Petroleum Price Volatility on Macroeconomic Indicators in India

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Abstract

The selling price of petrol and diesel in the domestic market is determined by the volatility of crude oil price in the international market and taxes and excise duty imposed on it. India is heavily dependent on foreign countries to meet its growing petrol-diesel demand. Consequently, net trade balance reflected in the BOP is always adverse, which in turn adversely affects all the macroeconomic indicators and thereby, the poor performance of the entire economy. So attempts should be made and petroleum price fluctuations in India must be controlled to reduce the current inflation and to maintain a balanced growth rate in the economy.

Key Words: GDP; Inflation; Volatility; Excise Duty; NIPA; CPI; WPI

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Introduction

The characteristic of an economy whether it is developed or under developed or developing is determined by the trends and pattern of economic indicators, technically called macroeconomic variables in that economy. Although, various macroeconomic variables are interrelated in some way or other, major determinants are GNP, GDP, investment, saving, general price level, and inflation, balance of payment, interest rates, population, and unemployment. World Economic Statistics indicates that India is the 5th largest economy in the world with a GDP of 2.94 trillion dollars; and is the second fastest growing major economy in the world after China. India's real GDP growth rate for 2020-21 has been revised down to 1.8 percent from 4.6 percent. The IMF forecast shows India as the fastest growing major economy and the only one expected to record a double-digit recovery from pandemic-hit 2019-2021. India's current account balance recorded a surplus of US$ 19.8 billion (3.9 percent of GDP) in Q1 of 2020-21 [14].

The Gross Domestic Product gives information about the income size of the economy and how an economy is performing in terms of domestic income. While, the General price level measures the change in price of goods and services per annum in an economy over time. Inflation indicates the fluctuation in price level and the value of money. It indicates a decrease in the purchasing power of the currency and of the public. The Balance of Payment (BOP) accounts helps to understand the economic dealings of a country

with other countries, viz; exports, imports, lending and borrowing abroad [8]. The selling price of petrol and diesel in the domestic market, which is determined by the volatility of crude oil price in the international market and the taxes and excise duty, imposed on it by the center and state governments affects the entire economy.

Review of Literature

Anjana Raju (2020) analyzed the relationship between crude oil prices and macroeconomic variables from BRICS countries. Devasia M D, et. al (2020) and Devasia M D and Karunakaran N (2020) studied the public revenue and expenditure of India. Kalicharan Modak (2015) observed the impact of crude oil price fluctuation on Indian economy. Anandan M and Ramaswamy (2013) and Mehmet Candemir (2015) also studied oil price movements and macroeconomic variables. Priyanshi Gupta (2015) examined the impact of oil price fluctuations on Indian economy.

Research Gap

India is heavily dependent on foreign countries to meet its growing petrol-diesel demand. Consequently, the net trade balance reflected in the BOP is always adverse, which in turn adversely affects all the macroeconomic indicators and thereby causes for the poor performance of the entire economy.

Research Objectives

The study is carried out to analyze and understand the volatility of domestic petroleum prices on India's major macroeconomic variables. It also analyses the trend and pattern of randomly selected three major macroeconomic variables, viz, GDP, price level, and inflation. More specifically, the objective includes:

- to examine the trend and variability in India's GDP, general price level and inflation,
-
- to examine the volatility in domestic petroleum prices in India and
-
- to examine the effect on petroleum price volatility on key macroeconomic variables in India.

