

# Co Movements and Causation Effects of Sustainable Investment Indices of Asian Emerging Countries stock markets and World Sustainable Index: A Comparative Study

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**Abstract** - In the last few years, the introduction of socially responsible investment indices have increased, thanks to the global investors and fund managers, focusing on sustainable investment for obtaining possible returns with low risk. Hence the world stock exchanges actively promote sustainability and transparency activities in their stock markets. In this connection, the present study aims to investigate the co movement and causal effects between Asian emerging countries' stock market sustainable indices returns and world sustainable index (Dow Jones Sustainability Index returns) during the study period from 1<sup>st</sup> April 2013 to 31<sup>st</sup> March 2018. The daily price returns of sample sustainable indices were analysed by using Descriptive Statistics, Augmented Dickey Fuller Test, Correlation Analysis, Regression Analysis and Pair Wise Granger Causality Test. The results of the study revealed that the Dow Jones Sustainability index had influenced by Asian emerging countries' stock market indices. At the same time, NIFTY 100 ESG Index and SSE Socially Responsible Index had unidirectional relationship with Dow Jones Sustainability Index during the study period. Thus the study advises the socially responsible investors to consider the international sustainable activities while investing their money in listed companies of sample indices.

**Key Words:** Asian countries, Causal Effect, Co Movement, Stock Market, Sustainable Index.

**GEL Classification:** G01, G31, C580

## I. INTRODUCTION

Sustainable and Responsible Investment (SRI) Strategies have been gaining currency given the increasing awareness about environmental stability, socio-economic development and adherence to ethical standards. One such strategy, that has gradually gained popularity among investors, is Environmental, Social and Governance (ESG) based investing. The underlying principle, behind ESG based investing, lies in identifying and quantifying the intangible value possessed by socially responsible, environmentally friendly firms, with robust governance policies in place. Environmental, Social and Governance (ESG) theme is an effective portfolio selection strategy, under the broader theme of sustainable and responsible investment (SRI). Fund managers and investors can focus upon firms, with better ESG performance, to generate higher returns with lower company specific risk. ESG based investment strategy has gained popularity, across global investors, with emphasis on investment in companies which have sustainable and responsible business models. The underlying drive, behind

ESG theme based investing, lies in generating returns from socially responsible, environment friendly and ethical firms, by reducing the company specific risk associated with ESG controversies.

As per the sustainable stock exchanges 2018 report, in the last two years, the world's stock exchanges have been promoting sustainability and transparency activities in their markets. As of the third quarter of 2018, 78 stock exchanges were committed to promoting sustainable and transparent markets. In particular, the number of green or sustainability bond listing segments had tripled from five in 2016 to 15 in the third quarter of 2018, expanding rapidly in line with the exponential growth in the green bond market.

Continued growth in stock exchange engagement, with sustainability activities, indicates a market demand for more information on sustainability and a growing understanding of the materiality of ESG issues to world economy performance. Hence the present study focused on the Co movement between Asian Emerging Countries' Sustainable Indices and Dow Jones Sustainability Index, during the study period.

## II. REVIEW OF LITERATURE

There are several national and international researchers, who had studied the sustainable investment and the present study reviews their findings as follows.

