

RAINFALL INDEX IMPACT ON EQUITY MARKETS (INDIA) – A STUDY

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ABSTRACT:

Indian economy one of the fastest growing economy in the world gradually Indian economy is shifting its base from agriculture to services and industries side. Even today Indian agriculture sector occupies 15% of the country's GDP. This study has been focused to measure the Indian economy movement along with MCX rainfall index movement. Granger causality test has been applied on johenson co-integrated data and found that Indian GDP, nifty, inflation and IIP were granger caused during the study period. Multi regression analysis such as arch, grach, tarch egrach, parch rejected the probability value of nifty volatility and observed that Indian nifty volatility didn't influenced by the rainfall index. This study is useful for the equity & commodity traders, government, agri related industries and formers.

Key words: Agri index, Comdex, GDP, IIP, Inflation, Nifty, Rainfall index.

INTRODUCTION:

Rainfall plays a critical role in Indian agriculture production. Majority of the population are depending on agriculture in India even though this sector contributes only 15% of the country's GDP. As agriculture sector performs simultaneous depend agri-industrial sector will also move upside. Rainfall index will impact direct on agriculture and this index will impact directly or indirectly on industrial sector. Industrial sector will have direct impact on stock market. By this we can know that increase in rainfall results in the increase in Indian economy.

As rainfall index increases, agriculture sector will also trend to increase, agriculture sector leads to growth in Indian economy and it will have positive impact on the industrial sector. This positive impact on industrial sector will increase demand in rural for the industrial products. This will results in increase in standard of living and purchasing level of people. This increase will have negative impact on the inflation which will push the rate to move down side.

As rainfall goes upside it pushes the agriculture sector and industrial sector along with the stock market and GDP. We know that the rainfall index as impact on different sectors and it states that there is very high impact on agriculture sector.

REVIEW of LITERATURE:

Hirshleifer and Shumway (2001) - In this, the author focused on how a individuals investor likely to buy or sell a equities on cloudy days and sunny days. They found that there is a dramatically reduced in buy or sell due to weather effect (i.e. in cloudy days). As this analysis is done in U.S only in five cities and it is limited to single investor. I am extending my analysis by including commodities and all seasonal days.

Asha latha K. V., Munisamy Gopinath, and A. R. S. Bhat (2012): This analysis has been focused climatic variation such as occurrence of drought will have negative impact on the yield of rainfed crop. The finding and the study revealed that small and medium formers were highly vulnerable to climate change which is focusing them to quite the agriculture profession by the rainfed formers. It has been suggested government should address immediately on this problem before this sector get collapse. My research is covering overall year data which is include rainfall days, drought days, favorable condition and non-favorable condition to the agriculture.

Shreekant Gupta, Partha Sen and Suchita Srinivasan(2012) - In this their study focused on two food grains namely rice and millets, how these will impact when there is a climate change in precipitation and temperature and they considered key inputs like irrigation, fertilizer and labour. They found that there is a significant impact of climate change on Indian agriculture. This article is considering only particular district and for the period 1966 to 1999. Whereas my article is considering data throughout nation and my analysis period is from 2008 to 2013.

Ganesh Tharala and Manoj Sabbani (2014) -This is mainly focused on how rainfall index will impact on the agri commodities. This article results shown that all the agri commodities are significantly influenced by the rainfall index. This analysis considered only agri commodities and that to for the period for 2013-2014. Extend to this analysis my article considering commodities & equity market and my analysis period is from 2008-2013.

Kanika Mahajan (2012) - The author's article is focused how rainfall shocks, which affect demand for labour in Indian agriculture, affect wage gap in agriculture between males and females. The author found that rainfall shocks do not affect the wage gap, but low rainfall years affect the wage gap negatively in the rain-fed rice growing regions of India. This analysis is limited to the India for the period of 1993-2007. Extend to this analysis my article is included further data for the period of 2008-2013 and considering other economy factors.

Ifabiyi Ifatokun Paul and Omoyosoye Oluwasina(2011) - In this article author focused on rainfall impact on maize(corn) yield in kwara state. This article observes that early maize suffer moisture deficiency in March and late maize suffer deficiency in November. While excessive rainfall in June to September have major impact on maize yield. This article considered only one product (maize) and in kwara state, Nigeria. My article considered all the agri-commodities.

