment horizons and under different market conditions. A study conducted by Jain et al. (2019) analysed MSCI and ESG indices and found that there is no significant difference in the performance between sustainable indices and traditional conventional indices.

Studies find that investors investing in sustainable investments are younger and better educated than conventional investors (Rosen et al., 1991; Perez-Gladish et al. 2012) and they are more likely to be women (Nillson, 2008; Nath et a.l. 2013). Even though profit maximization is at the very core of investing, studies find that socially responsible investors are willing to sacrifice some return for investing in socially responsible products (Borgers and Pownall, 2014; Gutsche and Ziegler, 2019) which challenges findings by Rosen et al. (1991) from 1991 that state that although investors value socially responsible behavior in companies they invest in, they are unwilling to sacrifice financial returns to achieve it. This shows a clear shift in investors' behavior over the last three decades from prioritizing profit maximization at all costs, to understanding a need for supporting companies that implement environmental, social, and corporate governance considerations into their business strategy.

Data and Methodology

We analysed data for the country subindices of the S&P Global BMI Index and the S&P Frontier BMI Index for European countries. Indices included in conventional market indices analysis are S&P France BMI, S&P Italy BMI, S&P Finland BMI, S&P Ireland BMI, S&P Germany BMI, S&P Austria BMI, S&P Poland BMI, S&P Hungary BMI, S&P Netherlands BMI, S&P Slovenia BMI, S&P Lithuania BMI, S&P Estonia BMI, S&P Sweden BMI, S&P Switzerland BMI, S&P Denmark BMI, S&P Spain BMI, S&P Belgium BMI, S&P Luxembourg BMI, S&P Portugal BMI, S&P United Kingdom BMI, S&P Croatia BMI, S&P Romania BMI, S&P Bulgaria BMI, S&P Turkey BMI, S&P Greece BMI, S&P Norway BMI, S&P Czech Republic BMI, S&P Cyprus BMI, S&P Russia BMI, and S&P Ukraine BMI. For the graphical analysis, values for various indices across multiple markets were used. Indices included in graphical analysis of conventional market indices and their ESG coun-

terparts are: S&P 500 Index, S&P 500 ESG Index, S&P BSE 100 Index, S&P BSE 100 ESG Index, S&P Japan 500 Index, S&P Japan 500 ESG Index, S&P Global 1200 Index, S&P Global 1200 ESG Index, S&P Global LargeMidCap Index, S&P Global LargeMidCap ESG Index, S&P Emerging LargeMidCap Index, S&P Emerging LargeMidCap ESG Index, S&P Emerging Plus LargeMidCap Index, S&P Emerging Plus LargeMidCap ESG Index, S&P United States LargeMidCap Index, S&P United States LargeMidCap ESG Index, S&P Canada LargeMidCap Index, S&P Canada LargeMidCap ESG Index, S&P Korea LargeMidCap Index, S&P Korea LargeMidCap ESG Index, Dow Jones Emerging Markets Index and Dow Jones Sustainability Emerging Markets Index. All data were collected from the official S&P Global web page.

For the analysis of conventional market indices, a multivariate analysis was performed using cluster analysis. Countries were divided into Eurozone countries (sixteen countries), the United Kingdom, and other European countries (fourteen countries). The following variables of conventional indices were analysed: YTD (Year-to-Date price return) which represents the price return from the first day of the current calendar year up to the date of data collection, 3YEARS (annualized three years price return) which represents annualized price return earned during the last three years, 5YEARS (annualized five years price return) which represents annualized price return earned during the last five years and 10YEARS (annualized ten years price return) which represents annualized price return earned during the last ten years.

To identify clusters of countries according to the chosen variables of conventional indices, different cluster analyses were applied. First of all, cluster analysis for the Eurozone countries was conducted, then for the other European countries, and finally for all countries (Eurozone countries, United Kingdom, and other European countries). Hierarchical and non-hierarchical cluster analyses were performed for each group of countries with different combinations of variables. Finally, different cluster solutions were observed and analysed.

To analyse differences between conventional market indices and their ESG counterparts graphical and analytical analysis was performed on various S&P and Dow Jones indices.

