

# Co-movements Dynamics and Spillovers among Socially Responsible Investment and International Capital Market: Evidence of Covid-19 Pandemic

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## Abstract

**Purpose :** Covid19 epidemic has culminated in societal and worldwide disparities and impaled benefits in ESG investment. The key objective of this study is to analyze the cointegration and risk spillovers pre and during Covid19 between SRI, Islamic, and Conventional stocks.

**Design/ Methodology/approach :** We include the dataset of nine variables of SRI, Islamic, and conventional indices and find the cointegration and spill-over effects with the help of DCC for the time duration of 2018 to 2022.

**Findings :** The outcomes show the existence of cointegration among SRI, Islamic, and conventional indices in Pre Covid19 and absence during Covid19, and having co-movements with common connections. Before the pandemic, DCC was inclined to spear, but during the pandemic, a diverse form appears at the same time, and extra variability is found in conditional covariance. The outcomes show that SRI gives a higher return with lower risk as compared to Islamic and conventional indices.

**Research Limitations/ Implications :** This analysis is confined to a few well-traded stock indexes. This research may have been expanded to add further stock indexes. The present research also took a restricted time period since it provides more information, although the same might have been investigated over a long period of time. These restrictions might be used to guide future studies in the pertinent area of finance.

**Originality/Value :** The current study tried to explain the cointegration and spillover of the volatility of selected stock markets that had not been seen in prior studies. This study also used methodological rigor to find associations among indices. It has also examined whether SRI indexes are more efficient than Islamic and conventional indices in terms of return.

**KeyWords:** Covid-19, Dependency, Volatility, Islamic Index and Conventional Index

## Introduction

As an astonishing virus, the foremost event of the novel coronavirus (Covid19) was confirmed on 31st Dec. 2019 in Wuhan City, China. Because of the high rate of infection, the WHO (World Health Organisation) dispensed an alert on 30th January 2020. Hence, on 11th March '20, WHO announced it is as a pandemic. The instant solution to evade the spread of the virus was seclusion, & closure was functional in many nations. As per economic experts, the global stock market is grievously affected by the pandemic. Further, the statement makes the addition of a 30% deterioration in the stock market that insinuates the volatility of equities and oil upsurge to the crisis extent. Moreover, newscasts regarding Covid19 in the global media led to adverse thoughts, anxiety, & ambiguity (Aslam et al. 2020a). Owing to this type of worry, international monetary markets have wilted.

The epidemic has culminated in societal and worldwide disparity and impaled benefits in environmental, social, and governance (ESG) investment. The ESG investment grasped \$35.3 trillion in the year 2020 as compared to 2018 amounted to \$30.7 trillion, attaining one-third of present entire worldwide securities beneath management, conferring by the GSIA (Global Sustainable Investment Association) (<http://www.gsi-alliance.org/>, accessed on 06 June 2022). As per the 2020 Inclinations Report, stakeholders considered ESG aspects at \$17 trillion of management securities, which is a 42% upsurge from 2018. This regular progress is predictable and concluded in long run. For explaining the environmental, social & governance funds some terminology is used like SRI (Socially Responsible Investment), responsible, impact, and sustainable investment.

In this study, we try to comprehend the SRI investment in respect of green investment, which develops old (traditional) financial investigation to develop it extra comprehensive. So, here are several influences that are helping out in the assessment of funds' performance. Since, for the last 30 years, SRI (Socially Responsible Investment) has been fascinated by the increased devotion of FIIs and DIIs, experts, and researchers. Compared to conventional

stocks, SRI investment uses awnings that contain and eliminate those stocks which use the pattern followed by investors and local people involved that affect professional behaviour (Renneboog, Ter-Horst, & Zhang, 2008). On the other hand, no particular accord is there for the term Socially Responsible Investment (SRI) in literature (Berry & Junkus, 2013), (Eurosif, 2010) states the description, "SRI associate the stakeholder's financial goal about their apprehensions towards the Environment, Society and Governance factors". Further currently, the term Islamic and Shariah finance have grown up as other types of ethical funds.

The outcomes of the paper confirm the presence of Cointegration among SRI, Conventional and Islamic indexes (in Pre Covid19) & co-movements with common connections. The key objective of this paper is to find out the cointegration and risk spillovers Pre and during Covid19 between the SRI, Islamic, and Conventional stocks from 2018 to 2022. For analyzing this, we use the VAR, VECM, and DCC-GARCH which give the empirical proof of Islamic and Conventional indices are enormously more or less on the vintage of SRI return. The Dynamic correlations incline to spear during the pandemic, and diverse forms arise as there is further inconsistency in conditional covariances. Completely, portfolio managers can attain the benefit by involving SRI and Islamic indexes for a long time but these benefits incline to decrease during the pandemic.

The contribution of this research to the existing literature on SRI, Islamic, and Conventional indexes is through investigating the spillover among SRI, Islamic, and Conventional stocks. While some earlier experiential research (for example, Gorka and Kuziak, 2022) have examined the association between SRI, Islamic, and conventional as far-off there is no research to date (a) to explore the association among SRI, Islamic, and Conventional stocks together (b) to analyze the up and down risk spillovers and conditional correlation between SRI, Islamic and Conventional indices by DCC-GARCH. This research attains to fulfill the gap through expressive relationships, through the study of the SRI index by the three consequent aspects. The risk spillovers among the

SRI, Islamic, and conventional indices are substantial in terms of statistical and economic. Our pragmatic outcomes have a significant role for environment-friendly investors and policymakers by designing the optimum portfolio diversification strategy by keeping in mind the systematic risk because this type of risk is harmful to returns

The balance study is designed as follows. Section 2 gives a

literature review. Section 3 shows the characteristics of data cast off for SRI, Islamic, and conventional indices. Section 4 presents the methods used to measure cointegration and risk spillover among SRI, Islamic, and conventional stocks. Precisely, Cointegration, VECM, VAR, and DCC-GARCH are explained in detail. Section 5 shows the empirical outcomes. Section 6 summarizes the conclusion.

**Literature Review -Table 1**

S. No	Authors	Data and Year	Methodology	Findings
1.	Joanna Gorka, Katarzyna Kuziak (2022)	Dow Jones and S&P 500 (2007-2019)	GARCH, Copula	It is found that there is high dependency among the variables during the calamity time and lower dependency on risky values in steady periods. Diversification profits change over time duration and it required a separate analysis of calamity and steadiness periods.
2.	Nur Hidayah , Putri Swastika (2022)	Indonesian Islamic, Conventional equities and SRI (2020-21)	MGARCH-DCC	The outcomes suggest that Islamic stocks are more volatile but also outperform the others and show no co-movement with conventional and SRI throughout the Pandemic crisis. The research provides actual evidence of the adaptability and effectiveness of Indonesia's Islamic index amid the pandemic. These results have regulatory ramifications for regulators involved in and dealing with influence or responsible investing as well as insightful and useful advice on portfolio diversification for investors.
3	Yunus Kilic et.al (2022)	ESG and Conventional Index (2007-2021)	Wavelet	The findings reveal substantial co-movement trends between stock returns and ESG based on various frequencies, time scales, and sample events across all nations, particularly throughout times of financial turbulence. Mostly, we find that in developed nations, there are negative co-movements in the return of stocks and return of ESG and positive co-movements in developing countries. This suggests that diversifying a portfolio with ESG stocks will have little impact on portfolio gains in developing nations, but will have a big impact in developed nations.
4.	Elmostafa Erraitab et.al (2022)	MoroccanESG10 and Conventional Index (2019-22)	CAPM- GARCH	Our results suggest that the ethical stocks not only demonstrate greater volatility than their conventional adversary but also demonstrate a worse return.

S. No	Authors	Data and Year	Methodology	Findings
5.	Fateh Saci et.al. (2022)	SRI and Traditional Fund (2016-2019)	Regression	The outcomes reveal that there is irrelevant differentiation between the returns of China SRI and Traditional funds. With this, risk association with SRI is lower in comparison to traditional funds. The result shows that SRI has an optimistic effect on the returns of China market.
6.	Paresh Kumar et.al. (2022)	Debt Instruments, Islamic and Conventional Stock (2019-2020)	DCC-MGARCH	The outcomes suggest steadily more fund increments and weaker profit throughout the pandemic. Stimulatingly, there is more correlation between Sukuk and Green Sukuk that suggests divergence benefits for risky tremors.
7.	Muhammad Arif et.al. (2021)	S&P, Dow Jones, Bloomberg Barclays, MSCI world (2008-2020)	VAR	The outcomes show highs and lows in the connection between environment-social and conventional funds which indicates various universal happenings like Oil and Eurozone debt Catastrophe shows the link among the alternative investments.
8.	Nana Liu et.al. (2021)	Green Bonds & Clean Energy stocks (2011 to 2020)	Co-VAR and Copula	The results suggest that there is an optimistic relationship and tail dependency between green bonds and the clean energy market. Whereas, the clean energy market shows the risky down or rising movements that create spill-overs which is asymmetric in the green bond market. It is risky for green bond investors to invest their funds in economic events
9.	Yang Gao, Yangyang Li, Yaojun Wang (2021)	China Green Bond Index, Shanghai S.E Composite Stock, Energy and Chemical stock, Industrial and Agricultural Index, Interbank and Repo market (2016-2020)	DCC-GJRGARCH	There are two-way dangerous spill-overs found among GB and the stock market. But there are single-way spill-overs from commodities and the stock market. So, that there are no significant risky spill-overs among GBs, Forex, and the Monetary market.
10.	Linh Pham, Canh Phuc Nguyen (2021)	Green Bonds, VIX, OVX (2014-2020)	Markov Stitching	The outcome suggests that the relationship between GBs and uncertainty is having time variations and dependency. Throughout less uncertainty, GB and uncertainty are less connected to each other GBs can be used as hedge security so, green bonds can be used to hedge towards ambiguity. These divergences are less during the high uncertainty situation

