Has the Risk of Socially Responsible Investments (SRI) Companies Stocks Changed in the COVID-19 Period? International Evidence

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Highlights

- Changes in risk of SRI companies in the periods before and after the COVID-19 pandemic are investigated.
- A broad dataset covering international SRI indices from 35 markets across 6 continents is used.
- Risk of SRI firms, measured by the beta coefficients, increased in most markets during the COVID-19 period.
- However, some countries show remarkable resilience and stability.
- Most notably, the risk of SRI companies from the countries in East Asia decreased during the COVID-19 pandemic.

Has the Risk of Socially Responsible Investments (SRI) Companies Stocks Changed in the COVID-19 Period?

International Evidence

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ABSTRACT:

In this study, we investigate changes in risk of Socially Responsible Investments (SRI) companies in the periods before and during the COVID-19 pandemic relying on a broad dataset covering SRI indices from 35 markets analysed between 2016 and 2021. Our results provide evidence that the systematic risk of the SRI firms, measured by the beta coefficient, increased in most countries around the world during the COVID-19 period. However, some markets in our sample show remarkable resilience and stability in terms of the changes in their risk patterns. In particular, the systematic risk of SRI companies from the markets in East Asia decreased during the COVID-19 pandemic, which contrasts with substantial increases in the systematic risk of the SRI firms from the SRI indices in all other regions around the world.

Keywords: Socially Responsible Investments (SRI); COVID-19 Pandemic; Sustainability; Stock Market; Risk; Asymmetric Beta

JEL codes: G15, G11, G12, C20, M14

1. Introduction

The nature of a relationship between social responsibility and firms' financial performance has been debated in the extant literature for well over past two decades. Early review studies, such as Margolis and Walsh (2003) who analysed 127 other papers, found a positive association regarding this linkage, while Orlitzky, Schmidt and Rynes (2003), who performed a meta-analysis relying on 52 other publications and a large sample covering 33,878 observations, concluded that adoption of social responsibility *"is likely to pay off"* in

terms of financial performance. Orlitzky, Schmidt, and Rynes (2003) also argued that markets do not penalize companies that are *"high in corporate social performance"*.

However, more recent reviews conducted by Revelli and Viviani (2013) and Revelli and Viviani (2015) reported a more mixed evidence, i.e. they found very symmetrically distributed positive, neutral and negative impact of socially responsible investments (SRI) on financial performance in case of 40, 80 and 41 papers, respectively (see Revelli and Viviani (2013)), and they further argued, based on the new meta-analysis relying on 85 studies and 190 experiments, that incorporation of corporate social responsibility in construction of stock market portfolios is neither a weakness nor a strength in comparison with conventional investments (see Revelli and Viviani (2015)).

Simultaneously, other related research also suggests that favourable performance of the SRI firms - when it occurs - can be explained, at least to some extent, by lower risk, i.e. the SRI stocks tend to be less risky relative to the market (see e.g. Orlitzky and Benjamin (2001), Lee and Faff (2009), Brzeszczyński and McIntosh (2014), Sassen, Hinze and Hardeck (2016) or Brzeszczyński, Ghimire, Jamasb and McIntosh (2019) and Brzeszczyński, Gajdka and Schabek (2021)). This risk channel has not been explored sufficiently well in the existing literature yet, because most papers so far have been focused predominantly on the analysis of SRI performance from the perspective of stock returns or other financial performance measures.

Among various available risk measures, the beta coefficient from Capital Asset Pricing Model (CAPM) is one of the most commonly used analytical tools on the stock market. However, its estimation relies on explicit assumption that the upside risk and downside risk, which it reflects, are perfectly symmetrical. In reality, this kind of symmetry very rarely exists. Nonetheless, such asymmetric effects can be captured using the dual beta parameters (Chong et al. (2011)).

Given that the extant literature has been concentrated so far mainly on the performance of the socially responsible investments, there is limited research available yet regarding more specifically the issue of risk and, in particular, the asymmetries in risk patterns among the SRI stocks. We contribute to this area of literature by investigating the risk of SRI companies using a global sample of SRI indices from 35 markets from 6 continents.[1] Moreover, we examine the changes in SRI risk patterns before and during the COVID-19 pandemic.

To the best of our knowledge, this paper is the first study, which uses such a broad dataset covering the SRI indices from as many as 35 markets.