Research Methodology

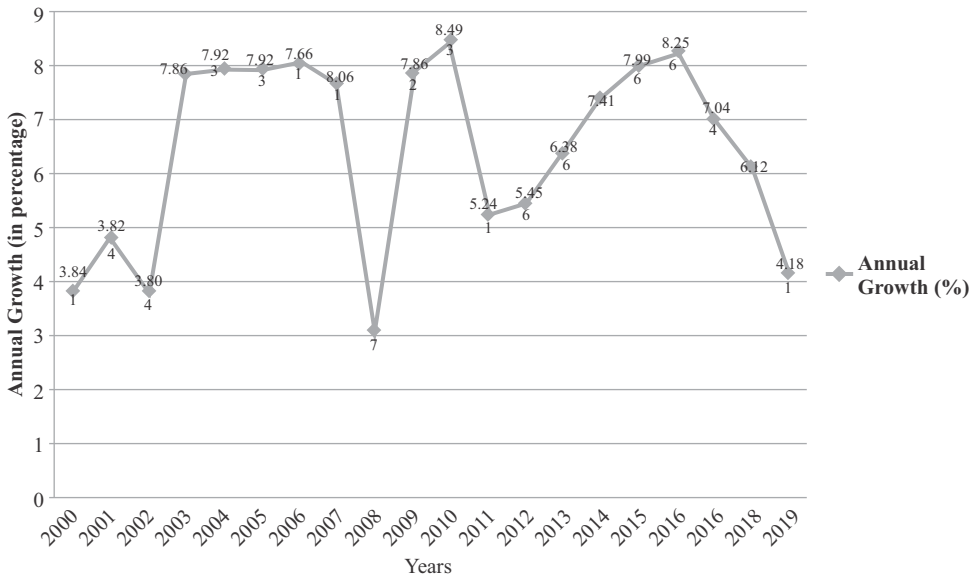
The study is an empirical investigation and done purely based on secondary data. The necessary data of petroleum prices, price indexes, inflation rates and GDP are obtained from the RBI Bulletin, official website sites of PPAC and other websites on macroeconomic trends. Data are analyzed using averages, percentage, trend analysis, correlation and regression.

Analysis and Discussion

GDP:

In the year 2000 India's GDP was 468.395 Billion US Dollar. In 2011 it increased to 1.823 Trillion Dollar, and then in 2012 to 1.828 Trillion Dollar. Further in the year 2014 and 2015, it was 1.857 Trillion Dollar, 2.039 Trillion Dollar, respectively. The trend and pattern of annual GDP growth rate is exhibited in Figure 1.

Figure.1: Trend of Annual GDP Growth Rate (in percent)



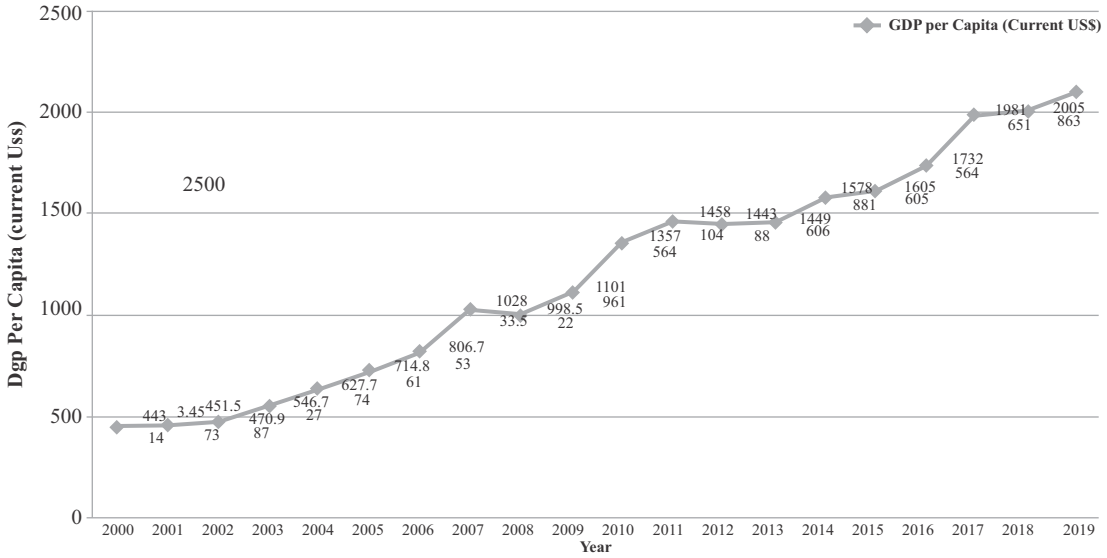
Source: https://data. worldbank.org /indicator/NY.GDP.MKTP.CD?locations=IN

