

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Management



Master Thesis

**The Impact of Macroeconomic Factors on Oil
Production in India**

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Itishree Asit Shah, BA

Economics and Management

Economics and Management

Thesis title

The impact of macroeconomic factors on production of oil in India

Objectives of thesis

The aim of this thesis is to evaluate the emerging trends in production of crude oil in India and to identify the impact of macroeconomic indicators on production of crude oil in India.

Methodology

Methodology for the literature review will be based on data collection from specialized publications, websites, journals and other written or online sources. The practical part of the thesis will include analysis of collected data using regression analysis in order to identify the impact of macroeconomic factors on crude oil production. Further, the available data will be analysed for evaluating correlation between any factors and pricing of petrol using data analytics tools. The data required for the study will be collected from various sources having a time period of 2000-2021.

The method of analysis and synthesis will be used to formulate the conclusion for thesis. The role of oil and gas industry in the economy, production process of crude oil and factors affecting the production of crude oil will be included in literary review of this thesis.

The proposed extent of the thesis

60 – 80 pages

Keywords

Indian oil industry, oil production, Gross Domestic Product, macroeconomic factors

Recommended information sources

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Declaration

I declare that I have worked on my Master thesis titled "The impact of macroeconomic indicators on oil production in India" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the Master thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2022

Itishree Asit Shah

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I would like to thank Ing. Tomas Maier, Ph.D. of the supervisor and all other persons, for their advice and support during my work on this thesis.

The impact of macroeconomic factors on oil production in India

Abstract

The thesis involves around the way macro-economic factors have an impact on Oil Production in India. Oil and Gas industry plays a very important role in India. The variables used for analysis include the macroeconomic indicators such as Gross National Product, Gross Domestic Product, Unemployment Rate, Inflation rate and Interest rate. The thesis is writtern with the help of previously written research paper and available data sources. This data is further cleaned and processed to get results. Based on this data processed a regression analysis is performed to understand the relationship between the variables. Elasticity of variables is also checked to see what impact they have.

Keywords: Indian Oil Industry ,Oil Production, Gross Domestic Product, Macro Economic Factors, Gross National Product , Inflation Rate, Interest Rate, Unemployment Rate

Title of Master Thesis in Czech

Abstrakt

Předkládaná diplomová práce se zabývá tím, jak makroekonomické faktory ovlivňují produkci ropy v Indii. Ropný a plynárenský průmysl hraje v Indii velice důležitou roli. Mezi vysvětlující proměnné využívané k analýzám jsou hrubý národní produkt, hrubý domácí produkt, nezaměstnanost, inflace a úroková míra. Práce navazuje na některé dřívější studie a jsou v ní využity nejaktuálnější dostupná data. Data byla seříděna, aby bylo dosaženo požadovaných výsledků. Na základě těchto zpracovaných dat je provedena regresní analýza k pochopení vztahu mezi proměnnými. Elasticita proměnných se také kontroluje, aby se zjistilo, jaký mají dopad.

Klíčová slova: Indický ropný průmysl, produkce ropy, hrubý domácí produkt, makroekonomické faktory, hrubý národní produkt, míra inflace, úroková míra, míra nezaměstnanosti

Table of content

1	Introduction.....	12
2	Objectives and Methodology	13
2.1	Objectives.....	13
2.2	Methodology	13
2.2.1	Methodological Approach	14
Literature Review		15
2.3	Overview of the oil and gas industry	15
2.3.1	Role of oil and gas industry in global economy	15
2.3.2	Impact of oil price on economic development.....	21
2.4	Oil and Gas industry in India	24
2.4.1	Market Size	24
2.4.2	Investments	25
2.4.3	Government Initiatives	26
2.4.4	Oil and gas imports of India	27
2.4.5	Oil & other petroleum product's exports of India	30
2.4.6	Production of Oil in India	30
2.4.7	Consumption of Oil in India	31
2.4.8	Foreign trade	32
2.4.9	Macroeconomic Indicators affecting production of Oil	33
2.4.9.1	Inflation	33
2.4.9.2	Gross Domestic Product (GDP) growth or Economic Growth	34
2.4.9.3	Interest rate	34
2.4.9.4	Foreign direct investment	35
2.4.9.5	Unemployment	36
2.4.9.6	Gross National Product.....	36
2.4.9.7	External Debt.....	37
3	PESTEL Analysis of Oil and gas Industry	38
3.1	Political factors.....	38
3.2	Economic factors.....	38
3.3	Social factors	39
3.4	Technological factors	39
3.5	Environmental factors	39
3.6	Legal factors.....	40
4	Practical Part	40