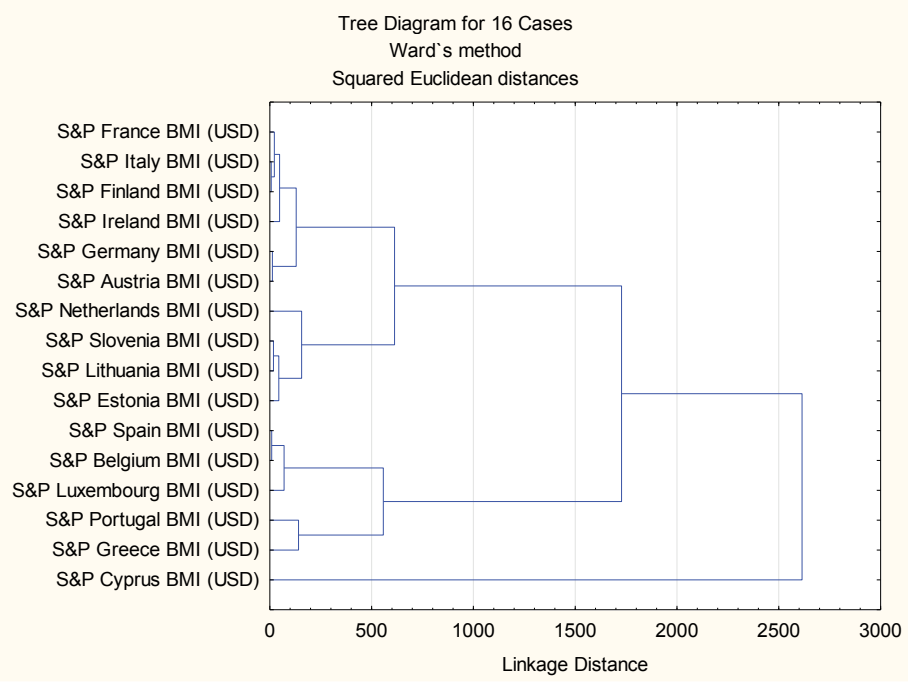
Results

In terms of the results of cluster analysis of conventional market indices, first, we performed clustering of Eurozone countries, then we performed clustering of other European countries and lastly, we performed clustering of Eurozone countries, the United Kingdom, and other European countries combined. For each of the previously mentioned clustering procedures, a hierarchical cluster analysis was first performed to select the number of clusters. According to the dendrograms resulting from the

hierarchical clustering, acceptable solutions were chosen. Finally, a non-hierarchical cluster analysis was performed for the selected cluster solutions and the results were compared.

For the clustering of Eurozone countries first, we performed hierarchical cluster analysis using Ward's method and squared euclidean distances. According to the dendrogram in Figure 1 the two, three, four, or five cluster solutions could be chosen. Based on the distances and composition of the clusters, a five-cluster solution was selected for further analysis. The first cluster consisted of S&P France BMI, S&P Italy BMI, S&P Finland BMI, S&P Ireland BMI, S&P Germany BMI, and S&P Austria BMI. The second cluster consisted of S&P Netherlands BMI, S&P Slovenia BMI, S&P Lithuania BMI, and S&P Estonia BMI. The third cluster consisted of S&P Spain BMI, S&P Belgium BMI, and S&P Luxembourg BMI. The fourth cluster consisted of S&P Portugal BMI and S&P Greece BMI while the fifth consisted of only S&P Cyprus BMI.

Figure 1: Hierarchical cluster analysis, dendrogram – Eurozone countries



Source: Authors

After hierarchical cluster analysis, we performed non-hierarchical cluster analysis using the k-means method for the chosen five-cluster solutions and obtained

the same cluster solution. The composition of the clusters is completely the same in both hierarchical cluster analysis and non-hierarchical cluster analysis, only the order of the clusters is different. The non-hierarchical cluster analysis confirmed chosen five-cluster solution, Table 1 shows the composition of the clusters and associated distances.

Table 1: Clusters, non-hierarchical cluster analysis using the k-means method – Eurozone countries

Clusters	Indicies	Distances
Cluster 1	S&P Italy BMI	0.904309
	S&P Finland BMI	1.026961
	S&P Germany	2.026886
	S&P France BMI	2.548848
	S&P Ireland BMI	2.600376
	S&P Austria BMI	2.878690
Cluster 2	S&P Belgium BMI	1.395515
	S&P Spain BMI	1.460149
	S&P Luxembourg BMI	2.420902
Cluster 3	S&P Cyprus BMI	0.000000
Cluster 4	S&P Portugal BMI	2.969073
	S&P Greece BMI	2.969073
Cluster 5	S&P Slovenia BMI	1.382505
	S&P Lithuania BMI	1.994695
	S&P Estonia BMI	2.602683
	S&P Netherlands BMI	3.831907

