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Dynamic Linkage among Crude Oil, Exchange Rates and P/E Ratio: The Case of India

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Abstract

Crude oil prices are one of the most necessary global commodity. Exchange Rates are another vital determinant of country's wealth and trade. Exchange rates and crude oil prices affects any nation's stock market performance. The study intends to examine the relationship of crude oil prices (Indian Basket), exchange rates (USD/INR) and Price/Earnings ratio of sectoral indices of the National Stock Exchange (Automobile, Information Technology, Nifty Bank and Metal Index) India. The study found high negative correlation between P/E ratios of indices and Indian Basket of Crude oil prices. The study found positive correlation between P/E ratios of indices and Exchange rate (USD/INR). The study used Johansen Cointegration test to test cointegration relationship among the selected variables. Overall the study found cointergration relationship among P/E Ratio of Bank Index, Crude oil and Exchange rate. Further, strong cointergration relationship among P/E Ratio of IT Index, Crude oil and Exchange rate. Further the study found no cointegration relationship among P/E ratio of Auto Index Crude oil and Exchange rate. Further, no cointegraton relationship among P/E ratio Metal index Crude oil and Exchange rate.

Key Words: Crude oil price, exchange rates, price/earnings ratio, nifty sectoral indices and johansen cointegration test.

1. Introduction

Indian economy is the sixth largest economy in the world. It is fast changing and has long term growth prospective. It has grown immensely over the years which had both positive and negative impact on various sectors of the economy. There are about 200 economic parameters in any economy and each is affected by the other. In the present day scenario, there is an increasing integration between financial markets and stock reforms. And in order to study the market one has to study the macroeconomic variables as these variables show an aggregate picture of the economic environment and so they have a broad impact on the stock market and on the economy as a whole. Some of the most influencing variables are crude oil prices, money supply, gross domestic product, exchange rates, etc. Many researchers have considered these variables and studied its impact on the stock market. The Crude Oil Basket is one of the most necessary worldwide commodities. It is the average of Dubai and Oman (sour) and the Brent crude oil Prices (sweet). It has been of the most volatile commodities in recent times in terms of price fluctuation. Oil is required by various sectors and it can have a major impact on its earnings. Similarly, the exchange rates also affect various sectors and their working. Exchange rate is the rate at which one currency is exchanged for another. Currency fluctuations are natural to most major economies. India depends on various countries for exports and imports as many companies are integrated and are pursuing international operation to get access to innovation and latest technology. Considering, USD/INR i.e. the rupee-dollar relationship, there has been a largely negative relationship in terms of the depreciation of rupee against dollar. The upward and downward movement of these exchange rates determines the value of stock of firms, when expressed in international currency, though P/E is independent of currency of statement. So, all such variables have a major impact on various sectors of our economy. In order to study the affect these variables on the sectors, Price/Earnings Ratio has to be studied and analyzed. Price/Earnings Ratio is the ratio which shows the value of a company. It measures the current price of share to earnings per share. It explains how much an investor will be willing to pay. It is a major determinant that determines the performance and earnings of a company. So, various investors and analysts study the P/E Ratio before taking any investing decision. Basically, higher P/E Ratio shows a higher stock price and lower P/E ratio shows a lower price of share. However, this might vary depending on whether it is long-term or short-term. All sectoral indices are affected by macroeconomic variables. The indices help in ascertaining the benchmark performance of stocks grouped together by similar type of industry. Some of them are Automobile, Banks, Information Technology sector and many others. And, the Nifty sectoral indices account for major market capitalization. Hence, in the modern economy, there is constant need for growth and change. And for studying the impact of changing economy one has to consider the valuable macroeconomic variables and analyze their impact before taking any investing decision.

2. Literature Review

Kumar (2017) pointed out that the earning per share is the main reflector of how market price changes and that each external factor has to be studied to know the impact of the same. Kuhan and Kavida (2017) observed that inflation and interest rates have a positive relation with the index and exchange rate has a negative effect with index.