Meir Statman (2000) compared the performance of socially responsible mutual funds (Domini social fund) and stock index (S&P 500), for the period of 1990-98. He found that socially responsible mutual funds' performance was better than stock index and other conventional mutual funds. Neutrality in the relationship between the indices is shown in the work of Hoti et al (2008), who noted the high level of correlation between conventional indices and socially responsible indices. Eduardo Ortas (2010) investigated the volatility level of socially responsible investment stock exchange indices in the Spanish market. Using GARCH models, the study found that compared to other indices, the SRI equity indices of Spanish markets recorded low volatility. Humprey et al (2012) stated that incorporating ESG into investment is part of responsible investment. Thus, from the investors' perspective, ESG analysis can be considered an additional tool to utilize, in addition to traditional financial analysis, the asset valuation and risk assessment, to determine a company's strengths and weaknesses. Fatemi and Fooladi (2013) clearly advised that investors and decision makers have to consider responsible investment strategies and to be aware of all costs and benefits economic, social and environmental, before investment in a project. Sudha. S (2014) tested the risk and return of Indian sustainable index and broad market indices. The study selected the S&P ESG India Index as a sustainable index and Nifty, S&P CNX 500 as broad market indices. The results of CAPM model and GARCH models, showed that S&P ESG India index's volatility was lower than the Nifty and S&P CNX 500. At the same time, the return of sustainable index was better than the other two broad market indices. Rajkumar, G. S. (2015) investigated the relationship between Indian stock market index daily returns and the three stock markets' indices daily returns of the ASEAN countries - Indonesia, Malaysia, and Singapore, during the study period 2004 - 2014. Using the Granger-causality and co-integration test, the study found that there was significant short-term unidirectional influence, from the Indian stock market to the three ASEAN countries stock markets while no long-term relation (no co-integration) was found between the Indian equity market with that of three ASEAN countries viz. Indonesia, Malaysia and Singapore equity markets. Tomo, A., and Landi, G. (2016) highlighted the necessity for a stronger ethical foundation, to be taken into investment decision-making processes, in order to transform the formal financial orientation to short term benefit. On the basis of socially responsible investment, Janusz Brzeszczynski (2016) compared the performance of

international energy and resource companies' stocks, with benchmark indices, for a period of ten years. The study found that socially responsible stock investments' annual average performance was higher than that of benchmark indices. Priyanka Garg (2017) developed the sustainability index with the Indian companies, using socially responsible investment methodology, for constructing the sustainable investment. When this methodology was tested against BSE 500 companies. it was proved that socially responsible investment can be taken as a standard framework, along with the methodology. Drezewski et al (2017) observed that the difference between the TI and SRI was due to the structural composition of indices. Henry Mynhardt (2017) analysed the efficiency of traditional stock market indices and socially responsible stock market indices. The results of the study showed that efficiency of socially responsible investment indices was low, especially the efficiency of Dow Jones Sustainability Index was very low compared to traditional index.

Majority of earlier researchers analysed sustainable investment indices, on the basis of efficiency. Some studies only compared the performance of Dow Jones Sustainability Index with other traditional stock exchanges indices. But no one analysed the Co Movement or Causation effect of Asian emerging countries' stock markets' sustainable indices on Dow Jones Sustainability Index. Hence the study aims to analyze the causal effect of Asian emerging countries' sustainable indices on world sustainable index that is, Dow Jones Sustainability Index.

## III. OBJECTIVES OF THE STUDY

The main objective of the present study was to investigate the co movements and causation effect of Asian emerging countries' sustainable indices on world sustainability index (DJSI) during the study period of April 2013 to March 2018. For this purpose, the study formulated the following objectives.

- To test normality and unit root of daily returns of Asian emerging countries' sustainable indices and Dow Jones Sustainability Index.
- To know the correlation between Asian emerging countries' sustainable indices and Dow Jones Sustainability Index.
- To test the impact of Asian emerging countries' sustainable indices on Dow Jones Sustainability Index.
- To analyse the co movements and causation effect of Asian emerging countries' sustainable indices on Dow Jones Sustainability Index.

**Hypotheses of the Study**

**NH01:** Daily returns of sample Asian emerging countries’ stock markets’ sustainable indices and Dow Jones Sustainability Index (DISI World) are not normally distributed.

**NH02:** Daily returns of sample Asian emerging countries’ stock markets’ sustainable indices and Dow Jones Sustainability Index (DISI World) are not stationary.

**NH03:** There is no correlation between daily price returns of Asian emerging countries’ sustainable indices and Dow Jones Sustainability Index.

**NH04:** Daily price returns of sample Asian emerging countries’ sustainable indices do not influence the Dow Jones Sustainability Index.

**NH05:** There is no co movement or causation effect between sample Asian emerging countries’ sustainable indices and Dow Jones Sustainability Index.

**IV. METHODOLOGY OF THE STUDY**

The methodology part covered the sample selection, sources of data, period of the study and statistical tools used in the study.

