Examining Cointegration and Market Dynamics Among the Global Sustainability and Social Responsibility Indices During Covid -19 Pandemic: An Empirical Analysis Across the ESG And SRI Indices of Emerging Markets.

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Abstract

The co-integration of global stock markets during crisis periods has gained increasing attention in recent years, carrying significant implications for market participants. This study examines the cointegration and causal relationship among the ESG and SRI indices of the emerging markets during the crisis period. The daily closing price data of the sustainability indices from 10 Emerging countries between Jan 2020 to Jun 2024 was employed in the study. The Johansen's Co-integration and Granger's Causality tests were used to evaluate long-term co-integration and short-term causal interactions among the study variables, determining if they move together and influence each other over time. The empirical results revealed that there was one Co-integration relationship during the from the COVID-19 period till date. The trace test and the maximum eigenvalue test values were considered to establish the co-integration among the selected market indices based on their probability values. The co-integration of global stock markets during crisis periods has gained increasing attention in recent years, carrying significant implications for market participants. The study has key implications for investors, traders, regulators, policymakers, and analysts, potentially shaping investment strategies, risk management, regulatory frameworks, and offering insights into market stability and integration during crises.

Introduction

The COVID-19 pandemic profoundly impacted global stock markets, leading to extreme volatility and sharp declines, particularly in early 2020. Major indices like the S&P 500 and Dow Jones experienced significant losses as economic uncertainty surged due to lockdowns, supply chain disruptions, and decreased consumer demand. Initially, ESG indices also saw declines alongside broader market sell-offs; however, they exhibited greater resilience over time. Companies that prioritized strong environmental, social, and governance practices were perceived as better equipped to navigate the crisis, resulting in a more stable performance compared to their non-ESG counterparts. As markets began to recover, ESG indices outperformed traditional ones, fuelled by a growing investor preference for sustainable investments and an emphasis on long-term resilience. The pandemic accelerated the

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shift toward sustainable investing, with sectors like renewable energy, technology, and healthcare gaining traction due to their alignment with ESG principles.
In emerging markets, ESG indices experienced sharp declines due to lockdowns and market volatility, but their long-term performance depended on the maturity of ESG frameworks and corporate transparency. Countries with stronger ESG policies, such as China, achieved positive results, highlighting the need for robust ESG frameworks. This study employs Johansen's Cointegration and Granger Causality tests to further analyse ESG index performance during and after the pandemic.

Objective

To examine the co-integration and causal relationships among ESG and SRI indices of emerging markets during the COVID-19 pandemic.

To employ Johansen's Co-integration and Granger's Causality tests to evaluate long-term and short-term interactions between the sustainability indices.

To determine whether the selected ESG and SRI indices move together and influence each other over time during crisis periods.
Based on the cointegrating and causal relationships the study aims to provide some significant insights for investors, traders, regulators, and policymakers on market stability, risk management, and integration during crises for sustainable investing.

Scope of the Study

This study examines ESG and SRI indices in emerging markets over the past five years, particularly during the COVID-19 crisis. ESG indices evaluate companies based on environmental, social, and governance criteria, offering insights into sustainability and ethical practices. By employing cointegration analysis, the research identifies long-term relationships between these indices, aiding investors in understanding which indices tend to move together over time, thus assisting in risk reduction and informed portfolio strategies. Causality tests will also be utilized to explore whether changes in one index can predict or influence another, revealing cause-and-effect dynamics in financial markets. Ultimately, the findings aim to enhance market efficiency, stability, and informed investment strategies in emerging markets, benefiting investors, traders, and speculators.

Review Literature

ESG and SRI indices are increasingly recognized as tools for sustainable investing, reflecting companies' ethical, environmental, and social practices. While developed markets have integrated these indices, emerging markets face challenges due to varying regulatory frameworks and socio-economic factors. This review explores the co-movement, diversification benefits, and market dynamics of ESG and SRI indices in emerging economies, emphasizing their role in enhancing financial stability.

(Md Akhtaruzzaman Sabri Boubaker, 2022) found that the COVID-19 media coverage index increased contagion transmission to equity markets during the pandemic, with the US identified as a net receiver of shocks, highlighting its vulnerability. (Panay otis Alexakis, 2022)analysed the stock returns of six Asian markets during the 1997 crisis, using linear and nonlinear Granger causality tests. They found bidirectional nonlinear Granger causality among the markets, indicating interconnectedness throughout the study period. (Een Nuraeni, 2022) analysed the impact of the COVID-19 pandemic on Islamic and ESG stock indices in Southeast Asia using event study and VECM methodologies. Their findings indicated significant effects on stock performance, notably that Singapore's ESG index remained unaffected by rising COVID-19 cases. (M.M Goyal, 2014) delved into the performance of ESG stocks in India from January 2008 to September 2013. The study finds that ESG portfolios outperformed blue-chip and market portfolios in both absolute and risk-adjusted returns, potential for