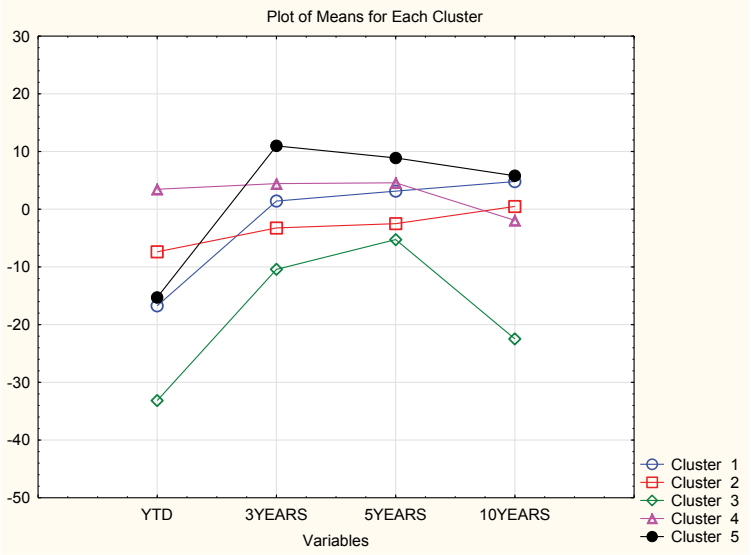
Table 2 shows additional non-hierarchical cluster analysis results. When analysing the *F* values, variables with the largest *F* values contribute the most to the separation between clusters. In this case, it is the variable annualized five years price return with an *F* value of 34.1034.

Table 2: Analysis of Variance – Eurozone countries

	Between SS		Within SS	df	**F**	signif. p
YTD	1146.561	4	157.8011	11	**19.98112**	0.000053
3YEARS	567.674	4	72.5998	11	**21.50286**	0.000037
5YEARS	302.061	4	24.3573	11	**34.10340**	0.000004
10YEARS	739.894	4	75.0210	11	**27.12183**	0.000012

Lastly, when we look at the graph of means in Figure 2, it is noticeable that the third cluster, consisting only of Cyprus, is separated from other clusters based on all four variables. The values for this cluster are below the average for all variables.

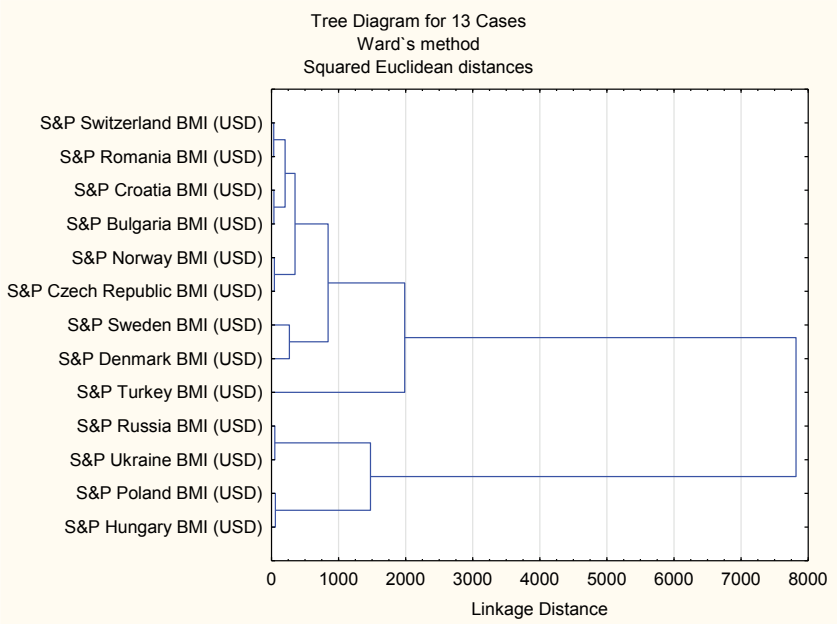
Figure 2: Graph of Means – Eurozone countries



Source: Authors

Next, we performed cluster analysis of other European countries. We started with hierarchical cluster analysis using Ward's method and squared euclidean distances. According to the dendrogram, shown in Figure 3, solutions with two, three, or four clusters could be chosen. Based on the distances and composition of the clusters, a three-cluster solution was selected for further analysis. The first cluster consisted of S&P Switzerland BMI, S&P Romania BMI, S&P Croatia BMI, S&P Bulgaria BMI, S&P Norway BMI, S&P Czech Republic BMI, S&P Sweden BMI, and S&P Denmark BMI. The second cluster consisted of only S&P Turkey BMI while the third cluster consisted of S&P Russia BMI, S&P Ukraine BMI, S&P Poland BMI, and S&P Hungary BMI.

