INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH
2021, Vol. 2, No. 2, 118 – 127
http://dx.doi.org/10.11594/ijmaber.02.02.06

Research Article

Overview of the ARIMA Model Average Crude Oil Price Forecast and its Implications on the Indian Economy Post-Liberalization

Syed Mohammad Faisal*, Ahmad Khalid Khan

Department of Accounting, Faculty of Management, Jazan University, Kingdom of Saudi Arabia

Article history:
Submission February 2021
Revised February 2021
Accepted February 2021

**Corresponding author:*
E-mail:
faisalsharar786@gmail.com

ABSTRACT

The crude oil markets have seen unpredictability over petroleum markets' good and bad times worldwide in the past few years. Various facets of the natural energy industry discuss in this research paper. The effect of the Indian ecosystem in determining oil demand and supply is vital to understand price fluctuations. Researchers in this research paper concentrates on the ARIMA model and other regression models used in the post-1991 LPG reforms to determine crude petroleum values and their primary effect on the Indian ecosystem (GDP) through time-series data from 1991 to 2019.

The ARIMA model is further evidence of the validation of datasets and the potential trend in the show of global oil rates. The uncouth oil historical values prophesy the potential movement from crude oil prices, and the recommended model-based fallouts are compelling and honest. Before applying the normality of data and unit-roots, the ARIMA model thoroughly checks at the level. If stationary is not detected, then unit-roots are suspended. The first step is to keep residuals static at the required level of significance to provide efficient forecasting using the ARIMA model used for this analysis.

JEL Classification: - C32, C53, Q40, Q47
Keywords: Unit Roots, LPG, GDP, Crude oil, ARIMA

Introduction

India is known as the world's third-leading oil-importing country and the world's seventh-largest economy as far as the present scenario is concerned. It finds it to be a key loser in the case of rising crude oil prices and a beneficiary in falling crude oil prices. The rapidity that the economy is mounting additional increases the country's need to import more and more crude oil to meet its industrial and domestic requirements.

With the latest development seen as the U.S striking sanctions to purchase crude oil from Iran, India faces the powerful and unpleasant effects of increasing crude oil prices and a weaker Indian rupee trend. India's crude oil import bill for 2018-2019 witnessed a rising trend sharply in March 2018 as India relies for 80% of its consumption needs on its crude oil Imports. The CAD (Current Account Deficit) and fiscal and economic deficits are getting more prominent in trade imbalance in the economy.

How to cite:
Faisal, S. M. & Khan, A. K. (2021) Overview of the ARIMA Model Average Crude Oil Price Forecast and its Implications on the Indian Economy Post-Liberalization. *International Journal of Multidisciplinary: Applied Business and Education Research 2* (2): 118 – 127. doi: 10.11594/ijmaber.02.02.06

The Oil Ministry in India has recently pointed out that India is more relaxed and comfortable if crude oil prices continue near to $50 per barrel, although $70 is way too much and would squeeze India's economy in a big way in the future if Saudi's drive crude oil prices tend to move further to $80 per barrel. To counterbalance and offset higher crude oil prices, the government either has to cut excise duty to impact state finances or reconsider fuel price to control the inflation rate, thus decreasing oil refiners' dent margins. The Indian Oil Ministry has been promoting to bring fuel price under the GST (Goods and Service Tax) domain that would decrease oil prices and make available immediate relief to the vast majority of people, therefore, reducing sharpened Inflation as currently, taxes build up 50% of the crude oil price collection.

The decline in crude oil rates has served the Indian government to elevate excise duty by INR 12 on petrol per liter and INR 13.77 on diesel per liter since April 2014 and help reduce (CAD) Current Account Deficit, raising GDP expectations to new heights. In its analysis, Morgan Stanley has mentioned that India's fiscal deficit is possible and expected to rise to 3.5% of India's GDP in the fiscal year 2018-2019 due to trade imbalance in the economy further. As per Nomura, a financial giant has mentioned that every $10 increase in oil prices affects India's CAD by 0.4% of India's GDP. In a few previous studies, the general election in India, 2019, Nomura forecast decreased India's GDP growth to 6.9% from 7.8%. Deutsche Bank also lowered its GDP forecast for India instead of extending CAD to 7.3% from 7.5%. Going to elections, India struggles with the unconstructive and, to an extent, the negative impact of the country's highest fuel prices in current years. India is stumbling under the most challenging assessment to fight against shocks of economic growth and Inflation under ever-rising crude oil prices.

