# 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 analyzed 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.

## 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 analyzed 127 other papers, found a positive association regarding this linkage, while Orlitzky et al. (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 et al. (2003) also argued that markets do not penalize companies that are *"high in corporate social performance"*.

However, the subsequent 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 inclusion 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 et al., 2016 or Brzeszczyński et al., 2019 and Brzeszczyński et al., 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 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, Sections 4, 5 and 6 report results and present their discussions and Section 7 concludes.

## 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. (2021) investigated performance of SRI stocks from 26 economies and showed 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 finding using data from over 6000 international companies. In turn, Bae et al. (2021) detected 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 et al. (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; and more recently Adamska and Dąbrowski, 2021, among others). The risk of investing in the SRI companies was investigated by Sassen et al. (2016), Orlitzky and Benjamin (2001), Lee and Faff (2009), Jin (2018) and more recently by Brzeszczyński et al. (2021), among others.[2]

Overall, the existing literature about the SRI as an investment style and about the stock market risk based on the international SRI

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[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. (2021) who investigated SRI stocks from 26 countries.

[2]   Different line of literature examines 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.

**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 |
| 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 |

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:

$$r_{it} = \alpha_i + \beta_i \cdot r_{mt} + \varepsilon_{it} \tag{1}$$

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 $\beta_i$ parameter, i.e. the systematic risk measure (relative to the world market).

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):

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

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[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.

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

| Markets | $\beta_i$ | $\beta_i^P$ | $\beta_i^N$ |
|---|---|---|---|
| Australia | 0.7933 | 0.5133 | 1.0669 |
| Austria | 1.0946 | 0.9469 | 1.2678 |
| BeNeLux | 1.0169 | 0.8387 | 1.0758 |
| Brazil | 0.7903 | 0.7019 | 0.8765 |
| Canada | 0.8196 | 0.6988 | 0.9377 |
| Chile | 0.6908 | 0.5788 | 0.8001 |
| China | 0.6393 | 0.6544 | 0.6244 |
| Colombia | 0.8579 | 0.3773 | 1.2687 |
| Egypt | 0.8269 | 0.3737 | 1.2697 |
| Finland | 0.8276 | 0.8973 | 0.9859 |
| France | 0.9742 | 0.9013 | 1.1912 |
| Germany | 1.1084 | 1.0431 | 1.1617 |
| Hong Kong | 0.7745 | 0.5154 | 0.8498 |
| India | 0.5038 | 0.1035 | 0.8948 |
| Indonesia | 0.6771 | 0.5822 | 0.7698 |
| Israel | 0.7632 | 0.6981 | 0.8268 |
| Italy | 1.0246 | 0.9486 | 1.0920 |
| Japan | 0.7384 | 0.5463 | 0.9260 |
| Malaysia | 0.4571 | 0.5367 | 0.3794 |
| Mexico | 0.6900 | 0.6923 | 0.7571 |
| New Zealand | 1.2580 | 1.1190 | 1.3938 |
| Peru | 0.5543 | 0.2790 | 0.8450 |
| Poland | 1.0630 | 1.1748 | 0.9538 |
| Russia | 0.5878 | 0.6581 | 0.5192 |
| Singapore | 0.8660 | 0.8491 | 0.8824 |
| South Africa | 1.1392 | 0.9468 | 1.3271 |
| South Korea | 1.1430 | 1.2596 | 1.0290 |
| Spain | 1.0241 | 1.0286 | 1.0197 |
| Sweden | 0.8726 | 0.8103 | 0.9361 |
| Switzerland | 0.6604 | 0.6063 | 0.7145 |
| Taiwan | 0.9152 | 0.9414 | 0.8381 |
| Turkey | 1.0326 | 1.0577 | 0.9919 |
| United Arab Emirates | 0.8565 | 0.6066 | 1.0754 |
| United Kingdom | 0.7129 | 0.5589 | 0.8634 |
| USA | 0.9875 | 0.9670 | 1.0075 |
| **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.