Figure 3: Hierarchical cluster analysis, dendrogram – other European countries



Source: Authors

After hierarchical cluster analysis, we performed non-hierarchical cluster analysis using a k-means method for the chosen three-cluster solution and obtained a similar cluster solution. Table 3 shows the composition of the clusters and associated distances. The cluster consisting of S&P Russia BMI, S&P Ukraine BMI, S&P Poland BMI, and S&P Hungary BMI remained the same (the second cluster). The first cluster of hierarchical cluster analysis splits into the next two clusters: one cluster consists of S&P Norway BMI, S&P Bulgaria BMI, S&P Croatia BMI, S&P Chech Republic BMI, and S&P Turkey BMI (the first cluster in non-hierarchical cluster analysis); and the other cluster consists of S&P Switzerland BMI, S&P Romania BMI, S&P Sweden BMI, and S&P Denmark BMI (the third cluster in non-hierarchical cluster analysis). Observing the distances, it is evident that S&P Turkey BMI with the largest distance of 10.49 could even be in a separate cluster.

Table 3: Clusters, non-hierarchical cluster analysis using the k-means method – other European countries

Clusters	Indicies	Distances
Cluster 1	S&P Norway BMI	2.844247
	S&P Bulgaria BMI	2.999837
	S&P Croatia BMI	4.682356
	S&P Czech Republic BMI	5.338529
	S&P Turkey BMI	10.49044
Cluster 2	S&P Russia BMI	6.072121
	S&P Hungary BMI	6.637533
	S&P Poland BMI	7.437176
	S&P Ukraine BMI	7.842572
Cluster 3	S&P Switzerland BMI	1.035908
	S&P RomaniaBMI	3.910386
	S&P Sweden BMI	4.739118
	S&P Denmark BMI	4.795555

Table 4 gives additional non-hierarchical cluster analysis results. When looking at *F* values, it is noticeable that variables' year-to-date price return with an *F* value of 15.29 and annualized three years price return with an *F* value of 26.76 contribute the most to the separation between clusters.

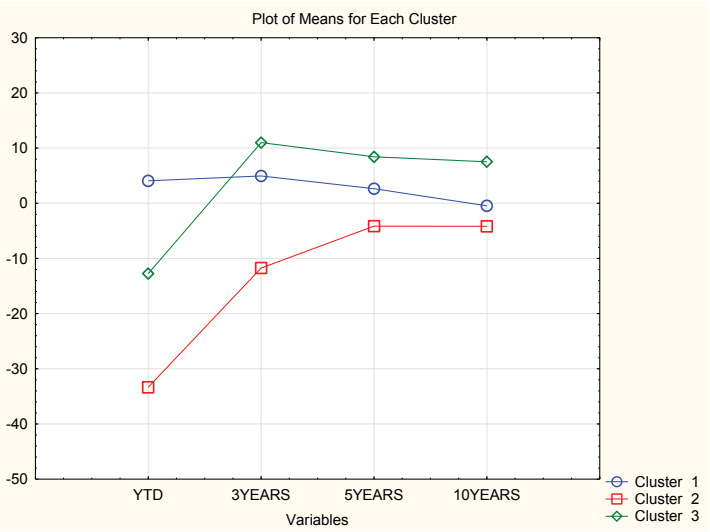
Table 4: Analysis of Variance – other European countries

	Between SS		Within SS	df	**F**	signif. p
YTD	3111.287	2	1017.181	10	**15.29367**	0.000908
3YEARS	1119.946	2	209.238	10	**26.76245**	0.000097
5YEARS	317.169	2	321.286	10	**4.93593**	0.032271
10YEARS	287.231	2	200.808	10	**7.15188**	0.011793