While the crude oil prices, FDI and GDP have unidirectional relationship with index. In the same way Rabia and Khakhan (2016) found positive relationship between crude oil prices and stock market of India. Further they explained that increase in prices has a negative impact on imports. Aijaz *et al* (2016) concluded that oil prices have a negative impact on stock market index whereas gold prices have a positive relation with the index.

Billah *et al* (2014) proved negative relationship between stock prices and exchange rates. Sahai and Bairagi (2014) found weak but significant relationship between crude oil prices and stock returns. Dhruv and Dharmesh (2014) found significant impact of exchange rates, oil prices and GDP on market price.

Similarly Singh (2014) found that money supply, gold and exchange rates have a major impact on the economy and the stock market respectively. However, author explained that increase in money supply, inflow of capital will create a favorable effect whereas outflow and increased prices will bring down the economy. Wan Ting Wu (2014) found that firms with higher Price/Earnings Ratio have a lower Return on Equity and the firms with a lower Price/Earnings Ratio have a more volatile Return on Equity.

Kumar and Maheswaran (2013) found that the long-run volatility crude oil prices have a negative impact on the Auto sector and positive impact on Metal sector.

Further, the short-run volatility crude oil has a positive effect on the Auto Sector but negative effect on Metal and Mining Sector.

Hemadiya and Devi (2013) found that earning per share is the one that has the most effect on the market price by analyzing both micro as well as macro-economic factors.

Singh *et. al.,* (2011) found impact of GDP on stock returns, whereas Inflation and Interest Rates found negative relationship portfolio performance. Sharma (2011) found that dividend per share and earnings per share are the major determinants of market price.

Objectives of the Study

1. To assess the relationship among crude oil prices, exchange rates and Price/Earnings Ratio of Sectoral Indices of NSE.

2. To analyze the co-integration relationship among Crude Oil Prices, Exchange Rates and Price/Earnings Ratio of Sectoral Indices of NSE.

Hypothesis of the Study

H_{0a}= The P/E ratios, Exchange rates and crude oil prices have unit root.

H_{ob} = There is no correlation relationship among exchange rates, Crude oil prices and Price/Earnings Ratio of Sectoral Indices of NSE.

H_{0c}= There is no co - integration relationship among Price/Earnings Ratio of Sectoral Indices of NSE, Exchange rates and crude oil prices.

3. Research Methodology

3.1 Data: The study collected monthly Price/Earnings Ratio of Sectoral Indices of NSE, crude oil prices and Exchanges rates.

3.2 Period of the study: The study collected monthly Price/Earnings Ratio of Sectoral Indices of NSE, crude oil prices and Exchanges rates for the period of 12 years from April 2006 to March 2017.

3.3 Sources of Data: The study collected monthly Price/Earnings Ratio of Sectoral India from National Stock Exchange (NSE), India website. The study collected exchange rate (USD/INR) from investing.com, the study collected Brent crude oil (Indian Basket Crude oil) prices from petroleum planning and analysis cell (ppac.org.in.)

3.4 Selection of Variables: The study selected P/E ratio of four major stock indices of NSE (Metal, Bank, IT and Auto index), USD/INR exchange rate and Brent crude oil (Indian Basket Crude oil) prices.

3.5. Analytical Tools

1. Cross Correlation: the study used cross correlation to assess the relationship between P/E ratio of sectoral indices and Crude oil, P/E ratio of sectoral indices and exchange rate (USD/INR).
2. Unit-root test: The study used Augmented Dickey–Fuller test (ADF) to test the presence of unit root in the selected variables during sample period
3. Johansen Cointegration Test: Since, all the selected P/E ratio of four stock indices of NSE (Metal, Bank, IT and Auto index), USD/INR exchange rate and Brent crude oil prices are non-stationary at level but stationary at first order difference, the study used Johansen Cointegration Test to check whether there exists a cointegration among the variables.

4. Analysis and Interpretation

4.1. Descriptive Statistics

Table (4.1.1): Shows descriptive statistics of USD/INR, PE ratios of Nifty bank and Crude oil.