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socially responsible investors to achieve higher returns through sustainable investments. (K. S., Nayak, & Kalra, 2021) analysed eight Asian stock markets from 2011 to 2018, finding positive impacts and unidirectional causality towards KOPSI and NIFTY, which indicated favourable diversification opportunities. The study also highlighted how the global recession significantly affected the US market, leading to downturns in major markets, including India. The recession resulted in widespread job losses and affected various sectors, particularly the service sector, leading to substantial losses for investors on the BSE. (Lee, 2022)developed an ESG index to assess corporate sustainability among 49 companies that issue sustainability reports. This paper examines the correlation between ASEAN-5 stock markets to assess the feasibility of market integration. It finds that while these markets are cointegrated, they are not fully integrated, leaving opportunities for further policy initiatives. International portfolio diversification across these markets is still beneficial, though the gains are reduced. (Reid W.click, 2005). The literature suggests that traditional correlation measures fail to capture global market integration accurately. A new measure based on multi-factor models reveals a significant rise in market integration over the last three decades, even when correlations among country indexes remain weak. (Kuntara Pukthuanthong, 2009). This study investigates the long-term relationships and short-term causal interactions among the US, Japanese, and ten Asian emerging stock markets, focusing on the 1997-1998 Asian financial crisis. It finds that both long-run cointegration and short-run causal linkages among these markets intensified during the crisis, leading to greater integration post-crisis compared to pre-crisis, highlighting the dynamic nature of international stock market integration during financial upheavals. (Jian Yang, 2003). The findings reveal that only companies in the low ESG group show a significant positive effect on the relationship between corporate economic responsibility and financial performance, highlighting the importance of ESG management for corporate sustainability. (Helen Chiappini, 2021) examined the impact of pandemic lockdowns on sustainable indexes in Europe and the USA, finding no significant difference in abnormal returns compared to traditional indexes. The results suggest that sustainable investments remain viable for financial-first investors during market distress. (Ramiz ur Rehman, 2021) examined the integration of ESG equity indices with conventional indices in BRICS countries from July 2013 to February 2018. Their analysis using Johansen co-integration and vector error correction models revealed that all ESG indices are integrated with conventional indices, indicating significant economic and financial cooperation, particularly in China and South Africa. Literature on sustainable and responsible investing (SRI) shows that integrating environmental, social, and governance (ESG) factors into investment strategies enhances financial performance and social impact, with companies demonstrating corporate social responsibility (CSR) during crises often outperforming competitors and influencing consumer preferences. (Jesús Manuel Palma-Ruiz, 2020)

Research Gap

A research gap refers to unexplored areas within a field of study, often arising from unanswered questions or inadequately researched concepts. Addressing these gaps enriches the existing body of knowledge, offering new perspectives and insights. While extensive research has examined cointegration, dynamic connectedness, and causality tests regarding ESG equity indices and conventional indices, much of the focus has been on developed economies' responses to the COVID-19 pandemic. Studies typically utilize cointegration and Granger causality tests, with some employing Vector Error Correction Models (VECM) for Islamic ESG indices. Additionally, the dynamic connections between ESG leader indices and the COVID-19 Media Coverage Index (MCI) have shed light on media influences on investor behaviour during the crisis. However, there is a notable lack of research concerning the impact of the pandemic on ESG stocks in emerging and underdeveloped countries. This gap is crucial as little research in the past five years has applied cointegration methods to these regions. Understanding the responses of developing nations during crises is essential for a comprehensive view of global ESG performance, especially in terms of resilience and sustainability during the pandemic.

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Methodology

Johansen's Cointegration Test is a statistical method that evaluates whether a group of non-stationary time series variables shares a stable, long-term equilibrium relationship. Many financial time series, such as asset prices, exhibit non-stationary behaviour, meaning their statistical properties change over time. If these series are cointegrated, they tend to move together, indicating a consistent long-term relationship despite short-term fluctuations. Johansen's test analyses multiple time series simultaneously using a Vector Autoregression (VAR) model, providing two statistics: the trace statistic, which tests the number of cointegrating vectors, and the maximum eigenvalue statistic, which tests for specific relationships. This test is essential in finance for understanding long-term asset trends and aiding investors in diversification and risk management. In contrast, Granger's Causality Test assesses whether one time series can predict another, revealing dynamic relationships. Together, these tests provide a comprehensive understanding of long-term equilibrium relationships and short-term predictive interactions, enabling informed trading strategies and portfolio management.

The Granger causality test assesses long-term causal relationships between variables using daily spot price return data for stationary variables. It determines whether past values of one variable can statistically predict another, making it valuable for analysing ESG (Environmental, Social, and Governance) and SRI (Socially Responsible Investing) indices during the COVID-19 pandemic. This test can identify if shifts in these indices influenced or were influenced by market performance, as well as detect bidirectional causality between ESG/SRI indices and traditional financial indicators. If ESG and SRI indices Granger-cause conventional stock indices, it indicates that sustainable investments respond to and influence market movements, creating a feedback loop. Ultimately, the Granger causality test offers insights for investors and policymakers by revealing the predictive power of ESG and SRI indices during economic uncertainty, guiding future sustainability-focused investment strategies.

Analysis of the data from 2019 – 2024

Graph for the time series

The below graph of Ftse4 Good Bursa Malaysia prices shows the time series of price movement of the stock for the period 2nd January 2019 to 30th September 2024.