**Sample Selection**

In the recent years, the global investors have been focusing on socially responsible investments. Hence the present study proposed to analyse the causation effect of Asian emerging countries’ sustainable indices on world sustainable Index. As per the Morgan Stanley Capital International (MSCI), the study selected nine Asian emerging countries for analysis. Among those countries, only five countries, namely, China, India, Korea, Malaysia and Thailand had initiated sustainable activities and their stock markets were listed in the United Nations Sustainable Stock Exchange initiatives during the study period. The last five years daily price data were available only for China, India, Korea and Malaysia. Hence the study finally selected those four Asian emerging countries as sample countries and Dow Jones Sustainability Index was considered as the sample of World Sustainable Index. The list of sample Asian emerging countries’ stock markets’ sustainable index are presented in the Table – 1.

**Table – 1: List of Sample Stock Market and Indices**

Sample Country	Sample Stock Market	Sample Indices
China	Shanghai Stock Exchange	SSE Social Responsibility Index
India	National Stock Exchange of India	Nifty 100 ESG Index
Korea	Korea Exchange	KRX SRI Index
Malaysia	Bursa Malaysia	FTSE Good Bursa Malaysia Index

**Source:** www.msci.com and www.sseinitiative.org

**Sources of Data**

The research was mainly based on secondary data and the daily prices of sample sustainable investment indices were collected from the Yahoo finance, Investing.com and official website of respected stock markets. The other data were collected from various websites, journals, magazine etc.

**Period of Study**

Since sustainability and transparency activities of world stock exchanges have increased only in the last few years, the study considered 1<sup>st</sup> April 2013 to 31<sup>st</sup> March 2018 as sample period for the analysis.

**Statistical tools used in the study**

The present paper used the following statistical tools, for testing the hypotheses of the study.

- a) **Descriptive Statistics** – It was used for analyzing the nature and normality of the daily returns of emerging Asian countries stock markets’ sustainable indices and Dow Jones Sustainability Indices, during the study period.
- b) **Augmented Dickey-Fuller test** – This test helped to analyse the unit root / stationarity of the daily returns of emerging Asian countries stock markets’ sustainable indices and Dow Jones Sustainability Indices, during the study period.
- c) **Correlation Analysis** – It was used for testing the correlation between emerging Asian countries stock markets’ sustainable indices and Dow Jones Sustainability Indices, during the study period.
- d) **Regression Analysis** – This test helped the researchers to know the influence of emerging Asian countries stock markets’ sustainable indices on Dow Jones Sustainability Indices, during the study period.
- e) **Pair wise Granger Causality Test** – To identify the co movement and causation effect between emerging Asian countries stock markets’ sustainable indices and Dow Jones Sustainability Indices, the study used this test.

**Limitations of the Study**

The study suffers from the following limitations.

- The present study focused only on the sustainable indices of Asian emerging countries’ stock markets.
- The period of the study was limited to five years from 1<sup>st</sup> April 2013 to 31<sup>st</sup> March 2018.

- The limitation was associated with statistical tools the limitations of the used in this study.

## V. RESULTS AND DISCUSSION

The results covered the analysis of Descriptive statistics, Augmented Dickey–Fuller (ADF) test, Correlation Analysis, Regression analysis and Pair Wise Granger Causality Test, for daily price returns of sample Asian emerging countries’ sustainable indices and Dow Jones Sustainability Index.

### a) Normality and Unit Root Test for Daily Price Returns of Sample Asian emerging countries sustainable indices and Dow Jones Sustainability Index.

The results of descriptive statistics, for daily returns of sample Asian sustainable indices and Dow Jones Sustainable Index, are illustrated in the Table – 2. It is to be noted that mean value of FTSE Good Bursa Malaysia Index was -0.0000884 and it showed that this index performed with negative return, during April 2013 to March 2018. But remaining sample indices, namely, Dow Jone Sustainable Index (0.000201), KRX SRI Index (0.000205), Nifty 100 ESG Index (0.000487) and SSE Social Responsibility Index (0.000163), recorded high mean return during the study period. The standard deviation measured the market unpredictability of daily returns of sample indices and the standard deviation values assumed high risk in SSE Social Responsibility Index with the value of 0.014132, followed by FTSE4 Good Bursa Malaysia Index (0.010684), Nifty 100 ESG Index (0.009386), KRX SRI Index (0.008941) and Dow Jone Sustainable Index (0.007593). While comparing the sample indices, Indian sustainable index, namely, NSE 100 ESG performed with high mean return and moderate risk, followed by KRX SRI

Index and Dow jone Sustainable Index, during the study period. Skewness values of all the sample indices, except KRX SRI index, were negative and the kurtosis values were greater than three for all the sample indices, which implied that daily returns of sample indices were leptokurtic. Further, Jarque Bera values of daily returns of sample Asian sustainable indices and world sustainable index (DJSI) were normally distributed during the study period. Hence the Null Hypothesis ( $NH_0_1$ ), Daily returns of sample Asian emerging countries’ stock markets’ sustainable indices and Dow Jones Sustainability Index (DISI World) are not normally distributed, during the study period, was rejected. In other words, the distribution of sample Asian sustainable Index and DJSI data was normal.

