Impact of COVID-19 on Import and Export of Petroleum Products and Crude Oil in India

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Abstract Imports and export have a significant contribution to increasing the effect of economies of scale and industrialization and lead to an increase in foreign exchange earnings. The oil and gas industry is a prime factor of development in the Indian economy. The natural gas and petroleum sector of India contributes one-seventh percent of the South Asian countries. Petroleum products can be considered ranked among the top five contributors of export trade in India. With the spread of COVID-19 at an exponential rate leading to shut down of industries, manufacturing, transportation, and offices, it has widely impacted the global supply chain. This research aims at studying the effect of COVID-19 on the export and import volumes of petroleum products and crude oil in India. Along with that, the research also covers the changes observed in the consumption and production of petroleum products and domestic and international exchange rate of crude oil before and after the outbreak of COVID-19.

Keywords COVID-19 · Import · Export · Petroleum products · Crude oil

1 Introduction

No nation is independent to deliver every good and service, and this prompts exchange among countries. These exchanges have become an essential need for financial development, exports bring the availability of a wider market and earn foreign exchange, while imports provide goods and services which are insufficient inside the nation. After adopting the new economic policy introduced in 1991, India experienced

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a higher rate of economic and export growth [1]. According to Macroeconomics and Elementary statistics, India exports more than 7500 commodities and imports more than 6000 commodities all over the world [2]. Mineral fuels including oil and petroleum products contribute about 48.3 billion US dollar having a value equivalent to 14.9 percent of total exports and 168.6 billion US dollar having a value equivalent to 33.2 percent of total imports of India in the year 2018. There are various factors that affect the imports and exports of a country. Foreign trade is an exchange of commodities among various countries. The rise in Domestic GDP and Foreign GDP often leads to a rise in domestic demand which encourages domestic firms to switch to foreign markets and the country will export more [3]. With the coronavirus outbreak, there has been a drastic change observed in the foreign trade across the world. Due to restrictions on travel and disruption in global supply chain, it is assumed to have a severe impact on foreign trade and the global economy.

1.1 Petroleum Products and Crude Oil

In 2017, petroleum products production amounted to 244 million metric tons which has impacted the private industry of petroleum immensely [4]. Petroleum products are essential parts of our imports and exports. The major petroleum products are Naphtha, FO Bitumen, LPG, MS, SKO, HSD, ATF, LDO, LSHS, Lubes, and others. These products are obtained by refining and fractioning of petroleum. Along with these petroleum products, crude oil and natural gas have a proportionate value in the total imports. Crude oil is a liquid source that is obtained naturally and often known as unrefined petroleum. Crude oil can be refined and used to produce petroleum products like gasoline, diesel, and other petrochemicals. India ranks third for importing crude oil for the year 2018 in the globe [5]. After coal, crude oil stands second and natural gas stands third for generation of energy sources in India [6]. Ministry of Petroleum and Natural Gas started working to minimize the import prices of petroleum products and crude oil by offering various incentives, building reserves for natural gas and crude oil storage, and increasing the refining of petroleum products [7].

1.2 Production and Consumption of Petroleum Products

Supply and demand are parts of price determination of the product. To keep the supply and demand of the product, it is necessary to keep producing the product as per the consumption. India ranks third in the consumption of petroleum products and crude oil across the globe in 2018 (Statista Research Department, 2020). With the growth in industrial sector, the production of petroleum products is insufficient, and so we import a major part of petroleum products from other countries. Oil reserves are being developed to increase the storage of petroleum products. Indian Strategic Petroleum Reserves Limited is responsible for maintaining the petroleum reserves.

The reason for the increase in consumption is due to the increase in petrol and diesel demand which in turn has been increasing due to more usage of private vehicles for transportation.

1.3 Prices of Crude Oil and Natural Gas

India is spending a critical expenditure of its trade abroad on importing unrefined fuel and natural gas, and this results in the steady issuance. India now has an excess of refining capacity which has led to transportation and fuel export to other countries like Europe and North America after meeting the domestic needs [8]. The exchange value of crude oil and natural gas affects the incentives spent on investment in energy using equipment. Various factors affect the pricing of crude oil and natural gas like seasonal fluctuations, weather changes, supply disruption, and inventory trends that are important for identifying the price relationship [9]. India imports oil from OPEC nations, so the raw petroleum costs are fluctuating as per Brent oil costs.

2 Objectives

The objective of the research is to understand the effect of a global pandemic on India's exports and imports of petroleum products and crude oil. Before and after the pandemic, the overall number of imports and exports of refined goods and crude oil will be analyzed. The identified factors are consumption of petroleum products, production of petroleum products, domestic price of crude oil, and international price of crude oil.

