EFFECT OF VOLATILITY OF SUSTAINABLE INDICES ON SHARE PRICE OF SELECT INDICES OF BOMBAY STOCK EXCHANGE

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ABSTRACT

According to the reports of world economic forum, India has proposed to reach zero emission by 2070 and 50 percent of energy from renewable sources by 2030. Developing sustainable development goals and aiming towards a sustained environment has made its way towards sustained investment, the investment made in clean energy is need for the hour as a global scenario. These forms of investments are launched at different intervals through the stock market Greenex indices in 2013, Carbonex in 2015 and ESG in 2017, which are considered sustainable indices under BSE for environmental protection in accordance with controlling carbon and green house gases leading to global warming and to increase the use of renewable source, this study has been carried to understand the effect and fluctuation of these indices on the indices such as energy, oil & gas and power which are directly connected to energy and resources. The analysis has been conducted using pairwise granger causality, ARCH and GARCH to identify the effect of volatility caused by these sustainable indices on the selected indices and also its effect on the overall indicating indices of BSE. The results are proved significantly concluding that there is cause and effect with fluctuations caused by the sustainability indices on the selected indices which is reflected in the changes in the share prices of the indices is a clear indication.

KEYWORDS: *Cause, Effect, Greenex, Carbonex, ESG, Energy, Oil And Gas, Power, BSE500 And BSE Sensex, Effect Of Volatility.*

INTRODUCTION

Top stocks from the S&P Global BMI are included in the Dow Jones Sustainability World Index. These stocks are chosen based on economic, environmental, and social characteristics. The United Nations Development Programme (UNDP) Human Development Index (HDI), the Global Footprint Network and its partner organizations' ecological footprint assessment, the Environmental Sustainability Index (ESI), and the experimental Environmental Performance

Index (EPI) are some of the notable metrics that influenced this choice. There are several benefits to sustainability reporting, including improved risk management tactics, cost and savings optimization, decision-making process simplification, and enhanced corporate reputation and trustworthiness**.**

The survey stated that, in accordance with the Working Group's recommendations, a framework for educating NPOs and FPEs about the SSE-mandated disclosure requirements pertaining to financials, governance, and performance as well as details about social impact, social audits, and information repositories, among other things, must be developed.According to the report, eight mutual funds focused on environmental, social, and corporate governance (ESG) were introduced in India as of December 24, 2020. SEBI published guidelines on green bonds in 2017, including the listing of green bonds on Indian stock exchanges, in an effort to encourage the issuing of green bonds in India. Introduction of green indices: S&P BSE 100 ESG Index (in 2017), MSCI ESG India (in 2013), and S&P BSE CARBONEX (in 2012). In 2020, the total amount of green bonds issued globally surpassed $1 trillion USD. According to the poll, "green bond issuance in the first half of 2020 slowed down from 2019 despite overall growth in the global bond markets."

Review of Literature

Dr.Renu Choudhary and Vandana Jain (2018) In order to help investors make better informed decisions about India's green theme, BSE introduced BSE-GREENEX, the country's first environmentally friendly stock index. It uses carbon emissions to gauge how well the business is performing. Based on turnover, market size, and a minimum carbon footprint, the Index consists of 20 equities. The creation of the index and the GREENEX idea are explained in this publication. In order to determine how stock market fluctuations, affect GREENEX, a comparison of SENSEX and GREENEX is conducted.

Ravneet Kaur (2018) This study aims to provide a detailed discussion of one such unique step that our country has taken in this direction: the BSE GREENEX, India's first Green Index and the 25th dynamic BSE index that evaluates stocks' carbon performance based on quantitative performance. The report also includes a list of some of the top green stocks on the Indian Capital Market along with a timeline of their results.

Tripathi and Kaur (2021) Noted that in emerging nations, the sustainable strategy might offer investors a secure investment vehicle in times of hardship. To the best of our knowledge, however, there are very few studies on the state of investments in India taking into account environmental and energy-related challenges in light of the UN-declared PRI. Our work is an attempt to close this significant research gap on the situation of green investing in India today in comparison to energy-intensive, carbon-emitting investments.

Debabrata Mukhopadhyay and Nityananda Sarkar (2021) Furthermore, in the context of the GARCH-in-mean model, the two green indices and BSESENSEX exhibit a large presence of risk premium, but the risk premium for the two carbon-emitting energy indices is negligible. Thus, all things considered, the study concludes that certain green funds, such the ones that represent BSE Carbonex, beat the benchmark stock index for investors, BSESENSEX, and the two energy indices that represent regular funds in India. A cursory examination of the risk and return term structure supports the BSE Carbonex green investment index. The results of this research thus

support the adoption of carbon-efficient practices by larger Indian businesses, even after taking into account the governance, social, and environmental implications of responsible investing.

Swati Sharma (2022) The performance of the BSE GREENEX is examined in this study. Analysis of the performance has also been done for the pre- and post-COVID periods. The outcome implies that returns have been consistent throughout time, and the index's post-covid performance has outperformed its pre-covid performance. The study shows that incorporating sustainable finance not only attracts greater profit but also stabilizes the financial market and economy because the post-COVID return outperforms the pre-COVID return.

Swagato Roy Chowdhury(2023) With regard to the two green indices of the Bombay Stock Exchange (BSE), CARBONEX and GREENEX, this study has sought to assess the state of the economic recovery. Up until July 20, 2021, these indices have been compared during the lockdown and unlock down periods. This study looked at whether there were any appreciable differences in the indices during the lockout and unlocking periods. An increase in these values would encourage greater investment in the Indian stock market going forward, even in the face of additional moderate COVID waves and partial lockdowns. A high mean variance would show progress in sustainable corporate operations since the lockdown period. The groups' one-way relationship An ANOVA has been conducted to see if the aforementioned phases show notable variations in the means of the GREENEX and CARBONEX indexes. The expectation of Indian investors on the post-COVID economic recovery will be enhanced by a notable deviation.

Statement of the Problem

India being one of the largest economies and fastest growing economies, with large number of industries, is third global level greenhouse gases emitter as per 2011 followed by China and USA, which is the main intention to legally obligate the aim towards reducing the carbon and green house gas emissions with respect to Kyoto protocol aiming to reduce by 20-25 percent. Country like is has taken measures through socially responsible investment by launching indices concentrating on lowering the emissions by making investments in sustainability indices such as Greenex, Carbonex and ESG focusing on the sustainable investments, the current study also focuses on understanding the effect and cause of these indices on the selected indicators indices subject to energy and natural resources. The study helps in investigating the effect of volatility on the selected indicator indices in long and short term with the help of suitable tools such as pairwise granger, ARCH and GARCH. And the results are found to be relatable.

The above problem is discussed with the help of research question:

- How will be the future trend of the selected sustainable indices in Bombay stock exchange.

- Is there any cause and effect of these sustainable indices on the selected indices of Bombay stock exchange

- Whether sustainable indices cause any effect of volatility on the share price of selected indices in Bombay stock exchange.

Objectives of the Study

- To examine the future trends of share price of select sustainable indices and share price of select indices of Bombay stock exchange in India.

- To study the cause and effect of share price of select sustainable indices on share price of select indices of Bombay stock exchange in India.

- To elucidate the effect of volatility of share price of select sustainable indices on share price of select indices of Bombay stock exchange in India.

Hypothesis of the Study

- There is no significant cause and effect of share price of select sustainable indices on share price of select indices of Bombay stock exchange in India.