The results of Augmented Dickey Fuller (ADF) Test, for daily returns of sample Asian countries and world sustainable stock indices, during the study period April 2013 to March 2018, are presented in the Table – 3. The Augmented Dickey Fuller Test values clearly indicated that all sample sustainable indices attained stationarity at level difference because ADF test values for Dow Jone Sustainable Index (-30.9577), FTSE4 Good Bursa Malaysia Index (-34.92518), KRX SRI Index (-35.18023), NIFTY 100 ESG Index (-31.68241) and SSE Social Responsibility Index (-10.67448) were less than the test critical values of 1% , 5% and 10% levels. The probability values of all the sample indices were also significant at 5% level and hence the study confirmed that the daily prices of sample Asian sustainable stock indices and Dow Jone Sustainable index were stationary. Hence reject the null hypothesis ( $NH_0_2$ ), Daily returns of sample Asian emerging countries’ stock markets’ sustainable indices and Dow Jones Sustainability Index (DISI World) are not stationary during the study period’.

**Table – 2 Results of Descriptive Statistics for daily returns of sample Asian emerging countries Sustainable stock indices and World Sustainable Index (DJSI).**

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
<b>DJSI</b>	0.000201	0.007593	-1.01999	10.80915	3544.933
<b>FTSE4 GOOD BURSA MALAYSIA</b>	-0.0000884	0.010684	-20.4764	601.8152	18808405
<b>KRX SRI</b>	0.000205	0.008941	1.49747	30.12524	36554.73
<b>NIFTY 100 ESG INDEX</b>	0.000487	0.009386	-0.49442	5.870406	473.525
<b>SSE SOCIAL RESPONSIBILITY Index</b>	0.000163	0.014132	-1.50532	14.15026	7075.348

**Source:** Yahoo finance, Investing.com and official website of respected stock markets, Computed in E-Views.

**Table – 3 Results of Augmented Dickey-Fuller test for daily returns of sample Asian emerging countries Sustainable stock indices and World Sustainable Index (DJSI)**

	Augmented Dickey-Fuller test statistic	Test critical values			Prob.
		1% level	5% level	10% level	
DJSI	-30.9577	-2.56674	-1.94107	-1.61654	0.000
FTSE4 GOOD BURSA MALAYSIA	-34.92518	-2.56681	-1.94108	-1.61653	0.000
KRX SRI	-35.18023	-2.56693	-1.94109	-1.61652	0.000
NIFTY 100 ESG INDEX	-31.68241	-2.56684	-1.94108	-1.61653	0.000
SSE SOCIAL RESPONSIBILITY Index	-10.67448	-2.5668	-1.94108	-1.61653	0.000

Source: Yahoo finance, Investing.com and official website of respected stock markets, Computed in E-Views.

**b) Correlation Analysis for Daily Price Returns of Sample Asian emerging countries sustainable indices and Dow Jones Sustainability Index.**

Table – 4 displays the results of correlation analysis among sample sustainable indices’ daily returns. It is to be noted that all the sample indices were positively correlated with other indices, except KRX SRI Index. The Korean Sustainable Index, namely, KRX SRI Index was negatively correlated with world sustainable represent index (Dow Jones Sustainable Index) and FTSE4 Good Bursa Malaysia Index, during the study period. FTSE4 Good Bursa Malaysia Index and SSE Social Responsibility Index were significantly correlated with the world sustainable index (DJSI) during the study period while rest of the indices, namely, KRX SRI Index and Nifty 100 ESG Index were not significantly correlated with DJSI. Hence the present study reject the null hypothesis (H<sub>0</sub>), ‘Daily price returns of Asian emerging countries’ sustainable indices do not correlate with Dow Jones Sustainability Index, during the study period’.

