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Empirical Study on relationship between India's Index of Industrial Production of Manufacturing Sector and Crude Oil Prices

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Abstract

This research paper is in the context of India's manufacturing sector and crude oil prices. The paper attempts to investigate relationship between Index of Industrial Production of manufacturing sector and Crude oil prices. India is oil importing country and fulfils its demand by imported crude oil. Hence it is very much interesting and essential to study the impact of crude oil prices on manufacturing sector. The data from April-2005 till Jan-2017 has been used for the study. The study has followed various methods of econometrics for analysis like unit root, Johansen Co-integration test, and VAR model. The study find absence of long term cointegration between variable, and attempts to establish relation with VAR model.

Keywords: Crude oil, Index of Industrial Production (IIP), Manufacturing, Economy

Introduction

In last two decades, Indian economy has grown rapidly and established its importance in global market. On one side India has advantage of large population and on another side it has disadvantage of having low natural resources of crude oil. As per U.S. Information Administration's data of 2017, India is the 3rd largest consumer of crude oil and it consumes 4.34 Million barrels per day and accounts to 4% of world's total daily demand. On other side, India does not have any contribution in the global crude oil production. This increases the burden on Balance of Payment due to higher import of crude. India is depended on around 82% of imported crude oil to satisfy its demand.

This means that India has capacity to influence global demand due to higher import but cannot influence global supply by oil export. Hence, it is an area of interest for researcher to study the impact of oil prices on Indian Economy. Growth of Economy is based on the overall growth of various sections like agriculture, industrial and services sector. In industry, manufacturing sector is very much important for any nation for the economic growth. Manufacturing sector of India includes various industries of steel, iron, metal, plastics etc. These sectors use gas, kerosene, petrol etc. as energy resource. These are by-products of crude oil. Higher crude prices affects their input cost. Hence, players of these sectors closely observes crude oil prices. Author in their previous work have proved that Stock Indices of India causes the crude prices but crude prices do not have significant impact on stock indices (Gujarati, Baser, Parikh, & Shah, 2018). Authors have justified the relation with the argument that economic growth of India increase the demand of crude oil which ultimately affects the global demand curve of crude oil. As crude is used as input for the economy, higher prices will lead to reduction in country's demand which leads to decrease in global demand which leads to decrease in prices of oil. Authors would like to check and confirm their previous finding by studying a particular sector. With this purpose authors have taken manufacturing sector to compare it with oil prices. Hence, the objective of this paper is to study the relationship of IIP-Manufacturing sector and Crude oil prices.

Objectives

- To study the relationship between Crude Oil Prices and Index of Industrial Production (IIP) of manufacturing sector of India.
- To investigate nature of association between two variables i.e. long run or short run.
- To establish VECM or VAR model

Literature Reviews

Selected literatures have been incorporated considering the objectives and requirement of the study.

Ewing & Thompson (2007) in their study have found co-movement between crude oil with key variables like Industrial production, unemployment, stock prices including unemployment. They found that crude oil prices lag industrial production. They also confirms that there is increase or decrease in oil prices with up and down in industrial production the oil prices changes with lag of 1 to 2 months. In this study they have considered variables on US economy.

The study by Gokmenoglua, Azin, & Taspinar (2015) on various variables like Industrial production, oil prices, inflation and GDP of Turkey. Their finding confirm that oil price changes affects the industrial production of Turkey which is a net oil importing country. These variables are associated on short run. Kumar M. (2014) have studied crude and nifty and found cointegration similarly Sahu (2014) in found the existence of long run relationship amongst oil price changes and Indian stock market. Sahu (2014) confirmed that crude oil prices do not causes the Indian Stock Market Indices. On other side, taking the crude oil prices as one of the macroeconomic determinants, Patel (2012) finds that stock market causes the oil prices. Using Vector Error Correction Model, the long run relationship between stock market and oil prices was found by Miller and Ratti (2009). Martín-Barragán, Ramos and Veiga (2013) have concluded that correlations with stock markets were affected by oil shocks. Ghorbel, Boujelbene and Boujelbene (2014) studied 22 oil importing and exporting countries and confirmed the existence of cointegration between stock market and oil market.