- There is no significant effect of volatility of share price of select sustainable indices on share price of select indices of Bombay stock exchange in India.

Research Methodology

The study is found to be analytical. **Source of Data**

The source of information is gathered from the official website of Bombay stock exchange. They are secondary source of information and other relevant data are collected from the journal, news articles and official reports of Government of India.

Period of Study

The period of study covers five years from 2018-2022 monthly data has been taken for analyzing the study.

Tools used for the study

The gathered information is analyzed using the statistical tools such as forecast analysis, pairwise granger causality, ARCH and GARCH model.

Analysis and Interpretation

Analysis of forecast of share prices of select indices in Bombay Stock Exchange with

Year	Greenex	Carbon	ESG	Power	Oil and Gas	Energy	BSE500	SENSEX
2018	33437.41	444434.3	41813.19	512787.9	3569740	1037370	3613783.86	8708317.47
2019	32889.2	460474.5	43903.03	477159.5	3522537	1156118	3642328.05	9397822.94
2020	32447.8	458852.5	45404.65	426664.7	3208026	1348074	3667023.01	9568525.73
2021	49003.58	654664.9	66153.71	702787.3	4074111	1718034	5374475.72	13341294.9
2022	55465.76	707932.3	71755.39	1096876	4701375	2035663	5838311.94	14344937.6
2023	58700.07	761627.6	78446.52	1061396	4659611	2226603	6281545.66	15637193.4
2024	68093.2	112037.1	89763.97	1304582	5163380	2545466	7195654.13	17634500.8
2025	77038.27	796328.4	100608.3	1552795	5710163	2845774	8060701.74	19633645.1
2026	82269.22	847271.4	107420.9	1716004	5981961	3103893	8569076.11	20880593.4
2027	89896.84	352650.8	117646.8	1865227	6326815	3378169	9361263.24	22746503
2028	98170.38	663624.6	127594.6	2105726	6814283	3678448	10153505.3	24545900.7
2029	104997.5	-232655	136416.8	2283282	7174857	3949858	10832919.3	26168925.9
2030	112020.3	3237214	145474.7	2459816	7530129	4226045	11534152.4	27815874.3
2031	119851.7	-4209036	155374.1	2657714	7948923	4512081	12310725.9	29619454.9
2032	127115.2	9347589	164501.8	2856072	8347020	4793546	13022384.9	31284095

respect to sustainability

Table 1

Source: computed using excel

The performance of selected indexes on the Bombay Stock Exchange is forecasted over the next 10 years and is shown in the following table for the years 2018–2022. Of particular note is the Greenex indexes' persistent rising trend in share prices within the given time frame. After initially rising, the Carbonex indices show a fall in 2029 and 2031, which suggests that the price of Carbonex shares has fluctuated. On the other hand, the share prices of the ESG indices are expected to continue rising. Furthermore, the BSE's energy, power, and oil & gas indices, which highlight renewable energy sources, show a continued growth prognosis. Lastly, there has been an overall rise in share prices as seen by the Bombay Stock Exchange's major indices, the BSE500 and BSE Sensex.

Pairwise granger causality between share price of select sustainable indices and select indices of Bombay stock exchange in India

Table 2

Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Prob.
GREENEX does not Granger Cause CARBON		23.8329	**0.0004**
ESG does not Granger Cause GREENEX	58	1.02336	0.3664
GREENEX does not Granger Cause ESG		17.0513	**0.0002**
ENERGY does not Granger Cause GREENEX	58	1.42211	0.2503
GREENEX does not Granger Cause ENERGY		7.79598	**0.0011**
OIL_AND_GAS does not Granger Cause GREENEX	58	2.02455	0.1421
GREENEX does not Granger Cause OIL_AND_GAS		16.4244	**0.0003**
POWER does not Granger Cause GREENEX	58	0.54266	0.5844
GREENEX does not Granger Cause POWER		12.7028	**0.0003**
ESG does not Granger Cause CARBON	58	4.25706	**0.0193**
CARBON does not Granger Cause ESG		4.21757	**0.0200**
ENERGY does not Granger Cause CARBON	58	1.71769	0.1893
CARBON does not Granger Cause ENERGY		0.63671	0.5330
OIL_AND_GAS does not Granger Cause CARBON	58	1.14562	0.3258
CARBON does not Granger Cause OIL_AND_GAS		2.52387	0.0897
POWER does not Granger Cause CARBON	58	0.95248	0.3923
CARBON does not Granger Cause POWER		0.89848	0.4133
ENERGY does not Granger Cause ESG	58	1.15841	0.3218
ESG does not Granger Cause ENERGY		0.47288	0.6258
OIL_AND_GAS does not Granger Cause ESG	58	1.52805	0.2264
ESG does not Granger Cause OIL_AND_GAS		3.04017	0.0562
POWER does not Granger Cause ESG	58	0.77989	0.4636
ESG does not Granger Cause POWER		1.40092	0.2553
OIL_AND_GAS does not Granger Cause ENERGY	58	1.66848	0.1983
ENERGY does not Granger Cause OIL_AND_GAS		2.73848	0.0738
POWER does not Granger Cause ENERGY	58	0.80056	0.4544
ENERGY does not Granger Cause POWER		1.45230	0.2432
POWER does not Granger Cause OIL_AND_GAS	58	6.55605	**0.0029**
OIL_AND_GAS does not Granger Cause POWER		0.79927	0.4550

Source: computed using EViews

The pairwise Granger causality test results on the share prices of particular sustainability indices and other energy-related indices are explained in the above table. Interestingly, it is discovered that the Granger cause and aid in the prediction of the share prices of Carbonex indices are shared by the Greenex indices. On the other hand, the idea that the share price of Greenex indices is influenced by the price of ESG indices is unsupported by any data. Moreover, it is found that there is a reciprocal relationship between the share prices of Greenex indices Granger and ESG indices; in the same way, the share prices of Greenex indices Granger and energy and

oil & gas indices are caused by each other. Furthermore, the Granger share price of Greenex indices is a direct cause of the shareFurthermore, the price of electricity indices is determined by the Granger share price of Greenex indices, and the price of Carbonex indices is determined by the Granger share price of ESG indices. The hypothesis is rejected as a consequence of the Granger causality test results, which show a causal relationship between the share prices of sustainable indices and certain energy indices, such as those for power, oil & gas, and energy.

Analysis of ARCH and GARCH Model for share price of Greenex Indices and Share price of select indices of Bombay stock exchange in India

Table 3

Least square for share price of Greenex Indices and Share price of select indices of Bombay stock exchange in India

Dependent Variable: GREENEX				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1106.229	364.8432	3.032067	0.0037
ENERGY	**0.011847**	0.002359	5.021193	**0.0000**
OIL_AND_GAS	**-0.000989**	0.001843	-0.536885	**0.5935**
POWER	**0.021552**	0.004838	4.455141	**0.0000**
R-squared	0.884696	Mean dependent var		3387.396
Adjusted R-squared	0.878519	S.D. dependent var		853.2632
S.E. of regression	297.3979	Akaike info criterion		14.29236
Sum squared resid	4952950.	Schwarz criterion		14.43198
Log likelihood	-424.7708	Hannan-Quinn criter.		14.34697
F-statistic	143.2237	Durbin-Watson stat		0.918049
Prob(F-statistic)	0.000000			

Source: computed using EViews

A simple least squares regression involving the share prices of Greenex Indices and a few selected indices of the Bombay Stock Exchange in India is thoroughly analyzed in the table. The correlation coefficient between the Greenex indexes and the share prices of electricity and energy is positive, suggesting a comparatively weak association. On the other hand, the oil and gas index share prices have a negative coefficient, indicating a negative association.While the T-statistics for oil and gas are negative, indicating an unacceptable scenario, the T-statistics value for the share prices of the energy and power indices exceeds 2, indicating a satisfactory result. Furthermore, the p-value is significant for the energy and power index share prices but not for the oil and gas index share prices. As a result, there appears to be a relationship between the Greenex indices and the share prices of energy and power indices, supporting the rejection of the null hypothesis regarding the former.