•In the year 2000 the GDP growth rate was only 3.841 per cent per annum and it has almost maintained this low rate of growth in the next two more years with 4.824 percent per annum in 2001. Since 2003 the growth trend has shown an increase registering 7.86 percent and reached the maximum of 8.061 percent point in 2006. Again, it has regained its position of rising trend in 2009 with 7.862 percent after a sizeable dip of 3.087 percent in 2008. Afterwards, the annual growth rate collapsed to 5.2 percent and has shown fluctuations year after year with 6.74 percent on an average for the period between 2011 and 2018. And in 2019 it even fell to a floor level of 4.181 percent due to the Covid19 pandemic.

GDP per capita:

In 2000 the GDP per capita was only 443.314 US Dollar. From the year 2000 to 2007 there is an increase in the GDP per capita. GDP per capita in 2008 was 998.522. From 2013 to 2019 there is an increase, and in 2019 it was 2099.599 US Dollar. The trend in GDP is presented in figure 2.

Figure 2: The Trend of GDP Per Capita



Source: https://data.worldbank.org /indicator/NY.GDP.PCAP.CD?locations=IN)

•Volatility of Price Level:

The impact of price volatility varies among consumers based on their overall service needs and purchasing practices. Prices to residential consumers tend to be much more stable than for commercial and industrial users. Residential customers see less price variation because their purchase bills reflect monthly average prices, which do not fluctuate as much as daily prices. The Consumer Price Index (CPI) is designed to measure changes over time in the level of retail prices of selected goods and services on which consumers of a defined group spend their incomes. The change in consumer price affects the real purchasing power of a household's money income and hence, the standard of living or welfare that they can achieve out of a given money expenditure [7]. An index may aim to measure the effects of price changes on the cost of achieving a constant standard of living as distinct from maintaining the purchasing power to buy a fixed consumption basket of goods and services, the cost of living index [1]. The wholesale price index (WPI) is an index that measures and tracks the changes in price of goods in the stages before the retail level. This refers to goods that are sold in bulk and traded between entities or business (instead between consumers). Obviously, the WPI is one of the key macroeconomic indicators of inflation. It measures changes in the price of goods at selected stages before reaching the retail level [4]. WPI basket does not cover services. The index basket covers commodities falling under 3 major groups; (a) Primary Article; (b) Fuel and Power; and (c) Manufactured products.

To compile WPI, prices are tracked under:

- Manufactured products: EX-factory price
- Agricultural commodities: Agri-market price
- Minerals: EX-Mines

The new WPI compilation series method consists of two stages, viz, (i) item level indices (i.e., elementary price index) and (ii) elementary price indices are aggregate using weighted arithmetic mean to obtain higher level (at sub-group/group/major group/All commodities level) induced [13].

Inflation:

In India, inflation rate is estimated on the basis of two main indices: CPI and WPI, which measures the retail and wholesale level price changes, respectively. In 1990 inflation rate is 8.975 and in 2019 it is only 7.66. During 1990-2000, it is highest as13.87 percent in 1991. In 2000-2010, the highest rate of inflation is 10.88 in 2009. During the decade 2010-2020, the highest inflation rate is marked in 2010 and is 11.99 percent [11].

Petroleum Price Volatility:

Petroleum otherwise known as crude oil is an important natural resource found beneath the Earth surface. Tar, oil and natural gas are the three most familiar types of petroleum. There are mainly three major uses for raw petroleum: (a) in transportation; (b) in generation of electricity; and (c) in production process or purposes. The complex mixtures obtained from crude oil having common physical and chemical properties are the petroleum products. Kerosene, gasoline, home heating oil, diesel fuel and petrol are such petroleum products. Petroleum is an important resource needed in all societies and economies that efficiently utilizes modern technologies. The economic importance of petroleum is also high as it has a very high demand in the modern world. In transportation, in machineries, industries, and so on it has become a basic and necessary resource today.