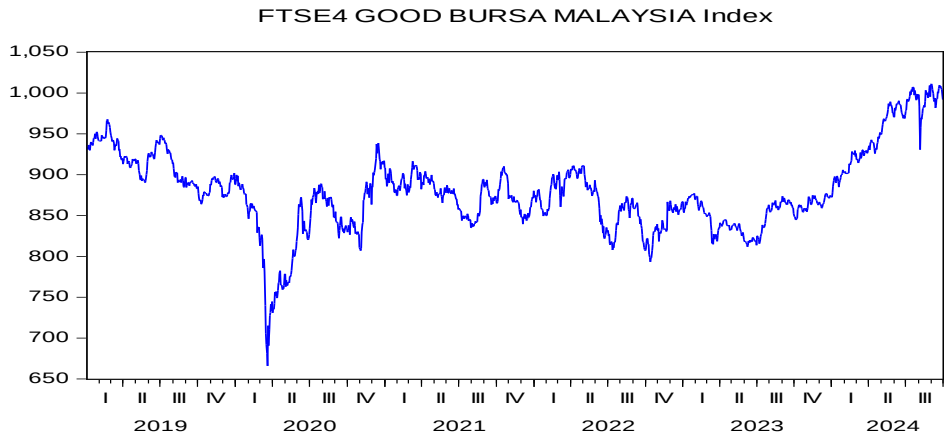

Figure – time series plot of the spot prices of Ftse4 Good Bursa Malaysia's ESG index for the period 2019-2024.

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Figure – Time series plot of spot prices of MSCI Korea's ESG index for the period 2019 – 2024.

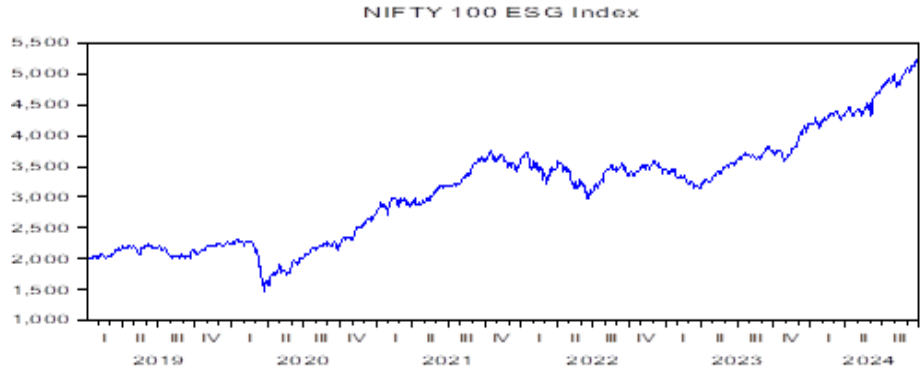

Figure – Time series plot of spot prices of NIFTY 100's ESG Index for the period 2019 – 2024.

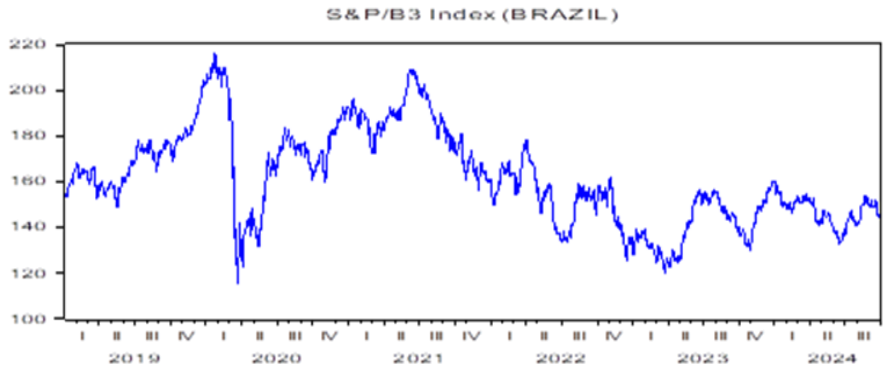

Figure – Time series plot of spot prices of S&P/B3 ESG Index for the period 2019 – 2024.

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Figure – Time series plot of spot prices of S&P China A 300 Index for the period 2019 – 2024.

Figure – Time series plot of spot prices of S&P/ESG EGYPT Index for the period 2019 – 2024.

Figure – Time series plot of spot prices of S&P/Hawkamah Index for the period 2019 – 2024.

Determination of VAR Lag Order for the commodities for the period 2019 – 2024.

VAR Lag Order Selection criteria for the selected ESG index.

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Table Lag Order Selection criteria for the selected ESG index.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-56163.56	NA	1.31E+24	75.39672	75.42165	75.40601
1	-33269.22	45542.84	6.30E+10	4.473183	44.93128*	44.80616
2	-33158.25	219.6991	5.80E+10*	44.64866*	45.02261	44.78801*
3	-33123.62	68.24387	5.91E+10	44.66794	45.21640	44.87233
4	-33086.41	72.96046	6.01E+10	44.68378	45.40675	44.95320
5	-33043.97	82.82876	6.06E+10	44.69258	45.59006	45.02704
6	-32988.33	108.0757	6.01E+10	44.69366	45.75565	45.08315
7	-32961.37	52.11241	6.19E+10	44.71325	45.95975	45.17777
8	-32912.28	94.41623*	6.19E+10	44.71313	46.13414	45.24269

Output generated from EViews 12

For performing the Johansen's Cointegration test, the number of lags needs to be detected. Akaike Information Criterion (AIC) is one relevant and reliable lag selection method. Thus, according to the Akaike Information Criteria, the number of lags to be chosen for performing the tests is 2.