Seth, Giridhar, & Krishnaswami (2016) in their paper have studied many industries which are directly or indirectly related with crude oil prices. They have stated that, those industries which are having crude products as direct source of raw material are impacted highly and negatively i.e. high prices leads to fall in production. Industries like paper, leather, tailors, semi-tailors, motor vehicle shown weak relationship due to less requirement of crude as its raw material. Hence, where crude oil is direct input raw material, then in such cases high impact of crude prices are seen. On other side, the industries like food does not get affected by higher crude prices. The study by Jain and Sigh (2013), taking the period from 1992 to 2011, have concluded that changes in crude prices have substantial impact on the rate of inflation, Index of Industrial Production (IIP) including forex reserve. Similarly, Sharma (2012) has concluded that changes in international crude prices results in higher inflation in India. Toraman, Başarır and Bayramoğlu (2011) in their study on various sectorial indices of Istanbul found that Industrial Index is highly affected by changes in oil prices.

Study by Gujarati, Baser, Parikh, & Shah (2018) confirms that India's buying capacity has significant impact on international crude oil prices and found that Nifty prices causes the crude prices. However, this finding is only applicable to country like India which is depended on imported crude oil. In contrast to this study, Aparna (2013) confirms that crude price rise has negative impact on GDP and IIP data. Whereas Chittedi (2011) in his study mentioned that fluctuations of Indian stock market has significant impact on crude prices. Ghosh (2008) has stated that Indian stock market is not inversely related with crude oil prices. Whereas Bhunia(2013) bidirectional relationship among crude and stock market which means the higher growth of economy will be seen from rising stock market which will impact crude prices. However, Indian will continue to consume huge quantity of crude oil till it continues to grow (Basher & Sadorsky, 2006). They also found that the oil prices impact significantly the returns of stock prices in emerging countries. But, according to them and up to some extent, the exact relationship between oil prices and stock return depends on data frequency being used. Chang and Yu (2013) concluded that the shocks in spot oil price immediately affects the returns of the stock markets which means oil shocks are negatively related with stock market. Oil exporting countries are always benefitted and oil importing countries will be at loss (Sujit and Kumar, 2011). This clearly indicates that country like India will be at loss when prices of crude goes up and at benefit when prices drops. Based on the analysis of 75 net energy importing countries, Esen and Bayrak (2017) in their study found significant relationship among energy consumption and economic growth.

Fang & You (2014) in study have concluded for India that if the oil prices are not rising due to rise in oil consumption in India, oil prices always have negative impact on Indian Economy. This again proves that India has capacity to influence global demand curve as mentioned by Gujarati, Baser, Parikh, & Shah (2018). Tonda, Ahuj and Tandon (2012) have studied energy sector companies and found that future prices of crude oil do not affect the stock prices of energy sector companies. Noor and Dutta (2017) concludes that volatility from the world oil market does not get transferred to Indian Stock Market which means crude prices do not have significant impact on various sectors of economy. Rafiq and Salimi (2011) mentioned that, in short run, uni-directional causality exists and moves from economic growth to energy consumption. Kumar and Maheswaran (2013) useful to understand the negative impact of crude oil and its relation with various sectors. Aktham Maghyereh (2007) mentioned that crude oil prices impact the stock market of Gulf Cooperation Council Countries. These countries are very rich in oil reserves.

Majority of the research work cited above have use many methods of econometrics and have done time series analysis. They are useful in knowing various methods of analysis. Main two books by Gujarati (2011) and Gujarati, Porter and Gunasekar (2012) were referred for conceptual clarity.

Data

Source

The series of Index of Industrial Production (IIP) of manufacturing sector is taken from Reserve Bank of

India (RBI) from (https://dbie.rbi.org.in). The series of IIP (Manufacturing) is as per the base year of 2004-05. This series is available from April-2004 to Jan-2017. The series of Crude oil spot prices is taken from Multi Commodity Exchange of India's website (https://www.mcxindia.com). These prices are available from April-2005 till Jan-2020.

Time period

To make both series comparable, the starting time frame has been set from April-2005 because of the availability of Oil prices. The ending point of the series is Jan-2017 data, because the IIP (Manufacturing) data with base of 2004-05 is available till Jan-2017. With this the duration of time period for both series is restricted from April-2005 till Jan-2017.

Data Grouping and Transformation.

The oil prices are available on day to day basis. Whereas IIP data is available on monthly basis. Hence the monthly average of oil prices have been taken for analysis. The IIP data is absolute index numbers where as oil prices are denominated in currency. Hence to make more accurate analysis both series were transformed to log series. Log series of crude prices is mentioned as 'crude_log' and log series of IIP (Manufacturing) is mentioned as 'iipm_log'.