Residual chart representing the clustering volatility for the period of 2018-2022
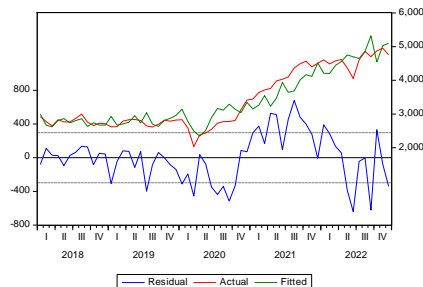
Clustering volatility is depicted in the graph, which shows alternating stages of low volatility followed by high volatility and high volatility followed by low volatility. The conditions for performing an ARCH effect test are met by this pattern. In particular, the first thirty to forty-eight months show minimal volatility, with the next thirty to forty-eight months showing increased volatility.

There is no ARCH effect among theshare price of Greenex Indices and Share price of select indices of Bombay stock exchange in India

Table 4 Testing for ARCH effect using Heteroskedasticity test

Heteroskedasticity Test: ARCH			
F-statistic	4.279885	**Prob. F (1,57)**	**0.0431**
Obs*R-squared	4.120654	**Prob. Chi-Square (1)**	**0.0424**
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	62242.40	17681.47	3.520206	0.0009
RESID^2(-1)	0.263421	0.127331	2.068788	0.0431
R-squared	0.069842	Mean dependent var		83839.98
Adjusted R-squared	0.053523	S.D. dependent var		112670.3
S.E. of regression	109613.6	Akaike info criterion		26.08062
Sum squared resid	6.85E+11	Schwarz criterion		26.15105
Log likelihood	-767.3783	Hannan-Quinn criter.		26.10811
F-statistic	4.279885	Durbin-Watson stat		1.951642
Prob(F-statistic)	**0.043112**			

Source: computed using EViews

Using a heteroskedasticity test, the table illustrates the existence of the ARCH effect and displays an observed R-square value of 4.1206. The null hypothesis is rejected when the p chi-square value is less than the significance level of 0.05. This result shows that the ARCH effect is unquestionably present in the model.

Table 5

Test for Auto Regression Conditional Heteroskedasticity test betweenshare price of Greenex Indices and Share price of select indices of Bombay stock exchange in India

Dependent Variable: GREENEX				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(5) + C(6)*RESID(-1)^2				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1693.603	270.6191	6.258255	0.0000
ENERGY	0.006543	0.001525	4.291744	**0.0000**
OIL_AND_GAS	-0.002452	0.001119	-2.191938	**0.0284**
POWER	0.028813	0.002992	9.630476	**0.0000**
Variance Equation				
C	13222.95	6685.736	1.977785	0.0480
RESID (-1) ^2	**1.096670**	0.476566	2.301191	**0.0214**
R-squared	0.838097	Mean dependent var		3387.396
Adjusted R-squared	0.829424	S.D. dependent var		853.2632
S.E. of regression	352.4053	Akaike info criterion		14.04269
Sum squared resid	6954612.	Schwarz criterion		14.25212
Log likelihood	-415.2806	Hannan-Quinn criter.		14.12461
Durbin-Watson stat	0.460915			

Source: computed using EViews

The table shows that an ARCH model is present in the link between Greenex Indices' share prices and the chosen indices of the Indian Bombay Stock Exchange. The coefficient value of 1.0966 for RESID (-1) indicates how the Greenex indices internally affect volatility. Additionally, a substantial ARCH influence on the volatility of Greenex indices with respect to certain Bombay Stock Exchange indices—namely, those in the Energy, Oil & Gas, and Power sectors—is indicated by the p-value being less than 0.05. This implies that the volatility of share prices in these specific indices is influenced by the ARCH effect.

There is no GARCH effect between share price of Greenex Indices and Share price of select indices of Bombay stock exchange in India

TABLE 6
Test for GARCH effect between share price of Greenex Indices and Share price of select indices of Bombay stock exchange in India

Dependent Variable: GREENEX				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(5) + C(6)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1123.094	406.8494	2.760467	0.0058
ENERGY	0.011906	0.003026	3.934533	**0.0001**
OIL_AND_GAS	-0.001085	0.002253	-0.481745	0.6300
POWER	0.021668	0.004617	4.693647	**0.0000**
Variance Equation				
C	49523.92	103943.5	0.476450	0.6338
GARCH(-1)	0.419886	1.231252	0.341023	**0.7331**
R-squared	0.884689	Mean dependent var		3387.396
Adjusted R-squared	0.878512	S.D. dependent var		853.2632
S.E. of regression	297.4060	Akaike info criterion		14.34773
Sum squared resid	4953217.	Schwarz criterion		14.55717
Log likelihood	-424.4319	Hannan-Quinn criter.		14.42965
Durbin-Watson stat	0.910587			

Source: computed using EViews

The relationship between the share prices of Greenex indexes and some indexes of the Bombay Stock Exchange in India is explained by the table, which also offers clarification on the GARCH effect. The corresponding P-value for the GARCH (-1) coefficient, which is reported as 0.419, is less than 0.05, suggesting statistical significance. The oil and gas industry is notably an exception to this rule. This suggests a long-term volatility influence of Greenex Indices on certain indices of the Bombay Stock Exchange, such as the energy, oil & gas, and power indices, even if the bulk of sectors have significance levels below 0.05. As a result, the GARCH effect is confirmed to exist and the null hypothesis is rejected.

Analysis of ARCH and GARCH Model for share price of Carbonex Indices and Share price of select indices of Bombay stock exchange in India
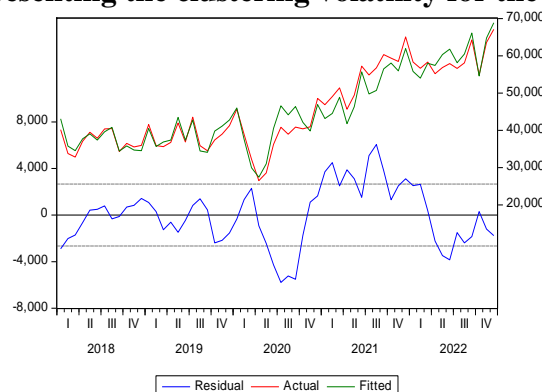
Table 7
Least square for share price of Carbonex Indices and Share price of select indices of Bombay stock exchange in India

Dependent Variable: CARBON				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1391.263	3261.497	-0.426572	0.6713
ENERGY	0.188074	0.021091	8.917221	**0.0000**
OIL_AND_GAS	0.075464	0.016472	4.581381	**0.0000**
POWER	-0.000544	0.043245	-0.012584	**0.9900**
R-squared	0.938843	Mean dependent var		45439.31
Adjusted R-squared	0.935567	S.D. dependent var		10473.56
S.E. of regression	2658.573	Akaike info criterion		18.67331
Sum squared resid	3.96E+08	Schwarz criterion		18.81293
Log likelihood	-556.1992	Hannan-Quinn criter.		18.72792
F-statistic	286.5596	Durbin-Watson stat		0.346988
Prob(F-statistic)	0.000000			

Source: computed using EViews

The share prices of Carbonex Indices and a few other indices from the Bombay Stock Exchange in India are subjected to a basic least squares regression, which is thoroughly examined in the table. The correlation coefficient value shows that the share prices of Carbonex Indices, energy, and oil and gas are positively correlated. On the other hand, the power index share prices have a negative coefficient, indicating the opposite link. While the T-statistics for electricity indices are negative, indicating an unsatisfactory performance, the values for the energy and oil and gas indices are greater than 2, suggesting a satisfactory result. Power indices do not exhibit a significant p-value, although the energy and oil & gas indices do. As a result, the energy and oil and gas indices reject the null hypothesis, confirming the influence of Carbonex Indices on their share price.

