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COINTEGRATION AND CAUSAL RELATIONSHIP BETWEEN PHARMACEUTICAL SECTOR AND NIFTY – AN EMPIRICAL STUDY

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ABSTRACT:
Predicting the Pharmaceutical stocks along with Nifty index is possibly one of the very toughest exercises in Indian Capital Markets. The present study focuses on Short & Long term dynamics of the Pharmaceutical industry in Indian capital market. The Pharmaceutical sector along with Nifty Index Regular closing monitory value are a sample to the analysis between June 2015 and June 2020. In the paper, ADF test is embarked to examine immovability of data and is evident that it is un-movable at initial difference level. The co-integration test of Johansen is applied to assess long-term balance of Nifty Index analysis with the pharmaceutical sector and to define the co-integration of the variables. Granger causality test is used to regulate causal & short-term relationship of the variables with the corresponding bidirectional casualties amidst them.

Introduction:

After privatization and globalization, Indian Capital markets have become more integrated worldwide. Due to independent movement of capital in financial markets, international capital markets and economies became progressively more integrated in the mid-1990s of globalization. Indian stock exchanges are popular not only in Asia, But also in global markets (Swetadri et al 2018). This stock-market reform process continued with successful FDI trend control in many sectors and capital market integration. Integrated capital markets can associate price fluctuations with other markets. Macro-Influenced financial markets, such as crude oil prices, gold prices, exchange rates (chinnadurai kathiravan et al 2019).

Capital market plays a pivotal role in Indian economy development and achieving the economic goals of various industries (Srihari 2017). Stock market is a place for selling long term debt or shares. It has two section forms, one is primary and later is secondary.

However, primary market helps companies collect resources by selling shares, and tributary market is the succeeding security sales and purchases. The Countries foremost stock exchanges are Bombay stock exchange and the NSE. The dawn of technology to markets primarily led to investor's trading and settlement processes (Anjali et al 2015).

Over the years, Pharmaceutical Industry in India has stretched at a multiplying annual growth rate of 15 percent and substantial market opportunities. Most pharmaceutical companies will continue to expand organically and inorganically through global alliances and associations (PWC 2020). Indian pharmaceutical Industry supplies 48% of global demand for different medicines and 41% of US demand for genetic medicines and 29% of all medicines in Europe (IBEF.org 2020). India's government has given affirmation to foreign direct investment policy in the pharmaceutical department to permit up to hundred percent FDI under certain conditions. Indian pharmaceutical industry has a chance to play a greater role in the global drug supply market. The Indian pharmaceutical sector is the nation's strategic industry, contributing 1.5% directly to GDP, with another 3% coming indirectly (Business line 2020).

Assessment of Literature

Rajiv Menon et al (2009) published a report on Indian stock market co-integration, including six 10-year stock exchanges. These markets were evaluated separately for co-integration testing. The study showed co-integration between Indian and US markets and also found good co-integration between Indian, Hong kong and Singapore markets.

A Anjali et al (2015) analyzed the long-term liaison amongst the federal bank capital market and banking. Secondary data was used from 1 January 2005 to 31 December 2014. Study analyzed ADF test, Granger test and analysis of co-integration. Co-integration study by Johansen revealed unidirectional movement between nifty and federal banks. Researchers came to conclusion that, the NSE effects contribute to banking sector movement.

Jiya tom (2020) studied Nifty 50 stock price macro variables from 2006 to 2017. FII has unit root after Initial variance finds patterns in Nifty 50, IIP, call currency, WPI and interchange rates. The co-integration test by Johansen showed that there is co-integration among the variables suggesting continuing equilibrium affiliation amongst macro variable and Nifty 50 index. Researcher concluded that granger causality test indicates exchange rates can affect nifty, but nifty does not affect exchange rates.

Eddie Simiyu et al (2020) investigated Kenya's stock market shocks. Consuming Johansen's co-integration, Vector fault rectification model and its effects resulted in bidirectional granger connection amongst the manufacturing and associated banking segments. There is no causality between investment and manufacturing industries. However, the study found that impulse retort investigation showed that shocks from other sectors to manufacturing and related sectors were less important. Shocks in banking sector were most powerful in their ability to respond from other market indices. This study concluded that the banking sector has the greatest propensity to affect volatility in other sector shocks.