The originality and the contribution of our paper is as follows. *Firstly*, we investigate the SRI stocks' systematic risk using its different aspects, such as asymmetric effects in risk, which is the issue very rarely examined in the context of SRI investments. *Secondly*, we contribute to better understanding of how COVID-19 pandemic affected the SRI companies' systematic risk in the global market (including detailed comparisons across geographical regions, but also between emerging and developed markets and from the perspective of other country-specific characteristics). *Thirdly*, we further explore the stability of differences in risk with respect to changes caused by the COVID-19 pandemic and also the stability of

[1] The existing studies typically use data from one market or only several markets at most. A notable exception is the paper by Badía et al (2020) who investigated SRI stocks from 26 countries.

differences between asymmetric betas (reflecting the risk patterns in bull and bear market phases). In summary, we believe that this is the first attempt to analyze the SRI stocks' systematic risk and its asymmetric patterns within such a broad framework and relying on such a large sample of international markets.

The structure of this paper is as follows: Section 2 discusses the literature, Section 3 provides the outline of the methodology and a summary of the data, Section 4 reports results and section 5 presents conclusions.

2. Literature Review

Recent literature has highlighted the severity of the impact of the coronavirus pandemic (COVID-19) on global capital markets (see e.g. Zhang et al. (2020), Dias et al. (2020), Chaudhary et al. (2020) or Mirza et. al. (2020), among others). The influence of COVID-19 on corporate social responsibility (CSR) and SRI investment has also been investigated. For example, He and Harris (2020) suggest that COVID-19 crisis should contribute to raising expectations regarding CSR. The genuineness of the CSR strategies should play more important role in the future as a tool for the companies to manage their relations with customers and with the general public (see He and Harris (2020) and Qiu et al. (2021)). Albuquerque et al. (2020) found that the US stocks with higher environmental and social (ES) ratings had significantly higher returns, lower volatility and higher operating profit margins during the first stage of the COVID-19 crisis. Other studies employing broad range of recent data focus on individual SRI companies. Badía et al. (2020) investigated performance of SRI stocks from 26 economies and found that they outperformed companies from the S&P Global 100 Index. They also discovered that Asia-Pacific SRI firms performed poorer than their US and European counterparts. Ding et al. (2020) supported this view using data from over 6,000 international companies. In turn, Bae et al. (2021) found no evidence that CSR affected US stock returns during the crash period. They concluded that pre-crisis CSR was not effective in protecting shareholder wealth from the consequences of a crisis. Demers et al. (2021) presented similar findings. The evidence for other countries and stock markets besides the USA was also reported in e.g. Palma-Ruiz, Castillo-Apraiz and Gómez-Martínez (2020) for Spain, Xiao and Jianqun (2021) and Broadstock et. al. (2021) for China or Lee and Lu (2021) for Taiwan. Some of the existing studies are also related to particular sectors of the economy particularly affected by the pandemic and government restrictions introduced in response to the COVID-19 virus outbreak, e.g. energy firms (Huang and Liu (2021)) or companies from industries which have become especially vulnerable, such as e.g. hospitality (Qiu et al. (2021)).

Regarding the SRI indices, the available results relying on this type of data are still limited, because sustainability and ethical indices have been introduced by respective stock exchanges around the world, in particular in smaller markets, relatively recently (some earlier papers include Sauer (1997), Statman (2000), Consolandi et al. (2009), Managi et al. (2012), Belghitar et al. (2014), among others). The risk of investing in the SRI companies was investigated by Sassen, Hinze and Hardeck (2016), Orlitzky and Benjamin (2001), Lee and

Faff (2009), Jin (2018) and more recently by Brzeszczyński, Gajdka and Schabek (2021), among others).[2]

Overall, the existing literature about the SRI as an investment style and stock market risk based on the international SRI indices data is still scarce. Therefore, we contribute to this field by providing new empirical results using SRI indices from a large sample consisting of 35 markets and by investigating changes in risk in the pre-COVID-19 and COVID-19 sub-periods.

3. Data and Methodology

Our database covers the period of 5 years from November 2016 to October 2021 (i.e. 60 months).

We use the data from a very broad dataset including SRI indices from 35 markets from different geographical regions and encompassing both developed markets and emerging markets.[3]

The source of data for the SRI indices as well as for the MSCI World index is Bloomberg. Table 1 presents the list and exact names of all indices investigated in this study.[4]

In the first step, we estimated the beta coefficients using the Sharpe single index model for all the 35 SRI indices:

$$r_{it} = \alpha_i + \beta_i \cdot r_{mt} + \varepsilon_{it} \quad (1)$$

where: r_{it} are the respective SRI index i returns and r_{mt} are the world market index (i.e. MSCI World) returns.