Residual chart representing the clustering volatility for the period of 2018-2022

The clustering volatility chart satisfies the requirements for additional testing of the ARCH effect by showing instances of low volatility followed by high volatility and vice versa. In particular, there is a low-volatility phase that lasts for the first thirty to forty months, followed by a high-volatility phase that lasts for the next twenty to thirty months.

There is no ARCH effect among theshare price of Carbonex Indices and Share price of select indices of Bombay stock exchange in India

Table 8 Testing for ARCH effect using Heteroskedasticity test

Heteroskedasticity Test: ARCH			
F-statistic	35.19452	Prob. F(1,57)	0.0000
Obs*R-squared	**22.52278**	Prob. Chi-Square(1)	**0.0000**
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2449900.	1156664.	2.118073	0.0385
RESID^2(-1)	**0.618461**	0.104250	5.932497	**0.0000**
R-squared	0.381742	Mean dependent var	6566423.
Adjusted R-squared	0.370895	S.D. dependent var	8961874.
S.E. of regression	7108211.	Akaike info criterion	34.42471
Sum squared resid	2.88E+15	Schwarz criterion	34.49513
Log likelihood	-1013.529	Hannan-Quinn criter.	34.45220
F-statistic	35.19452	Durbin-Watson stat	1.733898
Prob(F-statistic)	0.000000		

Source: computed using EViews

A heteroskedasticity test is used in the table to explain the ARCH effect, and the result is an observed R-square value of 22.5227. The null hypothesis is rejected since the p chi-square value is less than the crucial threshold of 0.05. This result indicates that there is an ARCH effect in the model.

Test for Auto Regression Conditional Heteroskedasticity test betweenshare price of Carbonex Indices and Share price of select indices of Bombay stock exchange in India

Table 9

Dependent Variable: CARBON				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(5) + C(6)*RESID(-1)^2				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C	1578.432	1596.362	0.988768	0.3228
ENERGY	**0.279730**	0.022561	12.39906	**0.0000**
OIL_AND_GAS	**0.050685**	0.009026	5.615538	**0.0000**
POWER	**-0.099905**	0.036062	-2.770394	**0.0056**
Variance Equation				
C	1900036.	639491.0	2.971169	0.0030
RESID(-1)^2	**0.643085**	0.337409	1.905951	**0.0507**
R-squared	0.906423	**Mean dependent var**		45439.31
Adjusted R-squared	0.901410	**S.D. dependent var**		10473.56
S.E. of regression	3288.596	**Akaike info criterion**		18.31142
Sum squared resid	6.06E+08	**Schwarz criterion**		18.52086
Log likelihood	-543.3427	**Hannan-Quinn criter.**		18.39334
Durbin-Watson stat	0.280190			

Source: computed using EViews

The table shows that there is an ARCH model in the link between the selected indices of the Bombay Stock Exchange in India and the share prices of Carbonex Indices. The internal influence of Carbonex indices on volatility is indicated by the ARCH, which has a coefficient value of 0.643 for RESID (-1). The P-value, which is less than 0.05, suggests that there is a substantial ARCH influence on the volatility of Carbonex indices with respect to certain Bombay Stock Exchange indices, particularly those related to the energy, oil and gas, and power sectors. This suggests that the volatility of share prices in these particular indices is influenced by the ARCH effect.

There is no GARCH effect between share price of Carbonex Indices and Share price of select indices of Bombay stock exchange in India

Table 10 Test for GARCH effect between share price of Carbonex Indices and Share price of select indices of Bombay stock exchange in India

Dependent Variable: CARBON				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(5) + C(6)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1262.983	4154.973	-0.303969	0.7612
ENERGY	**0.189579**	0.022992	8.245272	**0.0000**
OIL_AND_GAS	**0.074358**	0.020964	3.546955	**0.0004**
POWER	**-1.71E-05**	0.047734	-0.000359	**0.9997**
Variance Equation				
C	3958085.	42353218	0.093454	0.9255
GARCH(-1)	**0.404407**	6.393371	0.063254	**0.9496**
R-squared	0.938834	Mean dependent var		45439.31
Adjusted R-squared	0.935557	S.D. dependent var		10473.56
S.E. of regression	2658.783	Akaike info criterion		18.74006
Sum squared resid	3.96E+08	Schwarz criterion		18.94949
Log likelihood	-556.2017	Hannan-Quinn criter.		18.82198
Durbin-Watson stat	0.344773			

Source: computed using EViews

The GARCH effect between the share prices of Carbonex Indices and specific indices on the Bombay Stock Exchange in India is explained in the table. It is found that the GARCH (-1) coefficient is 0.4044, and the associated P value is greater than 0.05. Significantly, with the exception of power indices, significance is found below 0.05. This suggests that the GARCH influence of Carbonex indices on some Bombay Stock Exchange indices—namely, the energy, oil & gas, and power indices—may exhibit long-term volatility. As a result, the GARCH effect's existence is confirmed by the null hypothesis' rejection.

Analysis of ARCH and GARCH Model for share price of ESG Indices and Share price of select indices of Bombay stock exchange in India

Table 11 Least square for share price of ESG Indices and Share price of select indices of Bombay stock exchange in India

Dependent Variable: ESG				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-250.5654	356.8372	-0.702184	0.4855
ENERGY	**0.024103**	0.002308	10.44516	**0.0000**
OIL_AND_GAS	**0.005477**	0.001802	3.039340	**0.0036**
POWER	**0.001163**	0.004731	0.245874	**0.8067**
R-squared	0.939301	Mean dependent var		4483.833
Adjusted R-squared	0.936050	S.D. dependent var		1150.218
S.E. of regression	290.8719	Akaike info criterion		14.24798
Sum squared resid	4737963.	Schwarz criterion		14.38761
Log likelihood	-423.4395	Hannan-Quinn criter.		14.30260
F-statistic	288.8632	Durbin-Watson stat		0.337486
Prob(F-statistic)	0.000000			

Source: computed using EViews

The share prices of ESG Indices and particular indices on the Bombay Stock Exchange in India are analyzed in depth using a basic least squares regression, as shown in the table. The positive coefficient value indicates a weak correlation between the share prices of ESG indexes and the energy, oil and gas, and power sectors. While the T-statistics for electricity indices are negative, indicating an unacceptable scenario, the T-statistics values for the share prices of the energy and oil & gas indices surpass 2, indicating a satisfactory level. Furthermore, the p-value is not significant for electricity indices but substantial for the share prices of the energy and oil & gas indices. As a result, the null hypothesis about the influence of the energy and oil & gas indices' share prices on the share prices of ESG indices is rejected. This suggests that the share prices of the energy and oil & gas indices are impacted by ESG indexes.