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 $\beta_i^P$ and $\beta_i^N$ 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 ($\beta_i$) for all 35 indices in the entire sample period is 0.85. Malaysia has the smallest value of $\beta_i$ at the 0.4571 level, while New Zealand has the highest value of $\beta_i$ reaching 1.2580.

There is also a substantial difference in the average dual betas: 0.74 for $\beta_i^P$ and 0.95 for $\beta_i^N$, 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 (0.9294) than in the pre-COVID-19 period (0.7031), 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 1.0108 to 0.4543. Japan and Sweden also have much smaller beta parameters in the COVID-19 period.

**Table 3**

Estimates of beta coefficients $\beta_i$ for 35 SRI indices in the pre-COVID sub-sample and COVID sub-sample.

| Markets | pre-COVID period | COVID period | Difference |
|---|---|---|---|
| China | 1.0108 | 0.4543 | −0.56 |
| Sweden | 1.0974 | 0.7485 | −0.35 |
| Japan | 0.9599 | 0.6263 | −0.33 |
| Hong Kong | 0.8676 | 0.6522 | −0.22 |
| Taiwan | 0.9636 | 0.8157 | −0.15 |
| Turkey | 1.1064 | 0.9956 | −0.11 |
| Singapore | 0.8974 | 0.8048 | −0.09 |
| USA | 1.0277 | 0.9675 | −0.06 |
| Switzerland | 0.6827 | 0.6360 | −0.05 |
| South Korea | 1.1530 | 1.1239 | −0.03 |
| South Africa | 1.1240 | 1.1539 | 0.03 |
| BeNeLux | 0.9704 | 1.0118 | 0.04 |
| Italy | 0.9957 | 1.0487 | 0.05 |
| Israel | 0.6389 | 0.7843 | 0.15 |
| Germany | 0.9794 | 1.1615 | 0.18 |
| Mexico | 0.5386 | 0.7410 | 0.20 |
| Austria | 0.9387 | 1.1618 | 0.22 |
| Colombia | 0.7108 | 0.9553 | 0.24 |
| Finland | 0.6719 | 0.9237 | 0.25 |
| United Kingdom | 0.5500 | 0.8191 | 0.27 |
| Malaysia | 0.2636 | 0.5841 | 0.32 |
| Spain | 0.8165 | 1.1417 | 0.33 |
| Chile | 0.4740 | 0.8213 | 0.35 |
| United Arab Emirates | 0.6449 | 1.0426 | 0.40 |
| Canada | 0.5565 | 0.9557 | 0.40 |
| France | 0.7666 | 1.1873 | 0.42 |
| Peru | 0.3155 | 0.7539 | 0.44 |
| Russia | 0.3534 | 0.7955 | 0.44 |
| Indonesia | 0.3633 | 0.8522 | 0.49 |
| Poland | 0.6851 | 1.2584 | 0.57 |
| Australia | 0.3812 | 1.0151 | 0.63 |
| India | 0.0340 | 0.7145 | 0.68 |
| Egypt | 0.3464 | 1.1178 | 0.77 |
| New Zealand | 0.7164 | 1.5224 | 0.81 |
| Brazil | 0.0063 | 1.1791 | 1.17 |
| **Average:** | **0.7031** | **0.9294** | **0.23** |

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 the beta has grown substantially, although it remained still far below 1, i.e. at 0.7145. Poland experienced a large increase too from quite low level of 0.6851 to as high as 1.2584.

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 1.1240 to 1.1539) or South Korea (beta decreased, but also marginally: from 1.1530 to 1.1239). 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 analyzed 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 East 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 South–East Asia, Australia, New Zealand and India region (+0.59) and in the South and Central America (+0.48), whereas in North America, West and East 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 South–East Asia, Australia, New Zealand and India region and from South and Central America.[5]

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[5] We also analysed the differences in systematic risk across the developed markets and the emerging markets, which are illustrated in Figs. 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.