Research Methodology

Based on the literature reviews, objectives and scope of the study, data type and its properties below methods were adopted for the analysis.

Unit Root

The missing property of Unit root is essential for time series analysis. When series has unit root it is said to be non-stationary and for time series analysis it is primary condition for the series to be stationary. When mean and variance don't change over a period of time, then such series are considered to be stationary. Widely used test i.e. ADF – Augmented Dickey-Fuller test has been used for the purpose of Unit Root test.

Test of Cointegration by Johansen

Johansen's test of cointegration is used to check the long term equilibrium between two variable. Positive results of this test indicates that two variables are having long term equilibrium relationship.

VECM - Vector Error Correction Model

When two variables are associated in long run, then VECM test is applied to check the rate of error correction. This test is applied only if the two variables are found cointegrated as per the result of cointegration test. In our case it is Johansen's test of cointegration.

VAR - Vector Autoregressive Model

In a condition when cointegration is found absent among the variables, the VECM model is not applied. Instead of VECM, the analysis is done with VAR model. VAR model considers every variable as endogenous and test equation for each endogenous variable. Lagged values of every endogenous variable is considered with values of exogenous variable.

Wald Coefficient Test

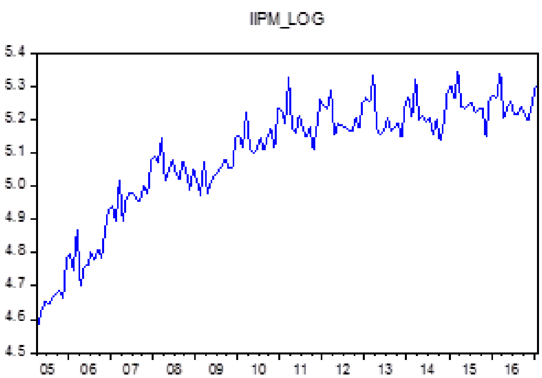
To check the significance level of coefficient, Wald Coefficient Test is used. This test allow to check multiple coefficient at a time in 'Eviews' software. Wald Test is also useful to check the joint significance of insignificant variables.

Analysis and Finding

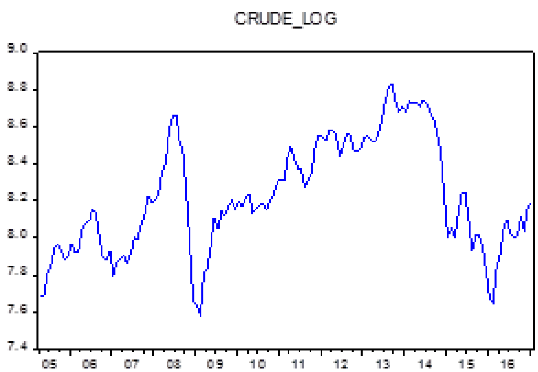
Descriptive statistics and Graphical Presentation

Table 1 : Descriptive statistics

	CRUDE_LOG	IIPM_LOG
Mean	8.219563	5.093140
Median	8.180561	5.151990
Maximum	8.832524	5.348535
Minimum	7.577783	4.587006
Std. Dev.	0.304560	0.177584
Skewness	0.128658	-1.111977
Kurtosis	2.079112	3.462231
Jarque-Bera	5.409294	30.52783
Probability	0.066894	0.000000
Sum	1167.178	723.2259
Sum Sq. Dev.	13.07874	4.446603
Observations	142	142



Graph 1 – Log series of IIP (Manufacturing)



Graph 2 – Log series of Crude prices

Based on the Graph 1 and Graph 2 it can be said that both series are not stationary and has got trend. When we look at the Jarque-Bera statistics, it can be concluded that Crude prices are found to be more normal compared to IIPM. This is also evident from the Graph 1 and Graph 2. By graphical presentation, we may say that, these series are not stationary. Therefore both the series are required to be tested for Unit Root.

Results of Unit Root Test:

Table 2 : Unit Root Test Statistics

Period	Max Lag**	Variable	t-Statistic for 5% level	at Level		at 1st Difference	
				t-Statistic	Prob.*	t-Statistic	Prob.*
April-2005 to	6	CRUDE_LOG	-3.442238	-2.82926	0.1894	-8.16485	0.0000
Jan-2017	6	IIPM_LOG	-3.442238	-2.76864	0.2115	-7.78377	0
** Lag Length: 0 (Automatic - based on SIC) *MacKinnon (1996) one-sided p-values.							