3 Literature Review

Crude oil is a major part of India's import and has a part in GDP. To recognize the relation among crude oil and GDP, studies formerly executed were referred. Paper by Gosh [10] estimates the interest for imported raw petroleum utilizing auto backward appropriated slack—ARDL testing approach. The demand of crude oil leads to the study of various factors of that determinants of exports to understand the demand and supply chain of petroleum products.

Shah [11] explores the determinants of India's export over the past thirty years and conducts the study for demand supply factors influencing the India's export behavior. The study suggested that government should consider export orient rate policy to take care of low and stable inflation. Two stage least squares (2SLS) substitution method was used for demand and supply equation model for export determination. Shah reasoned from the results that buoyant world demand plays a vital role on supply

of Indian exports. The Indian exports price was observed to be more elastic as the worth of exports was higher on the supply side.

Asmundson Irena, Dorsey Thomas, Khachatryan Armine, Niculcea Ioana, and Saito Mika observed that the price of trade finance rose during the 2008 crisis [12]. Other factors which affected the trade decline were as follows: trade output relationship, financial crisis and recession, related party trade which had a decline in trade across countries, and among various sectors due to varying intra-firm trade.

Kotishwar studied that the India exports have grown a resilience during 2008 crisis despite of the financial crisis and global economy slowdown (Kotishwar 2010). Jain [13] studied about the concurrent reforms taken by the government for subsidies of LPG, diesel which leaves a small amount of taxes obtained for the government. Three exclusive coverage levers had been identified: retail price, tax rate, and subsidies. The drop by crude oil permits government authorities to adopt subsidy. The reforms had been released for the duration of years from 2014 to 2017 that decreased the under-recovery bill. Petroleum subsidy reforms had been observed to be a stability among the stakeholders. However, the exercising hike duty on petroleum and diesel has raised the overall level of governments' consumption from the petroleum sector. It is not always feasible for the government to offer subsidy in marketplace costs for all fuels if so, there must be minimal alteration of prices with minimum impact on the profits of the organization.

Aruna and Narasimhan [14] studied the global exchange of import and export rates for India. The study revealed that there may be a fluctuation in exchange volume for India's export charges suggesting a depreciating rupee price and bargaining skills of Indian exporters. While the exchange rates were higher than import charges. Initially, ordinary least square method (OLS) was used to estimate exchange rate with polynomial distribution, but since asset prices like exchange rate are constant, it violates the time series assumptions and creates false regression. So, means of co-integration and error correction method technique were used to solve the issue. Hence, the impact of change rate depreciation on trade deficit was unclear, and imported inflation was a major risk identified.

The study estimated the global economy impacts during and after the pandemic (Buheji et al. 2020). According to them, the COVID-19 outbreak will drop the economy by 2.8% in the 2020. This will result in global depression by −12.5% within the third quarter. The impact of this global economy will be on the prices, which are estimated to recover by mid-2022. The study raises an alert for new normal wave for poverty due to the pandemic.

Maryla et al. [15] calculated macroeconomic and trade impact using the Envisage model. Envisage model which is a global computational general equilibrium model (CGE) is used for estimating the global trade impact. The results from this model gave global chain values from linkages and assumptions. From the study, it revealed that the direct impact of pandemic results in (a) reduction in employment, (b) increase cost in international transactions, (c) drop in transportation and travel services, and (d) decline in demand for services that require proximity between people. It is examined the effect of social distancing coverage on financial activities and stock exchange

[16]. Additionally, they studied the effect of many other global crisis which occurred in the past.

4 Methodology

The data is collected from sources like the reports of Ministry of Petroleum and Natural Gas [17] and CMIE Economic Outlook [18]. After collecting the data, it is analyzed with the help of graphs and other statistical methods. The data is grouped into periods Before COVID-19 and After COVID-19. The data taken for the group Before COIVD-19 is from October 2018 to May 2019, and the data taken for the group After COVID-19 is from October 2019 to May 2020. Both the groups have sample size, i.e., 8 months. Independent Sample t test is used to find the correlation among each group and evaluate the results to discover the impact.

To measure the impact of COVID-19 on import and export of the petroleum products and crude oil, we have created groups of similar sample size to run Independent Sample t test. An Independent Sample t test aims at comparing the means of two sets of data. It measures the statistical evidence that the sets of data taken are significantly different [19].

For our research, the sample variables like import, export, consumption, production of petroleum products, and international prices and domestic prices of crude oil are taken. There are two groups created for each of these variables, i.e., Before COVID-19 and After COVID-19, and means of the groups are compared to find the impact. The survey period for both groups was from October to May (i.e., 8 months) for the financial year 2018–19 and 2019–2020, respectively. The null hypothesis states that there is no difference observed in the mean of groups, 'Before COVID-19' and 'After COVID-19'. Independent Sample t test values are stated in two sections which provide different information: (a) Levene's equal variances test and (b) t-means equality test.