**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 |
|---|---|---|---|
| **East 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** |
| **South–East 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** |
| **North America** | | | |
| Canada | 0.56 | 0.96 | 0.40 |
| USA | 1.03 | 0.97 | −0.06 |
| **Average:** | **0.79** | **0.96** | **0.17** |
| **West and East 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** |
| **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.

## 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).

Second, we investigated whether the choice of different alternative division dates between the pre-COVID-19 and 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

**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 | 3.47753*** |
| (*p*-value) | (0.00090) |
| Welch F-test | 12.09320*** |
| (*p*-value) | (0.00090) |
| Tests for equality of means for positive and negative dual betas | |
| Satterthwaite-Welch *t*-test | 3.6297*** |
| (*p*-value) | (0.0006) |
| Welch F-test | 13.1748*** |
| (*p*-value) | (0.0006) |

Notes: *** - denotes significance at 1% level.
Source: Authors' calculations.

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 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: 1.0277, 1.0280, 1.0281 and 1.0129, respectively (and they are always significant at 1% level). In the COVID-19 period they equal to: 0.9675, 0.9671, 0.9669 and 0.9715, 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: 1.0108, 1.0259, 1.0366 and 0.9357, respectively (and they are always significant at 1% level), while in the COVID-19 period they are: 0.4543, 0.4456, 0.4368 and 0.4372, 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. Discussion

The results reported in Tables 2–4 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 epicenter 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 East 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 North 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 2–4 can also indicate that East Asian markets, as main producers of many industrial components

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[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 1.0108 and 0.4543, whereas the beta estimates from the quarterly models are 1.4116 and 0.4297, respectively (hence, the difference between both sub-periods was detected as even larger in its magnitude based on the results from the quarterly models).

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

(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 analyzed from a different perspective focused on the particular characteristics of individual countries. For example, low beta estimate for Malaysia, at the level of 0.4571, 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: Egypt, Indonesia, Malaysia, Turkey and United Arab Emirates. Subsequently, we analyzed 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 0.38 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 $\beta_i^P$ and $\beta_i^N$ 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 results 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 South Asia, where the COVID-19 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 analyzed 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 the 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 the 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 analyzes, 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 various stakeholders of SRI companies around the world.

## 7. Conclusion

We presented empirical evidence relying on a large dataset covering SRI indices from a broad group of 35 markets and we analyzed 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.

**CRediT authorship contribution statement**

**Janusz Brzeszczyński:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Jerzy Gajdka:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review &

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[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.

editing. **Piotr Pietraszewski:** Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Tomasz Schabek:** Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing.