The focus of our analysis based on model (1) is β_i parameter, i.e. the systematic risk measure (relative to the world market).

Table 1. List of all 35 international SRI indices investigated in this study.

	Markets	SRI indices
1.	Australia	DJSI Australia Index
2.	Austria	VÖNIX Austrian Sustainability Index

[2] Different line of literature investigates performance of SRI investments using various risk-adjusted measures. For example, Omuraa et al. (2021) through applying asset pricing models analyzed the performance of the ESG ETFs in the US and the MSCI SRI indices for the world, the US, Japan and Europe in the samples before and during the COVID-19 pandemic *versus* the conventional investments. Their results show outperformance of SRI indices during the pandemic period.

[3] In case of Belgium, Netherlands and Luxembourg there were no individual SRI indices available for all these three countries in the entire sample period of our analysis, so we used the SRI index for the BeNeLux region, i.e. the Euronext BeNeLux ESG Leaders Index.

[4] In Poland the RESPECT index ceased trading in December 2019 and it was subsequently replaced at the Warsaw Stock Exchange (WSE) by the WIG ESG index.

3.	BeNeLux	Euronext BeNeLux ESG Leaders Index
4.	Brazil	Bovespa Corporate Sustainability Index
5.	Canada	MSCI Canada ESG Leaders Index
6.	Chile	DJSI Chile Index
7.	China	Shanghai SRI Index
8.	Colombia	COLIR Index
9.	Egypt	S&P/EGX ESG Index
10.	Finland	OMX GES Sustainability Finland Index
11.	France	EURONEXT VIGEO France Index
12.	Germany	DAX ESG Index
13.	Hong Kong	Hong Kong CSI Index
14.	India	Morningstar India Sustainability Index
15.	Indonesia	SRI KEHATI Index
16.	Israel	TA-Maala Index
17.	Italy	MSCI Italy Country ESG Leaders Index
18.	Japan	S&P Japan 500 ESG Index
19.	Malaysia	FTSE4GOOD Malaysia Index
20.	Mexico	MSCI Mexico ESG Select Focus Index
21.	New Zealand	MSCI New Zealand ESG Index
22.	Peru	S&P BVL IBGC Index
23.	Poland	RESPECT Index / WIG ESG Index
24.	Russia	MOEX - RSPP Sustainability Vector Index
25.	Singapore	iEdge SG ESG Leaders Index
26.	South Africa	MSCI South Africa ESG Leaders Index
27.	South Korea	MSCI KOREA ESG Leaders Index
28.	Spain	FTSE4GOOD IBEX Spain Index
29.	Sweden	OMX Stockholm 30 ESG Responsible Index
30.	Switzerland	SIX SUSTAINABILITY Index
31.	Taiwan	MSCI TAIWAN ESG Leaders Index
32.	Turkey	BIST SUSTAINABILITY Index
33.	United Arab Emirates	S&P/Hawkamah ESG UAE Index
34.	United Kingdom	FTSE4GOOD Index
35.	USA	DJSI United States Index

Next we investigated the asymmetric effects in the systematic risk by using the dual betas approach.

The dual betas were determined through estimation of parameters of the Sharpe single index model in the adjusted version proposed by Chong et al. (2011):

$$r_{it} = \alpha_i + \beta_i^P \cdot D \cdot r_{mt} + \beta_i^N \cdot (1 - D) \cdot r_{mt} + \varepsilon_{it} \quad (2)$$

where: D is the dummy variable, which equals 1 when the international market index (MSCI World) return is positive and it equals 0 when it is negative.

The parameters β_i^P and β_i^N are the positive dual beta (for bull market states) and the negative dual beta (for bear market states), respectively.

In all models we tested for the autocorrelation of the error term and for the heteroscedasticity effects. If any of these issues was detected, it was subsequently removed. Autocorrelation was dealt with by adding AR and/or MA terms, while in case if heteroscedasticity existed, the relevant ARCH class model was estimated.

In the following section, we present and discuss the empirical results.

4. Results

Table 2 below presents the estimates of the beta coefficients for all 35 SRI indices. Estimation was performed using monthly data frequency.