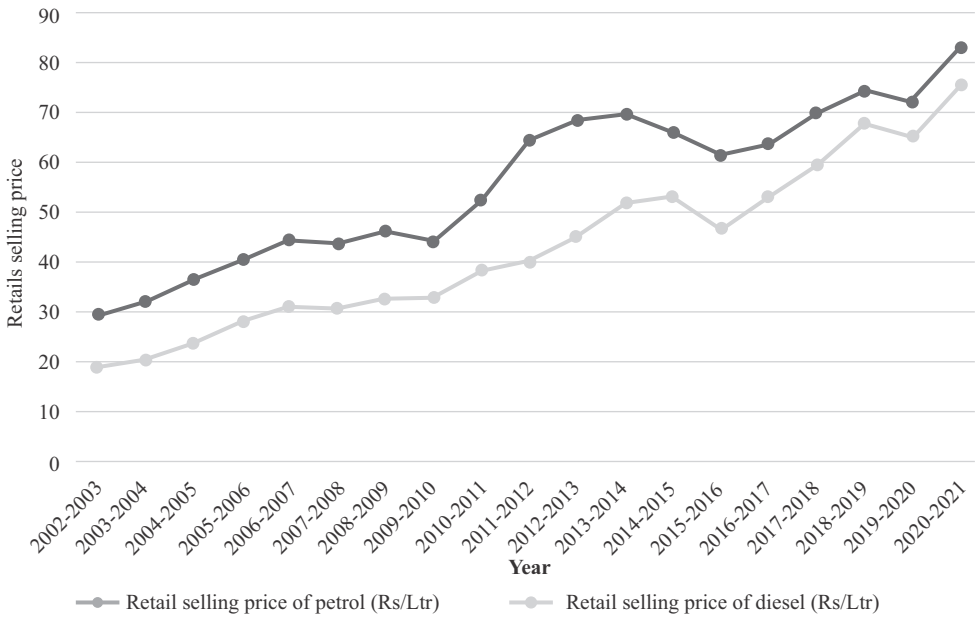
Table 1: Average Retail Selling Price of Petrol and Diesel (at Delhi, 2002 - 2021)

Year	Petrol (Rs/Liter)	Diesel (Rs/Liter)
2002-03	29.87	18.98
2003-04	32.17	20.55
2004-05	36.61	23.73
2005-06	40.66	28.39
2006-07	44.74	31.16
2007-08	43.96	30.83
2008-09	46.42	32.82
2009-10	44.35	33.03
2010-11	52.64	38.57
2011-12	64.71	40.27
2012-13	68.75	45.26
2013-14	69.76	51.97
2014-15	66.37	53.38
2015-16	61.59	47.01
2016-17	64.01	53.24
2017-18	70.02	59.78
2018-19	74.72	68.24
2019-20	72.32	65.60
2020-21	83.65	75.73

Source:https://www.ppac.gov.in/WriteReadData/userfiles/file/PP_9_b_RevisionInRSPs%20Petrol%20Diesel%20 (H)_20_4_2020.xl

In India the major use of petroleum is in transportation; 70 per cent of diesel and 99.6 percent of petrol is consumed in the transport sector alone. Diesel is the most demanded and consumed fuel in India and followed by petrol or gasoline. Also, petroleum is a very important energy source for production and manufacturing purposes. It is acclaimed that the variations in the retail selling price of petrol and diesel in India is due to the changes in international oil prices and the change in taxes imposed by the governments. The yearly average of retail selling price of petrol and diesel at Delhi for period 2002-17 is exhibited in table 1. Figure 3 show the price volatility of petrol and diesel over the years since 2002.

Figure 3: Petroleum Price in India (2002-2021)



It is evident that, although slightly fluctuating, the retail prices of both Petrol and diesel were on the rise year after year. The major factors caused for this rise and fluctuations are, cost of raw petroleum in the international market, increase in demand, misalignment between demand and supply, taxes and duties imposed by the government, and increased imports.

India follows the dynamic pricing system to determine the cost of petrol and diesel. In this system, retail selling prices of petrol and diesel will be revised daily. This scheme was implemented from 16th June 2017. It was introduced to ensure that the benefit of even the smallest change in international oil prices can be passed down to the dealers and consumers. The base price is thus obtained and the government has no role in it. The government then imposes taxes on the base price. This is the major reason for the daily hike in petroleum price in the country. The price build-up of Petrol per liter at Delhi as on 01 April 2021 is shown in table 2.