OBJECTIVES:

1. To know the relationship between rainfall index with select equity and commodity indices.
2. To know the rainfall index impact on agri index.
3. To measure the rainfall index impact on inflation and index of industrial production (IIP).
4. To know the rainfall index impact on GDP and Nifty.
5. To know the rainfall influence on nifty volatility.

NEED: To know how rainfall index is affecting the Indian economy and this study also tells us how it is influence the agri industries. In this study I am considering rainfall index from MCX India which has been averaged of three indices namely Jaipur rainfall index, Indoor rainfall index and Mumbai rainfall index. Equity markets consider the news which may influence economy of this country so that investors will take the decision in the markets to buy, sell or stay invested. The importance of the study is to help the investor's community of the both segment such as equity and commodity to take inform decision by observing the rainfall index movement.

SCOPE: This analysis has covered rainfall index data from three indices Mumbai, Indoor and Jaipur for the period of 2008 to 2013. Equity benchmark indicator has been considering from NSE base index nifty 50. This study has gathered data for the analysis from MCX Indian, NSE Indian and RBI data.

Empirical study:

Agri index, Comdex, GDP, IIP, Inflation, Nifty, Rainfall index.

RESEARCH METHODOLOGY:

This analysis has been done on secondary data by using descriptive statistical tools. The following formulas were considered for the analysis.

Johenson Co-integration: Co-integration is a statistical property of time series variables. Two or more time series are co-integrated if they share a common stochastic drift. If two time series x and y are co-integrated, a liner combination of them must be stationary.

$$Y - Bx = u, \text{ Where } u \text{ is stationary.}$$

Granger causality test: Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and

with lagged values of Y also included), that those X values provide statistically significant information about future values of Y.

Augmented Dickey-Fuller Test: Augmented Dickey-Fuller Test is a test for a unit root in a time series sample. It is an augmented version of the Dickey-Filler test for a larger and more complicated set of time series models.

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t,$$

T-test: As mentioned above, the t-test can only be used to test differences between two means. When there are more than two means, it is possible to compare each mean with each other mean using many t-tests.

Correlation: A correlation study is a research writing that attempts to relate an event to another events or sets of causality which precipitate the event.

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Regression: A statistical measure that attempts to determine the strength of the relationship between one dependent variable and the series of other changing variable.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

DATA ANALYSIS:

Objective 1: To know the relationship between rainfall index with nifty and commodity indices

		Rainfallindex	Nifty	Comdex
Rainfallindex	Pearson Correlation	1	.506*	0.265
	Sig. (2-tailed)		0.014	0.221
	N	23	23	23
Nifty	Pearson Correlation	.506*	1	.780**
	Sig. (2-tailed)	0.014		0
	N	23	23	23
Comdex	Pearson Correlation	0.265	.780**	1
	Sig. (2-tailed)	0.221	0	
	N	23	23	23

Interpretation: From the above analysis it is observed that the Pearson correlation between Rainfall index with Nifty and Comdex is moderately to slightly correlate & Comdex with nifty is strongly correlated.

Objective 2: To know the rainfall index impact on agri index

Johenson cointegration test:

Data Trend:	None	None	Linear	Linear	Quadratic		
Rank or	No Intercept	Intercept	Intercept	Intercept	Intercept		
No. of CEs	No Trend	No Trend	No Trend	Trend	Trend		
	LLR Model					AIC	SIC
0	-267.0039	-267.004	-267.002	-267.002	-266.796	27.10039	27.29953
1	-261.399	-257.882	-257.881	-255.71	-255.63	26.93990	27.33819
2	-259.0924	-254.819	-254.819	-251.664	-251.664	27.10924	27.70668

Interpretation: Johenson co-integration test has been applied between rainfall index and agri index. The Log likelihood values are observe in decreasing trend in both linear and quadratic along with alpha level. Hence data is stated to be co-integrated. So further analysis can be applied on this data.

Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
RAINFALLINDEX does not Granger Cause AGRIIINDEX	18	2.72312	0.0976
AGRIINDEX does not Granger Cause RAINFALLINDEX		0.69923	0.6116

Interpretation: To measure the rainfall index on agri index grander causality test as be applied the null hypothesis is h_0 of granger cause between rainfall and agri index is accepted because the probability value is observed significant and reject the alternative h_1 hypothesis. This test have proven that rainfall index didn't cause the agri index movement during the analysis period.

Objective 3: To measure the rainfall index impact on inflation and industrial production (IIP).

Best Model Statistics

Model Summary	
Multiple R	0.524
R Square	0.275
Adjusted R Square	0.203
Std. Error of the Estimate	1.80E+05
Log-likelihood Function Value	-145.582

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.46E+11	2	1.23E+11	3.793	0.04
Residual	6.47E+11	20	3.24E+10		
Total	8.93E+11	22			

COEFFICIENTS

	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	Beta	Std. Error	Beta	Std. Error		
(Constant)	78.647	450.747			0.174	0.863
inflation	22.491	15.966	0.268	0.19	1.409	0.174
iip	6.024	2.593	0.443	0.19	2.323	0.031

Interpretation: The above table depicts that rainfall index impact is observed on inflation and index of industrial production (IIP). The regression weight estimation has been applied between the variable and the probability value is observed is significant i.e. $0.04 < 0.5$. The coefficient values of inflation and index of industrial production were also observed significant both the values were less than the 0.5 (i.e. 0.17 and 0.031). The regression weighted estimate indicates that during the analysis period the inflation and index of industrial production (IIP) were influenced by the rainfall index.

Objective 4: To know the rainfall index impact on GDP and Nifty.

Johenson co-integration test with rainfall on GDP and Nifty.

	Data Trend	None	None	Linear	Linear	Quadratic	AIC	SIC
		No Intercept	Intercept	Intercept	Intercept	Intercept		
	No. of CEs	No Trend	No Trend	No Trend	Trend	Trend		
		LLR Model						
GDP	0	-176.055	-176.055	-176.024	-176.024	-175.748	18.00545	18.2046
	1	-167.89	-167.761	-167.744	-167.611	-167.542	17.58903	17.98732
	2	-163.282	-163.033	-163.033	-162.878	-162.878	17.52819	18.12563
Nifty	0	-285.165	-285.165	-284.883	-284.883	-284.425	28.91645	29.1156
	1	-276.251	-274.891	-274.821	-274.094	-274.039	28.42507	28.82336
	2	-271.816	-269.844	-269.844	-269.117	-269.117	28.38164	28.97908

Interpretation: Johenson co-integration test has been applied between rainfall index and GDP along with Nifty. The Log likelihood values are observe in decreasing trend in both linear and quadratic along with alpha level for GDP and nifty. Hence data is stated to be co-integrated. Hence further analysis can be applied on this data.

Granger casualty test:

	Null Hypothesis:	Obs	F-Statistic	Prob.
GDP	GDP does not Granger Cause RAINFALLINDEX	18	0.53366	0.7148
	RAINFALLINDEX does not Granger Cause GDP		0.24876	0.9033
Nifty	RAINFALLINDEX does not Granger Cause NIFTY	18	0.65098	0.6405
	NIFTY does not Granger Cause RAINFALLINDEX		4.01225	0.0388

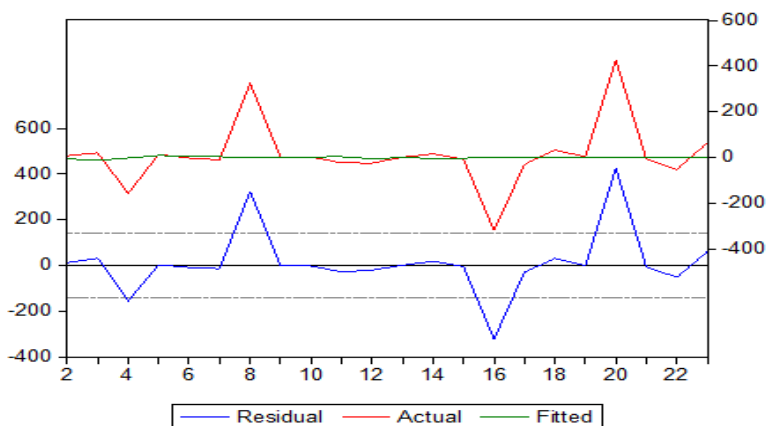
Interpretation: To measure the rainfall index on GDP and nifty grander causality test as be applied the null hypothesis is h_0 of granger cause between rainfall and GDP & nifty is accepted because the probability value is observed significant and reject the alternative h_1 hypothesis. This test has proven that rainfall index didn't cause the GDP and nifty movement during the analysis period.