The average beta (β_i) for all 35 indices in the entire sample period is 0.85. Malaysia has the smallest value of β_i at the 0.457192 level, while New Zealand has the highest value of β_i reaching 1.258088.

There is also a substantial difference in the average dual betas: 0.74 for β_i^P and 0.95 for β_i^N, respectively, which evidences a clear asymmetric effect and highlights greater vulnerability of SRI investments in the bear market periods.

Table 3 reports differences in the estimated beta parameters in the pre-COVID-19 sub-sample and COVID-19 sub-sample. The division date was chosen as December 2019, because December was the first month when COVID virus was discovered and reported, hence marking the beginning of the global pandemic. Table 3 reveals interesting findings, which can be summarised as follows.

First, the average beta in the COVID-19 period is substantially higher (0.929405) than in the pre-COVID-19 period (0.703147), which shows that the systematic risk of the SRI companies increased overall following the outbreak of the COVID-19 pandemic.

Second, there are however 10 markets (i.e. 29% of the entire sample) where the systematic risk actually decreased. The most notable case is China for which beta was reduced from 1.010857 to 0.454354. Japan and Sweden also have much smaller beta parameters in the COVID-19 period.

Table 2. Estimates of beta coefficients β_i, β_i^P and β_i^N for 35 SRI indices in the full sample period (November 2016 – October 2021).

Markets	$\boldsymbol{\beta_i}$	$\boldsymbol{\beta_i^P}$	$\boldsymbol{\beta_i^N}$
Australia	0.793373	0.513388	1.06691
Austria	1.094679	0.946964	1.267841
BeNeLux	1.016989	0.838719	1.075891
Brazil	0.790308	0.701986	0.876596
Canada	0.819656	0.698801	0.937727
Chile	0.690825	0.578878	0.800194
China	0.639314	0.654488	0.62449
Colombia	0.857992	0.377323	1.268747
Egypt	0.826984	0.373737	1.269792
Finland	0.827676	0.897399	0.985975
France	0.97428	0.901359	1.191258
Germany	1.10843	1.04312	1.161705
Hong Kong	0.77456	0.515473	0.84987
India	0.5038	0.10354	0.894841
Indonesia	0.677153	0.582233	0.769887
Israel	0.763256	0.69812	0.826893
Italy	1.024644	0.94869	1.092007
Japan	0.738411	0.546311	0.926087
Malaysia	0.457192	0.536772	0.379445
Mexico	0.690041	0.692301	0.757173
New Zealand	1.258088	1.119089	1.393886
Peru	0.554315	0.27906	0.845068
Poland	1.063057	1.174848	0.953841
Russia	0.587867	0.658134	0.519219
Singapore	0.866001	0.849199	0.882415
South Africa	1.139217	0.946805	1.327197
South Korea	1.143029	1.259682	1.029063
Spain	1.024154	1.028618	1.019792
Sweden	0.8726	0.810361	0.936197
Switzerland	0.660422	0.606392	0.714531
Taiwan	0.915266	0.941465	0.838141
Turkey	1.03265	1.057751	0.991902
United Arab Emirates	0.856511	0.606687	1.075407
United Kingdom	0.712948	0.558931	0.863418
USA	0.987563	0.967071	1.007583
Average:	**0.85**	**0.74**	**0.95**

Note: The estimations of betas were conducted based on the Sharpe single index models (1) and (2).

Source: Authors' estimations.

Table 3. Estimates of beta coefficients β_i for 35 SRI indices in the pre-COVID sub-sample and COVID sub-sample.