4.1	Analysis of macroeconomic indicators of Indian economy.....	40
4.1.1	Gross Domestic Product of India.....	40
4.1.2	Gross National Product of India	42
4.1.3	Inflation in India	44
4.1.4	Unemployment in India	47
4.1.5	Interest rate of Central Bank of India	49
4.1.6	Importing countries of crude oil by India	53
4.2	Regression Analysis	54
4.2.1	Linear Regression Model of GDP	54
4.2.2	Linear Regression Model of GNP	55
4.2.3	Linear Regression Model of Inflation.....	55
4.2.4	Linear Regression Model of Unemployment rate.....	56
4.2.5	Linear Regression Model of Interest rate	57
4.3	Correlation analysis.....	58
4.4	Elasticity.....	58
5	Results and Discussion	59
5.1	Analysis of Indian economy with focus on its macroeconomic indicators.....	60
5.2	The present scenario of the oil industry in India.....	62
5.3	Exporting countries of crude oil to India	62
5.4	The relationship between macroeconomic indicators and the oil and gas industry was analysed.	63
6	Conclusion	63
7	References.....	66
8	Appendix.....	76

List of pictures

Figure 1	Fifteen leading countries in oil imports by 2020.....	20
Figure 2	Prices of World Crude Oil Price (WTI) in US Billions(\$).....	21
Figure 3	Crude oil import of India.....	29
Figure 4	Petroleum product's import of India	29
Figure 5	Oil & other petroleum product's export of India	30
Figure 6	Crude oil Production	31
Figure 7	Gross Domestic Product of India	42
Figure 8	Gross National Product of India	44
Figure 9	Inflation in India	46
Figure 10	Unemployment rate of India.....	48
Figure 11	Interest rate of India	50
Figure 12	Volume of oil and gas production of India.....	52

List of tables

Table 1 Major Oil Producers in World in 2020	17
Table 2 Countries with Oil reserves as of 2021	18
Table 3 Importing countries of crude oil by India	53
Table 4 Regression Model of GDP.....	54
Table 5 Regression Model of GNP	55
Table 6 Regression Model of Inflation	55
Table 7: Regression Model of Unemployment rate.....	56
Table 8: Regression Model of Interest rate.....	57
Table 9: Correlation analysis of macroeconomic indicators and crude oil production	58
Table 10 Calculations of Elasticity of Variables	58

List of Formula

Formula 1 Regression Analysis	14
Formula 2 Correlation Analysis.....	15
Formula 3 Growth Rate	34

List of abbreviations

PIB:- Press Information Bureau
GDP:-Gross Domestic Product
ONGC:- Oil and Natural Gas Corporation

1 Introduction

India is the world's third-largest fuel consumer, but it may soon overtake the United States as per capita consumption rises. India consumes only 6% of the world's primary energy, and its per capita energy consumption is still one-third of the worldwide average (PIB). Because economic growth of India is tightly connected to its energy demand, demand for oil and gas is likely to rise dramatically, making the industry more appealing for investment (Oil & Gas Industry in India, 2021). The government has taken a lot of key initiatives to adopt a number of policies to meet growing needs. Many segments of the economy, including natural gas, petroleum products, and refineries, are open to 100 percent foreign direct investment (FDI). As indicated by the presence of Reliance Industries Ltd (RIL) and Cairn India, it now attracts both domestic and global investment. (Oil & Gas Industry in India, 2021.).

Demand for energy is expected to nearly double that to 1,123 million tons of oil equivalent, as gross domestic product (GDP) is expected to rise to USD 8.6 trillion by 2040. (India Energy Outlook 2021) India's oil and gas industry dates back to 1889 when the country's first oil was discovered near the town of Digboi in the province of Assam. India's natural gas industry began in the 1960s with the discovery of gas stations in Assam and Maharashtra. As of 31 March 2018, India estimated that crude oil was 594.49 million (MT) and 1339.57 billion cubic meters (BCM) of natural gas.

India imports 82% of its oil demand and aims to reduce that to 67% by 2022 through more ingrown technology oil exploration and switching to other energy sources. India ranks second in crude oil (including crude oil products) imports by 205.3 Mt in 2019 (Statistical review of World Energy 2020).

In March 2021, domestic crude oil production in India decreased by 5.2% and natural gas production by 8.1% at FY21 as producers released 30,491.7 Thousand Metric Tonnes (TMT) crude oil and 28670.6 Million Metric Standard Cubic Meters (MMSCM) natural gas (Singh, K. (2021, April 21)). In August 2021, crude oil production fell by 2.3%, but there was a 20.23% increase in domestic gas (India, P. T. of. (2021, September 22)).