Residual chart representing the clustering volatility for the period of 2018-2022
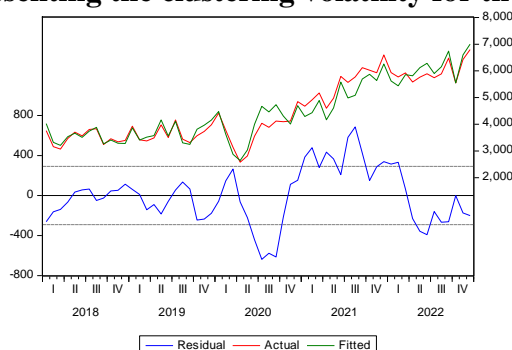
The clustering volatility chart satisfies the requirements for the ARCH effect test by showing instances of low volatility followed by high volatility and vice versa. To be more precise, there is minimal volatility over the first thirty to forty months, followed by a period of increased volatility during the next twenty to thirty months.

There is no ARCH effect among theshare price of ESG Indices and Share price of select indices of Bombay stock exchange in India

Table 12 Testing for ARCH effect using Heteroskedasticity test

Heteroskedasticity Test: ARCH				
F-statistic	36.28867	**Prob. F(1,57)**		0.0000
Obs*R-squared	**22.95061**	**Prob. Chi-Square(1)**		**0.0000**
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	29432.18	14020.83	2.099175	0.0402
RESID^2(-1)	**0.624317**	0.103638	6.024008	**0.0000**
R-squared	0.388993	**Mean dependent var**		79141.30
Adjusted R-squared	0.378274	**S.D. dependent var**		110423.8
S.E. of regression	87068.72	**Akaike info criterion**		25.62009
Sum squared resid	4.32E+11	**Schwarz criterion**		25.69052
Log likelihood	-753.7928	**Hannan-Quinn criter.**		25.64758
F-statistic	36.28867	**Durbin-Watson stat**		1.739821
Prob(F-statistic)	0.000000			

Source: computed using EViews

The table uses the heteroskedasticity test to explain the ARCH effect and shows an observed r-square value of 22.9506. The null hypothesis is rejected by the p chi-square value, which is less than the significance threshold of 0.05, indicating that the model shows an ARCH effect.

Test for Auto Regression Conditional Heteroskedasticity test betweenshare price of Carbonex Indices and Share price of select indices of Bombay stock exchange in India

Table 13

Dependent Variable: ESG				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(5) + C(6)*RESID(-1)^2				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C	272.8539	199.6954	1.366350	0.1718
ENERGY	**0.021363**	0.001847	11.56479	**0.0000**
OIL_AND_GAS	**0.003779**	0.000961	3.933679	**0.0001**
POWER	**0.006073**	0.003134	1.937669	**0.0527**
Variance Equation				
C	7194.328	4753.246	1.513561	0.1301
RESID(-1)^2	**0.902660**	0.457029	1.975061	**0.0483**
R-squared	0.927580	**Mean dependent var**		4483.833
Adjusted R-squared	0.923701	**S.D. dependent var**		1150.218
S.E. of regression	317.7173	**Akaike info criterion**		13.62120
Sum squared resid	5652880.	**Schwarz criterion**		13.83063
Log likelihood	-402.6359	**Hannan-Quinn criter.**		13.70312
Durbin-Watson stat	0.196937			

Source: computed using EViews

The association between the share prices of ESG Indices and the share prices of particular indices on the Bombay Stock Exchange in India can be seen in the table as supporting the existence of an ARCH model. RESID (-1) has a coefficient value of 0.902, indicating that ARCH has an impact on the internal dynamics of volatility in ESG indexes. An ARCH effect is clearly present on the volatility of ESG indices with respect to a subset of the Bombay Stock Exchange's indexes (energy, oil & gas, and electricity, for example), with a P-value of less than 0.05. This implies that the volatility of the share prices in these particular indices is influenced by the ARCH effect.

There is no GARCH effect between share price of ESG Indices and Share price of select indices of Bombay stock exchange in India.

Table 14 Test for GARCH effect between share price of ESG Indices and Share price of select indices of Bombay stock exchange in India

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Dependent Variable: ESG				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(5) + C(6)*GARCH(-1)				
C	237.9554	322.7834	0.737198	0.4610
ENERGY	**0.024375**	0.001539	15.84175	**0.0000**
OIL_AND_GAS	**0.001923**	0.001582	1.215726	**0.2241**
POWER	**0.012602**	0.005841	2.157465	**0.0310**
	Variance Equation			
C	-279.4086	1391.518	-0.200794	0.8409
GARCH(-1)	**1.069432**	0.051178	20.89642	**0.0000**
R-squared	0.929578	Mean dependent var		4483.833
Adjusted R-squared	0.925806	S.D. dependent var		1150.218
S.E. of regression	313.3035	Akaike info criterion		13.99704
Sum squared resid	5496910.	Schwarz criterion		14.20647
Log likelihood	-413.9111	Hannan-Quinn criter.		14.07896
Durbin-Watson stat	0.230616			

Source: computed using EViews

The GARCH effect for the share prices of ESG indices and other selected indices on the Bombay Stock Exchange in India is explained in the table. There is significance as the GARCH (-1) coefficient is 1.0694 and the P value is less than 0.05. The P value for the oil and gas indexes, however, is higher than 0.05, indicating an anomaly. This indicates that ESG indices have a long-term volatility GARCH influence on the chosen Bombay Stock Exchange indices, with the exception of the oil and gas indices. As a result, the GARCH effect is confirmed to exist and the null hypothesis is rejected.

Table 15 Pairwise granger causality between share price of select sustainable indices and share price of BSE 500 & BSE Sensex

| Null Hypothesis:	Obs	F-Statistic	Prob.
Pairwise Granger Causality Tests			
CARBON does not Granger Cause GREENEX	58	0.22054	0.8028
GREENEX does not Granger Cause CARBON		23.8329	**0.0004**
ESG does not Granger Cause GREENEX	58	1.02336	0.3664
GREENEX does not Granger Cause ESG		17.0513	**0.0003**
BSE500 does not Granger Cause GREENEX	58	0.32248	0.7258
GREENEX does not Granger Cause BSE500		24.0087	**0.0004**
SENSEX does not Granger Cause GREENEX	58	0.31911	0.7282
GREENEX does not Granger Cause SENSEX		16.4922	**0.0003**
ESG does not Granger Cause CARBON	58	4.25706	**0.0193**
CARBON does not Granger Cause ESG		4.21757	**0.0200**
BSE500 does not Granger Cause CARBON	58	0.97388	0.3843
CARBON does not Granger Cause BSE500		0.78456	0.4615
SENSEX does not Granger Cause CARBON	58	0.22341	0.8005
CARBON does not Granger Cause SENSEX		0.32131	0.7266
BSE500 does not Granger Cause ESG	58	0.68527	0.5084
ESG does not Granger Cause BSE500		0.86513	0.4269
SENSEX does not Granger Cause ESG	58	3.79981	**0.0287**
ESG does not Granger Cause SENSEX		4.54987	**0.0150**
SENSEX does not Granger Cause BSE500	58	0.14805	0.8627
BSE500 does not Granger Cause SENSEX		0.35128	0.7054

Source: computed using EViews

The Granger causality correlations between the share prices of the BSE 500 and BSE Sensex and certain sustainability indexes are shown in the table. Granger causation between Greenex indices and the share prices of BSE 500, BSE Sensex, Carbonex indices, and ESG indices is demonstrated. Furthermore, there is a reciprocal relationship between the share prices of Carbonex indices and the ESG indices Granger. ESG index share prices are a consequence of BSE Sensex Granger, and vice versa: BSE Sensex share prices are a consequence of ESG index Granger. This means that a definitive conclusion that there is a causal relationship between the chosen sustainable indices and the BSE 500 and BSE Sensex follows from the rejection of the null hypothesis.