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## Appendix

Figs. A1 and A2
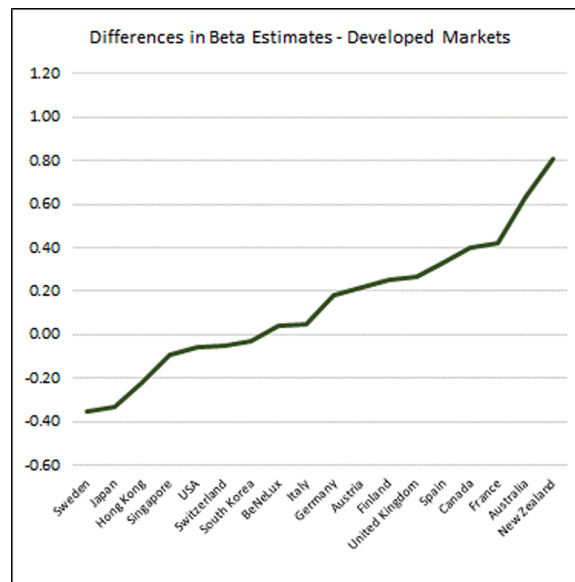


**Fig. A1.** Differences in beta estimates across developed markets between pre-COVID-19 and COVID-19 sub-periods.
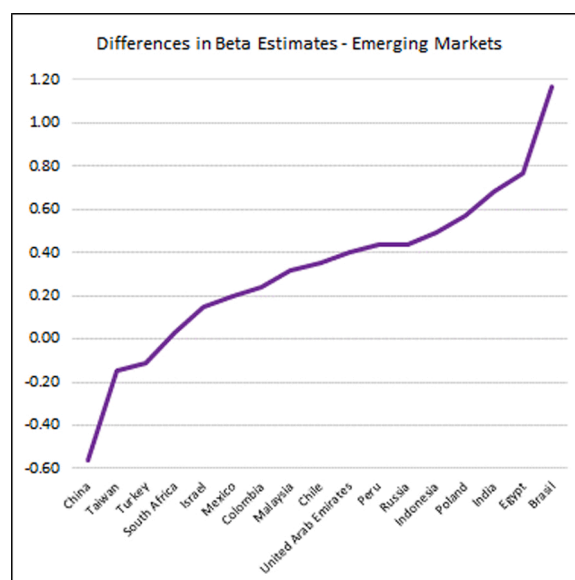


**Fig. A2.** Differences in beta estimates across emerging markets between pre-COVID-19 and COVID-19 sub-periods.

# References

Adamska, A., Dąbrowski, T.J., 2021. Investor reactions to sustainability index reconstitutions: Analysis in different institutional contexts. Journal of Cleaner Production 297, 126715.

Albuquerque, R., Koskinen, Y., Yang, S., Zhang, C., 2020. Resiliency of environmental and social stocks: An analysis of the exogenous COVID-19 market crash. Rev. Corp. Financ. Stud. 9, 593–621.

Badía, G., Ferruz, L., Cortez, M.C., 2021. The performance of social responsible investing from retail investors' perspective: International evidence. Int. J. Financ. Econ. 26, 6074–6608.

Bae, K.H., Sadok, E.G., Gong, Z.J., Guedhami, O., 2021. Does CSR matter in times of crisis? Evidence from the COVID-19 pandemic. J. Corp. Financ. 67, 1–18.

Belghitar, Y., Clark, E., Deshmukh, N., 2014. Does it pay to be ethical? Evidence from the FTSE4Good. J. Bank. Financ. 47, 54–62.

Broadstock, D.C., Chan, K., Cheng, L.T.W., Wang, X., 2021. The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. Financ. Res. Lett. 38, 1–12.

Brzeszczyński, J., Gajdka, J., Schabek, T., 2021. How risky are the socially responsible investment (SRI) stocks? Evidence from the Central and Eastern European (CEE) companies. Financ. Res. Lett. 42, 101939.

Brzeszczyński, J., Ghimire, G., Jamasb, T., McIntosh, G., 2019. Socially responsible investment and market performance: The case of energy and resource companies. Energy J. 40, 17–72.

Brzeszczyński, J., McIntosh, G., 2014. Performance of SRI portfolios in the UK stock market. J. Bus. Ethics 120, 335–362.

Chaudhary, R., Bakhshi, P., Gupta, H., 2020. Volatility in international stock markets: An empirical study during COVID-19. J. Risk Financ. Manag. 13, 208–225.

Chong, J., Pfeiffer, S., Phillips, G.M., 2011. Can dual beta filtering improve investor performance? J. Pers. Financ. 10, 63–86.

Consolandi, C., Jaiswal-Dale, A., Poggiani, E., Vercelli, A., 2009. Global standards and ethical stock indexes: The case of the Dow Jones Sustainability STOXX index. J. Bus. Ethics 87, 185–197.

Demers, E., Hendrikse, J., Joos, P., Lev, B., 2021. ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. J. Bus. Financ. Account. 48, 433–462.

Dias, R., Teixeira, N., Machova, V., Pardal, P., Horak, J., Vochozka, M., 2020. Random walks and market efficiency tests: Evidence on US, Chinese and European capital markets within the context of the global COVID-19 pandemic. Oecon. Copernic. 11, 585–608.