Source: Authors

Finally, when we analyse the graph of means in Figure 4, it is obvious that the second cluster, consisting of S&P Russia BMI, S&P Hungary BMI, S&P Poland BMI, and S&P Ukraine BMI, is separated from other clusters based on all variables. The values for this cluster are below the average for all variables

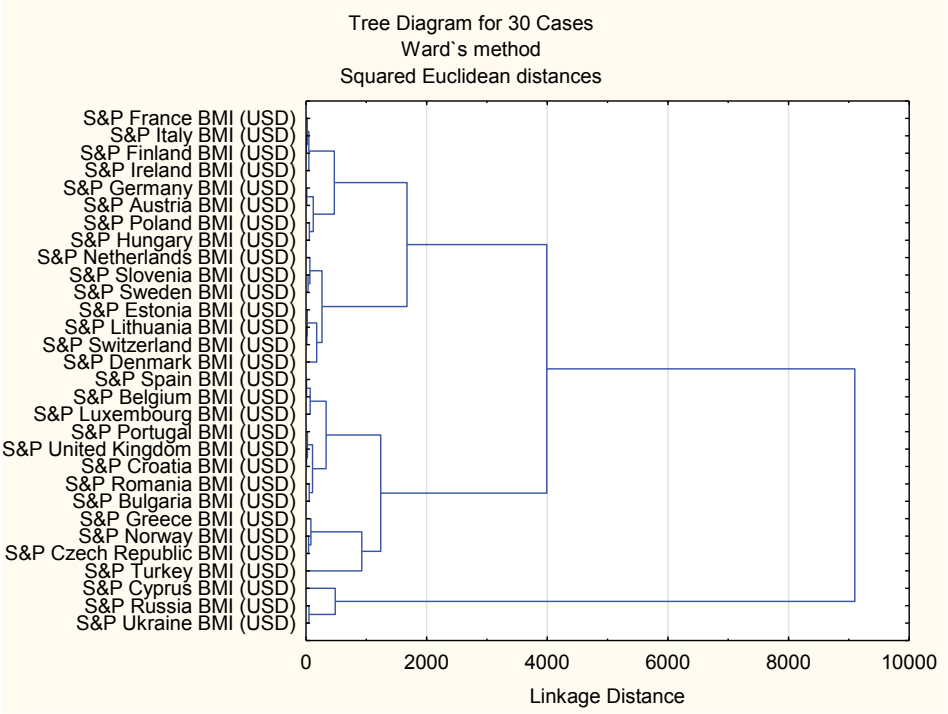
Figure 4: Graph of Means – other European countries



Source: Authors

After performing cluster analysis of Eurozone countries and cluster analysis of other European countries, we performed the cluster analysis of Eurozone countries, the United Kingdom, and other European countries. We started with hierarchical cluster analysis using Ward's method and squared euclidean distances. According to the dendrogram the two, three, four, or five cluster solution could be chosen. Based on the composition of the clusters, a five-cluster solution was selected for further analysis. The first cluster consisted of S&P France BMI, S&P Italy BMI, S&P Finland BMI, S&P Ireland BMI, S&P Germany BMI, S&P Austria BMI, S&P Poland BMI, and S&P Hungary BMI. The second cluster consisted of S&P Netherlands BMI, S&P Slovenia BMI, S&P Lithuania BMI, S&P Estonia BMI, S&P Sweden BMI, S&P Switzerland BMI, and S&P Denmark BMI. The third cluster consisted of S&P Spain BMI, S&P Belgium BMI, S&P Luxembourg BMI, S&P Portugal BMI, S&P United Kingdom BMI, S&P Croatia BMI, S&P Romania BMI, and S&P Bulgaria BMI. The fourth cluster consisted of S&P Turkey BMI, S&P Greece BMI, S&P Norway BMI, and S&P Czech Republic BMI. The fifth cluster consisted of S&P Cyprus BMI, S&P Russia BMI, and S&P Ukraine BMI.

Figure 5: Hierarchical cluster analysis, dendrogram – Eurozone countries, the United Kingdom, and other European countries



Source: Authors

After hierarchical cluster analysis, we conducted non-hierarchical cluster analysis using a k-means method for the chosen five-cluster solution. Table 5 shows the composition of the clusters and associated distances. It is noticeable that only the clustering of Cyprus, Russia, and Ukraine remained the same. In the second cluster, S&P Turkey BMI has the largest distance. That is the cluster that also includes S&P Croatia BMI. In the third, fourth, and fifth clusters, there are no strong separations among country subindices. It is noticeable that in the third cluster S&P Hungary BMI and S&P Spain's BMI have the largest distances. In the fourth cluster, S&P Denmark's BMI has the largest distance while in the fifth cluster S&P Netherlands BMI has the largest distance.