S. No	Authors	Data and Year	Methodology	Findings
11.	Muhammad Abubakr Naeem et.al. (2021)	Green Bonds and Commodities (2009-2020)	Time and Frequency domain spill-overs framework	The outcomes show that proof of irregular spill-overs between the investment transversely period and dissimilar occurrence sequences. Spill-overs for commodities have strong connections with Green Bonds. During the irregular spill-overs optimistic return spill-overs in the short run, on the other hand, pessimistic return spill-overs grasp two-time horizons but it is extra marked in the short run. GB's market through feasible environmental strategies attracts extra investors to achieve the target of the green economy.
12.	Vanita Tripathi and Amanpreet Kaur (2020)	SRI of BRICS nation (1 <sup>st</sup> Sept. 2019- 31 <sup>st</sup> Mar. 2020)	ARCH-GARCH	It is found that SRI outperforms in respect of risk and returns throughout epidemic time in diverse market conditions in BRICS nations.
13.	Hachmi Ben Ameer et.al (2020)	Asia Pacific, Europe and US SRI and Conventional stocks (2004-2016)	VAR	The findings imply that SRI stocks show less risk in comparison to conventional stocks when it comes to the risk hedging characteristics driven by the SR screening. A higher contribution and spillover impact occurred during the severe worldwide financial crisis. Furthermore, implications of systemic risk differ with market seasons and return distributions level.
14.	Mohammad Sahabuddin et.al (2020)	Islamic & Conventional (2011-2018)	VECM	The results demonstrate that the impulse response function (IRF) indicates negative (positive) in response to shocks with respect to one another in the Islamic and conventional indexes, weak (strong) impacts for anticipating the predicted errors of the specific indexes in both the short and long run. These results give investors and decision-makers practical insights into lowering risks and achieving the best level of return.
15.	Takashi Kanamura (2020)	MSCI Green Bonds, S&P Bonds, and Crude Oil (2014-2018)	DCC-GARCH	The results show that the performance of green bonds Asset is sophisticated in comparison of the Conventional bonds asset act but the dominance is rotting overtime ended.
16.	Thi Thu Ha Nguyen et.al. (2020)	Green Bonds, Commodity, Energy and Composite Index (2008-2019)	Wavelet	The outcomes suggest that there is a high correlation among all the variables during 2007-2009. Comovement between commodities, energy, and stocks is high in comparison to green bonds due to the diversification benefit and pessimistic correlation between commodities and stocks.

S. No	Authors	Data and Year	Methodology	Findings
17.	Daehyeon Park et.al. (2020)	S&P500 and S&P Green Bond (2010-2020)	DCC GARCH	The results suggest that the Green Bonds show asymmetric variations, these variations with equity are penetrating the optimistic return shock. In last it is analyzed that there are some spill-over effects between both markets, these are not responded knowingly to pessimistic shocks in another market.
18.	Linh Pham Toan Luu Duc Huynh (2020)	S&P Green Bonds, Solactive Green Bond Index, MSCI Global, US, European Green Bond Index (2016-2020)	VAR	The study suggests that indexes are relevant for investors because it is a recently developed and faster-growing green market.
19.	Basel Maraqa et.al (2020)	SRI, Conventional Index, and Crude Oil (2001-2020)	DCC-MGARCH	The outcomes suggest that there is a difference in dynamic interrelation among all the variables. Oil import countries and SSI shows a high correlation. Particularly, the association between stock and oil yields became high before and later world financial calamity. The results also suggest that there are substantial volatility spill-overs among the stock yields and other oil prices. This outcome shows significant suggestions for those stakeholders who want diversification and hedging of the stocks for SRI.
20.	Abdul Qoyum et.al (2020)	SRI and Islamic SRI (2011 - 2019)	CAPM, 3FF, 4F-Carhart and 5FF	The outcomes suggest that the Islamic SRI portfolio performs well compared to another three categories. Islamic SRI portfolio gives extra elasticity to Investment patterns.
21.	M. Ángeles López-Cabarcos et.al. (2019)	S&P 500 (2019)	GARCH	It finds that the returns of sustainable companies are affected by social network sentiments but have no impact on the returns of unsustainable industries.
22.	Aimei Ti, Ziping Du, and Wenjing Zhang (2019)	FTSE SRI and FTSE traditional stock (2013 - 2019)	GARCH	It shows that effect of info shocks is irregular leverage on bad news. Bad news generates additional volatility as compared to good news.
23.	David C. Broadstock et.al. (2019)	S&P Green Bonds, S&P Black Bonds, US Index, VIX, ADS, EPU, News and Oil (2008-2018)	DCC	The findings suggest that macroeconomic variables portray a significant role in supporting & subverting strong growth of the Green Bond markets.

S. No	Authors	Data and Year	Methodology	Findings
24.	Robert Joliet, Yulia Titova (2018)	SRI (2009-2015)	Logit/ Probit model	It is found that Conventional and SRI both provide the knowledge or financial information related to investment decisions, nevertheless, SRI's portfolio shows more regular sustainability nicks. So, last we conclude that SRI's showing process for investments decision, and pessimistic screening results in more dynamic portfolio heaviness of superlative outperformers in consistent ESG pillars.
25.	D Siswanto (2018)	Green Bonds and Conventional Bonds	Correlation	The outcome disclosed that subsequently the situation throughout the period was overfilled, this is not correlated to the recital and subsequently the issue time duration of green Sukuk. The decline in the price of Indonesian green Sukuk is instigated by macroeconomic issues later the virtuous picture of green investment always doesn't fascinate stockholders straight. Climate variation matters might not be the first contemplation subsequently stockholders might solitarily pursue it for return reasons.
26.	Fredj Jawadi et.al (2018)	Dow Jones Islamic Sustainability and the Conventional Stock(1999–2017) US	ARDL GARCH	The results suggest that conventional and ethical investments both have high levels of uncertainty with time-varying dynamics, and the conventional US stock market's uncertainty has a considerable and advantageous impact on the uncertainty in alternative stock markets. So, across the short and long run, uncertainty is a feature of both conventional and ethical stock markets. Despite the fact that these results demonstrate mean-reversion and risk spillovers from alternate stock markets to the conventional US market.
27.	Andrea Paltrinieri et.al (2018)	Islamic, conventional, and socially responsible stock (2005-2015)	DCC GARCH	The findings reveal the cointegration and co-movements among all three indices with bilateral causalities. Dynamic correlations tend to increase during times of crisis, but afterward, when conditional covariances are more variable, a quite different pattern starts to show. Lastly, outcomes show that all three forms of stock indexes respond favorably to changes in oil prices but unfavorably to increases in global equity market volatility, although to varying degrees. SRI and Islamic indexes can help investors to diversify their portfolios, especially during post-crisis times.

S. No	Authors	Data and Year	Methodology	Findings
28.	Juan C. Reboredo (2018)	Green Bonds and Other Financial Markets (2014-2017)	Copula	The outcome shows that it is co-movement among the GB and other financial markets, GB's paired with bond markets by commercial and assets bonds market & inadequate co-move by commodity, stock, and energy market. It is similarly found that GBs have insignificant divergence assistances for stockholders.
29.	Sajid Ali et.al. (2018)	Islamic and Conventional Stock (2003-2016)	MFDDFA	The outcomes suggest that the Islamic index changes speculation activities more than the conventional index. So the findings suggest that this study is beneficial for The findings of the study may help managers and policies maker to decrease the economic spin by optimum resources allocations.
30.	Ann-Kathrin Blankenberg Jonas F.A. Gottschalk (2018)	SRI (2002-2016)	Sharpe Ratio	The findings suggest that the sustainable stock indices portfolio doesn't accomplish pointedly differ from a conventional Index. The contemplation for including the SRI in the portfolio does not affect asset outcomes optimistically and might be useful for stakeholders deprived of the need for loss of returns.
31.	Mehmet Balcilar, Riza Demirer and Rangan Gupta (2017)	Dow Jones SRI or Conventional Index (2004 - 2015)	DCC-GARCH	The findings suggest that there are momentous bidirectional variations after conventional to SRI equities, which means that the pattern applicable for SRI is not essential protection for assets of normal market tremors. It is noticed that there is an active correlation between SRI and Conventional index, especially in Europe, active accompanying portfolio suggests conventional index and SRI index recover the risk and return outline of index portfolios in entire countries. In last, the outcome suggests that SRI can give diversification benefits as compared to conventional indexes worldwide.
32.	Olaf Weber, Wei Rong Ang (2016)	MSCI SRI emerging market and Conventional stock (2011-2014)	Fama and French & EGARCH	The outcomes recommend that bad tremors have more effect on the instability of the indices than optimistic tremors. In last, it is determining the SRI of emerging markets indices has lesser compassion return of market throughout the bearish situation.