Markets	pre-COVID period	COVID period	Difference
China	1.010857	0.454354	-0.56
Sweden	1.097488	0.748532	-0.35
Japan	0.959913	0.626367	-0.33
Hong Kong	0.867656	0.652214	-0.22
Taiwan	0.963663	0.815701	-0.15
Turkey	1.106449	0.995624	-0.11
Singapore	0.897409	0.804831	-0.09
USA	1.027729	0.967578	-0.06
Switzerland	0.682707	0.63605	-0.05
South Korea	1.15307	1.123919	-0.03
South Africa	1.124093	1.153906	0.03
BeNeLux	0.970408	1.011864	0.04
Italy	0.995738	1.048728	0.05
Israel	0.638903	0.784334	0.15
Germany	0.979486	1.161561	0.18
Mexico	0.538624	0.741084	0.20
Austria	0.938718	1.161898	0.22
Colombia	0.710803	0.955362	0.24
Finland	0.67192	0.923784	0.25
United Kingdom	0.550035	0.819199	0.27
Malaysia	0.26364	0.584151	0.32
Spain	0.816588	1.141732	0.33
Chile	0.474002	0.821386	0.35
United Arab Emirates	0.644982	1.042682	0.40
Canada	0.556573	0.95577	0.40
France	0.766687	1.187333	0.42
Peru	0.315513	0.753916	0.44
Russia	0.353474	0.795538	0.44
Indonesia	0.363357	0.852247	0.49
Poland	0.685125	1.258407	0.57
Australia	0.381283	1.015139	0.63
India	0.034008	0.714528	0.68
Egypt	0.346439	1.117849	0.77
New Zealand	0.716445	1.522487	0.81
Brazil	0.006357	1.179114	1.17
Average:	**0.703147**	**0.929405**	**0.23**

Note: The estimations of betas were conducted based on the Sharpe single index model (1).

Source: Authors' estimations.

Table 4. Estimates of beta coefficients for 35 SRI indices in the pre-COVID sub-sample and COVID sub-sample divided by geographical regions.

Markets	pre-COVID period	COVID period	Difference
Eastern Asia			
South Korea	1.15	1.12	-0.03
Singapore	0.90	0.80	-0.09
Taiwan	0.96	0.82	-0.15
Hong Kong	0.87	0.65	-0.22
Japan	0.96	0.63	-0.33
China	1.01	0.45	-0.56
Average:	**0.98**	**0.75**	**-0.23**
Southeastern Asia, Australia, New Zealand and India			
New Zealand	0.72	1.52	0.81
India	0.03	0.71	0.68
Australia	0.38	1.02	0.63
Indonesia	0.36	0.85	0.49
Malaysia	0.26	0.58	0.32
Average:	**0.35**	**0.94**	**0.59**
Northern America			
Canada	0.56	0.96	0.40
USA	1.03	0.97	-0.06
Average:	**0.79**	**0.96**	**0.17**
Western and Eastern Europe			
Poland	0.69	1.26	0.57
Russia	0.35	0.80	0.44
France	0.77	1.19	0.42
Spain	0.82	1.14	0.33
United Kingdom	0.55	0.82	0.27
Finland	0.67	0.92	0.25
Austria	0.94	1.16	0.22
Germany	0.98	1.16	0.18
Italy	1.00	1.05	0.05
BeNeLux	0.97	1.01	0.04
Switzerland	0.68	0.64	-0.05
Sweden	1.10	0.75	-0.35
Average:	**0.79**	**0.99**	**0.20**

Table 4. (continued)

Markets	pre-COVID period	COVID period	Difference
South and Central America			
Brazil	0.01	1.18	1.17
Peru	0.32	0.75	0.44
Chile	0.47	0.82	0.35
Colombia	0.71	0.96	0.24
Mexico	0.54	0.74	0.20
Average:	**0.41**	**0.89**	**0.48**
Africa and Middle East			
Egypt	0.35	1.12	0.77
United Arab Emirates	0.64	1.04	0.40
Israel	0.64	0.78	0.15
South Africa	1.12	1.15	0.03
Turkey	1.11	1.00	-0.11
Average:	**0.77**	**1.02**	**0.25**

Note: The estimations of betas were conducted based on the Sharpe single index model (1).

Source: Authors' estimations.

Third, among the markets where the systematic risk increased in the COVID-19 pandemic some countries experienced huge jumps in the beta estimates: most notably Brazil, New Zealand and Egypt. Also in case of India and Russia the betas increased substantially, although they remained still far below 1, i.e. 0.714528 and 0.795538 for India and Russia, respectively. Poland experienced a large increase too from quite low level of 0.685125 to as high as 1.258407.

Fourth, although there are large changes in the systematic risk detected in most markets, this is not necessarily the case for all of them. In a few instances some SRI indices experienced very small variation, for example South Africa (beta increased, but only marginally: from 1.124093 to 1.153906) or South Korea (beta decreased, but also marginally: from 1.153070 to 1.123919). Hence, some of the countries in our sample showed strong resilience and stability in terms of their systematic risk.

Finally, we divided all 35 markets into a few distinct geographical regions and we analysed changes in the systematic risk in such sub-groups. The results are reported in Table 4.