The series has unit root is null hypothesis of Unit Root Test. It has not been rejected at level. Values of t-Statistics (absolute) are higher than the critical value at 5% level of significance is found at 1st difference and not at level. The values of t-Statistic and probability values indicate that both series are stationary at 1st difference.

Johansen co-integration test.

To check the long run equilibrium between two variables Johansen co-integration test is applied. The condition of long run equilibrium is essential to apply VECM. Johansen co-integration test must be run on actual series or on transformed series, but not on differenced series. The result of Johansen co-integration test is shown in Table 3 and Table 4.

Table 3 : Johansen Cointegration Test (Trace Statistics)

Ideal Lag Length as per AIC Criteria	Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
6	None	0.070111	14.81503	15.49471	0.0631
6	At most 1	0.036373	5.001866	3.841466	0.0253
Trace test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values					

Table 4 : Johansen Cointegration Test (Max-Eigen Statistics)

Ideal Lag Length as per AIC Criteria	Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistics	0.05 Critical Value	Prob.**
6	None	0.070111	9.813161	14.2646	0.2245
6	At most 1	0.036373	5.001866	3.841466	0.0253
Max-eigenvalue test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values					

From Table 3 and Table 4, it is clear that at ideal lag length of 6 as suggested by AIC criteria, the probability values dos not support the existence of any long run association between two variables. As there is no cointeration between two variable for the time period under study, VECM cannot be applied. Here, Vector Autoregressive Model (VAR) has be applied instead of VECM.

VAR - Vector Autoregressive Model

VAR equation, all present and past values of exogenous variable as well as past or lagged values of endogenous variables are mentioned on right side of the equation. Therefore, endogenous variables are depended on the lagged values of its own and lagged values of exogenous variable. VAR equation considers all variable as endogenous variable and creates separate equations for it. Here, all series must be stationary to test under VAR model.

The standard model for Crude_Log and IIPM_Log can be defined as below.

$$d\,(\text{IIPM\_Log})_t = \sum_{i=1}^{m} \gamma_i\ d\,(\text{IIPM\_Log})_{t-i} + \sum_{j=1}^{m} \delta_j\ d\,(\text{Crude\_Log})_{t-j} + \wedge_2 t + \mu_{2t} \text{.........(Eq.1.1)}$$

$$d(\text{Crude\_Log})_t = \sum_{i=1}^{m} a_i\ d(\text{Crude\_Log})_{t-i} + \sum_{j=1}^{m} b_j\ d\,(\text{IIPM\_Log})_{t-j} + \wedge_1 t + \mu_{1t} \text{.........(Eq.1.2)}$$

Here d denotes the first difference of the series.

Standard VAR model was run in e-views and lag selection test was applied. As per Akaike information criterion (AIC) the ideal lag length of 5 for VAR was suggested. The VAR model was tested with lag length of 5 after taking 1st difference of Crude_Log and IIPM_Log series.

The VAR equations can be mentioned as below after arranging the system by variable:

D(IIPM_LOG) = C(1)*D(IIPM_LOG(-1)) + C(2)*D(IIPM_LOG(-2)) + C(3)*D(IIPM_LOG(-3)) + C(4)*D(IIPM_LOG(-4)) + C(5)*D(IIPM_LOG(-5)) + C(6)*D(CRUDE_LOG(-1)) + C(7)*D(CRUDE_LOG(-2)) + C(8)*D(CRUDE_LOG(-3)) + C(9)*D(CRUDE_LOG(-4)) + C(10)*D(CRUDE_LOG(-5)) + C(11))………..………………………………………………...Eq. 2.1

D(CRUDE_LOG) = C(12)*D(IIPM_LOG(-1)) + C(13)*D(IIPM_LOG(-2)) + C(14)*D(IIPM_LOG(-3)) + C(15)*D(IIPM_LOG(-4)) + C(16)*D(IIPM_LOG(-5)) + C(17)*D(CRUDE_LOG(-1)) + C(18)*D(CRUDE_LOG(-2)) + C(19)*D(CRUDE_LOG(-3)) + C(20)*D(CRUDE_LOG(-4)) + C(21)*D(CRUDE_LOG(-5)) + C(22)………………..……………………………………….Eq. 2.2

Significance of Coefficient

In the above equation 2.1 and 2.2 there are 11 coefficient in each equation. To establish VAR model in proper manner, these coefficient has be significant. To check the significance level, probability value of each coefficient can be derived by running the above equation with least square method. The probability of each coefficient given in Table 5.