	USD	P_E_BANK	IB_COIL
Mean	52.8283	17.8613	81.0923
Median	49.6500	17.6850	77.7999
Maximum	68.5980	30.3000	132.4712
Minimum	39.1950	8.4100	28.1240
Std. Dev.	9.1620	4.6514	25.9767
Skewness	0.2807	0.6647	-0.1181
Kurtosis	1.6488	3.3785	1.7876
Jarque-Bera	11.7750	10.5086	8.3915
Probability	0.0028	0.0052	0.0151
Observations	132	132	132

Source: (Researcher's own calculation)

Table (4.1.2): Shows descriptive statistics of USD/INR, PE ratios of Nifty Auto index and Crude oil.

	P_E_AUTO	USD	IB_COIL
Mean	31.1228	60.1538	82.6249
Median	29.7100	61.7950	101.1111
Maximum	55.4300	68.5980	123.6106
Minimum	16.4000	44.2100	28.1240
Std. Dev.	11.0685	6.2480	29.9378
Skewness	0.6210	-0.6239	-0.3923
Kurtosis	2.3949	2.3977	1.4194
Jarque-Bera	5.4877	5.5189	8.9529
Probability	0.0643	0.0633	0.0114
Observations	69	69	69

Source: (Researcher's own calculation)

Table (4.1.3): Shows descriptive statistics of USD/INR, PE ratios of Nifty IT index and Crude oil.

	USD	P_E_IT	IB_COIL
Mean	51.0137	15.6015	71.1587
Median	47.0650	16.8800	67.2200
Maximum	68.5980	24.1100	132.4712
Minimum	39.1950	4.5400	23.6800
Std. Dev.	8.5990	5.1283	29.1828
Skewness	0.7230	-0.4024	0.1572
Kurtosis	2.1069	2.0337	1.7732
Jarque-Bera	21.0605	11.5318	11.6944
Probability	0.0000	0.0031	0.0029
Observations	175	175	175

Source: (Researcher's own calculation)

Table (4.1.4): Shows descriptive statistics of USD/INR, PE ratios of Nifty Metal and Crude oil.

	IB_COIL	USD	P_E_METAL
Mean	82.6249	60.1538	15.9288
Median	101.1111	61.7950	12.7500
Maximum	123.6106	68.5980	44.3600
Minimum	28.1240	44.2100	8.6400
Std. Dev.	29.9378	6.2480	8.0609
Skewness	-0.3923	-0.6239	1.9213
Kurtosis	1.4194	2.3977	5.8729
Jarque-Bera	8.9529	5.5189	66.1794
Probability	0.0114	0.0633	0.0000
Observations	69	69	69

Source: (Researcher's own calculation)

Table 4.1.1 to 4.1.4 shows the descriptive statistics of exchange rates, Indian Basket crude oil prices and four P/E ratios of sectorial indices. That tables 4.1 to 4.4 clearly indicates the number of observations changes with respect to the P/E ratios of four sectorial indices respectively.

4.2. Cross Correlation

Table (4.2.1): Shows Cross Correlation among P/E of Bank Index Crude Oil prices and Exchange Rates (USD/INR).

Variables	USD	P_E_BANK	IB_COIL
USD	1.0000	----	----
P_E_BANK	0.1686	1.0000	-----
IB_COIL	-0.3313	-0.5144	1.0000

Source: (Researcher's own calculation)

Table 4.2.1 shows positive correlation between Exchange rate and P/E Ratio of Bank Index. Further negative correlation between Crude Oil prices and P/E Ratio of Bank Index.

Table (4.2.2): Shows Cross Correlation among P/E of Auto Index Crude Oil prices and Exchange Rates (USD/INR).

Variables	P_E_AUTO	USD	IB_COIL
P_E_AUTO	1.0000	----	----
USD	0.6883	1.0000	-----
IB_COIL	-0.7474	-0.7907	1.0000

Source: (Researcher's own calculation)

Table 4.2.2 shows positive correlation between Exchange Rate and P/E Ratio of Auto Index. Further, negative correlation between Crude Oil prices and P/E Ratio of Auto Index.