5 Results and Data Analysis

To understand the results obtained from the Independent Sample t test, we look at each variable individually for both the groups: Before COVID-19 and After COVID-19.

Imports: As observed from Table 1, the group Before COVID-19 ($N = 8$) was associated with import volume $M = 22{,}105.50$ (SD = 1453.284). By comparison, the group After COVID-19 ($N = 8$) with numerically smaller import volume $M = 22{,}032.13$ (SD = 2069.164). As seen from the Table 2, the presumption of homogeneity of variances was checked and confirmed by Levene's F test $F\ (14) = 0.451$, $p = 0.513$. Statistically significant effect was correlated with Independent Sample t test with values $t(14) = 0.82$, $p = 0.936$. The Hedges' g value obtained $= -0.0388$

which suggests that the import After COVID-19 have decreased in value. Hence, there is negative but smaller effect of COVID-19 on the total import values.

Exports: As observed from Table 1, the group Before COVID-19 ($N = 8$) was associated with export volume $M = 5028.63$ (SD = 584.046). By comparison, the group After COVID-19 ($N = 8$) with numerically greater Export volume $M = 5745.00$ (SD = 602.704). As seen from Table 2, the presumption of homogeneity of variances was checked and confirmed by Levene's F test $F\ (14) = 0.089$, $p = 0.769$. Statistically significant effect was correlated with Independent Sample t test with values, $t\ (14) = -2.414$, $p = 0.30$. The Hedges' g value obtained = 1.1413 which suggests that the export values have increased by more than one standard deviation in After COVID-19. Hence, there is a large positive effect of COVID-19 on the total export values.

Consumption: As observed from Table 1, the group Before COVID-19 ($N = 8$) was associated with consumption values $M = 18{,}298$ (SD = 878.737). By comparison, the group After COVID-19 ($N = 8$) with numerically smaller consumption value $M = 16{,}509.6300$ (SD = 3022.786). As seen from Table 2, the assumption of homogeneity of variances was tested and satisfied via Levene's F test $F\ (14) = 4.906$, $p = 0.044$. Statistically significant effect was correlated with Independent Sample t test with values, $t\ (14) = 1.607$, $p = 0.146$. The Hedges' g value obtained = -0.7596 which suggests that the consumption values have decreased in After COVID-19. Hence, there is medium negative effect of COVID-19 on the consumption values.

Production: As observed from Table 1, the group Before COVID-19 ($N = 8$) was associated with production values $M = 21{,}824$ (SD = 877.791). By comparison, the group After COVID-19 ($N = 8$) with numerically smaller production value $M = 21{,}007.5$ (SD = 27,533.861). As seen from Table 2, the presumption of homogeneity of variances was checked and confirmed by Levene's F test $F\ (14) = 7.942$, $p = 0.014$. Statistically significant effect was correlated with Independent Sample t test with values, $t\ (14) = 0.799$, $p = 0.446$. The Hedges' g value obtained = -0.3777 which suggests that the production value has decreased in After COVID-19. Hence, there is smaller negative effect of COVID-19 on the production values.

International Price: As observed from Table 1, the group Before COVID-19 ($N = 8$) was associated with production values $M = 58.2375$ (SD = 6.969). By comparison, the group After COVID-19 ($N = 8$) with numerically smaller production value $M = 43.5625$ (SD = 16.143). As seen from Table 2, the presumption of homogeneity of variances was checked and confirmed by Levene's F test $F\ (14) = 10.724$, $p = 0.006$. Statistically significant effect was correlated with Independent Sample t test with values, $t\ (14) = 2.361$, $p = 0.41$. The Hedges' g value obtained = −1.1159 which suggests that the international prices have decreased by more than one standard deviation in After COVID-19. Hence, there is larger negative effect of COVID-19 on the international prices.

Domestic Price: As observed from Table 1, the group Before COVID-19 ($N = 8$) was associated with production values $M = 66.612$ (SD = 7.231). By comparison, the group After COVID-19 ($N = 8$) with numerically smaller production value $M = 48.775$ (SD = 17.976). As seen from Table 2, the presumption of homogeneity of variances was checked and confirmed by Levene's F test $F\ (14) = 14.105$, $p =$

Table 1 Group statistics of group before COVID-19 and after COVID-19

Group Statistics					
Variable	Group	N	Mean	Std. Deviation	Std. Error Mean
Import	Before COVID-19	8	22105.50	1453.283	513.813
	After COVID-19	8	22032.13	2069.164	731.560
Export	Before COVID-19	8	5028.63	584.046	206.492
	After COVID-19	8	5745.00	602.704	213.088
Consumption	Before COVID-19	8	18298.00	878.737	310.680
	After COVID-19	8	16509.63	3022.786	1068.716
Production	Before COVID-19	8	21824.00	877.791	310.346
	After COVID-19	8	21007.50	2753.861	973.637
International_Price	Before COVID-19	8	58.2375	6.96951	2.46409
	After COVID-19	8	43.5625	16.14275	5.70732
Domestic_Price	Before COVID-19	8	66.6125	7.23078	2.55647
	After COVID-19	8	48.7750	17.97655	6.35567