The overall pattern, which is consistent in nearly all regions, is that the systematic risk increased in the COVID-19 period, however with one remarkable exception: in Eastern Asia the average beta actually decreased from 0.98 to 0.75 (i.e. recorded a *negative* difference -0.23). Among the regions where the systematic risk increased, the highest difference in beta coefficient occurred in the Southeastern Asia, Australia, New Zealand and India region (+0.59) and in the South and Central America (+0.48), whereas in Northern America, Western

and Eastern Europe and in the Africa and Middle East regions the differences were much smaller and similar in magnitude (at the levels +0.17, +0.20 and +0.25, respectively).

These results show, first and foremost, a remarkable resilience of the SRI firms from the East Asian stock markets during the COVID-19 pandemic and also relatively higher sensitivity of the companies from the Southeastern Asia, Australia, New Zealand and India region and from South and Central America.[5]

5. Robustness Analysis

In this section, we present results of robustness analysis of our findings reported so far in this paper.

First, we conducted two tests for the equality of means: Satterthwaite-Welch *t*-test and Welch F-test, which allow for comparing time series with unequal variances, in order to check statistical significance of: (a) differences in the estimated beta coefficients in pre-COVID-19 and COVID19 periods and (b) differences in the dual (asymmetric) betas.

Table 5 presents the results and provides evidence of the statistically significant differences (at 1% significance level) in the beta estimates in the pre-COVID-19 and in the COVID-19 periods for the full sample covering all 35 markets, which means that, overall, the risk between these two episodes indeed differs. It further shows that the differences are statistically significant also between the asymmetric betas in the whole sample (also at 1% significance level).

Table 5. Tests for equality of means: Satterthwaite-Welch *t*-test and Welch F-test

Tests for equality of means between betas in the pre-COVID-19 period and COVID-19 period	
Satterthwaite-Welch *t*-test (p-value)	3.47753*** (0.00090)
Welch F-test (p-value)	12.09320*** (0.00090)
Test for equality of means for positive and negative dual betas	
Satterthwaite-Welch *t*-test (p-value)	3.6297*** (0.0006)
Welch F-test (p-value)	13.1748*** (0.0006)

[5] We also analysed the differences in systematic risk across the developed markets and the emerging markets, which are illustrated in Figures A1 and A2 in the Appendix. They show that the range of differences is much narrower in case of developed markets (spanning from -0.35 to 0.81) than in the emerging markets (spanning from -0.56 to 1.17), which indicates the extent of differences in magnitude of variation of their systematic risk between the sub-periods before and during the COVID-19 pandemic.

Notes: *** - denotes significance at 1% level.

Source: Authors' calculations.

Second, we also investigated whether the choice of different alternative division dates between the pre-COVID-19 and in the COVID-19 periods matters and if our results are robust to it. The original date separating these two episodes was December 2019, so we performed more estimations for three other alternative division time-points in: January, February and March in the year 2020 as the COVID-19 pandemic was developing and spreading around the world (with most severe lockdowns implemented in most countries from March 2020).

The results broadly confirm that regardless of the selection of the division date between December 2019 and March 2020, our estimates are very similar and, therefore, they are robust. For instance, in case of the USA (as an example of market with small differences in beta estimates between the pre-COVID-19 and in the COVID-19 periods) the beta estimates in the pre-COVID-19 sample for the division dates in December 2019 and then January, February and March 2020 are: 1.027729, 1.028081, 1.028124 and 1.012979, respectively (and they are always significant at 1% level). In the COVID-19 period they equal to: 0.967578, 0.967107, 0.966991 and 0.971566, respectively (and they are also always significant at 1% level). In case of China (as an example of market with large difference in beta estimates between the pre-COVID-19 and in the COVID-19 periods) the beta estimates in the pre-COVID-19 sample are: 1.010857, 1.025962, 1.036646 and 0.935718, respectively (and they are always significant at 1% level), while in the COVID-19 period they are: 0.454354, 0.445637, 0.436861 and 0.437278, respectively (and almost always significant at 1% level with the exception of only one estimate significant at 5% level).[6]

Overall, we can conclude that our results are robust with respect to different alternative division dates between the pre-COVID-19 and COVID-19 periods (for four different time-points between December 2019 and March 2020) and also in terms of the identified differences in beta estimates relying on the Satterthwaite-Welch *t*-test and Welch F-test.[7]

[6] Due to space considerations, we do not report here all estimates for all markets, but they are available upon request.