2 Objectives and Methodology

2.1 Objectives

The aim of this thesis is to get proper understanding about the emerging trends in production of crude oil in India and to identify the impact of macroeconomic indicators on production of crude oil in India.

To assess the impact of Gross Domestic Product, Gross National Product, unemployment and inflation on the production of crude oil in India.

Hypothesis:

Question 1

H0: There is no impact of Gross Domestic Product on production of crude oil in India.

H1: There is an impact of Gross Domestic Product on production of crude oil in India.

Question 2

H0: There is no impact of Gross National Product on production of crude oil in India.

H1: There is an impact of Gross National Product on production of crude oil in India.

Question 3

H0: There is no impact of Unemployment on production of crude oil in India.

H1: There is an impact of Unemployment on production of crude oil in India.

Question 4

H0: There is no impact of Inflation on production of crude oil in India.

H1: There is an impact of Inflation on production of crude oil in India.

2.2 Methodology

The research methodology is a process of gathering data from the selected respondents, study the data, analyse the data and find out the information which is useful for making improvements. It also includes which method to be used for collecting data and which approach to be used for studying and interpreting the data collected for the study.

The objectives are formed for fulfilling the purpose of the thesis. The thesis is divided into two parts. The first part contains information about the role of oil and gas industry in world, oil and gas industry in india, market size, investments made by government of India for growth of oil and gas Industry in the literature review part of the thesis. The review of literature also includes information about crude oil exports, crude oil imports and crude oil production in India. Here, the information is gathered from secondary resources like

publications, journals, books, etc. Not only the major oil producing countries in world but also the countries with largest oil reserves as of 2021 are included in literary part. Beside this, the informatin about various macroeconomic indicators affecting the production of crude oil is also described in the thesis.

The second part of the thesis includes the analysis of secondary data. A secondary data required for the thesis will be collected from world bank's website. The data required for the study will be collected from various sources having a time period of April 2000 to March, 2020. The analysis of collected data has been done by using Microsoft Excel and Gretl. The data is analysed by using various statistical tools such as the regression and correlation method. Analysis of collected data is done by using regression analysis in order to identify the impact of macroeconomic factors on crude oil production. Further, the available data will be analysed for evaluating correlation between various macroeconoimc factors and production of crude oil.

The variables used for analysis include the macroeconomic indicators such as Inflation rate, Gross National Product, Unemployment, Gross Domestic Product, and Interest rate which are considered as independent variables. The dependent variable will be production of crude oil in India. The data of variables will be collected from world banks's website. The findings and recommendations are provided in the thesis based on the analysis. India is the targeted country for collecting the secondary data. The method of analysis and synthesis will be used to formulate the conclusion for thesis.

2.2.1 Methodological Approach

All the methodological approches which are essential for conducting the analysis are mentioned below:

Regression

The formula for regression analysis is as follows:

Formula 1 Regression Analysis

$$Y=a+bX+E \tag{1}$$

Where,

Y=Stands for the dependent variable

X=Stands for an independent variable

a=Stamds for the intercept

b=Stands for the slope

E=Stands for the error term

Correlation

The formula for correlation analysis is as follows:

Formula 2 Correlation Analysis

$$r(x,y) = \frac{\sum(Xi - Xavg)(Yi - Yavg)}{\sqrt{(\sum(Xi - Xavg)(\sum(Yi - Yavg))}}$$

(2)

Literature Review

2.3 Overview of the oil and gas industry

2.3.1 Role of oil and gas industry in global economy

When we consider the value, Oil and gas is one of the world's huge industries . It has an earning of around \$3.3 trillion in each year. Oil has a critical role in the world economy. It is also critical for the world's top producers, like the Saudi Arabia, US, Canada, Russia, and China. (Mcclay, 2020).

Hydrocarbons are made from crude oil and natural gas, which are natural substances usually found in rock in the crust of earth. These organic raw materials are formed by the compression of plant and animal remnants in sedimentary rocks such as sandstone, limestone, and shale. Upstream, midstream, and downstream are the three segments that make up the oil and gas business (Mcclay, 2020).

In general upstream can be considered as the first step of exploration. Upstream firms deal primarily with the exploration and initial production stages of the oil and gas industry. If expanded further, it also includes the drilling of exploration wells & drilling into established wells in order to recover oil and gas. (Hayes, A. (2019)).

As the name suggests, "midstream" relates to the process that is between upstream and downstream. Storing, refining, and delivery of petroleum products are all examples of midstream activity. Companies specialize in operating tanker ships, pipelines, or storage facilities may fall under this category. This approach is more prevalent in wealthy countries that have already invested in privately owned oil pipelines and storage facilities than in developing countries. (Chen, J., 2020).