Table 5: Clusters, non-hierarchical cluster analysis using the k-means method – Eurozone countries, the United Kingdom, and other European countries

Clusters	Indicies	Distances
Cluster 1	S&P Ukraine BMI	3.247877
	S&P Russia BMI	3.980896
	S&P Cyprus BMI	6.360118
Cluster 2	S&P Portugal BMI	2.458805
	S&P Bulgaria BMI	2.700881
	S&P Norway BMI	2.813069
	S&P Greece BMI	3.738457
	S&P Croatia BMI	4.036884
	S&P United Kingdom BMI	4.539482
	S&P Czech Republic BMI	5.530957
	S&P Turkey BMI	10.87858
Cluster 3	S&P Germany BMI	2.682983
	S&P Austria BMI	2.966227
	S&P Luxembourg BMI	3.174618
	S&P Poland BMI	3.520355
	S&P Belgium BMI	4.136801
	S&P Spain BMI	4.819018
	S&P Hungary BMI	5.086298
Cluster 4	S&P Switzerland BMI	0.880479
	S&P Estonia BMI	1.209435
	S&P Lithuania BMI	2.153580
	S&P Romania BMI	3.257182
	S&P Denmark BMI	4.744572
Cluster 5	S&P Ireland BMI	2.005483
	S&P Finland BMI	2.059915
	S&P Slovenia BMI	2.456477
	S&P Sweden BMI	2.499464
	S&P France BMI	2.864388
	S&P Italy BMI	2.950271
	S&P Netherlands BMI	4.548793

Table 6 shows additional non-hierarchical cluster analysis results. When looking at F values, it is noticeable that the variables' year-to-date price return with an F value of 31.57 and annualized three years price return with an F value of 28.95 contributed the most to the separation between clusters, same as clustering of other European countries.

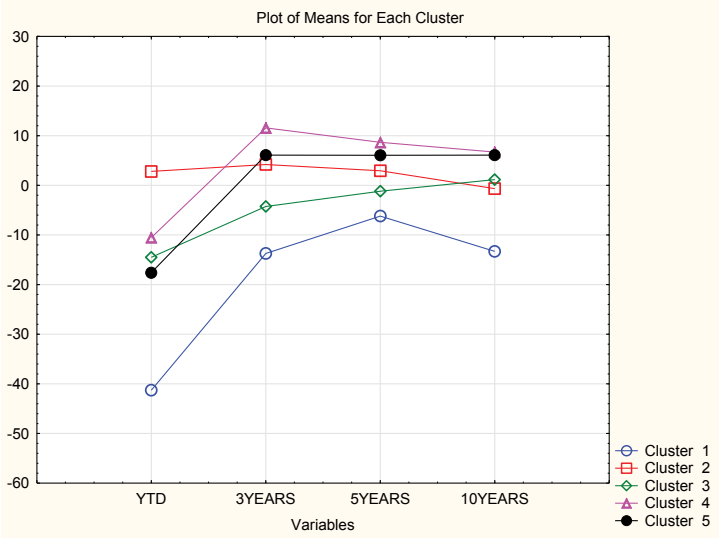
Table 6: Analysis of Variance – Eurozone countries, the United Kingdom, and other European countries

	Between SS		Within SS	df	**F**	signif. p
YTD	4589.883	4	908.7451	25	**31.56746**	0.000000
3YEARS	1629.151	4	351.7769	25	**28.94504**	0.000000
5YEARS	600.246	4	372.4988	25	**10.07127**	0.000054
10YEARS	978.357	4	329.9123	25	**18.53442**	0.000000

Source: Authors

Ultimately, when we analyse the graph of means in Figure 6 it is noticeable that the first cluster, consisting of S&P Cyprus BMI, S&P Russia BMI, and S&P Ukraine BMI is separated from other clusters based on all four variables. The values for this cluster are below the average for all variables.