Impact on Current Account Deficit (CAD)

As we know, the current account deficit of an economy gets broadened when the total worth of imported goods exceeds the total worth of exported goods, indicating how much India owes foreign currency to the world. With India's ever-increasing need for crude oil to meet its spending needs that have developed from 77.3% approximately in 2014 to 87.3% in 2019, the current account deficit is also expanding faster, thus inflating its import bill.

Therefore, widening CAD also puts pressure on the Indian rupee's value and weakens it against an essential bunch of currencies. As per SBI, reports suggest that Indian's CAD could further cross 2.5% of GDP for FY 2019-20, providing oil price continues at $80 per barrel. At present, CAD estimates at 0.5% for 2019-20.

Impact on Fiscal deficit

Thus, rising and mounting crude oil prices unfavorably and adversely affect India's fiscal deficit, which is the significant difference between the government's total profits and total expenses. As per our analysis during our research in this paper, India imports moves around 80% of its annual crude oil constraint that is approximately 1.5 billion barrels a year from the global markets. The rising trend in crude oil prices increases the government's entire outflow, therefore impacting and affecting its financial or fiscal deficit negatively. Fiscal shortfall gives impending into the amount of money the government has to have a loan to meet its outflows.

Impact on Valuation of Indian Currency

Faisal, S M (2016), the Rising trend in crude oil prices also adversely and negatively affect the rupee as more money flows out of the system to buy more dollars to make crude oil payments. Therefore sometimes, it is evident that RBI moves in to curtail rupee fall. The depreciating rupee has a waning and weakening effect on the countries overall economy. The rupee is at its lifetime low, as mentioned too in our past research paper ***Valuation of Currency and Its Impact on Investment: A Study in the Context of Many Confounding Factors*** published in the International Journal of Management and Commerce Innovations ISSN 2348-7585.

Khan, S M (2019), in their another paper on the depreciation of Indian currency titled ***"Depreciation of Indian Currency in the Current Economic Scenario"*** accepted for publication in International Journal of Economic Research,

(2019), India in a helpless and weaken spot in the result and deteriorating of Indian currency and therefore benefits the exporters as a whole and is thus a significant obstruction on the importers due to depreciation of Indian rupee.

Literature Review

Crude oil rate dynamic forces and progression can be premeditated through a stochastic modeling approach that seizures the time-dependent structure rooted in the time series crude oil amount numbers. Autoregressive Integrated Moving Average (ARIMA) generally recognized as Box-Jenkins Methodology (G. P. E. Box and G. M. Jenkins (1978) and the autoregressive conditional heteroscedasticity (ARCH) models with its addition to universal autoregressive conditional heteroscedasticity. (GARCH) models as familiarized by Engle (1982), and Bollerslev.

(1986) respectively billets the dynamic forces of conditional heteroscedasticity (the changing variance nature of the data). The advantages of ARIMA models are twofold; primarily, ARIMA models are a set of classic linear models which are anticipated for the linear time series and bagged linear characteristics in the time series (Wang et al., 2005).

Since World War II, Hamilton (1996) argued that U.S. recessions follow by oil price spikes, a strong link between the effects of oil prices and slumps on the U.S. economy. Furthermore, the crucial observations conclude by Brown and Yüce (2002).

Oil price escalations are estimated to shake net oil importers nations adversely, over and done with growing import bills leading to inflation, decreasing productivity, and joblessness (Bacon and Kojima, 2008). Like Chang and Wong (2003) indicated, the impact of oil volatilities on GDP, inflation, and unemployment has been significant. Pérez de Gracia (2005) accomplish that oil prices have a substantial effect on fiscal activity and amount indexes, although the bearing restricts to the short-run for some Asian countries.