Table (4.2.3): Shows Cross Correlation among P/E of IT Index Crude Oil prices and Exchange Rates (USD/INR).

	USD	P_E_IT	IB_COIL
USD	1.0000	-----	-----
P_E_IT	0. 4361	1.0000	-----
IB_COIL	-0.0292	0.5901	1.0000

Source: (Researcher's own calculation)

Table 4.2.3 shows positive correlation between both Exchange Rate and P/E Ratio of IT Index and Crude Oil prices and P/E Ratio of IT Index respectively.

Table (4.2.4): Shows Cross Correlation among P/E of Metal Index Crude Oil prices and Exchange Rates (USD/INR).

	IB_COIL	USD	P_E_METAL
IB_COIL	1.0000	-----	-----
USD	-0.7907	1.0000	------
P_E_METAL	-0.5839	0.5684	1.0000

Source: (Researcher's own calculation)

Table 4.2.4 shows negative correlation between Crude Oil prices and P/E Ratio of Metal Index and positive correlation between Exchange Rates and P/E Ratio of Metal Index respectively.

4.3. Unit Root Test

Table (4.3.1): Shows the unit root results of PE ratio of Bank Index, exchange rate and Crude oil price

At Level			
Variable Name	t Statistics	Probability	Conclusion
IB_COIL	-2.161393	0.2215	Non stationary
P_E BANK	-2.59903	0.0957	Non stationary
USD	-1.119685	0.7068	Non stationary
First Order Difference			
Variable Name	t Statistics	Probability	Conclusion
D(IB_COIL)	-7.157945 ***	0	I(1)
D(P_E BANK)	-11.31033 ***	0	I(1)
D(USD)	-10.59861 ***	0	I(1)

Source: (Researcher's own calculation) (*** indicates significant at 1% level)

Table 4.3.1 shows the result of ADF test. The ADF test is used to illustrate whether the variables under consideration are stationary or not. It can be inferred that variables of Crude Oil Prices, Exchange Rates and P/E Ratio are non-stationary at level. Further, it is found stationary at first difference.

Table (4.3.2): Shows the unit root results of PE ratio of Auto Index, exchange rate and Crude oil price

At Level			
Variable Name	t Statistics	Probability	Conclusion
IB_COIL	-0.994697	0.7507	non Stationary
P_E AUTO	-0.616254	0.8954	non Stationary
USD	-0.546555	0.9872	non Stationary
First Order Difference			
Variable Name	t Statistics	Probability	Conclusion
D(IB_COIL)	-5.570968 ***	0	I(1)
D(P_E B AUTO)	-7.207213 ***	0	I(1)
D(USD)	-8.071997 ***	0	I(1)

Source: (Researcher's own calculation) (*** indicates significant at 1% level)

Table 4.3.2 shows the result of ADF Test. It can be inferred that the 3 variables Crude Oil prices, Exchange Rates and P/E Ratio of Auto Index are non-stationary at level. Further, it is found stationary at first order difference.

Table (4.3.3): Shows the unit root results of PE ratio of IT Index, exchange rate and Crude oil price

At Level			
Variable Name	t Statistics	Probability	Conclusion
IB_COIL	-1.582139	0.4895	non Stationary
P_E IT	-1.428682	0.5672	non Stationary
USD	-1.601787	0.4795	non Stationary
First Order Difference			
Variable Name	t Statistics	Probability	Conclusion
D(IB_COIL)	-8.333601 ***	0.000	I(1)
D(P_E IT)	-13.57670 ***	0.000	I(1)
D(USD)	-12.12519 ***	0.000	I(1)

Source: (Researcher's own calculation) (*** indicates significant at 1% level)

Table 4.3.3 shows the result of ADF Test. It can be depicted that the 3 variables, Crude Oil prices, Exchange Rates and P/E Ratio of IT Index are non-stationary at level. Further, it was found stationary at first order difference.