Table 2 Independent Sample t-test values are stated in two sections which provide different information: (a) Levene's Equal Variances Test (b) t-Means Equality Test

Independent samples test								
Variables		Levene's test for equality of variances		t-test for equality of means				
		F	Sig.	*T*	d*f*	Sig.(2-tailed)	Mean difference	Std. Error difference
Import	Equal variances assumed	0.451	0.513	0.082	14	0.936	73.375	893.971
	Equal variances not assumed			0.082	12.555	0.936	73.375	893.971
Export	Equal variances assumed	0.089	0.769	−2.414	14	0.030	−716.375	296.724
	Equal variances not assumed			−2.414	13.986	0.030	−716.375	296.724
Consumption	Equal variances assumed	4.906	0.044	1.607	14	0.130	1788.375	1112.959
	Equal variances not assumed			1.607	8.175	0.146	1788.375	1112.959
Production	Equal variances assumed	7.942	0.014	0.799	14	0.438	816.500	1021.902
	Equal variances not assumed			0.799	8.408	0.446	816.500	1021.902
International_Price	Equal variances assumed	10.724	0.006	2.361	14	0.033	14.67500	6.21654
	Equal variances not assumed			2.361	9.522	0.041	14.67500	6.21654
Domestic_Price	Equal variances assumed	14.105	0.002	2.604	14	0.021	17.83750	6.85055
	Equal variances not assumed			2.604	9.207	0.028	17.83750	6.85055

0.002. Statistically significant effect was correlated with Independent Sample t test with values, t (14) = 2.604, p = 0.28. The Hedges' g value obtained = -1.2309 which suggests that the domestic prices have decreased by more than one standard deviation in After COVID-19. Hence, there is larger negative effect of COVID-19 on the domestic prices.

Thus, from the results we can say there is a major drop in the prices of crude oil for international and domestic markets due to COVID-19. There is also a major rise in the export volume which is a good indication for growth for the country. The import value has decreased negligible due to COVID-19. Both production and consumption of petroleum products are moderately decreased due to coronavirus.

6 Discussion

Out of the total demand of oil and petroleum products worldwide, Indian oil and gas industry have a share of 5.2% in the market. With the outbreak of COVID-19, there is massive reduction observed in the demand and the prices of crude oil which is a growing concern for Indian Oil and Gas Industry. India's petroleum consumption dropped the lowest in 10 years, a direct sign of the country's decreasing demand for petrol, diesel, and other petroleum products due to coronavirus. Alone in March 2020, the consumption of petroleum products fell by 18% as compared to the identical month a year ago [20]. Both imports and exports of petroleum products and crude oil have fallen sharply along with the demand and prices from March 2020 itself [21]. However, with the collapse of global oil prices, the country has reduced its import bill with increasing volume at the same time. For the financial year 2019–2020, the oil imports have increased in volume by 4% when compared with the previous year. In the month of April'20 Indian refiners stuffed tanks with inexpensive oil, sold additional cargoes to the central authorities for strategic reserves and with this the crude oil import had been declared as force majeure. India's oil imports reached the lowest since October 2011 in May 2020 as refiners with storage purchases cut due to dropping demands for fuel. Indian oil imports are set to recover in June 2020 with the refiners raising crude processing, and with the resumption of transport and industrial activities, the demand is also significantly increasing. This is a favorable situation for India to stock up more oil and save for investment during the reverse economic times. The recovery of the Indian Economy for petroleum industry may be a U-shaped recovery or a W-shaped recovery depending on the second/third wave outbreak of the virus. Though COVID-19 has led to petroleum industry sit up, the leaders are moving toward a long-term view creating partner ecosystem for long-term resilience.

7 Conclusion

The current pandemic-driven global crisis at coronavirus has hit the Indian Economy hard. The entire world is in great uncertainty. Oil and gas industry is among the one sectors of India which have been majorly impacted due to the disruption in the global supply chain. From the research, we conclude that the import after COVID-19 has decreased in value. Hence, there is negative but smaller effect of COVID-19 on the total import values. However, the export values have seen to be increasing when compared with the previous year export volume, and there is a negligible fall in import volumes when compared with the previous year. There is a huge fall in the demand of the petroleum products leading to global drop in the prices. This raises a great concern for the Indian Ministry of Petroleum and Natural Gas.

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