Analysis of ARCH and GARCH Model for share price of Greenex Indices and Share price of BSE500 and BSE Sensex in India

Table 16 Least square for share price of share price of Greenex Indices and Share price of BSE500 and BSE Sensex indices in India

Dependent Variable: GREENEX				
Method: Least Squares				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	178.2604	148.6340	1.199325	0.2354
BSE500	**0.014730**	0.002888	**5.099468**	**0.0000**
SENSEX	**-0.002412**	0.001216	**-1.983020**	**0.0522**
R-squared	0.920610	**Mean dependent var**		3387.396
Adjusted R-squared	0.917825	**S.D. dependent var**		853.2632
S.E. of regression	244.5983	**Akaike info criterion**		13.88582
Sum squared resid	3410215.	**Schwarz criterion**		13.99054
Log likelihood	-413.5745	**Hannan-Quinn criter.**		13.92678
F-statistic	330.4891	**Durbin-Watson stat**		1.821551
Prob(F-statistic)	0.000000			

Source: computed using EViews

The table provides a thorough breakdown of a basic least squares regression incorporating the Indian share prices of the BSE500, BSE Sensex, and Greenex Indices. The coefficient values show that there is little correlation between the share prices of the Greenex indexes and the BSE500 and BSE Sensex. The share price of the BSE Sensex indexes has a negative T-statistic, indicating an unsatisfactory scenario, whereas the share price of the BSE 500 index has a satisfactory T-statistic value above 2. The share prices of the BSE Sensex and BSE 500 indexes have both significant p-values. As a result, there appears to be a visible effect of Greenex indices on the share prices of the BSE500 and BSE Sensex indexes when compared to Greenex indices, rejecting the null hypothesis.

Residual chart representing the clustering volatility for the period of 2018-2022
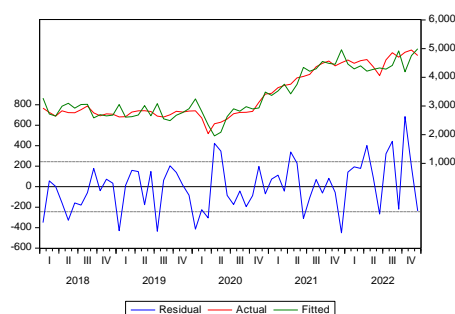
The graph demonstrates clustering volatility, meeting the requirements for additional testing the ARCH effect by showing times of low volatility followed by high volatility and vice versa. In particular, the first thirty to forty-eight months show minimal volatility, with the next thirty to forty-eight months showing increased volatility.

There is no ARCH effect among theshare price of Carbonex Indices and Share price of BSE500 and BSE Sensex indices in India.

Table 17 Testing for ARCH effect using Heteroskedasticity test

Heteroskedasticity Test: ARCH			
F-statistic	0.046971	**Prob. F(1,57)**	0.8292
Obs*R-squared	**0.048579**	**Prob. Chi-Square(1)**	**0.8256**
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	57329.22	12940.12	4.430346	0.0000
RESID^2(-1)	-0.028524	0.131610	-0.216729	0.8292
R-squared	0.000823	**Mean dependent var**	55707.87
Adjusted R-squared	-0.016706	**S.D. dependent var**	80432.06
S.E. of regression	81101.13	**Akaike info criterion**	25.47809
Sum squared resid	3.75E+11	**Schwarz criterion**	25.54852
Log likelihood	-749.6037	**Hannan-Quinn criter.**	25.50558
F-statistic	0.046971	**Durbin-Watson stat**	1.965049
Prob(F-statistic)	0.829193		

Source: computed using EViews

Using a heteroskedasticity test, the table shows the ARCH effect and displays an observed R-square value of 0.0485. The null hypothesis is accepted since the p chi-square value is greater than the significance level of 0.05. This result implies that the model does not include an ARCH effect. As a result, the model cannot be expanded to investigate GARCH and ARCH effects because there is no ARCH impact.

Analysis of ARCH and GARCH Model for share price of Carbonex Indices and Share price of BSE500 and BSE Sensex in India

Table 18 Least square for share price of share price of Carbonex Indices and Share price of BSE500 and BSE Sensex indices in India

Dependent Variable: CARBON			
Method: Least Squares			
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1733.833	193.8062	8.946221	0.0000
BSE500	**0.073517**	0.003766	**19.51974**	**0.0000**
SENSEX	**0.017972**	0.001586	**11.33390**	**0.0000**
R-squared	0.999104	**Mean dependent var**	45439.31
Adjusted R-squared	0.999073	**S.D. dependent var**	10473.56
S.E. of regression	318.9357	**Akaike info criterion**	14.41656
Sum squared resid	5798038.	**Schwarz criterion**	14.52128
Log likelihood	-429.4969	**Hannan-Quinn criter.**	14.45752
F-statistic	31784.47	**Durbin-Watson stat**	0.552864
Prob(F-statistic)	0.000000		

Source: computed using EViews

The table provides a thorough examination of a basic least squares regression incorporating the share prices of the Indian BSE500 and BSE Sensex indices, as well as the share prices of Carbonex Indices. The coefficient values show that there is little correlation between the share prices of the Carbonex indexes and the BSE500 and BSE Sensex. The share prices of the BSE500 and BSE Sensex have T-statistics values greater than 2, which indicates a desirable level. The p-values for the BSE500 and BSE Sensex index share prices are also noteworthy. This suggests that there is a noticeable effect of Carbonex indices on share prices, as the null hypothesis is rejected for the share prices of the BSE500 and BSE Sensex indices in respect to the share prices of Carbonex indices.

Residual chart representing the clustering volatility for the period of 2018-2022
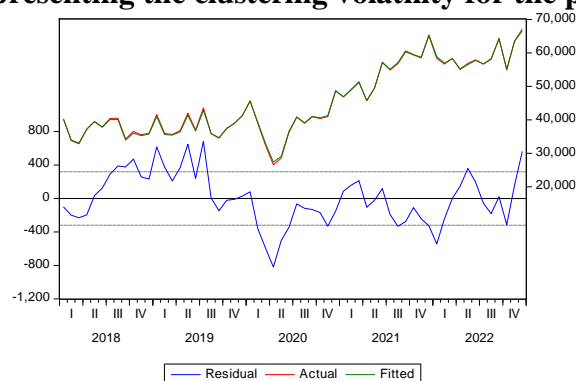
In order to meet the requirements for additional testing of the ARCH effect, the chart illustrating clustering volatility reveals a pattern of alternating between low and high volatility. In particular, there is little volatility during the first thirty to forty months, followed by a period of increased volatility during the next twenty to thirty months.