Figure 6: Graph of means – Eurozone countries, the United Kingdom, and other European countries

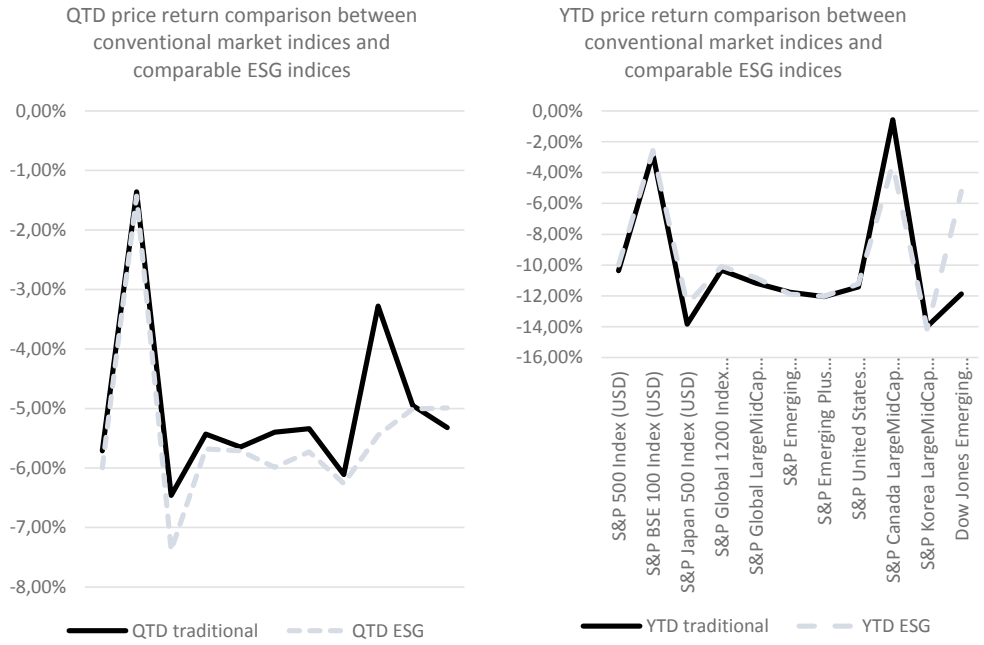


Source: Authors

Following the statistical analysis of conventional market indices, we move to graphical analysis of ESG indices and their conventional market indices counterparts. From chart 1 given in Figure 7, we can see that there is no significant difference between conventional market indices and their ESG counterparts on a quarter-to-date (QTD) basis. Values of all indices are negative as a result of the current geopo-

litical and macroeconomic situation. The same is true for year-to-date (YTD) price returns also seen in Figure 7 but from chart 2. Given the pressure in the global supply chain resulting from the COVID-19 pandemic and war in Ukraine as well as FED's rate hikes, it is understandable that values are negative.

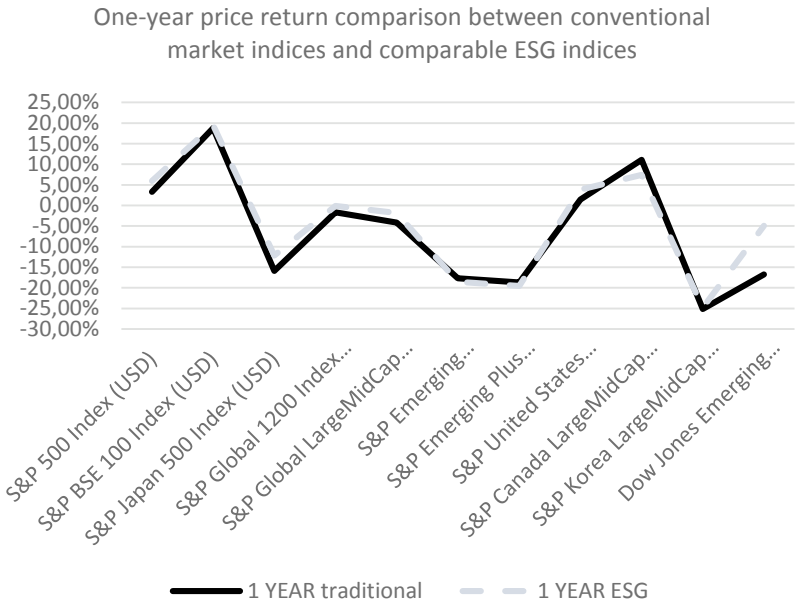
Figure 7: QTD and YTD price return comparison between conventional market indices and comparable ESG indices



Source: Authors

Looking at Figure 8 where we compare conventional market indices and their ESG counterparts on a one-year basis we can see that majority of indexes are negative except the S&P BSE 100 Index which measures the performance of the 100 largest Indian companies and its ESG counterpart, as well as S&P Canada LargeMidCap Index and its ESG counterpart. Again we see no significant difference between conventional market indices and their ESG counterparty on a one-year basis.