Johansen's Cointegration test

Table Johansen's Cointegration test results output from EViews 12

Unrestricted Cointegration Rank Test (Trace)

*Indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan – Quinn Information criterion

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 critical Value
None *	0.015048	91.22431	125.6154
At most 1	0.014234	68.55618	95.75366
At most 2	0.011671	47.12366	69.81889
At most 3	0.008470	29.57276	47.85613
At most 4	0.006665	16.85637	29.79707
At most 5	0.004577	6.859070	15.49471
At most 6	6.25E-07	0.000934	3.841466

Trace test indicates no co-integration at the 0.05 level

***Denotes rejection of the hypothesis at the 0.05 level.**

****Mackinnon-Haug-Michells (1999) p-values.**

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Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	EigenValue	Max-Eigen Statistic	0.05 Critical Value
None*	0.015048	22.66813	46.23142
At most 1	0.014234	21.43253	40.17757
At most 2	0.011671	17.55090	33.87687
At most 3	0.008470	12.71638	27.58434
At most 4	0.006665	9.997303	21.13162
At most 5	0.004577	6.858135	14.26460
At most 6	6.25E-07	0.000934	3.841466

Max-eigenvalue test indicates no cointegration at the 0.05 level

**Denotes rejection of the hypothesis at the 0.05 level*

***Mackinnon – Haug – Michells (1999) p-values*

Output generated from EViews 12

Hypothesis

H_0: There is no long run relationship or co-integration between the selected ESG indices.

H_1: There is a long run relationship or co-integration between the selected ESG indices.

Interpretation:

The trace test and the maximum eigenvalue tests were employed to establish the cointegration rank. The cointegration among the variables are interpreted based on their probability values. ****

Graph for spot prices of the ESG indices.

The below graphs display the daily spot prices of the selected ESG indices for the period starting 2nd January 2019 to 30Th September 2024. The graphs are plotted based on the daily spot prices returns data.

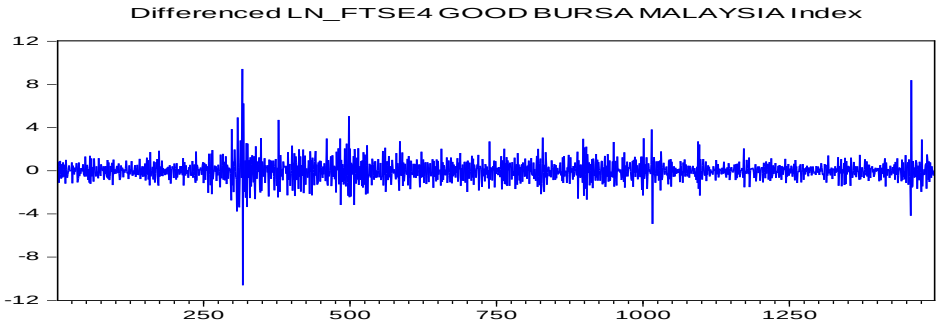

Figure Daily spot price returns plot of FTSE Good Bursa Malaysia Index during the period 2019-2024

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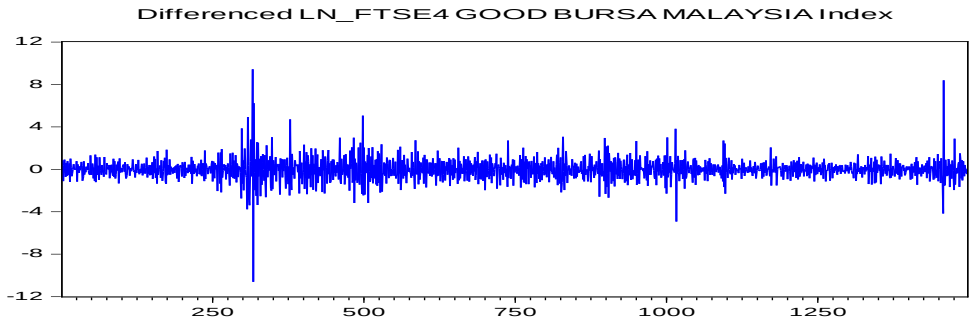

Figure Daily spot price returns plot of MSCI Korea ESG Index during the period 2019-2024

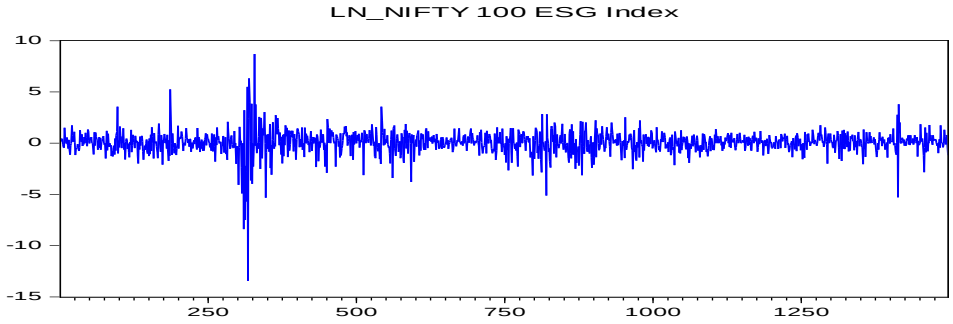

Figure Daily spot price returns plot of NIFTY 100 ESG Index during the period 2019-2024