S. No	Authors	Data and Year	Methodology	Findings
33.	Linh Pham (2016)	S&P Green Bond and S&P Green Project Bond (2010 - 2015)	GARCH	The study suggests that green project bonds have more volatility as compared to green bonds. It is also found that the shocks in the conventional market generate the spill-overs in GBs but it is not fixed over time. It shows the positive sign for portfolio diversification, risk handling, and asset pricing.
34.	Christos Alexakis, Vasileios Pappas and Alexandros Tsikouras (2016)	Conventional and Shariah Index (2000-2014)	Cointegration	The results show some up and downs with mixed market movements throughout multidirectional subtleties. But, later the addition of controllable variables to the model, pessimistic variables retain importance that indicates Shariah indices are less responsive throughout the depraved times.
35.	Md Ejaz Rana et.al. (2015)	Shariah and Conventional Stocks (2008-2013)	MGARCH	The outcomes reveal the pessimistic and arithmetically important impact of variations on an interest rate of KSE 100 and no effect on KMI 30. In case of Conventional and Shariah indices Exchange rate volatility is to be constant with positive and static index returns and coefficient risk. These outcomes are reliable for the concept of risk and return trade-offs. The result of the t-test reflects the momentous differences in the return of both indices. It shows that Shariah stock performs lesser than the conventional index in Pakistan
36.	Perry Sadorsky (2014)	SRI, DJSI, and S&P 500 (1998-2012)	DCC-GARCH	The results show that in context of DCC SRI gives SRI offers actual comparable outcomes in terms of hedging, and optimum portfolio stocks by the investment in S&P 500. This outcome helps out the stakeholders and portfolio executives to take extra well-versed fund investments decisions.
37.	Karim, Bakri Abdul et.al. (2014)	Conventional and Islamic Index (2000-2011)	Granger Causality Test	The results reveal that the Shariah index gives a higher return in comparison to conventional index during all time. Also, this research reveals that in short run bidirectional causality is found among both markets. The results give beneficial suggestions for stakeholders in Malaysia.

S. No	Authors	Data and Year	Methodology	Findings
38.	Ahdi Noomen Ajmi, et.al. (2014)	DJIM, MOVE, CBOE, VIX, FFR, US EPUI, EMU and S&P (1999-2010)	Granger Causality and Robust Causality test	The outcomes suggest there is constant linearity and nonlinearity causality among the Shariah and conventional index, but it is sturdy in Islamic market as compared to another. There is strong causality among the Shariah and financial menace factors. It proves the refusal of decoupling of the hypothesis of Shariah market by comparing with conventional markets, it reduced the portfolio diversification benefit. In last, conspicuous outcomes show a relation among the Shariah market, interest rate, and interest-bearing assets, which are unreliable by Shariah rules.
39.	Shunsuke Managi, Tatsuyoshi Okimoto, Akimi Matsuda (2012)	SRI and Conventional index of US, UK, and Japan (2001-2008 for US and UK/ 2003-2008 for Japan)	Markov Stitching Model	The study suggests two conditions i.e. Bull and Bear. These situations happen at the same time with both types of markets. There are no arithmetical differences is found in means and instabilities in SRI and Conventional indices in both situations. In last, we found strong Comovement among both the indices in two conditions.
40.	Li Huimin, Cheung Adrian and Roca Eduardo (2010)	SRI Index and FTSE4 (2001-2009)	Markov Stitching	It is found that SRI shows high returns in comparison to non-SRI. On the other hand, the risk familiar return of SRI and Non-SRI shows no differentiation.

From the literature review assembled in Table 1, we found that GARCH is the most common model to analyze the stock market tracked by Granger Causality and Markov Stitching. A lot of work is available on different stock indexes by applying different techniques but no study is done on SRI, Islamic, and conventional indices by applying DCC-GARCH for co-movements and Cointegration for long-run association together. It generates the gap for the present study. Considering the literature review variance, the reason for the current study is to analyze volatility spillover and cointegration between SRI, Islamic, and conventional indices.

### Hypothesis

This research inflates the existing literature on green investment by analyzing Cointegration and Dynamic

Correlations to highlight the effect of particular reasons on the co-movement of indices collapse by investigating different regions consisting of Asia-Pacific, Europe, and the USA. The Stock market frequently moves with each other very thoroughly by mitigating the necessity for exploring co-movements. Many researchers have analyzed those interdependencies by diversified methods and by adopting numerous methodologies. The hypothesis for this reason is:

NH01: There are no up and down risk spill-overs between SRI, Islamic, and Conventional indices Pre and during Covid19.

NH02: There is no cointegration Pre and Covid19 between the SRI, Islamic, and Conventional stocks.

## Data & Methodology

We collect the data from the MSCI index from the time period of 1st April 2018 to 31st March 2022, i.e., divided into two-time duration pre-Covid19 (1st April 2018 to 31st March 2020) and during-Covid-19 (1st April 2020 to 31st March 2022). We choose MSCI because it has a major collection of SRI index, Islamic index, and Conventional

index giving more options of indexes. The selection policy measured the representatives of indexes on a regional basis so we were required to observe the mutual key sub-areas with the USA, Asia Pacific, and Europe. As we start with the conventional index with the Islamic index as the standard. We functionalize a similar pattern to SRI indexes also.

**So, our final data set for analysis is the combination of 9 indexes, as shown in Table 2.**

SRI	Islamic	Conventional
MSCI Asia Pacific Ex Japan SRI(MAPJSI)	MSCI AC Asia Pacific Islamic Ex Japan Index (MAPIJ)	MSCI AC Asia Pacific Ex Japan Index (MAPJ)
MSCI Europe SRI (MESI)	MSCI Europe Islamic Index (MEI)	MSCI Europe Index (ME)
MSCI USA SRI (MUSI)	MSCI USA Islamic Index (MUI)	MSCI USA Index (MU)

The variations in securities configuration among indices categories & geographies are noteworthy, highlighting the support for deep study into co-movements and common causal linkages. Generally, SRI indexes contain securities characteristics that are identical to those of traditional indices. Energy stocks, on the other hand, are frequently omitted owing to environmental fears. The financial segment is largely omitted from Islamic indices in order to confirm with Shariah rules. The energy segment, on the other hand, is substantially more prominent in these assets

in the United States (20%), Europe (16.4%), and Asia-Pacific (9.3%). In the Asia-Pacific region, technology is tranquil important.

In Table 3 we give the descriptive statistics summary of daily returns of indices of SRI, Islamic, and conventional. We compute the daily returns on the basis of the following log function:

$$R_t = \ln(P_t/P_{t-1})$$

$R_t$  and  $P_t$  represent the daily returns of the day  $t$ .

**Table 3: Descriptive Statistics Pre Covid19**

	MAPJSI	MESI	MUSI	MAPIJ	MEI	MUI	MAPJ	ME	MU
Mean(%)	-0.004	-0.012	0.007	-0.021	-0.016	-0.006	-0.021	-0.022	0.000
Max.(%)	3.850	3.589	4.207	2.681	3.938	3.793	2.357	3.702	3.901
Min.(%)	-4.527	-5.726	-5.632	-2.613	-5.749	-5.136	-2.742	-6.107	-5.612
SD	0.541	0.508	0.665	0.482	0.539	0.632	0.469	0.533	0.648
Skewness	-1.798	-2.672	-1.042	-0.769	-2.264	-1.063	-1.085	-2.866	-1.340
Kurtosis	29.169	39.882	24.024	11.318	35.194	22.053	11.981	41.700	24.348
N. Obsvs	521	521	521	521	521	521	521	521	521

**Table 4. Descriptive Statistics during Covid19**

	MAPJSI	MESI	MUSI	MAPIJ	MEI	MUI	MAPJ	ME	MU
Mean(%)	0.047	0.031	0.054	0.034	0.036	0.046	0.027	0.033	0.051
Max.(%)	2.300	2.734	2.871	1.600	1.845	2.601	2.161	2.619	2.987
Min.(%)	-2.007	-1.932	-2.534	-1.759	-1.939	-2.722	-1.624	-2.254	-2.606
SD	0.426	0.520	0.514	0.450	0.505	0.463	0.462	0.534	0.495
Skewness	-0.141	-0.158	-0.248	-0.196	-0.442	-0.170	-0.107	-0.276	-0.165
Kurtosis	5.820	5.778	5.983	3.963	5.170	7.441	4.558	6.193	6.942
N. Obsvs	521	521	521	521	521	521	521	521	521

Descriptive Statistics are shown in Table 3 and Table 4 as Pre Covid19 and During Covid 19. In this, we analyze that all the indices of Pre Covid19 incline perform better than During Covid19 indices. The SRI index outperforms as compared to the Islamic and Conventional indexes in both time periods with maximum return. The SRI index is more volatile in Pre Covid 19 as compared to during the time period. Islamic and Conventional Index performances are mostly the same in all regions. During the Covid-19 period, all indices show negative skewness which represents that indices do not have a normal distribution as compared to Pre Covid-19, all indexes show negative skewness but lesser than during Covid-19. Kurtosis also reveals that all indexes of Pre Covid19 do not have a normal distribution. Both the above condition also verified by Jarque-Bera. As high kurtosis shows extreme outliers, that is high in MAPIJ and MAPJ in Pre Covid19.

## Methodology

In every index of our sample data, we acquire the day-to-day time series from the MSCI database. For analyzing the results of indices, we used three stages of statistical methodology. Firstly, we apply the multivariate GARCH model to determine the DCC (Dynamic Conditional Correlations) (R. Engle, 2002), which shows the instabilities and correlations having their past returns. Our selection of the R. Engle and Sheppard (2005); Dynamic Conditional Correlation gives the finest performance among the indexes relevant to the enormous panel technique and is more effective.

Multivariate Dynamic Conditional Correlation (DCC) methodology has the subsequent characteristics:

$$\epsilon_t = \sigma_t \eta_t,$$

$$\sigma_t^2 = \omega + \sum_{i=1}^q a_{0i} \epsilon_{t-1}^2 + \sum_{j=1}^p \beta_{0j} h_{t-j},$$

Here  $\sigma_t^2$  is a univariate GARCH framework,  $\alpha_{0i}$  and  $\beta_{0j}$  both are non-negative coefficients, and  $\omega$  is a positive coefficient.