Recessions were also studied by Blanchard and Gali (2007) that pigeonholed the macroeconomic performance of a set of industrialized economies in the aftermath of the oil price shocks of the 1970s and the previous epoch, using a six-variable VAR model. They found a substantial part of oil prices in the economy declines. Besides, they concluded these impacts might reducing with time due to the flexibility of the labor market.

The most significant literature about oil price astonishment on macroeconomic variables for this study was Kilian (2008), who presented proof that the recent rise in crude oil prices was motivated mainly by global aggregate demand surprises aids. Also, explain why this oil price surprise has been unsuccessful in causing a chief depression in the U.S. Using an SVAR model decaying the real oil price.

Tang et al. (2010), who studies small and elongated run special effects of oil fees in China, using the SVAR model, displayed that upsurges of oil price destructively affect yield and investment but affect the inflation interest rate.

Lescaroux and Mignon 2008 & Berument et al., 2010 established the price of oil could measure as wicked for oil-importing countries but worthy for oil-exporting countries, as it was verified as well by Aydın and Acar (2011), who established there is an adverse effect on GDP in terms of variations in the price of oil in Turkey. In line with Burbidge and Harrison (1984), who debated based on a VAR model, the oil price has contrary and sound effects on the macroeconomic variables in five Establishments for Economic Co-operation and Development (OECD) countries.

Though there is a current trend from many years ago to start using renewable sources of energy, crude oil is still the focus of many studies due to the relationship between the oil price and some macro-economic variables. Researchers, as Basak and Pavlova (2016) imply that the activity of financial investors in the oil futures market amplifies earlier realized and expected shocks. The above literature can be established moreover by Taghizadeh-Hesary et al. (2013) estimated the effect of oil price surprises on oil-producing and consuming markets; the study recycled a concurrent reckoning basis for unlike countries with commercial dealings. The outcomes exhibited that oil producers (Iran and Russian

Federation) assistance from oil price surprises, analogous to (Huseynov and Ahmadov, 2013), endorses that an upsurge in oil prices is a constructive surprise that lifts the national economy. Nevertheless, it leads to more significant inflation after intense literature review reveals only a few studies in this area of crude oil price estimation and Its Effect on the Post-Liberalization Indian Economy -An Overview" for investigation.

Objective of the study

a. To evaluate the current international price of fuel product's situation.
b. To predict by using the Box-Jenkins Forecasting Process (ARIMA Model) the prices of crude oil.
c. To strengthen the Autoregressive Integrated Moving Averages (ARIMA) paradigm to fuel product costs.

Research Methodology

The present study's data consist of yearly data collected from the international crude oil market from 1991 to 2019 for the diagnostic test of residuals, unit root, and normality of residuals tested before applying actual hypotheses testing ARIMA for forecasting.

Estimation

Researchers used maximum likelihood estimation (MLE). This estimation facilitated a smooth, assured, and efficient model with optimal lags