Table (4.3.4): Shows the unit root results of PE ratio of Metal Index, exchange rate and Crude oil price

At Level			
Variable Name	t Statistics	Probability	Conclusion
IB_COIL	-0.994697	0.7507	non Stationary
P_E METAL	-2.147871	0.2271	non Stationary
USD	-0.546555	0.9872	non Stationary
First Order Difference			
Variable Name	t Statistics	Probability	Conclusion
D(IB_COIL)	-5.570968 ***	0.000	I(1)
D(P_E METAL)	-2.14781 ***	0.000	I(1)
D(USD)	-8.071997 ***	0.000	I(1)

Source: (Researcher's own calculation) (*** indicates significant at 1% level)

Table 4.3.4 shows the result of ADF test. It can be depicted that the 3 variables Crude Oil price, Exchange Rates and P/E Ratio of Metal Index are non-stationary at level. Further, it was found stationary at first order difference.

4.4. Cointegration Test Results

Table (4.4.1): Shows cointegration results of Metal Index, Crude oil and Exchange rate

Series: USD P_E_METAL IB_COIL

Unrestricted Co-integration Rank Test (Trace)

No. of CE(s)	Eigenvalue (EV)	Trace Statistic	Prob.
None	0.178752	15.57530	0.7417
At most 1	0.034883	2.381001	0.9880
At most 2	3.19E-05	0.002135	0.9595

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Prob.
None	0.178752	13.19430	0.4345
At most 1	0.034883	2.378866	0.9793
At most 2	3.19E-05	0.002135	0.9595

Table 4.4.1 shows cointegration results of P/E Ratio of Metal Index, Crude oil and Exchange rate. The trace test and Maximum Eigenvalue statistics are clearly indicate that there is no cointergration relationship found among P/E Ratio of Metal Index, Crude oil and Exchange rate.

Table (4.4.2): Shows co-integration results of Bank Index, Crude oil and Exchange rate

Series: IB_COIL P_E_BANK USD

Trace Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Prob.
None	0.164068	35.28727	0.0105
At most 1	0.059717	12.70712	0.1260
At most 2	0.038515	4.948795	0.0261

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Prob
None	0.164068	22.58015	0.0311
At most 1	0.059717	7.758328	0.4038
At most 2	0.038515	4.948795	0.0261

Table 4.4.2 shows cointegration results of P/E Ratio of Bank Index, Crude oil and Exchange rate. The trace test and Maximum Eigenvalue statistics are clearly indicate existence of cointergration relationship among P/E Ratio Bank Index, Crude oil and Exchange rate.

Table (4.4.3): Shows co-integration results of Nifty IT Index, Crude oil and Exchange rate

Series: IB_COIL P_E_IT USD

Trace Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Prob.**
None *	0.104694	31.88691	0.0283
At most 1	0.051374	13.08672	0.1117
At most 2 *	0.023949	4.120831	0.0424

Maximum Eigenvalue Results

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Prob.**
None	0.104694	18.80019	0.1028
At most 1	0.051374	8.965891	0.2890
At most 2 *	0.023949	4.120831	0.0424

Table 4.4.3 shows cointegration results of P/E Ratio of IT Index, Crude oil and Exchange rate. The trace test and Maximum Eigenvalue statistics are clearly indicate existence of very strong cointergration relationship among P/E Ratio of IT Index, Crude oil and Exchange rate.

Table (4.4.4): Shows co-integration results of Nifty Auto Index, Crude oil and Exchange rate

Series: USD P_E_AUTO IB_COIL

Lags interval (in first differences): 1 to 2

Test Trace results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Prob.**
None	0.149242	15.30115	0.7602
At most 1	0.063586	4.633763	0.8464
At most 2	0.004500	0.297698	0.5853

Maximum Eigenvalue test results

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Prob.**
None	0.149242	10.66739	0.8223
At most 1	0.063586	4.336065	0.5853
At most 2	0.004500	0.297698	

Table 4.4.4 shows cointegration results of P/E Ratio of Auto Index, Crude oil and Exchange rate. The trace test and Maximum Eigenvalue statistics are clearly indicate that there is no cointergration relationship found among P/E Ratio of Auto Index, Crude oil and Exchange rate.