The final section of the oil and gas industry is known as downstream. This section entails the process of filtering raw materials, which are received during the upstream segment. Furthermore, this procedure encompasses the refinement of crude oil as well as the purification of natural gas. Natural gas, petrol, diesel oil, gasoline, lubricants, kerosene, jet fuel, asphalt, heating oil, and Liquefied Petroleum Gas are among the items that are marketed and distributed to clients and users in a variety of ways. Other forms of petrochemicals can be used to deliver oil and gas products. Although the majority of businesses south of the river have their headquarters in Calgary, the majority of their operations are based in Sarnia, Ontario, and Edmonton, Alberta. The downstream industry affects all states and territories — wherever consumers are located — and provides thousands of products (Mcclay, 2020).

Section 3 (2) of the Petroleum and Natural Gas Regulatory Board Act of 2006 established the Petroleum and Natural Gas Regulatory Board in 2006. The Regulatory Board is in charge of overseeing the refining, processing, storage, transportation, distribution, marketing, and sale of petroleum and petroleum products, as well as encouraging fair trade and competition among oil and gas enterprises. (Nishith Desai, 2018).

Oil is an important source of energy for the 21st century, used in all parts of the world, and its dependence seems to be continuing. Just after historic events of 1973 namely Yom Kippur War and the 1980's Islamic Revolution of Iran, which boosted oil costs tenfold, developed countries were able to reduce their dependency on oil (O'Sullivan, M. L.).

Crude oil plays a very vital role in global economic development and international trade. Almost every province is actively producing oil, exploring hard-to-reach reserves, and heavily investing in the expansion of oil and energy infrastructure.

Crude oil is one of the most important resources in the world, because, firstly, it is considered a major source of fuel, and, second, it is a paid commodity. Petroleum energy has a high value because of the convenience it provides. It has value added features as simple to mine, refine, distribute, retain, and consume. Coal had been not convenient at that because of the technology hinderance it had. Therefore, oil is the best energy source because it travels the most, which is why oil plays an amazing role in the global energy sector.

Table 1 Major Oil Producers in World in 2020

Country Name	BPD(Barrels per day)	Share of global production
United States	19.51 million bpd	19%
Saudi Arabia	11.81 million bpd	12%
Russia	11.49 million bpd	11%
Canada	5.50 million bpd	5%
China	4.89 million bpd	5%
Iraq	4.74 million bpd	5%
United Arab Emirates	4.01 million bpd	4%
Brazil	3.67 million bpd	4%
Iran	3.19 million bpd	3%
Kuwait	2.94 million bpd	3%

Source:<https://www.ig.com/en/trading-strategies/world-s-biggest-oil-producers-200722.amp>, own proceeding

According to the table above, the United States produces 19 percent of all oil, which is more than any country. Saudi Arabia, Russia, and Canada are the other main oil-producing nations.

In 2016, the oil trade represented an estimated \$ 300 billion in profits per day. The European countries and US nations have imported 22 million barrels a year. per day. It is a necessary resource for the economy, which can be replaced by renewable energy sources, which are relatively few (about 2.7% of global energy) (critical land, 2016).

The current state of the oil market reveals two distinct paths of development. The first is the significant rise in oil demand in Eastern Europe. Second, the oil refining business in OPEC provinces is growing rapidly. Saudi Arabia is a pioneer in this field, developing cutting-edge oil refining techniques and growing its reserves as a result.

The world's oil reserves have increased by 8% during 2012, reaching 236 billion tons. Over the last ten years, crude oil production has expanded by a record 117 million tons. A new trend has been observed amongst the countries of the world that has just explored oil reserves. Unaware of with the qualities not reaching upto the standards of countries.

Table 2 Countries with Oil reserves as of 2021

No.	Name of the country	Reserves billion barrels
1	Venezuela	303.81
2	Saudi Arabia	258.60
3	Iran	208.60
4	Canada	170.30
5	Iraq	145.02
6	Kuwait	101.50
7	UA Emirates	97.80
8	Russia	80.00
9	Libya	48.36
10	Nigeria	36.89
11	Kazakhstan	30.00
12	China	26.02
13	Qatar	25.24
14	Brazil	12.71
15	Algeria	12.20
16	Ecuador	8.27
17	Norway	8.12
18	Angola	7.78
19	Azerbaijan	7.00
20	Mexico	5.79
21	Oman	5.37
22	Sudan	5.00
23	India	4.60
24	Vietnam	4.40
25	Malaysia	3.60
26	Egypt	3.30
27	Yemen	3.00
28	R. of Congo	2.88
29	Syria	2.50
30	Uganda	2.50

Source: The U.S. Energy Information Administration, 2021 – URL: https://www.theglobaleconomy.com/rankings/oil_reserves/#India

The 2021 average based on 187 countries was 8.87 billion barrels. The highest value was in Venezuela: 303.81 billion barrels and the lowest was in Afghanistan: 0 billion barrels.