Table 5 : p-values to check Significance of Coefficient

Sr No	**C(1)**	**C(2)**	**C(3)**	**C(4)**	**C(5)**	**C(6)**	**C(7)**	**C(8)**	**C(9)**	**C(10)**	**C(11)**
Coefficient	-0.596	-0.114	0.114	-0.212	-0.292	0.002	-0.080	0.042	0.080	-0.076	0.009
Std. Error	0.086	0.100	0.099	0.101	0.086	0.054	0.057	0.057	0.058	0.054	0.004
t-Statistic	-6.941	-1.137	1.152	-2.103	-3.378	0.035	-1.411	0.739	1.382	-1.400	2.120
Prob.	0.000	0.257	0.251	0.036	0.001	0.972	0.159	0.461	0.168	0.163	0.035

Sr No	**C(1)**	**C(2)**	**C(3)**	**C(4)**	**C(5)**	**C(6)**	**C(7)**	**C(8)**	**C(9)**	**C(10)**	**C(11)**
Coefficient	-0.046	0.006	0.352	0.243	0.086	0.322	0.123	-0.157	0.004	-0.065	-0.001
Std. Error	0.142	0.166	0.165	0.167	0.143	0.089	0.094	0.095	0.095	0.090	0.007
t-Statistic	-0.325	0.036	2.139	1.456	0.598	3.607	1.307	-1.645	0.040	-0.728	-0.186
Prob.	0.746	0.972	0.033	0.147	0.550	0.000	0.193	0.101	0.968	0.468	0.853

As per above table, C(2), C(3), C(6), C(7), C(8), C(9), C(10), C(12), C(13), C(15), C(16), C(18), C(19), C(20), C(21), C(22) are found to be insignificant as per p values and requires to be removed from the equation.

6.6 Wald Coefficient Test

It might be possible that one coefficient may be insignificant for the equation, but it might have joint significance for the equation with other insignificant variable. Hence, to eliminate, it has to be tested that all the above coefficient must not have joint significance for the equation. For this Wald Coefficient Test is done.

Null Hypothesis for Joint significance is as below:

Table 6 : Result of Wald Coefficient Test

H_0: C(2) = C(3) = C(6) = C(7) = C(8) = C(9) = C(10) = C(12) = C(13) = C(15) = C(16) = C(18) = C(19) = C(20) = C(21) = C(22) = 0			
Test Statistic	**Value**	**df**	**Probability**
Chi-square	18.58237	16	0.2909

As the probability value is above 0.05 we can accept null hypothesis which means that all these coefficient jointly do not have significance in the equation. Individual they all are insignificant but jointly also they are insignificant. Therefore, all these coefficient can be removed from the equation.

Re-estimating VAR after removing insignificant variable. Final equation can be written as below after removing insignificant variable.

D(IIPM_LOG) = C(1)*D(IIPM_LOG(-1)) + C(4)*D(IIPM_LOG(-4)) + C(5)*D(IIPM_LOG(-5)) + C(11)..eq3.1

D(CRUDE_LOG) = C(14)*D(IIPM_LOG(-3)) + C(17)*D(CRUDE_LOG(-1))…………...……..eq3.2

It can be here noted from eq.3.1 that, for deriving IIPM_log prices, Curde_log prices are not significant. Therefore, we may interpret that Crude_log prices do not have significant impact on IIPM_log prices. IIPM_log prices are only depended on its lag values.

From eq. 3.2 we may conclude that IIPM_log price of 3rd lag has significant impact on crude oil prices. Hence, Crude_Log prices are depended on 3rd lag of IIPM_log prices and 1st lag of its own.

It can be concluded that, IIPM is not impacted by crude oil prices but crude oil prices are impacted by IIPM.