**Table – 4 Results of Correlation Analysis for daily returns of sample Asian emerging countries’ Sustainable stock indices and World Sustainable Index (DJSI).**

	DJSI	FTSE4 GOOD BURSA MALAYSIA	KRX SRI	NIFTY 100 ESG INDEX	SSE SOCIAL RESPONSIBILITY Index
DJSI	1				
FTSE4 GOOD BURSA MALAYSIA	0.164787**	1			
KRX SRI	-0.02211	-0.01978	1		
NIFTY 100 ESG INDEX	0.007652	0.000684	0.009784	1	
SSE SOCIAL RESPONSIBILITY Index	0.224858**	0.111387**	0.079147**	0.011041	1

\*\*Correlation is significant at the 0.01 level (2-tailed).

Source: Yahoo finance, Investing.com and official website of respected stock markets, Computed in SPSS.

**c) Regression Analysis for Daily Price Returns of Sample Asian emerging countries sustainable indices and Dow Jones Sustainability Index.**

The results of regression tests, for the sustainable indices of sample Asian countries stock market and world represent sustainable index (DJSI), are illustrated in the Table – 5. The impact of Asian sustainable indices on Dow Jones Sustainable Index is displayed in the Table. In the study, Asian sustainable stock indices (FTSE4 Good Bursa Malaysia Index, KRX SRI Index, Nifty 100 ESG Index, SSE Social Responsibility Index) were considered independent variables and Dow Jones Sustainable Index Considered as the dependent variable.

The T –Test values indicated that FTSE4 Good Bursa Malaysia Index, SSE Social Responsibility Index and Nifty 100 ESG Index positively influenced the Dow Jones Sustainable Index, with values of 4.959, 7.464 and 0.198 respectively. The KRX SRI Index negatively influenced Dow Jones Sustainable Index. Among the sample Asian sustainable indices, SSE social responsibility index highly influenced the Dow Jones Sustainable Index.

However, there was negative influences between the KRX SRI Index and Dow Jones Sustainable Index. The results of model summary indicated the overall analysis of regression analysis. The regression value of (R-Value) (0.072), Adjusted R – Square Value of (0.068) and F statistic value were greater than three (22.637) and Durbin-Watson Test value was near two (1.759) and it

was significant. Hence the null hypothesis  $H_0$ , Daily price returns of sample Asian emerging countries' sustainable indices do not influence the Dow Jones Sustainability Index during the study period, was rejected.

**Table – 5 Results of Regression Analysis for daily returns of sample Asian emerging countries Sustainable stock indices and World Sustainable Index (DJSI)**

Coefficients							
	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
	B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
(Constant)	0	0		0.942	0.346	0	0.001
KRX SRI	-0.031	0.024	-0.036	1.281	0.2	-0.079	0.017
FTSE4 Good Bursa Malaysia	0.099	0.02	0.14	4.959	0	0.06	0.139
SSE Social responsibility	0.115	0.015	0.212	7.464	0	0.085	0.145
Nifty 100 ESG Index	0.005	0.023	0.006	0.198	0.843	-0.041	0.05
Dependent Variable: DJSI							
Model Summary <sup>b</sup>							
R	R Square	Adjusted R Square	Std. Error of the Estimate	F Change	df 1	df2	Durbin-Watson
.268a	0.072	0.068	0.007456	22.637	4	1173	1.759
a Predictors: (Constant), Nifty 100 ESG Index , FTSE4 Good Bursa Malaysia, KRX SRI, SSE Social responsibility							
b Dependent Variable: DJSI							

**Source:** Yahoo finance, Investing.com and official website of respected stock markets, Computed in SPSS.

**d) Pair Wise Granger Causality Test for Daily Price Returns of Sample Asian emerging countries sustainable indices and Dow Jones Sustainability Index.**

The Pair wise Granger Causality Test was administered for indentifying the causal relationship between sample Asian sustainable stock indices and Dow jones sustainable stock indices. The Table – 6 enumerates the results of Granger Causality Test, from the values of F Statistic. Only unidirectional causal relationship was found between DJSI and Nifty 100 ESG Index (3.19249), DJSI and SSE Social Responsibility Index (3.86804). The rest of the two indices, namely, FTSE4 Good Bursa Malaysia Index and KRX SRI Index did not record any causal relationship with DJSI, during the study period. The probability value for the F - statistics also proved unidirectional causality during the study period. Hence the null hypothesis,  $H_0$ , 'There is no Co movement or causation effect between sample Asian emerging countries' sustainable indices and Dow Jones Sustainability Index, during the study period', was rejected. From the results, the study found that the movement of daily returns of Nifty 100 ESG Index and SSE Social Responsible Index was based on the movement of DJSI's price return, during the study period.