In the second stage, we construct a cointegration model proposed by R.F Eagle and Granger (1987) for testing the long-run symmetry among different indexes. According to the model, there are two data series  $X_t$  and  $Y_t$ , these two must be cohesive at order 1, they can be co-integrated if a linear equation exists among them that shows stationarity. However, if the series is found to be non-stationary, then they run meticulously with each other in long run and show cointegration exists among them. The variables are:

$$X_t, Y_t \sim I(1)$$

Linear equation among them as below:

$$u_t = y_t - \beta x_t$$

$$u_t \sim I(0)$$

Here,  $\beta$  is a cointegration parameter that represent cointegration speediness. According to this, R. F. Engle and Granger (1987) states, ECM (Error Correction Model) is occurred only when there is cointegration between the two variables.

$$\Delta Y_t = a_0 + \sum_{i=1}^n \beta_{1i} \Delta Y_{t-1} + \sum_{i=1}^n \beta_{2i} \Delta X_{t-1} + \varphi_1 z_{t-1} + \epsilon_1 t \quad \Delta X_t = \gamma_0 + \sum_{i=1}^n \delta_{1i} \Delta Y_{t-1} + \sum_{i=1}^n \delta_{2i} \Delta X_{t-1} + \varphi_1 z_{t-1} + \epsilon_2 t$$

In the above equation, the equilibrium (Error Correction Model) is denoted by  $z_t$ , which allows the variables to return back to long-run equilibrium, whenever they can diverge from a stable state of equilibrium. Firstly, we checked the non stationary of all the indexes. The null hypothesis shows the nonstationary position. For this purpose, ADF (Augmented Dickey-Fuller) test was applied & the lag dimensions are measured by AIC (Akaike's Information Criteria). Later, for checking the stationarity, we applied the Johansen test (1988) to check cointegration. For this, we applied Johansen in 1988 and Johansen & Juselius in 1989 models to check dual statistics which help to identify the cointegration directions i.e.,  $\lambda$  trace (trace statistics) & highest Eigen value statistics  $\lambda$  Max.

Later checking the cointegration, we test VECM (Vector Error Correction Model) to measure the path of Granger Causality to determine the indexes lead and lags. The Error Correction Model shows the long-run association between the indexes. The association is lawful once a minimum single error correction value is substantial in cointegration. Once the error correction value is substantial then the consistent dependent variable is endogenic if not it is exogenic. At last, to find out the well understanding interaction between the variables we apply the impulse response function instead of Granger Causality. Usually, it is applied for examining the result of a single variable for an impulse with another variable in a manner that includes the other variables also. In case there is a response in a single variable for an impulse with other it is assumed underlying to the earlier. We analyzed responses are there in all indexes of all areas to impulse.

## Results

### Dcc Garch

Table 5 shows the outcomes of the DCC-GARCH model for the approximation of parameters i.e.  $\omega$ ,  $\alpha$ , and  $\beta$ .  $\alpha$  parameter deals with the level at which the volatility shocks provender today accomplishes into subsequent stage's volatility though  $\alpha + \beta$  helps to measure the degree at which this consequence disappears over time. Our analysis of Pre Covid-19 shows the spillover effects among the indices in the short as well as in long run also in both period  $\alpha$  measures is relatively less mostly in the case of each index taken in the study which indicates that the markets are quite stable. As joined with the  $\beta$  parameters, every market reveals that  $\alpha$  is quite less response to market shockwaves and high perseverance in conditional volatility ( $\beta$  more than 0.8). Solitary, the Asia Pacific SRI index & USA Islamic, and USA conventional vary through comparatively higher  $\alpha$  and a quite lesser  $\beta$ .

As per DCC estimates during Covid-19  $\alpha$  measures is relatively high in each index that shows the markets are not stable during Covid-19 when there is a lockdown situation in the economy once the lockdown is removed  $\alpha$  measures come to a lesser and shows stability but when the second wave of Covid-19 arises  $\alpha$  is again unstable and high. As joined the  $\beta$  parameters, every market reveals that  $\alpha$  is quite less response to market shockwaves and high perseverance in conditional volatility ( $\beta$  more than 0.9). Solitary, the Asia Pacific and USA SRI index and the USA conventional vary through comparatively higher  $\alpha$  and a quite lesser  $\beta$ .

**Table 5. DCC-GARCH Model before Covid19**

	$\omega$	$\alpha$	$\beta$
MAPJSI	0.0070**	0.3212***	0.6664***
MESI	0.0092*	0.1749**	0.7880***
MUSI	0.0088**	0.2706***	0.7175***
MAPIJ	0.0097	0.1333	0.8152**
MEI	0.0074*	0.1685***	0.8119***
MUI	0.0096**	0.2457***	0.7259***
MAPJ	0.0070*	0.1182**	0.8461***
ME	0.0092*	0.1820**	0.7868***
MU	0.0075**	0.2878***	0.7111***

**Table 6. DCC GARCH Model during Covid19**

	$\omega$	$\alpha$	$\beta$
<b>MAPJSI</b>	0.0099*	0.1579*	0.7914***
<b>MESI</b>	0.0078*	0.1056*	0.8684***
<b>MUSI</b>	0.009	0.1050*	0.8597**
<b>MAPIJ</b>	0.0055	0.0469*	0.9244***
<b>MEI</b>	0.0045	0.0643*	0.9176***
<b>MUI</b>	0.0093	0.1402*	0.8155***
<b>MAPJ</b>	0.016	0.1170*	0.8066***
<b>ME</b>	0.0069	0.0769*	0.8988***
<b>MU</b>	0.0132*	0.1858*	0.7701***

Table 5 & 6 represents the results of dynamic conditional correlation before and during Covid19 among the sets of SRI, Islamic, and conventional stocks. The ARCH test figures give a substantial sign of heteroscedasticity so we undertake the GARCH (1,1) model that helps to detect the behavior of conditional variance of the DCC sequence. After our DCC study, we envisage the duos of conditional

covariance between the index before and during the pandemic period in each pair. Fig. 1 shows the conditional correlation of all pairs of indexes before the pandemic. For instance, Panel A shows the correlation between the Asia Pacific SRI index and other countries' SRI indexes. We find the shrill spear in the conditional correlation in November 2019

**Table 7. DCC results before Covid19**

	Asia Pacific	Europe	USA
<b>COR(S-I)</b>	0.58***	0.97***	0.96***
<b>COR(S-C)</b>	0.52***	0.98***	0.98***
<b>COR(I-C)</b>	0.95***	0.98***	0.96***
<b>Lamda1</b>	0.06	0.06***	0.15***
<b>Lamda2</b>	0.51	0.82***	0.71***

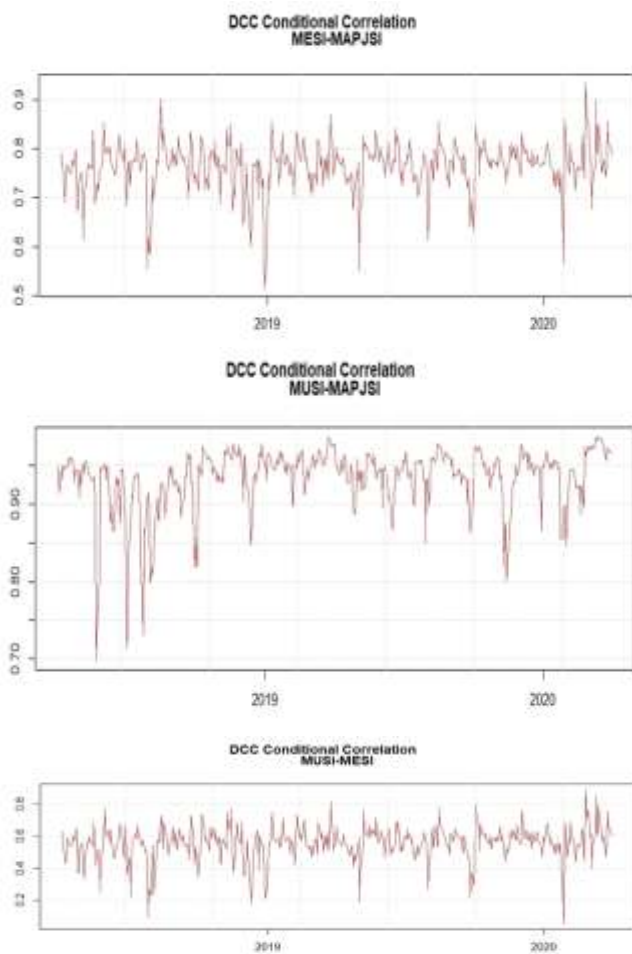
**Table 8. DCC results during Covid19**

	Asia Pacific	Europe	USA
<b>COR(S-I)</b>	0.45***	0.94***	0.87***
<b>COR(S-C)</b>	0.52***	0.97***	0.96***
<b>COR(I-C)</b>	0.89***	0.96***	0.91***
<b>Lamda1</b>	0.010	0.02**	0.07***
<b>Lamda2</b>	0.96***	0.96***	0.85***

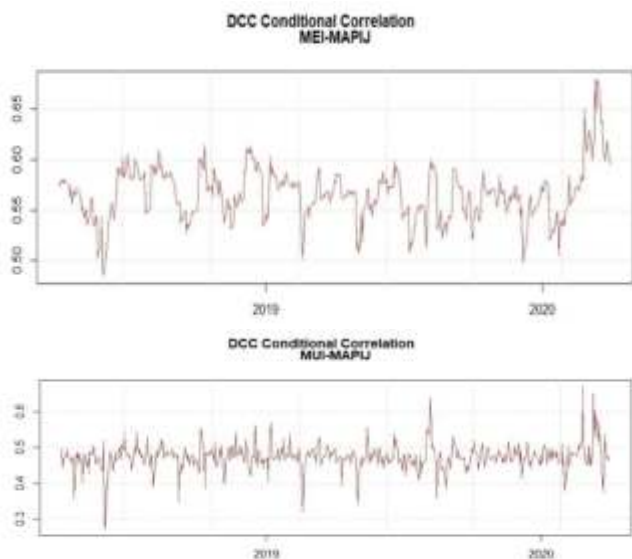
due to Covid-19 news in the markets. We also found the next spear which is lesser in degree in Asia-Pacific but very high in Europe and USA SRI index in March 2020 due to the spreads of Covid-19 in all over the world and the

lockdown in the economy. The same spear is found in Panels B & C also for the degree of shock. Dynamics in the correlation show an adjacent position among all the pairs.