Objective 5: To know the rainfall index influence on nifty volatility.

Heteroskedasticity:

F-statistic	1.681783	Prob. F(4,13)	0.2138	
Obs*R-squared	6.138165	Prob. Chi-Square(4)	0.1891	
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	25369.87	18873.27	1.344222	0.2019
RESID^2(-1)	-0.182066	0.245772	-0.74079	0.472
RESID^2(-2)	-0.18131	0.248928	-0.72837	0.4793
RESID^2(-3)	-0.174477	0.248604	-0.70183	0.4952
RESID^2(-4)	0.687651	0.377041	1.823811	0.0912
R-squared	0.341009	Mean dependent var	22183.12	
Adjusted R-squared	0.138243	S.D. dependent var	51800.34	
S.E. of regression	48086.71	Akaike info criterion	24.62953	
Sum squared resid	3.01E+10	Schwarz criterion	24.87686	
Log likelihood	-216.6658	Hannan-Quinn criter.	24.66364	
F-statistic	1.681783	Durbin-Watson stat	1.921596	
Prob(F-statistic)	0.213849			

Interpretation: The above analysis of Heteroskedasticity test has been applied to measure the rainfall index influence on nifty volatility. The probability value of arch test is found to be significant i.e. $0.213 < 0.5$. Hence regression model can be applied to measure rainfall index caused to the nifty volatility.



Interpretation: The above graph of residual test indicates that nifty trend line moving above the fitting value which indicates that nifty is expressing volatility. Hence multi regression model can be applied to find rainfall index influence on nifty volatility.

REGRESSION MODEL	Variable	Coefficient	Std. Error	z-Statistic	Prob.	AIC	SIC	HQC
ARCH	NIFTY	-0.000623	0.107281	-0.005807	0.9954	12.77384	12.92262	12.80889
GARCH	NIFTY	-0.008997	0.206053	-0.043662	0.9652	12.67738	12.87575	12.72411
TARCH	NIFTY	0.004313	0.232866	0.018521	0.9852	12.67026	12.91823	12.72868
EGARCH	NIFTY	0.002169	0.153979	0.014086	0.9888	12.87624	13.02502	12.91129
PARCH	NIFTY	-0.003653	0.16212	-0.022535	0.982	12.76428	12.96265	12.81101

Interpretation: The above table of multi regression analysis shows that mean values of all the models probability values stated to be not significant because the probability value is greater than the 0.05 and all the criteria such as AIC, SIC, HQC were satisfied under conditional Heteroskedasticity test. Hence rainfall index didn't influence the volatility during the analysis period.

FINDINGS:

- 1) It has been observed that nifty and comdex are positively moving along with the rainfall index during the analysis period.
- 2) The study observes that rainfall index doesn't cause agri index performance during the analysis period.
- 3) Rainfall index influenced the inflation and IIP during the analysis period.
- 4) The study found that rainfall index affected the Indian economy because the granger casualty test proven Indian GDP and equity index nifty both were getting granger caused during the analysis period.
- 5) Multi regression analysis indicated that nifty volatility didn't caused by the rainfall index.

CONCLUSION: I conclude the analysis on rainfall index impact on Indian equity markets. This analysis has been emphasis how Indian economy got influenced by the rainfall index movement. For the study five years data has been consider i.e.2008 to 2013. The focus of the study is to measure the equity market returns and its volatility got affected by the rainfall index fluctuations. This study has proven that Indian economy along with equity benchmarks were influenced by the rainfall index. Hence there is a further scope to do research in this area wee the latest rainfall index data i.e.2014 and 2015 should be include further research and how growing economy is changing according to the rainfall index movements.

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