Interpretation

From Table 1 of descriptive statistics and Graph 1 and Graph 2, prima facia it can be concluded that series are not stationary. When compared both variable with each other based on Jarque-Bera statistics, it can be said that curde_log prices are found to be more normal than IIPM_log prices. When both series were tested for unit root, none of them was found stationary at level which is clearly revealed by probability values shown in Table 2. Both series are found to be stationary at 1st difference. Hence all econometric analysis can be done with VECM or VAR model. Once the stationarity condition is satisfied, long run co-integration among variable was tested with Johansen co-integration test and its result are shown in Table 3 and Table 4. Trace Statistics and Max-Eigen Statistics with p-values do not confirms the long run association between two variables. Hence VECM cannot be applied. To check out the short run association, VAR model was tested. VAR model was run with ideal lag length of 5 as suggested by AIC criterion. Based on it Eq. 2.1 and Eq. 2.2 were derived. To identify the significant coefficient, the equations were run with standard ordinary least square method and probability values were found. Based on the probability values it was found that out of 22 total coefficient, 16 coefficient were found to be insignificant. To eliminate from the VAR model, all the 16 coefficient were tested for joint significance with Wald Test. Based on the result of Wald Test it was found that jointly these coefficient do not have any significance in the equation. Hence, all the coefficients were removed and Eq. 3.1 and Eq. 3.2 were derived. Based on the Eq.3.1 and Eq. 3.2 it can be interpreted that IIPM prices can be predicted with the use of lag values of its own. But to predict Crude prices, third lag of IIPM was required because of significant impact.

It can also be interpreted that, Crude Oil prices do not impact the IIPM significantly, but IIPM has significant impact on the Crude Oil prices. In other words we may interpret that India's manufacturing sector can influence crude oil prices but crude oil prices do not impact manufacturing sector's growth significantly.

Conclusion

The crude prices in India and manufacturing sector's data (IIP) were studied for its impact on each other. It can be concluded that manufacturing sector of India can impact the crude oil prices significantly but this study did not find any evidences of crude oil's significant impact on manufacturing sector of India. This could be because of the India's capacity to influence global demand of crude oil. On other side, it has no capacity to influence global supply. As crude is a commodity which provide many by-products which are used in manufacturing sector as primary source of energy. This finding is in line with the pervious finding of authors in which it was found that India's economic growth leads to higher demand of crude and increases global demand results in higher crude prices. At the same time, higher economic growth will lead to rise in stock prices. But when economic growth declines, it will reduce the crude consumption by economy which will result in lower global demand leads to reduction in prices. Both studies concludes that India's economic growth has significant impact on global crude prices, but crude prices do not have significant impact on Indian economy. Within the scope of this study, we may conclude that India's manufacturing sector has significant impact on crude prices but crude prices do not have significant impact on performance of manufacturing sector. This study may stand correct only for the countries which relies only on imported crude oil like India. The finding of this study is also limited to the time duration taken for the study. It may show different result for different time period. This study does not confirm the causal relationship between two variables, but it advocates the impact of one on another as per the VAR model derived.

References

Aktham Maghyereh, A. A.-K. (2007). Oil prices and stock markets in GCC countries: new evidence from nonlinear cointegration analysis. Managerial Fiancne, 33(7), 449-460.

Aparna, A. (2013, October-November). Impact of Oil Prices on the Indian Economy. NMIMS Management Review, XXXIII, 141-147.

Basher, S. A., & Sadorsky, P. (2006). Oil price risk and emerging stock markets. Global Finance Journal, 224-251. doi:10.1016/j.gfj.2006.04.001

Bhunia, D. A. (2013, January). 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, 2(1), 1-10.

Chang, K.-L., & Yu, S.-T. (2013). Does crude oil price play an important role in explaining stock? Energy Economics (39), 159-168. doi:http://dx.doi.org/10.1016/j.eneco.2013.05.008

Chittedi, K. (2011). Does oil price matter for Indian stock markets? Centre for Development Studies (Jawaharlal Nehru University), India. Munich Personal RePEc Archive.

Esen, O., & Bayrak, M. (2017). Does more energy consumption support economic growth in net energy-importing countries? Journal of Economics, Finance and Administrative Science, 22(42), 75-98. doi:10.1108/JEFAS-01-2017-0015

Ewing, B. T., & Thompson, M. A. (2007). Dynamic cyclical co-movements of oil prices with industrial production, consumer prices, unemployment, and stock prices. Energy Policy (35), 5535-5540. doi:doi:10.1016/j.enpol.2007.05.018

Fang, C.-R., & You, S.-Y. (2014). The impact of oil price shocks on the large emerging countries' stock prices: Evidence from China, India and Russia. International Review of Economics and Finance, 29, 330-338. doi:http://dx.doi.org/10.1016/j.iref.2013.06.005

Ghorbel, G., Boujelbene, M. A., & Boujelbene, Y. (2014). Behavioral explanation of contagion between oil and stock markets. International Journal of Energy Sector Management, 8(1), 121-144. doi:10.1108/IJESM-09-2012-0007

Ghosh, T. P. (2008, June). Multi-factor estimation of stock index movement: A case analysis of Nifty 50, National Stock Exchange of India. WP 72/2008. Dubai, UAE: University of Wollongong in Dubai.