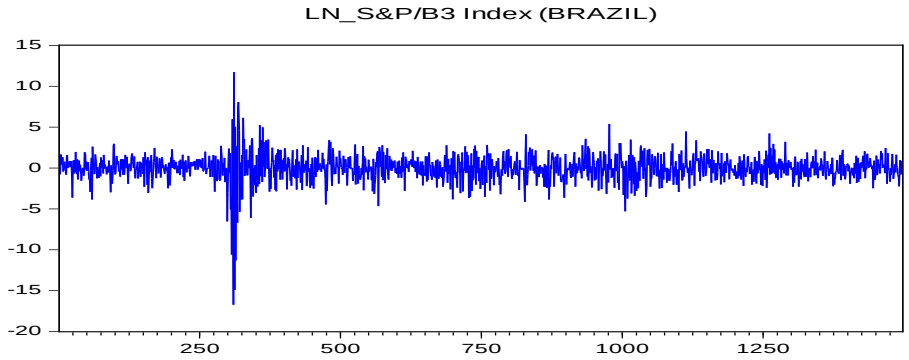

Figure Daily spot price returns plot of S&P/B3 Index during the period 2019-2024

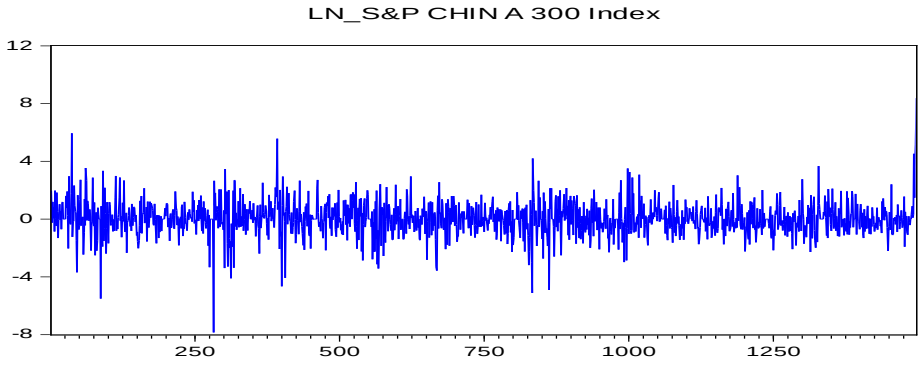

Figure Daily spot price returns plot of S&P CHINA 300 Index during the period 2019-2024

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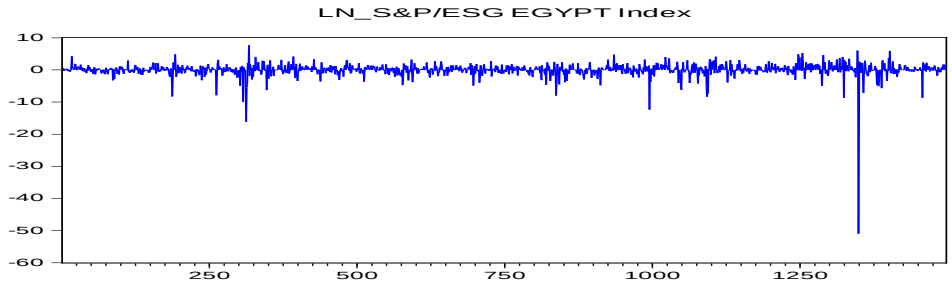

Figure Daily spot price returns plot of S&P/ESG EGYPT Index during the period 2019-2024

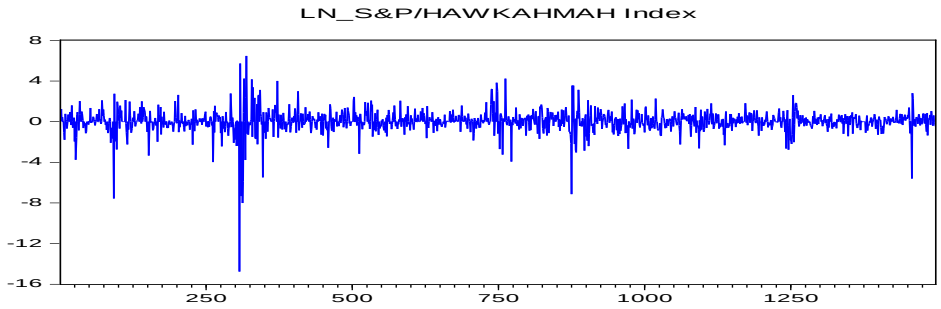

Figure Daily spot price returns plot of S&P/HAWKAHMAH Index during the period 2019-2024