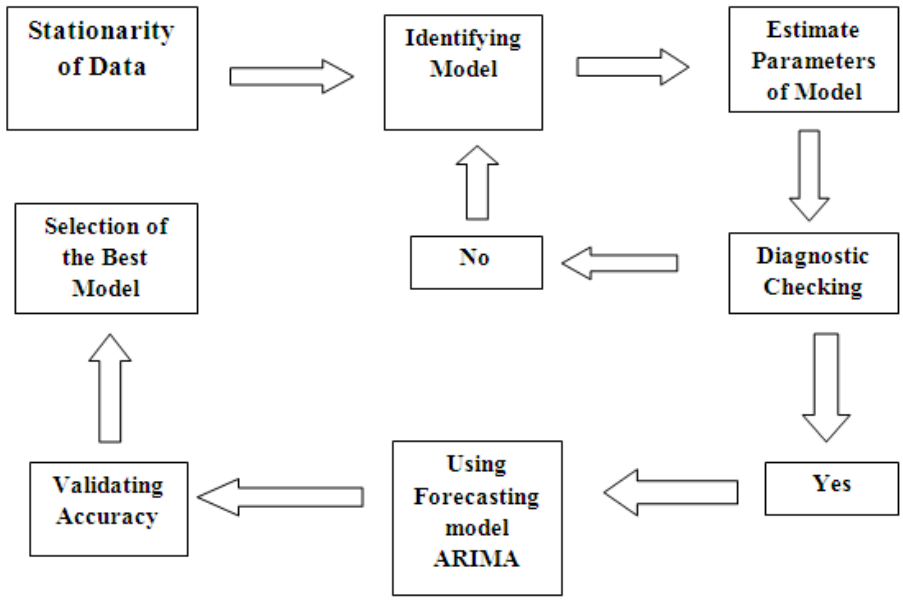


Figure 1. Box-Jenkins Approach of Forecasting

ARIMA (AR & MA) Box-Jenkins - Model

Autoregressive (AR) Model

As shown below, a common strategy for univariate time-series representation is recognized as Autoregressive (AR) expression:

$$\mathbf{Wt= \sigma +\partial 1Yt-1+\partial 2Yt-2+\cdots+\partial pYt-1+Zt}$$

Z_t is white noise where W_t is the time series (an error term of residuals), and

$$\sigma = (1 - \sum_{i=1}^{n} \partial i)\delta$$

As stated in the model, ∂ is known as the mean phase. An autoregressive model or reflection when doing econometrics is generally defined as a linear regression of the series's present values aligned with one or more previous values of the residual time series

As seen in the report's research section, they still have straightforward and uncomplicated analysis and explanation. It is possible to evaluate the AR (Auto-Regressive) model using a variety of different models, including the Least Squares Process model.

Moving Average (MA) Model

Appropriate representation core often is perceived as the Model Moving Average (MA) for any time-series data or estimation techniques as addressed here:

$$Xt=\partial+Ct-\beta 1Ct-1-\beta 2Ct-2-\cdots-\beta qCt-q$$

The value of q in this model describes as its MA (Moving Average) equation array. Where Xt is the time sequence, the average of the sequence is ∂ the gaussian distribution words are At-i, and the mathematical model's significant constraints and parameters are $\beta_1,\ldots, \beta_q$.

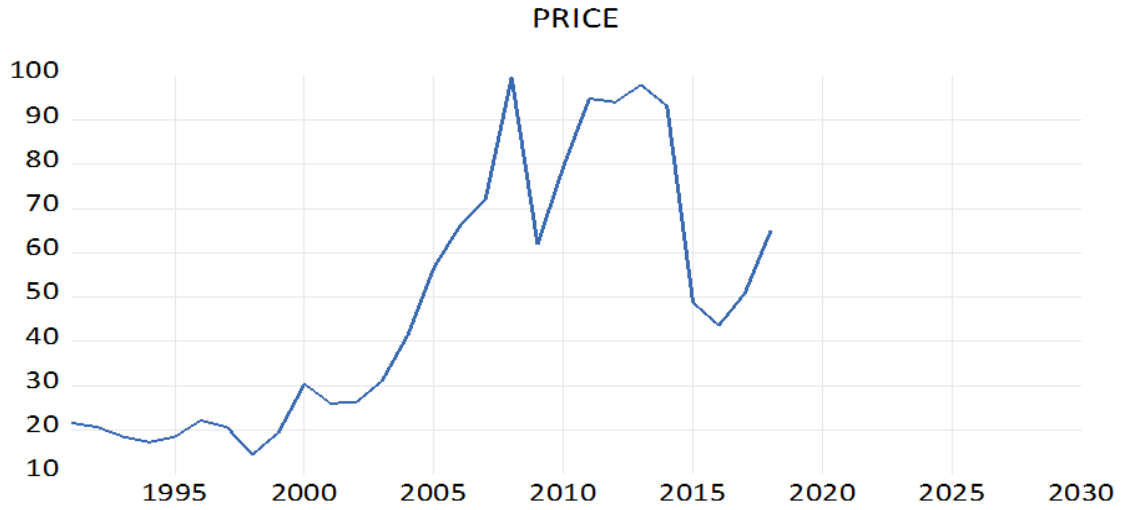


Figure 2.

Testing Hypotheses for Residuals (diagnosis testing)

H_0: Prices are non-stationary/unit root

H_1: Prices are stationary/no unit root

Table 1.

Particulars		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.395289	0.5696
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Table 2.