5. Conclusion

The study pertains to the analyze the relationship between Crude Oil Prices, Exchange Rates and Price/Earnings Ratio of selected NSE Sectoral Indices. The study found high negative correlation between P/E ratios of indices and Indian Basket of Crude oil prices. The study found positive correlation between P/E

ratios of indices and Exchange rate (USD/INR). Further, the cointegration results found cointergration relationship among P/E Ratio of Bank Index, Crude oil and Exchange rate. Further, strong cointergration relationship among P/E Ratio of IT Index, Crude oil and Exchange rate. Further the study found no cointegraton relationship among P/E ratio of Auto Index Crude oil and Exchange rate. Further, no cointegraton relationship among P/E ratio Metal index Crude oil and Exchange rate. The foreign exchange market, stock market, crude oil market participants, policy makers and regulators can take advantage of positive and negative relationship. Moreover market participants can consider the same for optimum portfolio construction and induce short term trading opportunities.

References

[1] Arif Billah Dar, A. S., & Samantaraya, A. (2014). The relationship between stock prices and exchnage rates in Asian Markets : A wavelet based correlation and quantile regression approach. South Asian Journal of Global Business Research, 3(2), 209-224.

[2] Dhruv, N. P., & Raval, D. D. (2014). A study on effect of macro-economic variables and P/E Ratio on Stock Returns. Journal of Commerce and Management(2).

[3] Kumar, D., & Maheswaran, S. (2013). Evidence of long memory in the indian stock maarket. Asia-pacific Journal of Management, 9(1), 9-21.

[4] Hemadivya, K., & Devi, D. V. (2013). A study on relationship between market price and earnimg per share with reference to selected comapnies. International journal of marketing, Financial services and management research, 2(9), 126-133.

[5] P, M. R., K, K., & Kavida, D. V. (2017). Impact of selected macroeconomic indicators on S&P BSE SME IPO Index. Indian Journal of Commerce and Management studies, 8(1), 28-32.

[6] R, N., & K, N. (2016). Impact of Crude oil prices on bomaby stock exchange. Journal of business and financial affairs, 5(4), 1-3.

[7] Kumar, D. P. (2017). Impact of Earning per share and price aerning ratio on market price of share : A study on Auto sector in India. International Journal of Research, 5(2), 113-118.

[8] Singh, P. (2014). Indian stock market and macroeconomic factors in current scenario. International journal of research in research in business management, 2(11), 43-54.

[9] Ozlen, S. (2014). The Effect of Company Fundamentals on Stock Values. International Disciplinary Journal, 71(3), 595-602.

[10] Sharma, D. S. (2011). Determinants of Equity share prces in India. Journal of Ar ts, Science and Commerce, 2(4), 51-60.

[11] Singh, T., Mishra, S., & Varsha, M. S. (2011). Macroeconomic factors and Stock returns : Evidence from Taiwan. Journal of Economics and International Finance, 2(4), 217-227.

[12] Sahai, V. P., & Bairagi, P. (2014). Impact of changes in oil prices on Indian stock market. Precedings of Management, 204-208.

[13] Aijaz, U., Faisal, M., & Meraj, A. (2016). Impact of oil and gold prices on stock market index. Journal of buisness strategies, 10(2), 69-84.

[14] Wu, W.-T.(2014). The P/E and Profitability. Journal of Economics and Business Research , 12(1), 67-76.

[15] USD INR Historical Data. (n.d.). Retrieved February 15, 2018, from https://in.investing.com/currencies/usd-inr-historical-data

[16] Index Historical Data. (n.d.). Retrieved February 20, 2018, from https://www.nseindia.com/products/content/equities/indices/historical_index_data

[17] Price-Earnings-Ratio- P/E Ratio. Retrieved February 20, 2018, from https://www.investopedia.com/terms/p/price-earningsratio.asp

[18] Key Macroeconomic Variables (n.d.). Retrieved February 20, 2018, from https://bizfluent.com/info-8180727-key-macroeconomic-variables.html