Descriptive statistics of the the Selected Emerging markets ESG Indices

	LN FTSE4 Bursa Malaysia	LN MSCI Korea	LN Nifty 100 ESG	LN S&P B3	LN S&P China A 300 ESG	LN S&P/ ESG Egypt	LN S&P/ Hawkahmah
	LN FTSE4 Bursa Malaysia	LN MSCI Korea	LN Nifty 100 ESG	LN S&P B3	LN S&P China A 300 ESG	LN S&P/ESG Egypt	LN S&P/Hawkahmah
Mean	0.004042	0.025594	0.063674	-0.004032	0.025604	0.005198	0.022886
Median	0.000000	0.000000	0.075727	0.000000	0.000000	0.000000	0.000000
Maximum	7.139629	10.67023	8.699691	11.72742	8.378041	7.689897	6.470387
Minimum	-5.568107	-10.67217	-13.44716	-16.72302	-7.842575	-50.95260	-14.75381
Std.Dev.	0.738621	1.655149	1.115368	1.648716	1.170810	2.029616	1.080583
Skewness	-0.228854	-0.028449	-1.575472	-1.323750	0.109236	-11.46273	-2.545753
Kurtosis	16.08598	7.880327	25.95127	19.43274	8.188908	272.3998	35.69172
Jarque-Bera	10694.35	1485.824	33475.98	17280.62	1682.409	4559726	68280.17
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	6.050616	38.31367	95.31927	-6.035827	38.32869	7.781113	34.26022
Sum Sq. Dev	816.1602	4098.322	1861.093	4066.524	2050.712	6162.537	1746.818
Observations	1497	1497	1497	1497	1497	1497	1497

Output generated from EViews

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Descriptive statistics are obtained using the differentiated daily returns data of the selected Emerging markets ESG Indices. From the above table it can be observed that S&P/ESG Egypt has the highest volatility of (2.029) followed by MSCI Korea of (1.65) and S&P B3 of (1.64), S&P China A 300 ESG (1.17), Nifty 100 ESG of (1.11), S&P/Hawkahmah of 1.080 and FTSE4 Bursa Malaysia of (0.73) have lower volatilities.

The selected ESG indices are not normally distributed since the probability value is more than 0.05.

Stationary tests

Table: Augmented Dickey–Fuller Test (ADF) Results for the Selected Emerging countries ESG Indices and first differences

	AT LEVEL			FIRST DIFFERENCE		
	t-statistic	p	Conclusion	t-statistic	p	Conclusion
S&P/B3 Index (BRAZIL)	-2.1154	0.2387	Non- stationary	-43.0369	0.0001	Stationary
FTSE4 GOOD BURSA MALAYSIA Index	-2.0219	0.2775	Non- stationary	-39.2590	0.0000	Stationary
NIFTY 100 ESG Index	-0.8333	0.9946	Non- stationary	-39.54038	0.0000	Stationary
S&P CHINA 300 Index	-2.4822	0.1200	Non- stationary	-36.88120	0.0000	Stationary
S&P/ESG EGYPT Index	-2.563801	0.1009	Non- stationary	-30.13755	0.0000	Stationary
S&P/HAWKAHMAH Index	-0.7286	0.8375	Non- stationary	-36.9997	0.0000	Stationary
MSCI KOREA ESG Index	-1.9257	0.3205	Non- stationary	-39.13871	0.0000	Stationary

Test results (Augmented Dickey – Fuller Test)

Hypothesis

H_0 (Null Hypothesis): the time series of the ESG Index Closing Prices has a unit root (non-stationary).

H_1 (Alternative Hypothesis): the time series of the ESG Index Closing prices does not have a unit toot (stationary).

Interpretation: when the probability is greater than 0.05 then the null hypothesis (H_0) can be accepted and the alternative Hypothesis (H_1) can be rejected and vice versa.

Since all the p-values (0.0000) are less than a commonly chosen significance level (like 0.05), the null hypothesis can be rejected (H_0) for all seven ESG indices. The data for all ESG indices exhibits stationarity after first order differencing.

The ADF test results suggest stationarity for all seven ESG indices at first order of difference.

The values fo T-statistic are negative. The higher negative value indicates the strong rejection of the hypothesis that there is a unit root. Hence, the time series of the variables has a unit root at level.

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Granger Causality test

Granger Causality test results, output generated from EViews 12

Pairwise Granger Causality Tests
Sample: 1 1497
Lags: 5

Null Hypothesis	Observation	f-statistic	Prob
LN_MSCI_KOREA_ESG_INDEX does not Granger Cause LN_FTSE4_GOOD_BURSA_MALA	1492	0.51008	0.7688
LN_FTSE4_GOOD_BURSA_MALA does not Granger Cause LN_MSCI_KOREA_ESG_INDEX		2.25442	0.0468
LN_NIFTY_100_ESG_INDEX does not Granger Cause LN_FTSE4_GOOD_BURSA_MALA	1492	5.23217	9.E-05
LN_FTSE4_GOOD_BURSA_MALA does not Granger Cause LN_NIFTY_100_ESG_INDEX		5.68128	3.E-05
LN_S_P_B3_INDEX__BRAZIL_ does not Granger Cause LN_FTSE4_GOOD_BURSA_MALA	1492	26.2032	2.E-25
LN_FTSE4_GOOD_BURSA_MALA does not Granger Cause LN_S_P_B3_INDEX__BRAZIL_		3.24170	0.0065
LN_S_P_CHIN_A_300_INDEX does not Granger Cause LN_FTSE4_GOOD_BURSA_MALA	1492	0.20607	0.9600
LN_FTSE4_GOOD_BURSA_MALA does not Granger Cause LN_S_P_CHIN_A_300_INDEX		1.57651	0.1636
LN_S_P_ESG_EGYPT_INDEX does not Granger Cause LN_FTSE4_GOOD_BURSA_MALA	1492	3.34532	0.0052
LN_FTSE4_GOOD_BURSA_MALA does not Granger Cause LN_S_P_ESG_EGYPT_INDEX		4.98675	0.0002
LN_S_P_HAWKAHMAH_INDEX does not Granger Cause LN_FTSE4_GOOD_BURSA_MALA	1492	3.15376	0.078
LN_FTSE4_GOOD_BURSA_MALA does not Granger Cause LN_S_P_HAWKAHMAH_INDEX		1.70648	0.1300
LN_NIFTY_100_ESG_INDEX does not Granger Cause LN_MSCI_KOREA_ESG_INDEX	1492	1.88429	0.0941
LN_MSCI_KOREA_ESG_INDEX does not Granger Cause LN_NIFTY_100_ESG_INDEX		4.17975	0.0009
LN_S_P_B3_INDEX__BRAZIL_ does not Granger Cause LN_MSCI_KOREA_ESG_INDEX	1492	31.9396	5.E-31
LN_MSCI_KOREA_ESG_INDEX does not Granger Cause LN_S_P_B3_INDEX__BRAZIL_		6.65378	4.E-06
LN_S_P_CHIN_A_300_INDEX does not Granger Cause LN_MSCI_KOREA_ESG_INDEX	1492	1.06377	0.3787
LN_MSCI_KOREA_ESG_INDEX does not Granger Cause LN_S_P_CHIN_A_300_INDEX		2.40104	0.0352
LN_S_P_ESG_EGYPT_INDEX does not Granger Cause LN_MSCI_KOREA_ESG_INDEX	1492	1.98919	0.0775