**PANEL A. SRI Index**



**PANEL B. Islamic Index**



**PANEL C. Conventional Index**

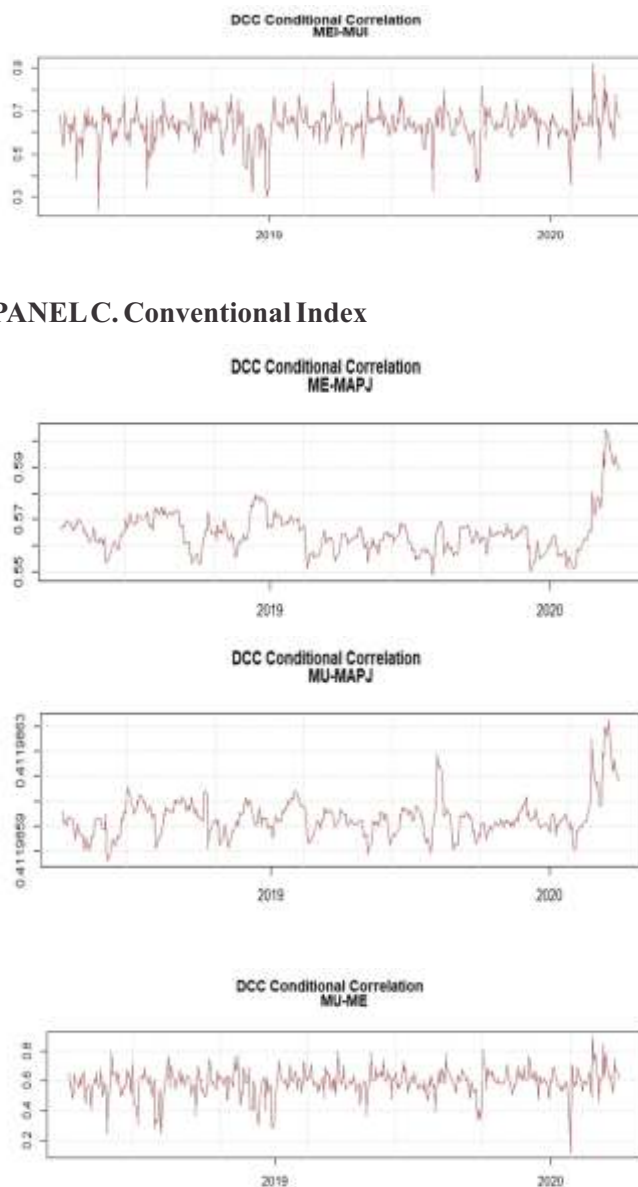
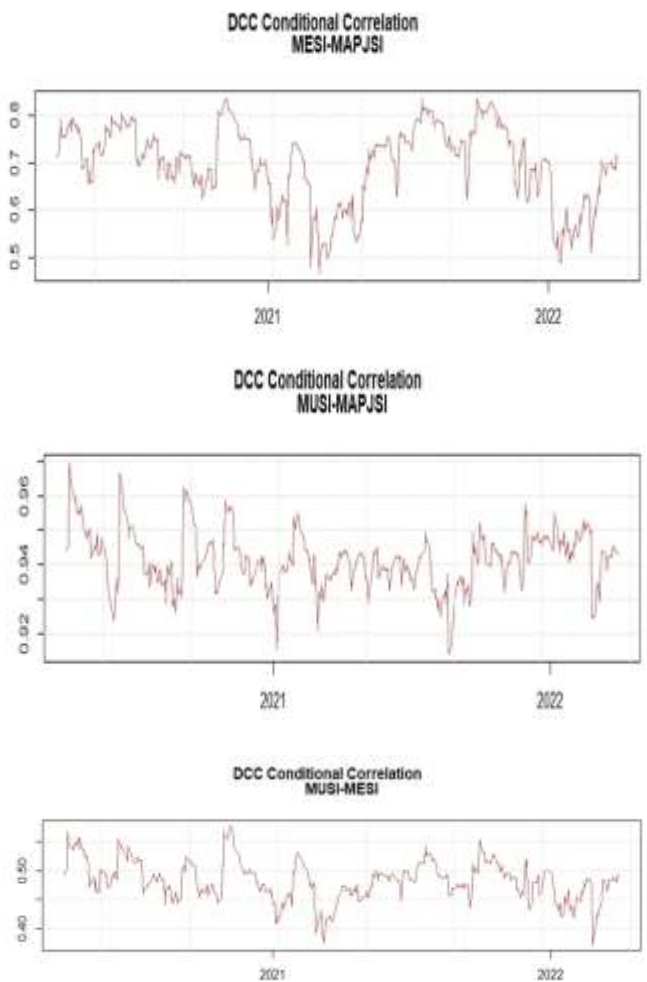


Fig.1 Dynamic Conditional Correlation before the Covid-19 pandemic. Panel A shows the correlation between Asia-Pacific and other countries' SRI indexes. Panel B shows Asia-Pacific and other countries' Islamic indexes. Panel C shows Asia-Pacific and other countries' conventional indices.

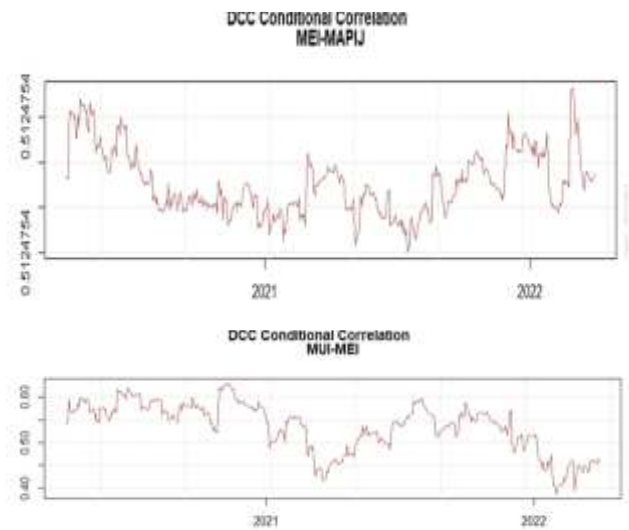
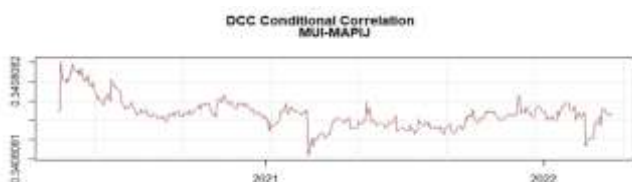
Relatively diverse forms appear during the pandemic period. Here, it is shown extra inconsistency in the shapes of pairs of conditional correlation with all spears in Fig.2. The foremost spear is found in the mid of 2020 where we

get a momentous spear in covariances among Asia Pacific, Europe, and USA SRI, Islamic and conventional indices owed to Covid-19 spread & WHO declares Covid-19 as an epidemic disease for the entire world (first wave). The same high spear is noticeable near the mid of 2021 mainly among the Asia Pacific and Europe SRI, Islamic and conventional index and relatively low in the USA (second wave). A tierce spear seems in the start of 2022 including nearly all braces (third wave). At Overall see the fewer covariances during the complete crisis period.

PANEL A. SRI Index



PANEL B. Islamic Index



PANEL C. Conventional Index

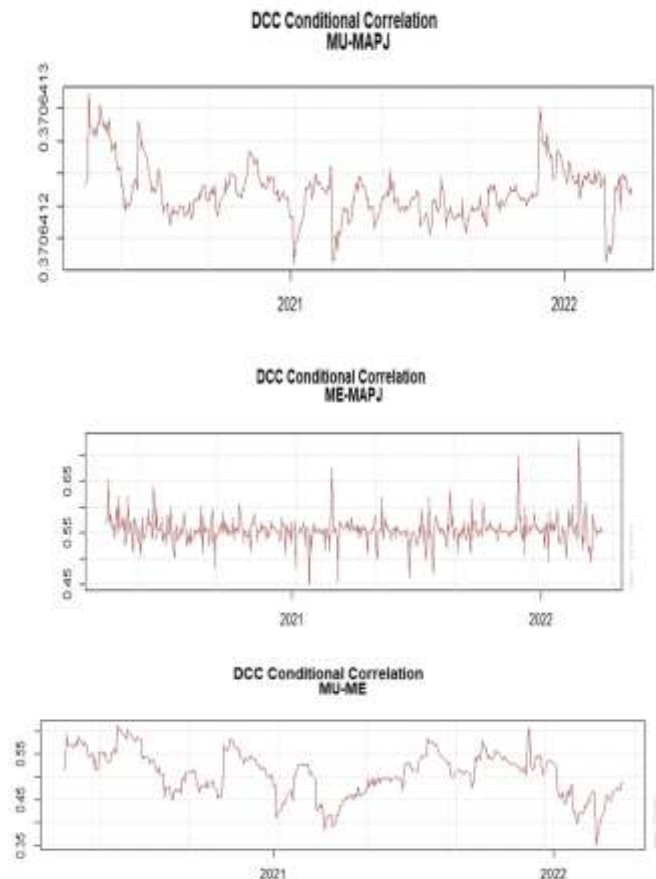


Fig.1 Dynamic Conditional Correlation during the Covid-19 pandemic. Panel A shows the correlation between Asia-Pacific and other countries' SRI indexes. Panel B shows Asia-Pacific and other countries' Islamic indexes. Panel C shows Asia-Pacific and other countries' conventional indices.