Particulars		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.226185	0.0003
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation

Analysis

The findings explicitly prove that 0.0003 rejects at a 5 percent of the overall level of significance; thus, our null hypothesis cannot justify the urge to analyze the evidence further.

As a result, it is clear that the null hypothesis for residual (price) diagnosis admitted as a residual (held unit root at the level displayed in Table 1). However, well along, by implementing the related Improved Dicky-Fuller Test, the residual was necessary for distant data examination, as seen in Table 2.

Hypotheses testing(diagnostic) for Residuals

H_0: Residuals have no serial correlation between them.
H_1: Residuals have a serial correlation between them.

Table 3. At first difference the auto correlation function

Sample: 1991 2019
Included Observations: 28

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.076	-0.076	0.1758	0.675
		2	-0.088	-0.095	0.4209	0.810
		3	0.009	-0.006	0.4237	0.935
		4	-0.170	-0.181	1.4133	0.842
		5	-0.063	-0.097	1.5546	0.907
		6	0.306	0.272	5.0520	0.537
		7	-0.126	-0.108	5.6701	0.579
		8	-0.003	-0.002	5.6706	0.684
		9	-0.218	-0.289	7.7432	0.560
		10	-0.119	-0.072	8.4005	0.590
		11	-0.012	-0.077	8.4077	0.676
		12	-0.011	-0.164	8.4145	0.752

Analysis

Initially, researchers evaluated results in two parts; partially correlated residues in the first part; thus, a null level hypothesis discarded, that not required at a 5 percent level of significance, and next examined with the assistance of E-Views at the first contrariety and obtained acceptable for the implementation of the Box-Jenkins ARIMA forecasting model as seen in Table 4.

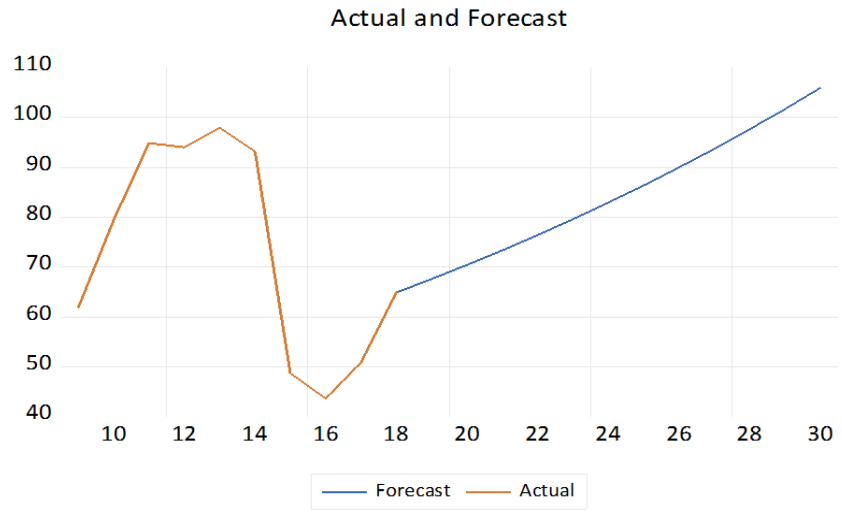
Table 4.

Automatic ARIMA Forecasting

Selected dependent variable: DLOG(PRICE)
Included observations: 28
Forecast length: 11 Years from 2019

Number of estimated ARMA models:	25
Number of non-converged estimations:	0
Selected ARMA model:	(0,0)(0,0)
AIC value:	0.186932

Graph 1.



Graph 2.