Nsisong P et al (2016) explored the complex relationship amongst crude oil values and stock market pointers and Nigerian economic progress using VAR model and Johansen co-integration study. Study found the long-term sustainable

relationship between variables using Johansen co-integration tests. Extended affiliation with a vector-autoregressive order model VAR (3). They concluded that crude oil values, movement of stock markets and economic growth have an extended affiliation.

D Bhuvaneshwari et al (2017) evaluated co-integration and causality amongst Nifty 50 shock values and altercation rates since January 2006 to December 2015. Researcher evaluated Johansen lack of extended affiliation amongst nifty and exchange rates. Variables do not co-integrate long-term relationships, but short-term causality relationships were strong between shock values and nifty-fifty. Study settled that there is a short-term association amongst shock values and exchange rates.

Many analysts performed various sectoral capital market studies in India and other global markets. Many studies testing Johansen's co-integration and Granger's causality test among different sectors. This study explores the possible Pharmaceutical sector relation with Nifty 50 index.

Objectives

1. To study the cointegration relationship between Pharmaceutical sector and Nifty Index
2. To study the course of the causal affiliation amongst Pharmaceutical sector and Nifty Index.

Hypothesis

The below mentioned hypothesis are set to empirically verified to study the aforesaid objectives

$H_{1:}$ The study variables Nifty 50 and Pharma Sector are normal distribution.

$H_{2:}$ There is non-stationary exists between the variables

$H_{3:}$ There is no long-term equilibrium relationship amongst the variables

$H_{4:}$ There is no causality prevailing amongst the variables

Data and Research Methodology

Present paper targets at scrutinizing the co-integration and causal affiliation amongst Pharmaceutical sector and Nifty 50 for the period of June 2015 to June 2020. The daily closing prices of both Pharmaceutical sector and Nifty 50 have been collected from NSE website.

The key statistical tools used in the study are ADF unit root test, Johansen cointegration and Granger causality tests.

Testing for Unit root test

The ADF unit root test is applied to check the immobile of the present study along with it to find the direction of integration between the variables.

The Augmented Dickey – Fuller unit root test is grounded on the Null hypothesis *(H_0):* Unit root is existent in yt this point outs that yt is not *I(0),* i.e., is not integrated of order at level *(0),* which implies yt is un-stationary. If the premeditated Augmented Dickey – Fuller unit root test statistics is fewer than null hypothesis is prohibited, or else null hypothesis is acknowledged. If the facts is identified non-stationary at a level, the Augmented Dickey – Fuller unit root test is to be testing a unit root. In the above situation, stationary data to be co-integrated at first level *I(1).*

Johansen's Cointegration Test

Johansen cointegration test is an econometric variables test that predicts the long-term affiliation amongst 2 or more variables based on ADF test. The co-integration of Johansen defines the number of co-integrated vectors for whichever number of non-stationary variables of parallel level order and most cases at *I(1).* This implies that two or more variables are co-integrated if either of time series variables is immobile

The key point here is that if the variables are in long-term affiliation amongst Yt and Xt, the variables will grow in due moment and there will be a general

tendency to link them. What we need is a linear blend of Yt and Xt that is a stationary variable *(I(0)* for a balance or long-run relationship to occur.
Johansen advises 2 trials statistics that is, λmax statistics and λtrace statistics to regulate the co-integrating rank (number of co-integrating associations). The trials statistcs institutes the rank of the π matrix built on its Eigen standards (and henceforth the number of co-integrating associations)
$(r)=-T\ (1-\lambda\ i)\ ki=r+1$ (1) λmax $(r,+1)=-T\ ln(1-\lambda\ r+1)$ (2)
A resolution concerning the presence of a long-term affiliation is built on the price of the trial statistic gained from model.

Granger Causality test
The Granger causality test is statistical hypotheses it calculates 1 variable have sufficient to predict other variable in a given period of time. Its capability to forecast the forthcoming values of the variables by using time series data of additional time series (Granter 1988). The current learning trails the Granger causality model in VAR framework.
$Yt = \alpha iYt-i + \beta iXt-i + \varepsilon 1t$
$Xt = \lambda iXt-i + \delta iYt-i + \varepsilon 2t$

Data Analysis and Interpretation

Descriptive statistics
Table 1The descriptive statistics results. Study demonstrates that, a major gap is evident amongst minimum and maximum Nifty 50 and Pharma segment variables. The skewness is negative (-0.0425) for Nifty 50 suggesting that the distribution's long left tail is thicker than the upper tail and Pharma sector's skewness is positive (0.35895), indicating that the long right distribution tail is thicker than the lower tail.
Nifty 50 and Pharma sectors' Kurtosis coefficient values are positive and found to be less than 3, suggesting platykurtic distribution. The Jarque-Bera test statistics indicate that every variable is abnormally disseminated. ***Hypothesis 1,*** thus, discharged and concluded that Nifty 50 and Pharma sectors are not usually distributed. Results are considered to be consistent with (D. Bhuvanshwari et al 2017).