[7] As further robustness checks, we also estimated beta coefficients from models using different interval for constructing the indices returns, i.e. based on quarterly frequency data. The results from quarterly models, however, had to rely naturally on much shorter sub-samples, because the number of datapoints in the time series changed from 60 monthly observations to 20 quarterly observations and it was further split into 13 quarterly observations in the pre-COVID-19 period and only 7 quarterly observations in the COVID-19 period. Such short samples, as well as additionally the existence of the intervalling effect in beta estimation, made the comparisons difficult, but nevertheless the results from quarterly models show similar effects regarding the differences (sometimes even more distinct) between both sub-periods. For example, for China as the first market listed in Table 3, the beta estimates from the monthly models for the pre-COVID-19 and COVID-19 periods are 1.010857 and 0.454354, whereas the beta estimates from the quarterly models are 1.411680 and 0.429733, respectively (hence, the difference between both sub-periods was detected as even larger in its magnitude based on the results from the quarterly models).

6. Discussion

The results reported in Tables 2, 3 and 4 show very clear geographical differences in risk and in changes in risk for individual markets in the periods before and during the COVID-19 pandemic.

A possible explanation of this finding may be related to the fact that the closer a particular region is located to the epicentre of the COVID-19 pandemic in China the more investors may have known about the Covid virus or possibly they may have also had better information about the likely future development of the pandemic. This view is consistent with the results and interpretations presented recently by Szczygielski et al. (2022). Such knowledge could be ultimately translated into a resolution of some of the COVID-19 related uncertainty in the respective markets leading to less severe impact on stock prices (see more details in Szczygielski et al. (2022)).

The above explanation corresponds also with the pattern of data indicating the severity of the impact of the COVID-19 pandemic captured by the international death rates, i.e. as of the year 2021 the world's highest cumulative death rate (per 1 million of people) caused by COVID-19 was recorded in South America in Peru (6056.88), whereas in Eastern Asia it was relatively much lower, i.e. China (3.21), India (324.44), Japan (145.78), Pakistan (128.21), South Korea (92.04). The data for Northern America and Europe position these regions in the middle, i.e. USA (2421.86), United Kingdom (2159.35), France (1797.00), Italy (2245.32), Poland (2418.58) or Germany (1290.08).[8]

The countries in the East Asia region may also have naturally more experience in managing major health crises, especially after the SARS epidemic in 2002-2003, which could have been translated into further reduction of uncertainty.

Our results in Tables 2, 3 and 4 can also indicate that East Asian markets, as main producers of many industrial components (technological parts, such as semi-conductors etc., but also exporters of raw materials), which were the first link in global logistic chains, have been least impacted by the slowdown of the global economy. In contrast, other international markets, which heavily depend on those components, may have been perceived by investors as more risky in comparison with the pre-pandemic period. This situation could have also contributed to the uncertainty reduction in respective stock markets.

The differences in risk, which we detected in this study, can also be analysed from a different perspective focused on the particular characteristics of individual countries. For example, low beta estimate for Malaysia, at the level of 0.457192, may suggest that the risk of SRI stocks more broadly in Islamic countries is low (or at least lower than in other countries) because companies there follow certain religious principles (related, in this case, to Islamic finance rules).[9]

In order to investigate this matter deeper, we divided our whole sample into two groups: Islamic countries and non-Islamic countries. The Islamic countries dataset includes:

[8] See: https://ourworldindata.org/covid-deaths

[9] We would like to thank the anonymous Reviewer for highlighting this idea. It prompted us to do more analyses, which we concisely summarise in this section.

Egypt, Indonesia, Malaysia, Turkey and United Arab Emirates. Subsequently, we analysed the estimates of beta coefficient for those two groups.

The average beta in the whole period for all 35 markets is equal to 0.85, while for the sample of Islamic countries it is lower at 0.77 level, so this group of markets is characterised, indeed, by lower systematic risk. However, when the beta estimates are further examined, it appears that changes between the pre-COVID-19 and COVID-19 periods are substantially greater for the Islamic countries' indices (averages of 0.54 and 0.92, respectively) than for the non-Islamic countries' indices (averages of 0.73 and 0.93, respectively), which yields the differences of 0.36 and 0.20, respectively, and the average values of the absolute differences equal to 0.42 and 0.32, respectively.