## Cointegration Analysis

For this purpose, we apply the Dicker-Fuller test to analyze cointegration. The outcomes confirm the null hypothesis is rejected by the unit root. All series show non-stationarity so we ran the cointegration model between all the indices of all countries. Mostly in all the regional indexes of all time durations below inquiry, there is a minimum of one cointegration equivalence in Pre Covid19 and no cointegration during Covid19. So, for Pre Covid19 period we ran VECM, and During Covid19 we ran VAR. If required, results will be provided.

In table 10 to 12 state the outcomes of the VECM test analysis for joint connections between SRI, Conventional and Islamic indexes. Tables suggest the statistics together for the error rectification terms and effect on each variable. In every situation, we apply the inclination requirement for best fitting the model. With this, we regulate the units of intervals (lags) backed by using the lag orders assortment analyzing for pre-approximation to deal with the autocorrelation fears which finally occur by the LM testing for remaining autocorrelation. Designed for the individual region, we account for the consequences of diverse methods with SRI, conventional and Islamic indices as the dependent variable, correspondingly. Table 10. In the case of Asia Pacific, the results focus on the joint causal association between the three indexes. In equation first, the

SRI is constrained to be zero. By seeing the  $\Delta\text{MAPJSI}$  (by variation in SRI indices) we find it is more than the equilibrium and we suppose it is a dropdown that is precisely what we receive, the coefficient is  $-0.0000212$  through quicker alteration speed.

In Table 11. We originate one equation of cointegration in the Europe index. The error rectification terms are substantial only while contemplating the SRI stocks ( $\Delta\text{MESI}$ ) and Islamic stocks ( $\Delta\text{MEI}$ ) analog. By seeing the ( $\Delta\text{MESI}$ ) the cointegration equation shows SRI indices are less than the equilibrium as collated with the Islamic analog & we find the optimistic indication of error rectification terms in equation (0.01175).

In Table 12. A diverse shape arises in the USA, and a single equation of cointegration is found. The error rectification terms are considerable once seen in the variation in the SRI index ( $\Delta\text{MUSI}$ ), the presence of a common connecting association is found, and relatively the connectedness turns from Islamic and Conventional indexes towards the SRI. In this, SRI indices are observed as more than the equilibrium. As per the requirement of equilibrium, the SRI index values are down as a pessimistic constant ( $-0.19425$ ). Conferring the concept, in VECM analysis, causation arises mutually from the coefficients of lagged variation variables, for apprehending short-run dynamics, and the coefficients of the error rectification term, that detent long-run subtleties.

**Table 10. VECM (Vector Error Correction Model) analysis, MSCI Asia Pacific Indices (Pre Covid19)**

	$\Delta(\text{MAPJSI})$	$\Delta(\text{MAPIJ})$	$\Delta(\text{MAPJ})$
CointEq1	-2.12E-05	1.68E-06	-7.53E-06
$\Delta(\text{MAPJSI}(-1))$	-0.17276***	0.206935***	0.095231***
$\Delta(\text{MAPJSI}(-2))$	0.251931***	0.121908***	0.05956**
$\Delta(\text{MAPJSI}(-3))$	0.103725	0.048168	0.022754
$\Delta(\text{MAPJSI}(-4))$	-0.13393**	-0.11744***	-0.04265**
$\Delta(\text{MAPIJ}(-1))$	1.070488***	0.644914***	0.298111***
$\Delta(\text{MAPIJ}(-2))$	0.100634	0.148442	0.070267
$\Delta(\text{MAPIJ}(-3))$	-0.17552	-0.13173	-0.04368
$\Delta(\text{MAPIJ}(-4))$	0.443917	0.267818	0.131817*
$\Delta(\text{MAPJ}(-1))$	-2.35106***	-1.84595***	-0.84679***
$\Delta(\text{MAPJ}(-2))$	-0.1365	-0.226	-0.11407
$\Delta(\text{MAPJ}(-3))$	0.402959	0.439622	0.159664
$\Delta(\text{MAPJ}(-4))$	-0.69546	-0.4755	-0.25691
C	-0.02707	-0.49771	-0.23031

**Table 11. VECM (Vector Error Correction Model) analysis, MSCI Europe Indices (Pre Covid19)**

	$\Delta(\text{MESI})$	$\Delta(\text{MEI})$	$\Delta(\text{ME})$
CointEq1	0.011754	0.01352	0.00992
$\Delta(\text{MESI}(-1))$	0.358462	0.251236	0.374798
$\Delta(\text{MESI}(-2))$	0.409703	0.203384	0.442908
$\Delta(\text{MESI}(-3))$	-0.08434	-0.05836	-0.03624
$\Delta(\text{MESI}(-4))$	-0.59248*	-0.35761*	-0.6335*
$\Delta(\text{MEI}(-1))$	1.226241***	0.829437***	1.353291***
$\Delta(\text{MEI}(-2))$	-0.92956**	-0.6302**	-0.9769**
$\Delta(\text{MEI}(-3))$	0.466966	0.222353	0.445459
$\Delta(\text{MEI}(-4))$	-0.41728	-0.26365	-0.36718
$\Delta(\text{ME}(-1))$	-1.04461***	-0.71356***	-1.13937***
$\Delta(\text{ME}(-2))$	0.318171	0.277863	0.335572
$\Delta(\text{ME}(-3))$	-0.09916	-0.00629	-0.12278
$\Delta(\text{ME}(-4))$	0.870316**	0.53574**	0.869753**
C	-0.24515	-0.21451	-0.65463

**Table 12. VECM (Vector Error Correction Model) analysis, MSCI USA Indices (Pre Covid19)**

	$\Delta(\text{MUSI})$	$\Delta(\text{MUI})$	$\Delta(\text{MU})$
CointEq1	-0.19425***	-0.14135***	-0.17925**
$\Delta(\text{MUSI}(-1))$	-0.23687	-0.12247	-0.21525
$\Delta(\text{MUSI}(-2))$	-0.11337	0.032014	-0.03934
$\Delta(\text{MUSI}(-3))$	-0.14364	-0.06864	-0.12789
$\Delta(\text{MUSI}(-4))$	-0.18302	-0.23221	-0.3572
$\Delta(\text{MUI}(-1))$	0.219799	0.129962	0.283106
$\Delta(\text{MUI}(-2))$	-0.33488	-0.19533	-0.33828
$\Delta(\text{MUI}(-3))$	0.019498	-0.00218	0.021628
$\Delta(\text{MUI}(-4))$	-0.02998	0.035735	0.06265
$\Delta(\text{MU}(-1))$	-0.14044	-0.06805	-0.17803
$\Delta(\text{MU}(-2))$	0.524179	0.225129	0.456103
$\Delta(\text{MU}(-3))$	0.254899	0.143582	0.239146
$\Delta(\text{MU}(-4))$	0.142378	0.168619	0.262826
C	0.580955	-0.1082	0.244242

### VAR Analysis

As standard, we construct a VAR estimates model for during the Covid-19 period. Based on BIC principles, the lag period ( $p=2$ ) is selected for VAR and the results are revealed in Table.13-15. The VAR assessment demonstrates: in our first eq. of  $\Delta\text{MAPJSI}$ , the coefficient  $\Delta\text{MESI}(1)$  and  $\Delta\text{MUSI}(1)$  is remarkably optimistic on a 5% level of significance, which means Europe and USA SRI index a remarkably optimistic result on  $\Delta\text{MAPJSI}$  during the overall duration of the sample. In our second equation of  $\Delta\text{MESI}$ , the coefficient of  $\Delta\text{MAPJSI}(1)$  is insignificant

which means the Asia Pacific ex-Japan SRI index doesn't distress the  $\Delta\text{MESI}$  index. But in the same equation, the coefficient of  $\Delta\text{MUSI}(1)$  is optimistic at a 1% level, which indicates the USA SRI index has a positive impact on  $\Delta\text{MESI}$ . In our third equation of  $\Delta\text{MUSI}$ , the coefficient of  $\Delta\text{MAPJSI}(1)$  and  $\Delta\text{MESI}(1)$  are remarkably optimistic. In petite, the VAR estimates demonstrate that  $\Delta\text{MESI}(1)$  and  $\Delta\text{MUSI}(1)$  index have an optimistic underlying result on  $\Delta\text{MAPJSI}$ , but  $\Delta\text{MAPJSI}$  has no substantial underlying consequences on  $\Delta\text{MESI}(1)$  and  $\Delta\text{MUSI}(1)$ .