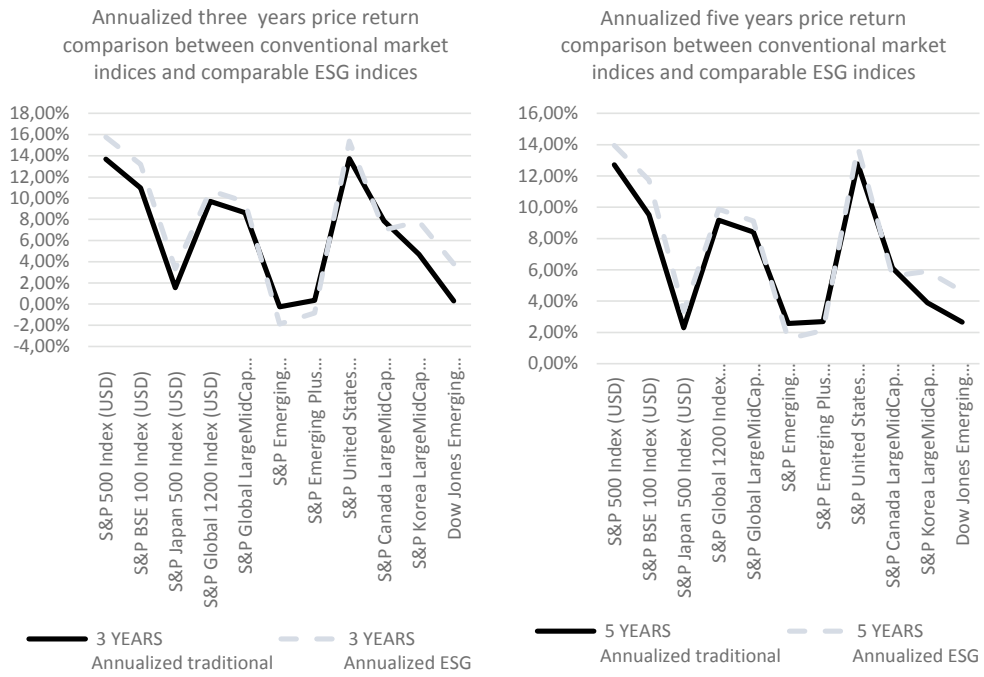
Figure 8: One-year price return comparison between conventional market indices and comparable ESG indices



Source: Authors

Following one year comparison, we move to annualized three years and five years price comparisons between conventional market indices and comparable ESG indices seen in Figure 9. We can once again, this time on a larger time series, see that there is no significant difference between conventional market indices and their ESG counterparts. Only a slight difference can be seen in S&P 500 Index and Dow Jones Emerging Markets Index and their ESG counterparts favoring ESG indices.

Figure 9: Annualized three and five years price return comparison between conventional market indices and comparable ESG indices



Source: Authors

Conclusion

This paper aims to identify performance differences between conventional European equity indices and ESG indices. For analysis of indices, we performed a multivariate analysis using cluster analysis.

In cluster analysis of conventional market indices in all three clustering procedures Cyprus, Russia and Ukraine had below-average values for all four analysed variables. In the clustering of Eurozone countries, the variable annualized five years price return contributed the most to the separation between clusters. In clustering of other European countries, the variables year-to-date price return and annualized three years price return contributed the most to the separation between clusters. In the clustering of Eurozone countries, the United Kingdom, and other European countries also the variables' year-to-date price return and annualized three years price return contributed the most to the separation between clusters. Also, there are no significant performance differences between conventional market indices and their

ESG counterparts. In further research, it could be beneficial to focus on a year-to-date price return and annualized three years price return variables since they contributed the most to the separation between clusters in both clusterings, the clustering of the other European countries as well as the clustering of the Eurozone countries, the United Kingdom and other European countries.

The findings of this research evidence that ESG factors are important for corporate financial performance and risk. Higher ESG scores are related to higher profitability and affects, of course, firm value, moreover, firms with better governance suffer smaller negative firm value responses.

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