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LN_MSCI_KOREA_ESG_INDEX does not Granger Cause LN_S_P_ESG_EGYPT_INDEX		2.45683	0.0316
LN_S_P_HAWKAHMAH_INDEX does not Granger Cause LN_MSCI_KOREA_ESG_INDEX	1492	2.74451	0.0178
LN_MSCI_KOREA_ESG_INDEX does not Granger Cause LN_S_P_HAWKAHMAH_INDEX		1.28995	0.2655
LN_S_P_B3_INDEX__BRAZIL_ does not Granger Cause LN_NIFTY_100_ESG_INDEX	1492	21.2608	1.E-20
LN_NIFTY_100_ESG_INDEX does not Granger Cause LN_S_P_B3_INDEX__BRAZIL_		3.11170	0.0085
LN_S_P_CHIN_A_300_INDEX does not Granger Cause LN_NIFTY_100_ESG_INDEX	1492	1.21510	0.2995
LN_NIFTY_100_ESG_INDEX does not Granger Cause LN_S_P_CHIN_A_300_INDEX		1.65051	0.1436
LN_S_P_ESG_EGYPT_INDEX does not Granger Cause LN_NIFTY_100_ESG_INDEX	1492	4.71786	0.0003
LN_NIFTY_100_ESG_INDEX does not Granger Cause LN_S_P_ESG_EGYPT_INDEX		2.04171	0.0702
LN_S_P_HAWKAHMAH_INDEX does not Granger Cause LN_NIFTY_100_ESG_INDEX	1492	3.51018	0.0037
LN_NIFTY_100_ESG_INDEX does not Granger Cause LN_S_P_HAWKAHMAH_INDEX		2.50192	0.0289
LN_S_P_CHIN_A_300_INDEX does not Granger Cause LN_S_P_B3_INDEX__BRAZIL_	1492	0.41828	0.8363
LN_S_P_B3_INDEX__BRAZIL_ does not Granger Cause LN_S_P_CHIN_A_300_INDEX		3.75706	0.0022
LN_S_P_ESG_EGYPT_INDEX does not Granger Cause LN_S_P_B3_INDEX__BRAZIL_	1492	1.19103	0.3112
LN_S_P_B3_INDEX__BRAZIL_ does not Granger Cause LN_S_P_ESG_EGYPT_INDEX		2.38533	0.0363
LN_S_P_HAWKAHMAH_INDEX does not Granger Cause LN_S_P_B3_INDEX__BRAZIL_	1492	5.77029	3.E-05
LN_S_P_B3_INDEX__BRAZIL_ does not Granger Cause LN_S_P_HAWKAHMAH_INDEX		4.88650	0.0002
LN_S_P_ESG_EGYPT_INDEX does not Granger Cause LN_S_P_CHIN_A_300_INDEX	1492	2.49782	0.0291
LN_S_P_CHIN_A_300_INDEX does not Granger Cause LN_S_P_ESG_EGYPT_INDEX		0.82589	0.5312
LN_S_P_HAWKAHMAH_INDEX does not Granger Cause LN_S_P_CHIN_A_300_INDEX	1492	0.75347	0.5835
LN_S_P_CHIN_A_300_INDEX does not Granger Cause LN_S_P_HAWKAHMAH_INDEX		0.76730	0.5733
LN_S_P_HAWKAHMAH_INDEX does not Granger Cause LN_S_P_ESG_EGYPT_INDEX	1492	2.36181	0.0380
LN_S_P_ESG_EGYPT_INDEX does not Granger Cause LN_S_P_HAWKAHMAH_INDEX		1.74184	0.1220

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Interpretation

The results of Granger Causality test from the above table can be interpreted as follows:

There is an absence of causal relationship between:

S&P/CHINA A 300 Index and FTSE4 good Bursa Malaysia Index

S&P/CHINA A 300 Index and NIFTY 100 ESG index

S&P/Hawkahmah Index and S&P/CHINA A 300 Index

It can be observed that there is no causal relationship between these variables as their probability is greater than 0.05.