Similarly, the differences in dual betas follow the same pattern. The differences between β_i^P and β_i^N for Islamic countries are 0.63 and 0.90, respectively, while for non-Islamic countries they are 0.76 and 0.96, respectively, which means differences of 0.27 and 0.20, respectively. Once again, the difference is smaller for the non-Islamic countries group.

These results show that although the systematic risk is lower overall in Islamic countries markets, the stability of the changes in systematic risk appears to be greater in non-Islamic countries' markets. This is an interesting finding which calls for further research.

Our findings also have a few different practical implications for investors and other stakeholders, which can be summarised as follows. (a) Consistently with the stream of literature which presents evidence showing that SRI activity is generally associated with lower risk, we found that SRI stocks have generally lower than average systematic risk, so they can be used as assets reducing investor's portfolio systematic risk below the market average (i.e. below the beta coefficient equal to 1) although the reduction opportunities depend on the specific sub-periods and they vary across the geographical regions. In particular during the COVID-19 sub-period the SRI stocks' systematic risk increased in most regions of the world, however it decreased in Southern Asia, where the COVID pandemic started (and where it was also first restrained). (b) We found lower than average systematic risk of SRI stocks (beta coefficient lower than 1) in almost all analysed regional markets in both bull and bear periods with the only exception of the Africa and Middle East region, where during the bull market the beta coefficient was a little higher than the average. (c) Our analysis of systematic risk asymmetry shows that the SRI stocks' risk during the bull market is higher than during bear market, which may help in improving the investors' decision-making processes where the knowledge about SRI stocks returns' sensitivity with respect to market returns (measured by the beta coefficient) may contribute to better investment performance. (d) Our findings also show that due to SRI risk asymmetry the 'traditional' beta coefficient's estimate, which is used for example in CAPM model or in Sharpe model, misrepresents the actual systematic risk that is captured more precisely by the dual beta estimates for bull and bear markets. In consequence, our findings may contribute to better evaluations of the SRI companies' cost of capital (in particular in bull and bear market phases), typically estimated by the CAPM model and further used in many other financial analyses, such as for example the company valuation or investment appraisal. Therefore, our findings can lead to improving both the effects of the capital market investment decisions and also other types of corporate finance decisions made by stakeholders of SRI companies around the world.

7. Conclusions

We presented empirical evidence relying on a large dataset covering SRI indices from a broad group of 35 markets and we analyse changes in their systematic risk in the sub-samples before COVID-19 pandemic and during the COVID-19 sub-period. Our findings clearly illustrate that systematic risk - captured by their beta coefficients - has increased, on average, across the whole investigated group.

However, some markets in our sample show remarkable resilience and stability in terms of the changes in their risk patterns. In particular, the systematic risk of SRI companies from the countries in East Asia decreased during the COVID-19 pandemic period, which contrasts with increase of the systematic risk of SRI companies from the SRI indices in all other regions around the world.

We also detected substantial differences in the average values of the dual betas, which clearly show the existence of asymmetric effects in the risk of the SRI stocks. This finding points towards the conclusion about greater vulnerability of the SRI investments in the bear market periods.

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APPENDIX

Figure A1. Differences in beta estimates
across developed markets
between pre-COVID-19 and COVID-19 sub-periods.

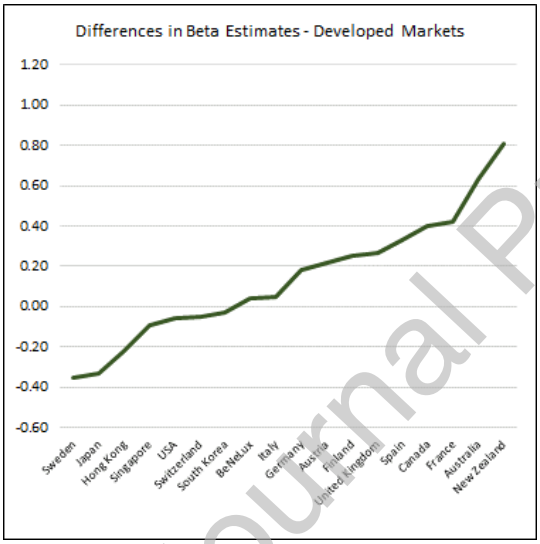

Figure A2. Differences in beta estimates
across emerging markets
between pre-COVID-19 and COVID-19 sub-periods.