Gokmenoglua, K., Azin, V., & Taspinar, N. (2015). The Relationship between Industrial Production, GDP, Inflation and Oil Price: The Case of Turkey. Procedia Economics and Finance, 497-503. Doi:10.1016/S2212-5671(15)00762-5

Gujarati, D. (2011). Econometrics by Examples. India: Palgrave Macmillan.

Gujarati, D., Porter, D., & Gunasekar, S. (2012). Basic Econometrics (5 ed.). New Delhi, India: McGraw Hill Education (India) Private Limited.

Gujarati, H., Baser, N., Parikh, A., & Shah, M. (2018). An Empirical Study on Relationship Between Crude Oil Prices and Nifty50 Index of Indian Stock Market: A Comparative Analysis for Pre & Post Recession Of 2008. Contemporary Challenges and Futuristic Approaches for Creating Sustainable Society. I, pp. 315-325. Gandhinagar: Excel India Publisher.

Herrera, A. M., Lagalo, L. G., & Wada, T. (2011). Oil Price Shocks and Industrial Production: Is the Relationship Linear? Macroeconomic Dynamics, 15(3), 472-497. doi:10.1017/S1365100511000290

Jain, H., & Singh, P. S. (2013, may 5). Macro-Economic Impact of Crude Oil Prices on Economy: An

Empirical Study of Indian Economy from 1992 to 2011. International Journal of Management and Social Sciences Research (IJMSSR), 2(5).

Kumar, D., & Maheswaran, S. (2013). Correlation transmission between crude oil and Indian markets. South Asian Journal of Global Business Research, 2(2), 211-229.

Kumar, M. (2014, February). The impact of oil price Shocks on Indian Stock and Foreign Exchange Markets. Money & Finance, pp. 57-88.

Martín-Barragán, B., Ramos, S. B., & Veiga, H. (2013, march). Correlations between oil and stock markets: A wavelet-based approach. Statistics and Econometrics Series 04.

Miller, J. I., & Ratti, R. A. (2009). Crude Oil and Stock Markets: Stability, Instability, and Bubbles. JEL classification: C13, C32, Q43.

Noor, M. H., & Dutta, A. (2017). On the Relationship between Oil and Equity Markets: Evidence from South Asia. International Journal of Managerial Finance,, 13(3). Doi:10.1108/IJMF-04-2016-0064

Patel, S. (2012, August). The effect of macroeconomic determinants on the performance of the Indian stock market. NMIMS Management Review, XXII, 117-127.

Rafiq, S., & Salimi, R. (2011). The linkage between energy consumption and income in six emerging economies of Asia - An empirical analysis. International Journal of Emerging Markets, 6(1), 50-73. doi:10.1108/17468801111104377

Seth, D., Giridhar, B. S., & Krishna swami, S. (2016, April). Impact of Crude Oil Price Changes on Select Indian Industries. International Journal of Social Sciences and Management, 3(2), 87-92. doi:10.3126/ijssm.v3i2.14622

Sharma, V. (2012). Three critical economic factors that influence the Indian Stock Market. Money Life. Retrieved from http://www.moneylife.in/article/three-critical-economic-factors- that influence- the-Indian-stock-market/28695.html.

Sujit, K. S., & Kumar, B. R. (2011). Study on dynamic relationship among gold price, oil price, exchange rate and stock market returns. International Journal of Applied Business and Economic Research, 9(2).

Tarak Nath Sahu, K. B. (2014). An empirical study on the dynamic relationship between oil prices and Indian stock market. Managerial Finance, 40(2), 200-215.

Tonda, D., Ahuja, P., & Tandon, N. (2012, January). An Empirical Analysis Of The Price Movements Of Futures Prices Of Brent Crude Oil On The Energy Sector Companies In Indian Bourses. Zenith - International Journal of Multidisciplinary Research, 2(1), 32-47.

Toraman, C., Başarır, Ç., & Bayramoğlu, M. F. (2011). Effects of Crude Oil Price Changes on Sector Indices of Istanbul Stock Exchange. European Journal of Economic and Political Studies, 109-123.