Table 2: Price Build-up of Petrol at Delhi (01 April 2021)

Elements	Unit	Amount (in Rs)	Percent to total
Base price	1 Liter	32.79	…
Freight	1 Liter	0.28	…
Price charged to dealers (excluding excise duty & VAT)	1 Liter	33.07	36.52
Excise Duty	1 Liter	32.9	36.33
Dealer Commission (average)	1 Liter	3.69	4.07
VAT (including VAT on Dealer Commission)	1 Liter	20.9	23.08
Retail selling price at Delhi -(rounded)	1 Liter	90.56	100.00

Source:https://www.google.com/url?sa=t&source=web&rct=j&url=https://iocl.com/Products/PetrolDieselPrices.aspx&ved=2ahUKEwjD_YzT8_LvAhXS6nMBHSkmAEUQFjAAegQIBRAC&usg=AOvVaw1KyzUerjwLITi8yplSEx3B

Obviously, the retail selling price of petrol and diesel in India is based on international crude oil prices, OMC margin, transportation costs, freight costs, central and state government taxes, excise duty and other taxes, together makes the retail selling price of Petrol per liter in the country. Tax and excise duty component is the heaviest portion of the petrol's retail selling price per liter in the country (table 2).

Petroleum Price on Macroeconomic Indicators:

The effect of petroleum price on GDP, general price level (WPI) and the inflation rate in India are examined and is given in table 3.

Table 3: Petroleum Price and Macro Indicators

Year	Petrol (Rs/Ltr)	Diesel (Rs/Ltr)	Petroleum Price (Average of Column B & C)	GDP (Annual Growth Rate)	GDP Per Capita (in US$)	WPI (All commodities) (Base year = 2004-05)	Inflation Rate
2002-03	29.87	18.98	24.425	3.80	470.10	89.05	4.3
2003-04	32.17	20.55	26.36	7.86	546.73	93.91	3.81
2004-05	36.61	23.73	30.17	7.92	627.70	100.0	3.77
2005-06	40.66	28.39	34.525	7.92	714.80	104.5	4.25
2006-07	44.74	31.16	37.95	8.10	806.70	111.4	5.8
2007-08	43.96	30.83	37.395	7.70	1028.30	116.6	6.37
2008-09	46.42	32.82	39.62	3.10	998.50	126.0	8.35
2009-10	44.35	33.03	38.69	7.90	1102.00	130.8	10.88
2010-11	52.64	38.57	45.605	8.50	1357.60	143.3	11.99
2011-12	64.71	40.27	52.49	5.20	1458.10	156.1	8.86
2012-13	68.75	45.26	57.005	5.40	1443.90	166.87	9.31
2013-14	69.76	51.97	60.865	6.40	1573.90	175.61	10.91
2014-15	66.37	53.38	59.875	7.40	1605.60	177.8	6.35
2015-16	61.59	47.01	54.3	7.80	1732.60	171.24	5.87

Year	Petrol (Rs/Ltr)	Diesel (Rs/Ltr)	Petroleum Price (Average of Column B & C)	GDP (Annual Growth Rate)	GDP Per Capita (in US$)	WPI (All commodities) (Base year = 2004-05)	Inflation Rate
2016-17	64.01	53.24	58.625	8.20	1981.70	174.21	4.94
2017-18	70.02	59.78	64.9	7.00	2005.90	179.36	2.49
2018-19	74.72	68.24	71.48	6.12	2099.60	187.0	4.86
2019-20	72.32	65.6	68.96	4.20	..	..	7.66
2020-21	83.65	75.73	79.69	..	..	..	..

Source:https://www.ppac.gov.inhttps://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=IN; https://www.statista.com/statistics/271322/inflation-rate-in-india/

The correlation between GDP's annual growth rate and Petroleum Price is negative (r=-0.004); between WPI and Petroleum Price it is positive (r=0.982). Similarly, the Correlation between Inflation rate and Petroleum Price is also positive (r=0.145). The result of the regression function is shown in table 4, 5 and 6.