There is no ARCH effect among theshare price of Carbonex Indices and Share price of BSE500 and BSE Sensex indices in India

Table 19 Testing for ARCH effect using Heteroskedasticity test

Heteroskedasticity Test: ARCH			
F-statistic	6.233104	**Prob. F(1,57)**	0.0155
Obs*R-squared	**5.815832**	**Prob. Chi-Square(1)**	**0.0159**
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	68346.69	20732.08	3.296664	0.0017
RESID^2(-1)	0.320196	0.128252	2.496619	0.0155
R-squared	0.098573	**Mean dependent var**		98097.54
Adjusted R-squared	0.082759	**S.D. dependent var**		136063.8
S.E. of regression	130312.0	**Akaike info criterion**		26.42656
Sum squared resid	9.68E+11	**Schwarz criterion**		26.49699
Log likelihood	-777.5835	**Hannan-Quinn criter.**		26.45405
F-statistic	6.233104	**Durbin-Watson stat**		1.986241
Prob(F-statistic)	0.015453			

Source: computed using EViews

The observed r-square value of 5.8158 is revealed in the table, which uses the heteroskedasticity test to highlight the ARCH effect. When the p chi-square value is less than the significance level

of 0.05, the null hypothesis is rejected. This implies that the ARCH effect is present in the model in a definitive way.

Test for Auto Regression Conditional Heteroskedasticity test betweenshare price of Carbonex Indices and Share price of BSE500 and BSE Sensex indices in India
Table 20

Dependent Variable: CARBON				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(4) + C(5)*RESID(-1)^2				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1395.543	92.09881	15.15268	0.0000
BSE500	**0.072452**	0.006918	10.47270	**0.0000**
SENSEX	**0.018679**	0.002789	6.698470	**0.0000**
Variance Equation				
C	32145.21	17325.67	1.855351	0.0635
RESID(-1)^2	**0.891002**	0.447801	1.989730	**0.0466**
R-squared	0.999016	**Mean dependent var**		45439.31
Adjusted R-squared	0.998982	**S.D. dependent var**		10473.56
S.E. of regression	334.2377	**Akaike info criterion**		14.24522
Sum squared resid	6367747.	**Schwarz criterion**		14.41975
Log likelihood	-422.3567	**Hannan-Quinn criter.**		14.31349
Durbin-Watson stat	0.432117			

Source: computed using EViews

The table shows the relationship between the share prices of the BSE500 and BSE Sensex indexes in India and the share prices of Carbonex Indices according to the ARCH model. The result of 0.891 for the coefficient indicates how the Carbonex indexes affect volatility in the RESID (-1) calculation. The BSE 500 and BSE Sensex index share prices are impacted by the substantial ARCH influence on the volatility of Carbonex indexes, as indicated by the P value, which is less than 0.05. This implies that the volatility of the share prices of the chosen indices is significantly shaped by the ARCH effect.

There is no GARCH effect between share price of Carbonex Indices and share price of Carbonex Indices and Share price of BSE500 and BSE Sensex indices in India.

Table 21 Test for GARCH effect between share price of Carbonex Indices and share price of Carbonex Indices and Share price of BSE500 and BSE Sensex indices in India

Dependent Variable: CARBON				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(4) + C(5)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1682.782	226.9262	7.415550	0.0000
BSE500	**0.071838**	0.005065	14.18308	**0.0000**
SENSEX	**0.018698**	0.002165	8.634562	**0.0000**
Variance Equation				
C	18675.95	56352.41	0.331414	0.7403
GARCH(-1)	**0.817355**	0.584774	1.397728	**0.1622**
R-squared	0.999101	**Mean dependent var**		45439.31
Adjusted R-squared	0.999069	**S.D. dependent var**		10473.56
S.E. of regression	319.5363	**Akaike info criterion**		14.45984
Sum squared resid	5819895.	**Schwarz criterion**		14.63437
Log likelihood	-428.7952	**Hannan-Quinn criter.**		14.52811
Durbin-Watson stat	0.532172			

Source: computed using EViews

The GARCH effect between the share prices of Carbonex Indices and certain indices of the Bombay Stock Exchange in India is explained in the table. 0.8173, the GARCH (-1) coefficient, is found, and the associated P value is greater than 0.05. With the exception of power indices, significance is seen below 0.05, suggesting long-term volatility in the GARCH effect of Carbonex indices on the share prices of particular BSE indices in India (BSE500 and BSE Sensex). Thus, the existence of the GARCH effect is confirmed by the rejection of the null hypothesis.
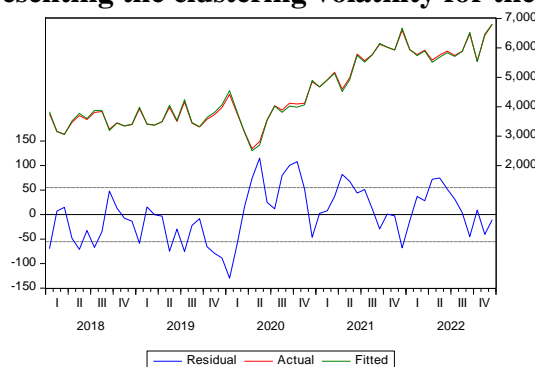
Analysis of ARCH and GARCH Model for share price of ESG Indices and Share price of BSE500 and BSE Sensex in India.

Table 22 Least square for share price of share price of ESG Indices and Share price of BSE500 and BSE Sensex indices in India

Dependent Variable: ESG				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-367.4929	33.52006	-10.96337	0.0000
BSE500	**0.005287**	0.000651	**8.115522**	**0.0000**
SENSEX	**0.003144**	0.000274	**11.46393**	**0.0000**
R-squared	0.997778	**Mean dependent var**		4483.833
Adjusted R-squared	0.997700	**S.D. dependent var**		1150.218
S.E. of regression	55.16201	**Akaike info criterion**		10.90713
Sum squared resid	173442.3	**Schwarz criterion**		11.01185
Log likelihood	-324.2140	**Hannan-Quinn criter.**		10.94809
F-statistic	12797.82	**Durbin-Watson stat**		0.704198
Prob(F-statistic)	0.000000			

Source: computed using EViews

In comparison to the share prices of the BSE 500 and BSE Sensex indexes in India, the table presents a thorough examination of the simple least squares regression for the share prices of ESG indexes. A minor correlation has been observed between the share prices of ESG indices and the BSE500 and BSE Sensex, as indicated by the coefficient values. For the BSE500 and BSE Sensex share prices, the T-statistics values are both over 2, which indicates a favourable condition. The BSE500 and BSE Sensex index share prices both have large p-values. The share prices of the BSE500 and BSE Sensex indices in respect to the share prices of ESG indices thus reject the null hypothesis, suggesting that there is a noticeable influence of ESG indices on the share price.

Residual chart representing the clustering volatility for the period of 2018-2022

The chart displays the clustering volatility that elucidates the low volatility followed by high volatility and high volatility followed by low volatility which fulfills the conditions fir ARCH effect test further. There is low volatility for first 36 months and high volatility in the period of next 20 to 30 months

There is no ARCH effect among theshare price of ESG Indices and Share price of BSE500 and BSE Sensex indices in India.

Table 23 Testing for ARCH effect using Heteroskedasticity test

Heteroskedasticity Test: ARCH			
F-statistic	6.268153	**Prob. F(1,57)**	0.0152
Obs*R-squared	**5.845295**	**Prob. Chi-Square(1)**	**0.0156**
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1930.298	579.2383	3.332476	0.0015
RESID^2(-1)	0.315604	0.126059	2.503628	0.0152
R-squared	0.099073	**Mean dependent var**	2857.493
Adjusted R-squared	0.083267	**S.D. dependent var**	3573.032
S.E. of regression	3421.041	**Akaike info criterion**	19.14659
Sum squared resid	6.67E+08	**Schwarz criterion**	19.21701
Log likelihood	-562.8243	**Hannan-Quinn criter.**	19.17408
F-statistic	6.268153	**Durbin-Watson stat**	1.873011
Prob(F-statistic)	0.015181		

Source: computed using EViews

The table explains the ARCH effect using the heteroskedasticity test, the observed r-square value 5.845, where the p chi square value is below the significant value of 0.05, which rejects the null hypothesis concluding that there isARCH effect in the model.