**Table – 6 Results of Pair wise Granger Causality Test for daily returns of sample Asian emerging countries Sustainable stock indices and World Sustainable Index (DJSI).**

Null Hypothesis	F-Statistic	Prob.	Results
FTSE4 GOOD BURSA MALAYSIA does not Granger Cause DJSI	0.10233	0.9027	Accepted
DJSI does not Granger Cause FTSE4 GOOD BURSA MALAYSIA	0.41351	0.6614	Accepted
KRX SRI does not Granger Cause DJSI	0.37205	0.6894	Accepted
DJSI does not Granger Cause KRX SRI	0.909	0.4032	Accepted
NIFTY 100 ESG INDEX does not Granger Cause DJSI	1.32824	0.2653	Accepted
DJSI does not Granger Cause NIFTY 100 ESG INDEX	<b>3.19249</b>	<b>0.0414</b>	<b>Rejected</b>
SSE SOCIAL RESPONSIBILITY does not Granger Cause DJSI	0.01355	0.9865	Accepted
DJSI does not Granger Cause SSE SOCIAL RESPONSIBILITY	<b>3.86804</b>	<b>0.0211</b>	<b>Rejected</b>

Source: Yahoo finance, Investing.com and official website of respected stock markets, Computed in E-Views.

## VI. CONCLUSION AND IMPLICATIONS

The present study was focused on the co movement and causation effect between emerging Asian countries' stock markets sustainable indices and Dow Jones Sustainability Index during the study period from 1<sup>st</sup> April 2013 to 31<sup>st</sup> March 2018. The results of econometric tools, namely, Descriptive statistics, Augmented Dickey Fuller Test, Correlation Analysis, Regression Analysis and Pair Wise Granger Causality Test confirmed that the Asian emerging stock market sustainable indices experienced co movement with the world sustainable index, namely, Dow Jones Sustainability Index. The Descriptive statistics and Augmented Dickey Fuller Test confirmed that daily prices of Asian emerging countries' stock markets sustainable indices, namely, FTSE4 Good Bursa Malaysia index, KRX SRI Index, Nifty 100 ESG Index, SSE Social responsibility Index were normally distributed and attained stationarity at level difference. Hence the data were eligible for further analysis. It is to be noted from the correlation analysis, the FTSE4 Good Bursa Malaysia Index, Nifty 100 ESG Index and SSE Social Responsibility Index correlated with Dow Jones Sustainability Index. In other words, Dow Jones Sustainability Index performance or movements highly correlated with those three sustainable indices during the study period. Regression analysis revealed that FTSE4 Good Bursa Malaysia Index, SSE Social Responsibility Index and Nifty 100 ESG Index had positively influenced the Dow Jones Sustainability Index and among these indices, SSE Social Responsibility Index highly influenced the Dow Jones Sustainable Index during the study period. Finally, the study employed Pair Wise Granger Causality Test and the results showed that there was unidirectional relationship between Nifty 100 ESG Index and DJSI, SSE Social responsibility index and DJSI during the study period. The remaining two sample indices, namely, FTSE4 Good Bursa Index and KRX SRI Index did not have any bidirectional or unidirectional relationship with DJSI during the study period. In short, these results confirmed that the daily price returns of world sustainable index (Dow Jones Sustainability Index) was influenced by the Asian emerging stock market sustainable indices and some indices recorded causal effect and co movement with Dow Jones Sustainability Index during the study period. Hence the study recommended to sustainable investors to consider the international sustainability and transparency activities while investing their money in listed companies of sustainable index. The study also suggested that the initiators of sustainability indices may give more awareness programmes related to the socially responsible investments for obtaining more investments from the public.

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