Table 1: Descriptive statistics of Nifty and Pharm sector

PARTICULARS	**NIFTY**	**PHARMA**
Mean	9776.89	9851.779
Median	9978.55	9490
Maximum	12362.3	13470
Minimum	6970.6	6432.3
Std. Dev.	1438.83	1475.948
Skewness	-0.0425	0.35895
Kurtosis	1.72277	2.319068
Jarque-Bera	84.181	50.29878
Probability	0.0000	0.0000
Observations	1233	1233

Testing the data for Staionarity
The results for the ADF unit root test for checking stationarity of the facts obtained in Table 2.

Table 2: Results of Augmented Dickey-Fuller Test at level

	Intercept	but no trend		Intercept and	trend	

Variables	Test statistics	Critical value (5%)	Prob.	Test statistics	Critical Value (5%)	Prob.
Nifty Index	-1.85	-2.86	0.3553	-2.69	-3.41	0.2372
Pharma Sector	-1.89	-2.86	0.3357	-3.22	-3.41	0.0809

Results of Augmented Dickey-Fuller Test at 1st difference

	Intercept but no trend			Intercept and trend		
Variables	Test statistics	Critical value (5%)	Prob.	Test statistics	Critical Value (5%)	Prob.
Nifty 50	-9.01	-2.86	0.0000	-9.02	-3.41	0.0000
Pharma Sector	-33.30	-2.86	0.0000	-33.31	-3.41	0.0000

From the above table 2, it's identified that Nifty 50 and Pharma sector to be non-stationary at level form but found that to be stationary at first difference I(1). Hence both variable are integrated at first difference I(1). Therefore, ***Hypothesis 2*** rejected and it's understood that the variables (Nifty 50 and Pharma Sector) taken for this study are stationary. Co-integration test can be applied on Nifty 50 and Pharma sector variables, as supported in (Hina Shahzadi 2012).

Testing for being of Long-term equilibrium association

Johansen's co-integration test is smeared to discover the linear relationship or long-term cointegration amid the variables, to be exact, whether there is any long-term affiliation amongst Nifty 50 and Pharma Sector. 2 trials are applied, the Trace and Maximum Eigen value test to regulate the sum of vectors. A lag of 1 to 4 (in 1st differences) is applied to every series, centered on the AIC (Akaike Information Criterion).

Table 3: Results of Johansen's Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.015470	20.81658	15.49471	0.0072
At most 1	0.001360	1.670816	3.841465	0.1961
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.015470	19.14577	14.26460	0.0078
At most 1	0.001360	1.670816	3.841465	0.1961
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				

**MacKinnon-Haug-Michelis (1999) p-values	

Outcomes show trace test and maximum value test is more than 5 percent precarious. Consequently, both test standards are noteworthy. ***Hypothesis 3*** was also dismissed, which implies there is long relationship/association between Nifty 50 and Pharma sector. Suggesting that the model has one co-integration vector, which means that the variable moves together for a long-term relationship. It can infer that a stationary, long-term affiliation exists between variables as supported in (Saha and Bhunia 2011) and (Amalendu Bhunia 2013). Figure shows the Co-integrating relationship between variabls.1.