Test for Auto Regression Conditional Heteroskedasticity test betweenshare price of ESG Indices and Share price of BSE500 and BSE Sensex indices in India

Table 24

Dependent Variable: ESG				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(4) + C(5)*RESID(-1)^2				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-362.5161	34.40600	-10.53642	0.0000
BSE500	**0.005297**	0.000653	8.117423	**0.0000**
SENSEX	**0.003127**	0.000276	11.32659	**0.0000**
Variance Equation				
C	1672.246	634.0683	2.637327	0.0084
RESID(-1)^2	0.427518	0.318816	1.340955	0.1799
R-squared	0.997740	**Mean dependent var**		4483.833
Adjusted R-squared	0.997661	**S.D. dependent var**		1150.218
S.E. of regression	55.63177	**Akaike info criterion**		10.88985
Sum squared resid	176409.0	**Schwarz criterion**		11.06438
Log likelihood	-321.6955	**Hannan-Quinn criter.**		10.95812
Durbin-Watson stat	0.664338			

Source: computed using EViews

The table exhibits that ARCH model betweenshare price of ESG Indices and Share price of BSE500 and BSE Sensex indices in India. The RESID (-1) is coefficient value of 0.4275 ARCH indicates the internal effect of ESG indices in volatility. And the P value is above 0.05 which explains that there is no ARCH effect of volatility of ESG indices on Share price of BSE500 and BSE Sensex indices meaning that ARCH effect influences the volatility of share prices of the select indices.

There is no GARCH effect between share price of ESG Indices and Share price of BSE500 and BSE Sensex indices in India

Table 25 Test for GARCH effect between share price of ESG Indices and Share price of BSE500 and BSE Sensex indices in India

Dependent Variable: ESG				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(4) + C(5)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-379.5681	40.23287	-9.434280	0.0000
BSE500	0.004950	0.000617	8.019511	0.0000
SENSEX	0.003289	0.000265	12.40622	0.0000
Variance Equation				
C	261.8576	1037.976	0.252277	0.8008
GARCH(-1)	0.918216	0.361795	2.537946	0.0112
R-squared	0.997762	Mean dependent var		4483.833
Adjusted R-squared	0.997684	S.D. dependent var		1150.218
S.E. of regression	55.35755	Akaike info criterion		10.96383
Sum squared resid	174674.1	Schwarz criterion		11.13836
Log likelihood	-323.9150	Hannan-Quinn criter.		11.03210
Durbin-Watson stat	0.724949			

Source: computed using EViews

The table elucidates the GARCH effect between share price of ESG Indices and Share price of BSE500 and BSE Sensex indices in India. GARCH (-1) coefficient shows a value of 0.9182 and the P value is found to below 0.05 and the significant is below 0.05 for BSE500 and BSE Sensex indices, which means there is long-term volatility the GARCH effect of ESG indices on Share price of BSE500 and BSE Sensex indices in India, hence the null hypothesis is rejected confirming the GARCH effect.

Findings of the Study

- The share prices of sustainable indices, like Greenex, and some energy indices covering the electricity, oil & gas, and overall energy sectors are found to be causally related.

- There is evidence that the Greenex indices are not correlated with the share prices of the energy and power indices, which refutes the null hypothesis related to the former.

- The Indian Bombay Stock Exchange's chosen indices and Greenex Indices' ARCH effect have an effect on the share price volatility of these specified indices.

- The GARCH impact is confirmed, demonstrating the long-term volatility effects of Greenex Indices on the energy, oil and gas, and power indices of the Bombay Stock Exchange.

- As a result, the energy and oil and gas indices' share prices attest to the impact of Carbonex Indices on their market values.

- ARCH has a major impact on the volatility of Carbonex indices, especially when it comes to certain Bombay Stock Exchange indexes associated with the electricity, energy, and oil and gas industries.

- The GARCH influence of Carbonex indices may cause long-term volatility in some Bombay Stock Exchange indexes, including those related to energy, oil & gas, and power. The GARCH effect is confirmed to exist when the null hypothesis is rejected.

- It is implied that ESG indices have an impact on the share prices of energy and oil & gas indices since the impact of share prices in these indices on ESG indices is not supported.

- Regarding a subset of Bombay Stock Exchange indexes, there is a definite ARCH effect on the volatility of ESG indices, suggesting that the ARCH effect affects the share prices in these particular indices.

- With the exception of the oil and gas indices, certain Bombay Stock Exchange indices are GARCH-influenced by ESG indices. The null hypothesis is rejected as a result of this validation of the GARCH effect.

- When compared to Greenex indices, the share prices of the BSE500 and BSE Sensex indexes show a discernible impact from Greenex indices, refuting the null hypothesis.

- The fact that the null hypothesis pertaining to Carbonex indices was rejected suggests that there is a discernible impact on share prices, especially when comparing the BSE500 and BSE Sensex indices to Carbonex indices.

- Share prices of the BSE 500 and BSE Sensex indices are impacted by a significant ARCH influence on the volatility of Carbonex indexes. This implies that the volatility of the share prices of the chosen indices is substantially shaped by the ARCH effect.

- The existence of long-term volatility is confirmed by the GARCH effect of Carbonex indexes on the share prices of particular BSE indices in India (BSE500 and BSE Sensex), as shown by the rejection of the hypothesis.

- In regards to ESG indices, the share prices of the BSE500 and BSE Sensex indexes have a discernible impact on share prices, hence refuting the null hypothesis.

- The lack of an ARCH effect on the volatility of ESG indices implies that the BSE500 and BSE Sensex indexes' share price volatility is unaffected by the ARCH effect.

- The rejection of the null hypothesis highlights the long-term volatility in the GARCH effect of ESG indices on the share prices of the BSE500 and BSE Sensex indexes in India, confirming the existence of the GARCH effect.

CONCLUSION

Socially responsible investment that is sustainability indices of Bombay Stock Exchange, focuses on the investing in securities that meets sustainability investments. The indices under the BSE sustainability indices which contains Greenex, Carbonex and ESG Indices, and the selected indices which is exactly a representation of sustainable indices such as Energy, Oil and Gas along with power indices. And theoverall index from BSE500 and BSE Sensex has been taken for the analysis concludes the cause, effect and the fluctuation with respect to volatility is been elaborately found in the study. There is cause and effect of the share price of select sustainable indices. And almost all the selected indices representing the sustainable indices has been related and influenced by the sustainable indices over the period and the long term volatility and short term volatility has been clearly identified in the stock market. Even though there is volatility in the share price due to the sustainable indices there is chance of high risk and return. But a fluctuation in share price if it is cause hike that is lead to increase in value of investment, but in turn the return may be less than the actual one with a increased risk, so the socially responsible investment as its nature the risk is mandatorily involved and return is expected in long term not in short term.so it is a social responsibility of a person with sustainable motive to make investment based on the investment decisions can be a game changer for sustainable development goals to control the emissions and environmentally sustaining the resources which can be done through the investments with sustainability indices in Bombay stock exchange can help in making a chance in society.

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