Ding, W., Levine, R., Lin, C., Xie, W, 2020. Corporate Immunity to the COVID-19 Pandemic. National Bureau of Economic Research. Working Paper No. 27055.

He, H., Harris, L., 2020. The impact of COVID-19 pandemic on corporate social responsibility and marketing philosophy. J. Bus. Res. 116, 176–182.

Huang, W., Liu, H., 2021. Impact of COVID-19 on stock price crash risk: Evidence from Chinese energy firms. Energy Econ. 101, 1–10.

Jin, I., 2018. Is ESG a systematic risk factor for US equity mutual funds? J. Sustain. Financ. Invest. 8, 72–93.

Lee, D., Faff, R., 2009. Corporate sustainability performance and idiosyncratic risk: A global perspective. Financ. Rev. 44, 213–247.

Lee, K.J., Lu, S.L., 2021. The impact of COVID-19 on the stock price of socially responsible enterprises: An empirical study in Taiwan stock market. Int. J. Environ. Res. Public Health 18, 1–16.

Managi, S., Okimoto, T., Matsuda, A., 2012. Do socially responsible investment indexes outperform conventional indexes? Appl. Financ. Econ. 22, 1511–1527.

Margolis, J.D., Walsh, J.P., 2003. Misery loves companies: Rethinking social initiatives by business. Adm. Sci. Q. 48, 268–305.

Mirza, N., Naqvi, B., Rahat, B., Rizvi, S.K.A., 2020. Price reaction, volatility timing and funds' performance during COVID-19. Financ. Res. Lett. 36, 1–8.

Omuraa, A., Rocaa, E., Nakai, M., 2021. Does responsible investing pay during economic downturns: Evidence from the COVID-19 pandemic. Financ. Res. Lett. 42, 101914.

Orlitzky, M., Benjamin, J.D., 2001. Corporate social performance and firm risk: A meta-analytic review. Bus. Soc. 40, 369–396.

Orlitzky, M., Schmidt, F.L., Rynes, S.L., 2003. Corporate social and financial performance: A meta-analysis. Organ. Stud. 24, 403–441.

Qiu, S.C., Jiang, J., Liu, X., Chen, M.H., Yuan, X., 2021. Can corporate social responsibility protect firm value during the COVID-19 pandemic? Int. J. Hosp. Manag. 93, 1–12.

Palma-Ruiz, J.M, Castillo-Apraiz, J., Gómez-Martínez, R., 2020. Socially responsible investing as a competitive strategy for trading companies in times of upheaval amid COVID-19: Evidence from Spain. Int. J. Financ. Stud. 8, 41–54.

Revelli, C., Viviani, J.L., 2013. The link between SRI and financial performance: Effects and moderators. Manag. Int. 17, 105–122.

Revelli, C., Viviani, J.L., 2015. Financial performance of socially responsible investing (SRI): What have we learned? A meta-analysis. Bus. Ethics Eur. Rev. 24, 158–185.

Sassen, A., Hinze, A., Hardeck, I., 2016. Impact of ESG factors on firm risk in Europe. J. Bus. Econ. 86, 867–904.

Sauer, D.A. 1997. The impact of social-responsibility screens on investment performance: Evidence from the Domini 400 social index and Domini equity mutual fund. Rev. Financ. Econ. 6, 137–149.

Statman, M., 2000. Socially responsible mutual funds. Financ. Anal. J. 56, 30–39.

Szczygielski, J.J., Brzeszczyński, J., Charteris, A., Bwanya, P., 2022. The COVID-19 storm and the energy sector: The impact and role of uncertainty. Energy Econ. 109, 105258.

Xiao, H., Jianqun, X., 2021. The impact of COVID-19 on seasoned equity offering: Evidence from China. Pac. Econ. Rev. 26, 539–572.

Zhang, D., Hu, M., Ji, Q., 2020. Financial markets under the global pandemic of COVID-19. Finance Res. Lett. 36, 1–7.