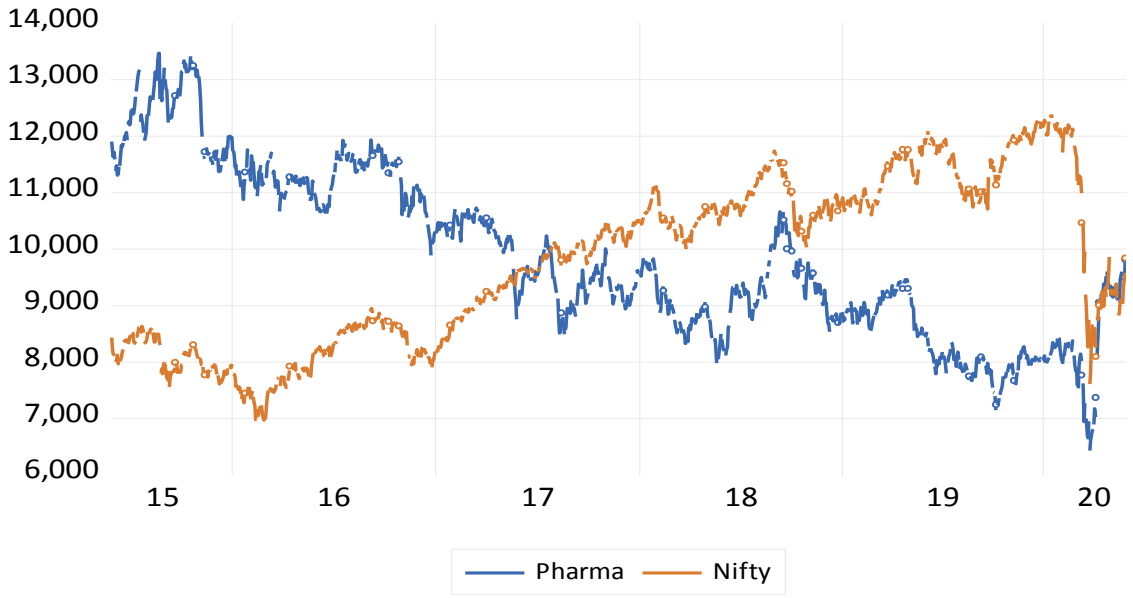

Fig. 1: Cointegration Relationship between Nifty Index and Pharma Sector

Testing for Granger Causality

Granger causality investigates to show if one data series variable is having adequate to forecast other data series variable in a specific age of time and also helps in defining the short run affiliation among the variables.

Table 3: Results of Granger causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
PHARMA does not Granger Cause NIFTY	1231	90.1322	3.E-37
NIFTY does not Granger Cause PHARMA		7.93464	0.0004

The outcomes point out that there is causality amongst the Nifty index and pharma sector. The direction of causality found to be bi-directional (From Pharma → Nifty Index and also Nifty Index → Pharma Sector) and noteworthy at 5%. Consequently, ***Hypothesis 5*** overruled. The outcome of the above investigation is discovered equivalent to the studies by (Kutty 2010) and (D. Bhuvaneshwari et al 2017).

Conclusion

The research explored the co-integration and causal affiliation amongst Nifty Index and the Pharmaceutical sector using daily data for June 2015 - June 2020. The research variables data series was I (0) level non-stationary and became stationary series at initial variance. All research variables are combined at order level I(1). Johansen's co-integration test showed no long-term affiliation amongst stock values and exchange amount. This implies long-run partnership co-movement amongst the Nifty Index and Pharma Market. Granger causality test is used to detect if there is causal and short-term Nifty 50 index and Pharma Sector relationship. Granger causality test fallouts in bidirectional causality i.e. causality since Nifty index to Pharma meadow and vice versa. It follows that the above research backs (Ali et al 2011) and (Rathod 2015). In this analysis, variables are co-integrated at long-term relationship and in short, causality between variables is significant. There is a common assumption amongst the investors that there is a correlation between Nifty index and Pharmaceutical industry, and they are predictable based on both variables values.

Reference:

1. Ali, S., Butt, B. Z., & Rehman, K. (2011). Comovement between emerging and developed stock markets: An in- vestigation through cointegration analysis. World Applied Sciences Journal, 12(4), 395-403.
2. Anil Kumar Bhuyan, A. K. D. (2018). A dynamic causality analysis between gold price movements and stock market returns : Evidence from India. Journal of Management Research and Analysis, 5(2), 117–124. https://doi.org/10.18231/2394-2770.2018.0019
3. Anjali, A., & Thomachan, K. T. (2015). Long Run Relationship between Capital Market and Banking Sector ? A Cointegration on Federal Bank. Bonfring International Journal of Industrial Engineering and Management Science, 5(1), 05–09. https://doi.org/10.9756/bijiems.8020
4. Bhuvaneshwari, D., & Ramya, K. (2017). Cointegration and Causality between Stock Prices and Exchange Rate: Empirical Evidence from India. SDMIMD Journal of Management, 8(1), 39. https://doi.org/10.18311/sdmimd/2017/15720
5. Chinnadurai Kathiravan, M. S. (2019). Relationship between Crude Oil Price Changes and Airlines Stock Price : The Case of Indian Aviation Industry. International Journal of Energy Economics and Policy, 9(5), 7–13.
6. DR Bhunia, A. (2013). Cointegration and Causal Relationship Among Crude Price, Domestic Gold Price and Financial Variables- an Evidence of Bse and Nse. Journal of Contemporary Issues in Business Research Journal of Contemporary Issues in Business Research ISSN, 2(1), 2305–8277.
7. Ekong, N. P., & Ebong, D. W. (2016). On the Crude Oil Price, Stock Market Movement and Economic Growth Nexus in Nigeria Evidence from Cointegration and Var Analysis. Asian Journal of Economic Modelling, 4(3), 112–123. https://doi.org/10.18488/journal.8/2016.4.3/8.3.112.123
8. Ekong, N. P., & Ebong, D. W. (2016). On the Crude Oil Price, Stock Market Movement and Economic Growth Nexus in Nigeria Evidence from Cointegration and Var Analysis. Asian Journal of Economic Modelling, 4(3), 112–123. https://doi.org/10.18488/journal.8/2016.4.3/8.3.112.123
9. Granger, C. W. J. (1988). Some recent development in a concept of causality. Journal of Econometrics, 39(1–2), 199–211. https://doi.org/10.1016/0304-4076(88)90045-0
10. Johansen, S. (1988). Statistical analysis and cointegrating vectors. Journal of Economic Dynamics & Control, 12, 231-254.
11. Kumar, V., & Singh, K. (2020). Dynamic linkage between nifty-fifty and sectorial indices of national stock exchange Abstract : AMERICAN JOURNAL

OF ECONOMICS AND BUSINESS MANAGEMENT, 3(2), 17–27. https://doi.org/10.31150/ajebm.Vol3.Iss2.148

12. Kurisetti, P. (2018). Test of Co-integration and Equilibrium Relationship among the Selected Sectoral Indices : Empirical Evidence from NSE India . Pacific Business Review International, 10(11), 114–123.
13. Kutty, G. (2010). The relationship between exchange rates and stock prices: the case of Mexico. North American Journal of Finance and Banking Research, 4(4), 1-12.
14. Markowitz, H. (1952). Portfolio selection. Journal of Finance, 7, 77-91.
15. Mishra, P. K., Das, J. R., & Mishra, S. K. (2010). Gold price volatility and stock market returns in India. American Journal of Scientific Research, 9, 47-55.
16. Omojefe, G., Harcourt, P., Harcourt, P., & Monte, C. (2019). Measuring Co-Movement in International Portfolio Diversification. 5(4), 25–34.
17. Parthasarathy, S. (2019). Does Nifty Index Inclusion (still) Convey Information ? A Comprehensive Empirical Examination in the Indian Stock Market. Asian Journal of Finance & Accounting, 11(1), 307–331. https://doi.org/10.5296/ajfa.v11i1.14866
18. Rathod, K. (2015). An empirical analysis on performance of Indian indices over world indices - A study of economy recovery phase. Paripex - Indian Journal of Research, 4(7), 410-412.
19. Sahu, P. K., Dey, S., Sinha, K., Singh, H., & Narsimaiaha, L. (2019). Cointegration and Price Discovery Mechanism of Major Spices in India. American Journal of Applied Mathematics and Statistics, 7(1), 18–24. https://doi.org/10.12691/ajams-7-1-3
20. Samadder, S., & Bhunia, A. (2018). INTEGRATION BETWEEN INDIAN STOCK MARKET. Journal of Commerce & Accounting Research, 7(1), 13–23.
21. Sharma, A., Giri, S., Vardhan, H., Surange, S., Shetty, R., & Shetty, V. (2018). Relationship between Crude Oil Prices and Stock Market : Evidence from India. International Journal of Energy Economics and Policy, 8(4), 331–337.
22. Sharma, A., Giri, S., Vardhan, H., Surange, S., Shetty, R., & Shetty, V. (2018). Relationship between Crude Oil Prices and Stock Market : Evidence from India. International Journal of Energy Economics and Policy, 8(4), 331–337.
23. Simiyu, E., Korir, J., & Laiboni, G. (2020). Dynamic Linkages of Stock Market Sectors : Evidence from the Kenyan Stock Market. Journal of Finance and Economics, 8(1), 33–39. https://doi.org/10.12691/jfe-8-1-5
24. Simiyu, E., Korir, J., & Laiboni, G. (2020). Dynamic Linkages of Stock Market Sectors : Evidence from the Kenyan Stock Market. Journal of Finance and Economics, 8(1), 33–39. https://doi.org/10.12691/jfe-8-1-5