**Table 13. VAR (Vector Autoregressive) Estimates, MSCI Asia Pacific Indices (During Covid19)**

	$\Delta$ MAJPSI	$\Delta$ MESI	$\Delta$ MUSI
$\Delta$ MAPJSI(-1)	0.629548**	-0.287336	-0.855573
	[2.367223]	[-1.022002]	[-1.455825]
$\Delta$ MAPJSI(-2)	0.354124	0.328327	0.807255
	[1.337984]	[1.17342]	[1.380217]
$\Delta$ MESI(-1)	0.029534	0.865533***	0.14951
	[0.306355]	[8.492526]	[0.701801]
$\Delta$ MESI(-2)	-0.023085	0.098315	-0.117911
	[-0.240645]	[0.969435]	[-0.556215]
$\Delta$ MUSI(-1)	0.189581**	0.277728***	1.266293***
	[1.98405]	[2.749348]	[5.997007]
$\Delta$ MUSI(-2)	-0.187357**	-0.288201***	-0.260272
	[-1.964509]	[-2.858465]	[-1.234962]
<b>C</b>	15.54253*	22.56283**	23.57871
	[1.818875]	[2.49762]	[1.248656]
<b>R-sq.</b>	0.995954	0.991791	0.995211
<b>Adjusted R-sq.</b>	0.995907	0.991695	0.995155

**Table 14. VAR (Vector Autoregressive) Estimates, MSCI Europe Indices (During Covid19)**

	$\Delta$ MAP	$\Delta$ MEI	$\Delta$ MUI
$\Delta$ MAPIJ(-1)	0.918685***	-0.077256*	-0.141104*
	[19.59718]	[-1.76703]	[-1.948861]
$\Delta$ MAPIJ(-2)	0.064796	0.087967**	0.12467*
	[1.396839]	[2.033331]	[1.74011]
$\Delta$ MEI(-1)	0.150514**	0.809298***	-0.059577
	[2.583298]	[14.89341]	[-0.662056]
$\Delta$ MEI(-2)	-0.118227**	0.130495**	0.10155
	[-2.038524]	[2.412564]	[1.133684]
$\Delta$ MUI(-1)	0.201809***	0.196638***	0.967559***
	[6.121071]	[6.395022]	[19.00114]
$\Delta$ MUI(-2)	-0.214908***	-0.175522***	0.011799
	[-6.467188]	[-5.663426]	[0.229894]
<b>C</b>	13.85023***	11.08899**	19.99313**
	[2.604408]	[2.235789]	[2.434149]
<b>R-sq.</b>	0.993133	0.991936	0.994507
<b>Adjusted R-sq.</b>	0.993053	0.991841	0.994443

Table 14. the VAR assessment demonstrates: in our first eq. of  $\Delta$ MAPIJ, the coefficient  $\Delta$ MEI(1) and  $\Delta$ MUI(1) is remarkably optimistic at 1% and 5% levels of significance, which means Europe and USA Islamic index a remarkably optimistic result on  $\Delta$ MAPJSI during the overall duration of the sample. In our second equation of  $\Delta$ MEI, the coefficient of  $\Delta$ MAPIJ(1) is insignificant which means the Asia Pacific ex-Japan Islamic index doesn't affect the

$\Delta$ MEI index. But in the same equation, the coefficient of  $\Delta$ MUI (1) is optimistic at a 1% level, which indicates the USA Islamic index has a positive impact on  $\Delta$ MEI. In our third equation of  $\Delta$ MUI, the coefficient of  $\Delta$ MAPIJ(1) and  $\Delta$ MEI (1) are insignificant that indicates the Asia Pacific ex-Japan Islamic index and Europe Islamic index don't affect the  $\Delta$ MUI index.

**Table 15. VAR (Vector Autoregressive) Estimates, MSCI USA Indices (During Covid19)**

	$\Delta\text{MAPJ}$	$\Delta\text{ME}$	$\Delta\text{MU}$
$\Delta\text{MAPJ}(-1)$	0.91713***	-0.329822**	-0.378063
	[19.04458]	[-2.001024]	[-1.160717]
$\Delta\text{MAPJ}(-2)$	0.071354	0.368999**	0.340661
	[1.491636]	[2.253727]	[1.052902]
$\Delta\text{ME}(-1)$	0.027318*	0.801253***	-0.076863
	[1.735812]	[14.87518]	[-0.722102]
$\Delta\text{ME}(-2)$	-0.019729	0.144225***	0.108482
	[-1.261404]	[2.694121]	[1.025468]
$\Delta\text{MU}(-1)$	0.05308***	0.199462***	0.984064***
	[7.062506]	[7.753844]	[19.35838]
$\Delta\text{MU}(-2)$	-0.055978***	-0.185092***	-0.000717
	[-7.384782]	[-7.134086]	[-0.013989]
<b>C</b>	4.210987*	22.54886***	31.98847*
	[1.665637]	[2.605874]	[1.870732]
<b>R-sq.</b>	0.993135	0.991722	0.994948
<b>Adjusted R-sq.</b>	0.993055	0.991626	0.994889

Table 15. the VAR assessment demonstrates: in our first eq. of  $\Delta\text{MAPJ}$ , the coefficient  $\Delta\text{ME}(1)$  and  $\Delta\text{MU}(1)$  is remarkably optimistic at 1% and 10% level of significance, which mean Europe and USA conventional index a remarkably optimistic result on  $\Delta\text{MAPJ}$  during the overall duration of the sample. In our second equation of  $\Delta\text{ME}$ , the coefficient of  $\Delta\text{MAPJ}(1)$  is insignificant which means the Asia Pacific ex-Japan conventional index doesn't affect the  $\Delta\text{ME}$  index. But in the same equation, the coefficient of  $\Delta\text{MU}(1)$  is optimistic at a 1% level, which indicates USA conventional index has a positive impact on  $\Delta\text{ME}$ . In our third equation of  $\Delta\text{MU}$ , the coefficient of  $\Delta\text{MAPJ}(1)$  and  $\Delta\text{ME}(1)$  are insignificant which indicates the Asia Pacific ex Japan and Europe conventional index doesn't affect the  $\Delta\text{MU}$  index. In petite, the VAR estimates demonstrate that  $\Delta\text{ME}(1)$  and  $\Delta\text{MU}(1)$  index has an optimistic underlying result on  $\Delta\text{MAPJ}$ , but  $\Delta\text{MAPJ}$  has no substantial underlying consequences on  $\Delta\text{ME}(1)$  and  $\Delta\text{MU}(1)$ .

### Managerial and Financial Suggestions

Generally, dynamic correlations tend to spear in the course of the pandemic, whereas there is further inconsistency in conditional covariance at any time during the pandemic period. It means that portfolio managers want to be more careful about consistent SRI and Islamic stocks in a varied portfolio. Institutional investors can take advantage of the

benefits of diversification by including SRI and Islamic indexes because during the pandemic long-term dynamic correlation tend to decrease. So,  $\text{NH01}$  is rejected.

Cointegration takes place when there is a long-term association between two data sets, but once they return to the equilibrium must follow the short-term exits at whatsoever the purpose, portfolio managers get the advantage from this deviation. Policies targeting the benefit of divergence in the long term must include the blends of short and long spots. By rare exemption, our outcomes show the extensive contributory association among SRI, Islamic and conventional stocks pre Covid-19. When we involve Asia-Pacific and Europe provinces, the conventional stocks lay beneath the long-run equilibrium in comparison to SRI whereas the Islamic stocks stand more than such equilibrium which means portfolio managers get profit by including more Islamic and SRI indexes and less conventional index in their portfolio in a short time duration. In the USA, there is no proof of a mutual contributory relationship is found between all the indices. On the other hand, during Covid-19 the VAR assessment demonstrates that Europe and USA SRI index gives remarkably optimistic results. Asia Pacific distressed the Europe index due to the insignificant coefficient. But the USA has a positive relationship with Europe which means

portfolio managers get benefitted by including the SRI index in their portfolio. Of this, NH02 is also rejected.

## Conclusion

This study links the rising form of relatively empirical work on Social, Ethical, and conventional funds. We have subsidized existing literature in various ways. Firstly, our study involves the SRI index. Secondly, as associated with prior research covering the limited quantity of worldwide equity indexes, we have sophisticated our study at a regional level and also test the behavioral variances between SRI, Islamic, and conventional indexes. Thirdly, we cover the time horizon of pre and during the Covid-19 pandemic. Lastly, the earlier study includes only cointegration among Islamic and conventional indexes, we involve SRI stock. Dynamic conditional correlation discloses covariance between the indexes and diagonally regions identically adjacent during the pandemic. Rather diverse forms appear during pandemic time with high inconsistency in conditional covariance.

Furthermore, the cointegration method discloses the co-movements between SRI, Islamic, and conventional indexes with common connections. We found the co-movement in Asia-Pacific, whereas in Europe we find connectedness between the conventional and SRI index and to Islamic index. We also discover the joint connecting association, with the relatively same extent, among the Islamic and conventional indices in the USA.

Due to the effect of Covid-19, we have seen an adverse response in all indexes across the regions to be a tremor in worldwide market instability, even though to diverse extents. By including SRI and Islamic stocks investors gain the portfolio diversification benefit. During the Covid-19 pandemic, divergence benefits incline to decline to specify that all stock indexes respond to instability flows and selling by institutional stockholders, whereas dynamic correlation inclines to reduce over the long run.

This study unlocks the paths intended for more study. The DCC-GARCH method mainly finds dynamic correlations between market places and suggests portfolio divergence chances. Though, this method flouts stockholders' asset-holding time duration. Future studies can discourse that problem by adding recent wavelet conversions to improve the study of the effect of diverse asset prospects on portfolio

diversification profits (Gencay, Selcuk, & Whitcher, 2001). Furthermore, specified current variations in the financial market. It would be exciting to find their effect on the co-movement and dynamic correlation of our variables. Assuming Socially Responsible Investment remains to raise, there will be continuing imperious to appreciate these and some other suggestions for financial policies and practices.