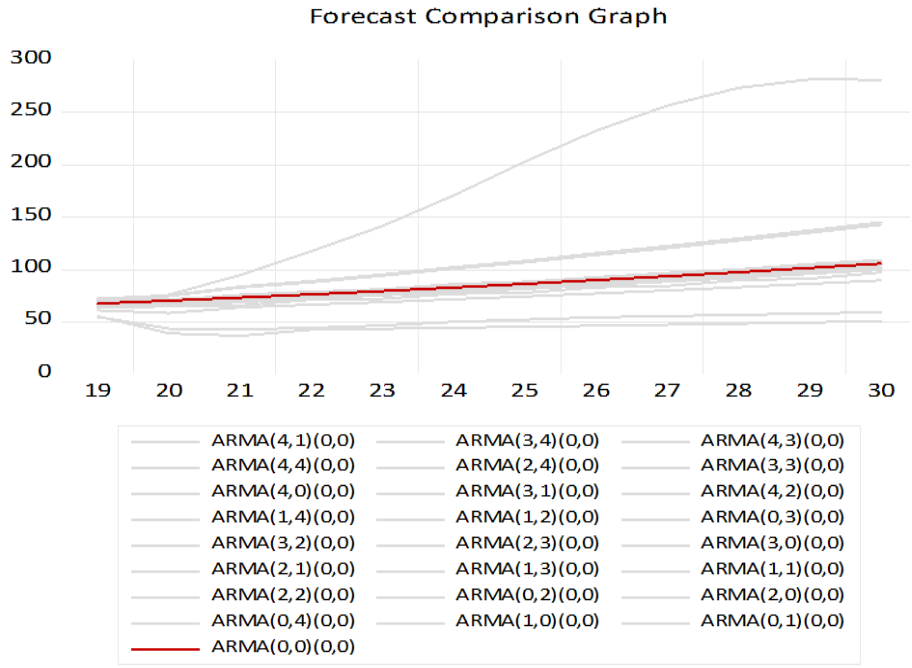


Table 5.

Model Selection Criteria Table
Dependent Variable:
DLOG(PRICE)
Sample: 1991 2019
Included observations: 28

Model	LogL	AIC*	BIC	HQ
(0,0)(0,0)	**-0.523581**	**0.186932**	**0.282920**	**0.215474 ****
(0,1)(0,0)	-0.468527	0.256928	0.400910	0.299741
(1,0)(0,0)	-0.494591	0.258859	0.402841	0.301672
(0,4)(0,0)	2.314450	0.273004	0.560967	0.358630
(2,0)(0,0)	0.279641	0.275582	0.467558	0.332667
(0,2)(0,0)	0.222841	0.279790	0.471765	0.336874
(2,2)(0,0)	1.812026	0.310220	0.598184	0.395847
(1,1)(0,0)	-0.224898	0.312955	0.504931	0.370040
(1,3)(0,0)	1.482068	0.334662	0.622625	0.420288
(2,1)(0,0)	0.297328	0.348346	0.588316	0.419702
(3,0)(0,0)	0.295449	0.348485	0.588455	0.419841
(2,3)(0,0)	2.267772	0.350535	0.686493	0.450433
(3,2)(0,0)	2.255665	0.351432	0.687390	0.451330
(0,3)(0,0)	0.233278	0.353091	0.593060	0.424446
(1,2)(0,0)	0.228568	0.353439	0.593409	0.424795
(1,4)(0,0)	2.122210	0.361318	0.697275	0.461216
(4,2)(0,0)	2.705844	0.392160	0.776111	0.506329
(3,1)(0,0)	0.494753	0.407796	0.695760	0.493423
(4,0)(0,0)	0.300213	0.422206	0.710170	0.507833
(3,3)(0,0)	2.269140	0.424508	0.808460	0.538677
(2,4)(0,0)	2.268501	0.424556	0.808507	0.538724
(4,4)(0,0)	4.015068	0.443328	0.923268	0.586039
(4,3)(0,0)	2.916079	0.450661	0.882606	0.579101
(3,4)(0,0)	2.886358	0.452862	0.884808	0.581302
(4,1)(0,0)	0.300560	0.496255	0.832213	0.596153

Analysis

The investigators picked Price as a dependent variable according to Table 5 and predicted the chosen analysis for 12 years from 1991-2019 until 2030. International forecasting of crude oil prices was the primary issue, and researchers converged on traditional aims of raw fuel costs, as viewed in Graph 3.

Table 6 model selection parameters are also one of the most commonly used predictive model at 0.186 metrics of the Box-Jenkins model ARIMA, where several designs created and the most appropriate at (0,0)(0,0) chosen with its logL value -0.523 and AIC value (Akaike Information Criterion) .