Table 4: Regression GDP = f (P) (Analysis Summary Output)

Regression Statistics								
Multiple R	0.004062601							
R Square	1.65047E-05							
Adjusted R Square	-0.066649062							
Standard Error	1.661196811							
Observa-tions	17							
ANOVA								
	Df	SS	MS	F	Significance F			
Regression	1	0.000683202	0.000683202	0.000247575	0.987653568			
Residual	15	41.39362268	2.759574845					
Total	16	41.39430588						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	6.863711872	1.415986415	4.847300651	0.000213194	3.845608285	9.881815459	3.845608285	9.881815459
X Variable 1	-0.000457146	0.029053696	-0.015734517	0.987653568	-0.062383632	0.061469341	-0.062383632	0.061469341

GDP = F (P), where P is the Petroleum Price given in Column D as independent variable

Table 5: Regression WPI = f (P) (Analysis Summary Output)

Regression Statistics								
Multiple R	0.98270127							
R Square	0.965701786							
Adjusted R Square	0.963415239							
Standard Error	6.554169838							
Observations	17							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	18142.54362	18142.54362	422.3405623	2.12752E-12			
Residual	15	644.357134	42.95714227					
Total	16	18786.90075						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	31.33082888	5.586704351	5.608105765	4.98959E-05	19.42305048	43.23860727	19.42305048	43.23860727
X Variable 1	2.355751006	0.11462992	20.55092607	2.12752E-12	2.111423117	2.600078895	2.111423117	2.600078895

WPI = F (P), where WPI is the whole price index (proxy taken for general price level) given in column D of the table 3.

Table 6: Regression Inflation rate = f (P) (Analysis Summary Output)

Regression Statistics								
Multiple R	0.145271779							
R Square	0.02110389							
Adjusted R Square	-0.044155851							
Standard Error	2.934801206							
Observations	17							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	2.785316452	2.785316452	0.323382986	0.5779971			
Residual	15	129.1958718	8.613058119					
Total	16	131.9811882						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.289755824	2.501593195	2.11455477	0.051620519	-0.042263831	10.62177548	-0.04226	10.62178
X Variable 1	0.029188889	0.051328549	0.568667729	0.5779971	-0.080215322	0.138593101	-0.08022	0.138593

IR = F (P), where IR is the Inflation Rate given in column F as a dependent variable.

Research Findings

The result of analysis shows that the petroleum price in the country adversely affects the annual growth of GDP and directly causes price rise and inflation. Therefore, petroleum price fluctuations in India must be controlled to reduce the current inflation. Hence, timely action of the government with required policy measures to control the price fluctuations of petroleum is necessary to maintain a balanced growth rate in the economy.

Conclusion

Price volatility is used to describe price fluctuations of a commodity over a specific period and is measured by the day-to-day percentage difference in the price of commodities. The degree of variation provides a measure of price uncertainty in markets. The selling price of petrol and diesel in the domestic market, which is determined by the volatility of crude oil price in the international market and taxes and excise duty imposed on it, affects the entire economy. India is heavily dependent on foreign countries to meet its growing demand. The analysis shows that the petroleum price in the country adversely affects the annual growth of GDP and directly causes rise in general price level and inflation. So, appropriate policy is required in India to control and reduce the current inflation and to maintain a balanced growth rate in the country.

Recommendations

- The Petroleum price in India must be controlled and stabilized to reduce the rising current inflation and to maintain a balanced growth in the country.
- The taxes and duties imposed on petroleum products by the government should be reduced to the maximum, at least in this recession periods
- Petroleum products also must be brought under GST tax structure so that the price will come down if GST is implemented in the country.

Limitations

The study is based on secondary data and the limitation of secondary data is exhibited in the study also.

Scope for Future Research

Necessary and required policy is needed for deliberate reduction and stabilization of petroleum prices in the country. The petroleum price fluctuations in India must be controlled to reduce the current inflation and to maintain a balanced growth rate in the country.

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