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## References:

- Ajmi, A. N., Hammoudeh, S., Nguyen, D. K., & Sarafrazi, S. (2014). How strong are the causal relationships between Islamic stock markets and conventional financial systems? Evidence from linear and nonlinear tests. *Journal of International Financial Markets, Institutions, and Money*, 28, 213-227.
- Alexakis, C., Pappas, V., & Tsikouras, A. (2017). Hidden cointegration reveals hidden values in Islamic investments. *Journal of International Financial Markets, Institutions and Money*, 46, 70-83.
- Ali, S., Shahzad, S. J. H., Raza, N., & Al-Yahyaee, K. H. (2018). Stock market efficiency: A comparative analysis of Islamic and conventional stock markets. *Physica A: Statistical Mechanics and Its Applications*, 503, 139-153.
- Ameer, H. B., Jawadi, F., Jawadi, N., & Cheffou, A. I. (2020). Assessing downside and upside risk spillovers across conventional and socially responsible stock markets. *Economic Modelling*, 88, 200-210.
- Arif, M., Hasan, M., Alawi, S. M., & Naeem, M. A. (2021). COVID19 and time-frequency connectedness between green and conventional financial markets. *Global Finance Journal*, 49, 100650.
- Aslam, F., Awan, T. M., Syed, J. H., Kashif, A., & Parveen, M. (2020). Sentiments and emotions evoked

- by news headlines of coronavirus disease (COVID19) outbreak. *Humanities and Social Sciences Communications*, 7(1), 1-9.
- Balcilar, M., Demirer, R., & Gupta, R. (2017). Do sustainable stocks offer diversification benefits for conventional portfolios? An empirical analysis of risk spillovers and dynamic correlations. *Sustainability*, 9(10), 1799.
  - Berry, T. C., & Junkus, J. C. (2013). Socially responsible investing: An investor perspective. *Journal of business ethics*, 112(4), 707-720.
  - Blankenberg, A. K., & Gottschalk, J. F. (2018). Is socially responsible investing (SRI) in stocks a competitive capital investment? A comparative analysis based on the performance of sustainable stocks.
  - Broadstock, D. C., & Cheng, L. T. (2019). Time-varying relation between black and green bond price benchmarks: Macroeconomic determinants for the first decade. *Finance research letters*, 29, 17-22.
  - Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. *Journal of Business & Economic Statistics*, 20(3), 339-350.
  - Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276.
  - Engle, R. F., & Sheppard, K. (2005). Theoretical properties of dynamic conditional correlation multivariate GARCH. University of California, San Diego Working Paper.
  - Erraitab, E., & El Khamlichi, A. (2022). Ethical and Conventional Stock Price Performance: An Empirical Investigation under CAPM-GARCH Models. *International Journal of Social and Administrative Sciences*, 7(2), 53-68.
  - Eurosif. (2010). *European SRI Study 2010*. Paris.
  - Gao, Y., Li, Y., & Wang, Y. (2021). Risk spillover and network connectedness analysis of China's green bond and financial markets: Evidence from financial events of 2015–2020. *The North American Journal of Economics and Finance*, 57, 101386.
  - Gençay, R., Selçuk, F., & Whitcher, B. J. (2001). *An introduction to wavelets and other filtering methods in finance and economics*. Elsevier.
  - Górka, J., & Kuziak, K. (2022). Volatility Modeling and Dependence Structure of ESG and Conventional Investments. *Risks*, 10(1), 20.
  - Hemche, O., Jawadi, F., Maliki, S. B., & Cheffou, A. I. (2016). On the study of contagion in the context of the subprime crisis: A dynamic conditional correlation–multivariate GARCH approach. *Economic Modelling*, 52, 292-299.
  - Hidayah, N., & Swastika, P. (2022). Performance Of Conventional, Islamic, And Social Responsible Investment (Sri) Indices During Covid-19: A Study Of Indonesian Stock Market. *Journal of Islamic Monetary Economics and Finance*, 8(4), 517-534.
  - Jawadi, F., Jawadi, N., & Cheffou, A. I. (2018). Uncertainty assessment in socially responsible and Islamic stock markets in the short and long terms: an ARDL approach. *Applied Economics*, 50(39), 4286-4294.
  - Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, 12(2-3), 231-254.
  - Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration--with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, 52(2), 169-210.
  - Joliet, R., & Titova, Y. (2018). Equity SRI funds vacillate between ethics and money: An analysis of the funds' stock holding decisions. *Journal of Banking & Finance*, 97, 70-86.
  - Karim, B. A., Datip, E., & Shukri, M. H. M. (2014). Islamic stock market versus conventional stock market. *International Journal of Economics, Commerce and Management*, 2(11), 1-9.
  - Kanamura, T. (2020). Are green bonds environmentally friendly and good performing assets?. *Energy Economics*, 88, 104767.
  - Kilic, Y., Destek, M. A., Cevik, E. I., Bugan, M. F., Korkmaz, O., & Dibooglu, S. (2022). Return and Risk Spillovers between the ESG Global Index and Stock Markets: Evidence from Time and Frequency Analysis. *Borsa Istanbul Review*.
  - Li, H., Cheung, A., & Roca, E. (2010, August). Socially responsible investment, good and bad times. In *23rd Australasian Finance and Banking Conference*.
  - Liu, N., Liu, C., Da, B., Zhang, T., & Guan, F. (2021). Dependence and risk spillovers between green bonds

- and clean energy markets. *Journal of Cleaner Production*, 279, 123595.
- López-Cabarcos, M. Á., Pérez-Pico, A. M., & López-Pérez, M. L. (2019). Does social network sentiment influence S&P 500 environmental & socially responsible index?. *Sustainability*, 11(2), 320.
  - Managi, S., Okimoto, T., & Matsuda, A. (2012). Do socially responsible investment indexes outperform conventional indexes?. *Applied Financial Economics*, 22(18), 1511-1527.
  - Maraqa, B., & Bein, M. (2020). Dynamic interrelationship and volatility spillover among sustainability stock markets, major European conventional indices, and international crude oil. *Sustainability*, 12(9), 3908.
  - Narayan, P. K., Rizvi, S. A. R., & Sakti, A. (2022). Did green debt instruments aid diversification during the COVID19 pandemic?. *Financial Innovation*, 8(1), 1-15.
  - Naeem, M. A., Adekoya, O. B., & Oliyide, J. A. (2021). Asymmetric spillovers between green bonds and commodities. *Journal of Cleaner Production*, 314, 128100.
  - Nguyen, T. T. H., Naeem, M. A., Balli, F., Balli, H. O., & Vo, X. V. (2021). Time-frequency comovement among green bonds, stocks, commodities, clean energy, and conventional bonds. *Finance Research Letters*, 40, 101739.
  - Paltrinieri, A., Floreani, J., Kappen, J. A., Mitchell, M. C., & Chawla, K. (2019). Islamic, socially responsible, and conventional market comovements: Evidence from stock indices. *Thunderbird International Business Review*, 61(5), 719-733.
  - Pham, L., & Nguyen, C. P. (2021). Asymmetric tail dependence between green bonds and other asset classes. *Global Finance Journal*, 50, 100669.
  - Park, D., Park, J., & Ryu, D. (2020). Volatility spillovers between equity and green bond markets. *Sustainability*, 12(9), 3722.
  - Pham, L. (2016). Is it risky to go green? A volatility analysis of the green bond market. *Journal of Sustainable Finance & Investment*, 6(4), 263-291.
  - Pham, L., & Huynh, T. L. D. (2020). How does investor attention influence the green bond market?. *Finance Research Letters*, 35, 101533.
  - Qoyum, A., Al Hashfi, R. U., Zusryn, A. S., Kusuma, H., & Qizam, I. (2021). Does an Islamic-SRI portfolio really matter? Empirical application of valuation models in Indonesia. *Borsa Istanbul Review*, 21(2), 105-124.
  - Reboredo, J. C. (2018). Green bond and financial markets: Co-movement, diversification and price spillover effects. *Energy Economics*, 74, 38-50.
  - Rana, M. E., & Akhter, W. (2015). Performance of Islamic and conventional stock indices: empirical evidence from an emerging economy. *Financial Innovation*, 1(1), 1-17.
  - Renneboog, L., Ter Horst, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of banking & finance*, 32(9), 1723-1742.
  - Siswanto, D. (2018, November). Performance of Indonesian green sukuk (islamic bond): a sovereign bond comparison analysis, climate change concerns?. In *IOP Conference Series: Earth and Environmental Science* (Vol. 200, No. 1, p. 012056). IOP Publishing.
  - Sadorsky, P. (2014). Modeling volatility and conditional correlations between socially responsible investments, gold and oil. *Economic Modelling*, 38, 609-618.
  - Saci, F., Jasimuddin, S. M., & Hasan, M. (2022). Performance of Socially Responsible Investment Funds in China: A Comparison with Traditional Funds. *Sustainability*, 14(3), 1476.
  - Sahabuddin, M., Muhammad, J., Yahya, M. H., & Shah, S. M. (2020). Co-movements between Islamic and conventional stock markets: An empirical evidence. *Jurnal Ekonomi Malaysia*, 54(3), 27-40.
  - Ti, A., Du, Z., & Zhang, W. (2019, December). Analysis on the volatility of sustainable stock index and traditional stock index based on GARCH model. In *2019 International Conference on Economic Management and Model Engineering (ICEMME)* (pp. 47-50). IEEE.
  - Tripathi, V., & Kaur, A. (2020). Socially responsible investing: performance evaluation of BRICS nations. *Journal of Advances in Management Research*, 17(4), 525-547.
  - Weber, O., & Ang, W. R. (2016). The performance, volatility, persistence and downside risk characteristics of sustainable investments in emerging market. *ACRN Oxford Journal of Finance and Risk Perspectives*, 5(2), 1-12.