Besides, sharp rise in foreign crude oil prices is there, as predicted by the ARIMA model, as seen in Graph 3. Compared to previous ups and downs, i.e., a forecast period of 12 years after 2019, it is incredibly evident that fuel products' prices suggest a steady growth pattern from 2019 to 2030.

Conclusion and Discussion

The crude oil prices were too volatile during the research that influenced the economy as a whole and affected the Indian economy from time to time, as described and analyzed in our empirical analysis. The price movements have never been static and fluctuated throughout the period as monitored and analyzed during forecasting by applying the ARIMA model. Different hypotheses were

formed and made pertinent data by diagnostic residuals (price and GDP) as a part of our study and research.

Since our entire study and research revolved around crude oil prices post-liberalization from the period of 1991-2019, we have applied the Box-Jenkins Model of ARIMA, and based on that, forecasting was done as far as crude oil prices were concerned and also elaborated its impact on the Indian economy.

Rising crude oil prices unfavorably affects the economy and denting its overall growth prospects considering all the factors mentioned above during our research. The majority of all Indian industries need crude oil for its industrial and business requirements to produce its end product; thus, raising crude oil increases their key and high costs and decreases, therefore, margins. Therefore some of the sectors getting negative impacted would be Tyre, Paints, Plastics, Airlines, and of course oil & Lubricants, etc. The effectiveness of these Industries has to be adversely affected due to an increase in input costs.

On the other hand, researchers carefully monitored before forecasting in this paper that the oil exploration companies stand to have gained out of it. The country is one of the major trade and industry revitalization barometers to deteriorate due to negative impacts on the Indian financial system due to rising crude oil prices. As noticed and monitored by eminent researchers Faisal, A. K. (2018), the midcaps and small caps are the most terribly hit as they must encounter so many problems passing on the input costs to the end-users. The economic revitalization as well revival, therefore, would be very delicate with ever-increasing CAD (Current Account Deficit), weakening down Indian rupee, and rising continuous fiscal deficits.

With the assistance of various figures and graphs mentioned above, significant findings during the analysis. Researchers faced some complexities during the diagnosis of residuals to test unit roots at a level for further application of actual tests that desired to apply the ARIMA model of forecasting.

Bypassing through researchers has applied their best expertise skills and knowledge by showing the best suitable ARIMA model and predicted expected future prices that move upward in various graphs as mentioned earlier and figures.

Limitation of the Research and Further Scope

Many different versions, tests, and experiments have left for the future due to paucity of time (i.e., the experiments with real data are usually very strenuous and time taking, needful sundry hours to complete a single run). Prospect effort concerns the thorough analysis of particular tools, new proposals to try different methods.

References

Bacon, R., Kojima, M. (2008), "Oil Price Risks. Viewpoint: Public Policy for the Private Sector" Note No. 320. Available from: https://www.Openknowledgeworldbank.org/handle/10986/11151.

Basak, S and A Pavlova (2016): "A model of financialization of commodities", Journal of Finance, vol 71(4), pp 1511–1556.

Berument, M., Ceylan, N., Dogan, N. (2010), "The impact of oil price shocks on the economic growth of selected MENA1 countries" The Energy Journal, International Association for Energy Economics, 1, 149-176.

Blanchard, O., Gali, J. (2007), "The Macroeconomic Effects of Oil Shocks: Why are the 2000s so Different from the 1970s?" NBER Working Paper 13368. p77.

Bollerslev, Tim (1986). "Generalized Autoregressive Conditional Heteroskedasticity", Journal of Econometrics, No. 31, p.307-327

Box, G. E. P., and Jenkins, G. M. (1976), Time Series Analysis: Forecasting and Control, revised edition, San Francisco: Holden Day.

Brown, S., Yüce, M. (2002), "Energy prices and aggregate economic activity: An interpretative survey" The Quarterly Review of Economics and Finance, 42(2), 193-208.

Burbidge, J., Harrison, A. (1984), "Testing for the effects of oil-price rises using vector autoregressions" International Economic Review, 25(2), 459-484.

Chang, Y., Wong, J. (2003), "Oil price fluctuations and Singapore economy" Energy Policy, 31(11), 1151-1165.