There is a unidirectional relationship between:

MSCI Korea ESG index and FTSE4 Bursa Malaysia

S&P/ESG EGYPT and FTSE4 Good Bursa Malaysia

S&P/Hawkahmah Index and FTSE4 Good Bursa Malaysia

NIFTY 100 ESG Index and MSCI Korea Index

S&P/CHINA A 300 Index and MSCI Korea Index

S&P/ESG EGYPT Index and MSCI Korea Index

S&P/Hawkahmah index and MSCI Korea Index

S&P/ESG EGYPT Index and NIFTY 100 ESG Index

S&P/Hawkahmah Index and NIFTY 100 ESG Index

S&P/CHINA A 300 Index and S&P/B3 Index

S&P/ESG EGYPT Index and S&P/B3 Index

S&P/ESG EGYPT Index and S&P/CHINA A 300 Index

S&P/Hawkahmah Index and S&P/ESG EGYPT

The probability values with E are not considered as they are insignificant values.

Findings and suggestions

Findings of the study

The empirical results of the study exhibited that, there is a long run relationship or co-integration between the selected Emerging countries ESG Indices namely, MSCI Korea ESG, FTSE4 Bursa Malaysia, S&P/ESG EGYPT, NIFTY 100 ESG, S&P/CHINA A 300, S&P/Hawkahmah, S&P/B3 Index as per trace and maximum eigenvalue tests using Johansen's cointegration test.

Test Conducted	Findings
Johansen's Cointegration test	The Johansen's cointegration test results suggest there is no cointegration between the countries as indicated in the tests.
Granger Causality test	The findings suggest that investors should be cautious when dealing with S&P/CHINA A 300 ESG, given its higher volatility compared to other indices like S&P/Hawkahmah Index, NIFTY

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	100 ESG index, FTSE4 good Bursa Malaysia Index. Moreover, the confirmation of normal distribution enhances the robustness of statistical analyses, bolstering confidence in market modelling and risk management strategies.
Descriptive statistics of the returns	The analysis of descriptive statistics reveals that S&P/CHINA A 300 exhibits the highest volatility among the selected emerging countries ESG indices, followed by S&P/Hawkahmah Index, NIFTY 100 ESG index, FTSE4 good Bursa Malaysia Index. Furthermore, the normal distribution assumption is supported for the ESG indices, enhancing the reliability of statistical inferences drawn from the data.
ADF	The comprehensive analysis indicates that all seven ESG indices exhibit stationarity after first-order differencing, supported by the ADF test. This suggests a stable long-term behaviour in the time series data, enhancing the reliability of forecasting and risk management strategies for these ESG indices.

Implications

Asia is considered as the hub of the world's emerging economies housing Japan, Hong Kong, Singapore, South Korea and Taiwan, which are already listed as the high-income economies by World Bank, whereas India and China are listed as lower middle-income and upper-middle-income economies, respectively. In fact, India and China, two of the region's largest economies, are experiencing massive surge in their economic development showing signs of becoming the global economic powers in the near future. The developing Asia had shown resilience towards Covid-19 and has a remarkable steady growth rate, in addition to its significant growth in intra-regional cross-border trade, financial and investment flows, a result of regional integration.

Studies showed that companies with robust ESG practices exhibited less volatility and better stock price performance compared to their peers, particularly in sectors most affected by the pandemic. Unrestricted movement of capital throughout the world has increased the expectations of the investors in terms of enhanced earning opportunities and diversified portfolio investments ultimately leading to stock market integration. However, the intensity of co- integration between stock markets decides whether a particular stock market provides diversification opportunities or not. The least integrated ones provide with the most diversification opportunities and the most integrated ones provide the least diversification opportunities (Palamalai S., 2013)). In fact, these days, the investors are keen in internationally diversifying their portfolios, thereby maximizing their returns and reducing risks (Bodie et al., 1999; Siddiqui, 2009; Tahir et al., 2013; Wong et al., 2004, 2005).

Conclusion

The world faced a significant downturn during the COVID-19 pandemic, following a series of crises that severely impacted economies. However, the emerging economies of the emerging countries demonstrated resilience, prompting this research to investigate stock market integration among key Asian economies during this period. The study analysed stock price data from January 2019 to September 2024, employing advanced statistical and econometric methods such as co-integration, and VAR Granger causality tests, stationary tests and Augmented Dicky fuller test to ensure accurate results.

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The findings indicated a positive influence of emerging countries indices on each other, with all indices showing positive correlations, although the strength of these correlations ranged from low to moderate. Moreover, only one bidirectional causality relationship was identified among the selected stock indices, while the others exhibited unidirectional causality. Notably, no co-integrating vectors were found among the selected stock markets, suggesting that the prices of these Emerging stock Markets were not co-integrated during the COVID-19 pandemic. In summary, the results indicate that global market participants have substantial diversification opportunities within Emerging stock Markets. The study highlights the individual behaviours of the selected stock markets in relation to one another during the COVID-19 pandemic, providing valuable insights for market participants, regulators, and policymakers to enhance their understanding of emerging stock market interlinkages and to make informed investment decisions during challenging economic times

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