Cuñado, J., Pérez de Gracia, F. (2004). "Oil Prices, Economic Activity and Inflation: Evidence for Some Asian Countries" Faculty Working Papers. P1-36.

Engle, Robert F. (1982). "Autoregressive Conditional Heteroscedasticity with Estimates of Variance of United Kingdom Inflation", Econometric 50:987-1008.

Faisal and Ahmad (2018) " Foreign Direct Investment (Influx) from different nations and its impact on Economic Development in India: - A detailed study in Service sector and its contribution in overall economic development". International Journal of Scientific and Research Publications, Volume 8, ISSN 2250-3153, DOI: 10.29322/IJSRP.8.5.2018.p7710

Faisal, S M (2016), Valuation of Currency and Its Impact on Investment: A Study in the Context of Many Confounding Factors in International Journal of Management and Commerce Innovations ISSN 2348-7585

Hamilton, J. (1996), "This is what happened to the oil price-macro economy relationship" Journal of Monetary Economics, 38(2), 215-220.

https://dbie.rbi.org.in/DBIE/dbie.rbi?site=home

https://rbi.org.in/Scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy

https://www.imf.org/en/Research/commodity-prices

Huseynov, S., Ahmadov, V. (2013), Oil Windfalls, Fiscal Policy and Money Market Disequilibrium. William Davidson Institute Working Paper No. 1051. p40.

Khalid and Syed "An Empirical Study of Technological Innovations in the Field of Accounting - Boon or Bane" Business and Management Studies, Vol. 4 , No. 1; March 2018, https://doi.org/10.11114/bms.v4i1.3057

Khan A (2019) "Impact of Demonetization on Outwards Foreign Direct Investment of India - Special Reference to Asian Countries" SUMEDHA-Journal of Management Referred Journal of CMR College of Engineering & Technology January-March 2019, Volume 8, No. 1, pp 23-42ISSN: 2277-6753 (Print) ISSN: 2322-0449 (Online).

Khan, Faisal (2018) Role and Significance of FDI (Outward) in Indian perspective An Analysis: Post Demonetization Period. J Account Mark 7: 276. doi: 10.4172/2168-9601.1000276

Khan, S M (2019) "Depreciation of Indian Currency in the Current Economic Scenario". International Journal of Economic Research.

Kilian, L. (2008), "Exogenous oil supply shocks: How big are they and how much do they matter for the U.S. Economy?" Review of Economics and Statistics, 90(2), 216-240.

Lescaroux, F., Mignon, V. (2008), "On the influence of oil prices on economic" OPEC Energy Review, 32, 343-380.

Omar, Ahmad and Mohammad (2017) "An Investigation Of Indian Security Market The Viewpoint Of FMCG Companies Who Voyage From Good To Great" International Journal of Economics, Commerce and Management, Vol. V, Issue 12, http://ijecm.co.uk/wpcontent/uploads/2017/12/51258.pdf

Omar, Mohammad and Khan, (2018). An Analysis of Optimal Inventory Accounting Models - Pros and Cons, European Journal of Accounting, Auditing and Finance Research, Vol.6, No.3, pp. 65 -77, http://www.eajournals.org/wp-content/uploads/An-Analysis-of-Optimal-Inventory-Accounting-Models-Pros-and-Cons.pdf

S.Suleiman, Alabi, M. A, Issa, Suleman, U. Usman, Umar Adamu, "Modeling and Forecasting the Crude Oil Price in Nigeria" International Journal of Novel Research in Marketing Management and Economics, Vol. 2, Issue 1, 2015, pp: (1-13).

Taghizadeh-Hesary, F., Yoshino, N., Abdoli, G., Farzinvash, A. (2013), "An estimation of the impact of oil shocks on crude oil exporting economies and their trade partners" Frontiers of Economics in China, 8(4), 571-591.

Tang, W., Wu, L., Zhang, Z. (2010), "Oil price shocks and their short-and long-term effects on the Chinese economy" Energy Economics, 32(1), 3-14.

Wang, S.Y., L.A. Yu and K.K. Lai, 2005. Crude oil price forecasting with TEI@I methodology. J. Syst. Sci. Complexity 18: 145-166.