Therefore, considering the estimates available, at the current level of oil production, storage facilities will be sufficient for at least 42 years, including Venezuela - 58, Saudi Arabia - 83 years, China - 21, Norway – 9, Iran - 69 years, Algeria - 19, Libya - 56, Kazakhstan - 47, UK - 5 years, Russia - 22, USA - 10, Indonesia – 9.

There are various points to consider regarding the long-term prospects for the development of the global oil drilling industry in relation to its provision of nature reserves.

There are also strong opinions that it will lose much of its position already in the first half of the 21st century and, in general, the current century will be a century of gas and coal. Indeed, earth's reserves and projected gas resources far exceed the capacity of oil wells (Simrnov, n.d.).

However, certain aspects of use, especially coal, from the perspective of environmental problems, as you know, greatly reduce the scope of its use.

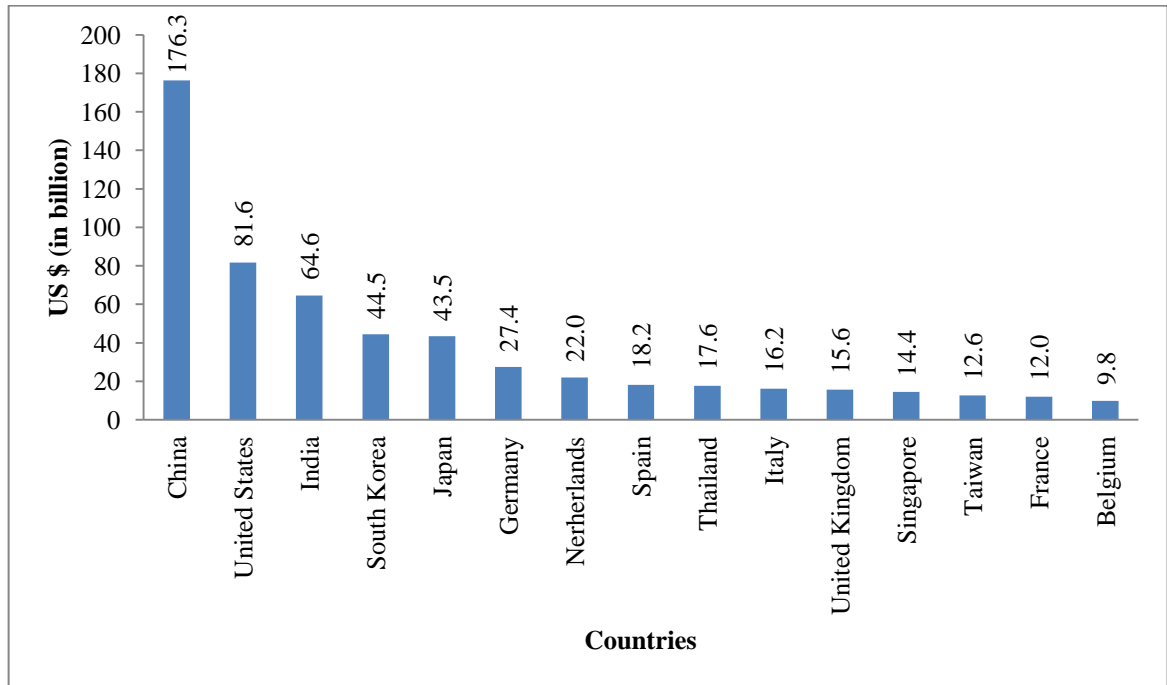
A new trend of increasing Fuel consumption worldwide has increased, mJOR reasons being urbanization, accelerating economic development in such densely populated countries as China and India as well as population growth,. Population growth in industrial cities have lead to more consumption of energy and thus ending to more demand of fuel.

Daily crude oil demand is steadily increasing, rising from 95 million barrels in 2015 to 110.3 million barrels by 2035. (BP, 2018). Prices are likely to rise if demand for oil exceeds supply. This occurred at the start of the twenty-first century, when economic expansion increased energy demand. Oil prices reached at \$ 115 per barrel in 2014. Prices fell nearly half to \$ 59.7 per barrel in 2018. Oil exports are carried out by all countries in the world, without exception. It circulates between 50 percent of the world's oil through international commerce channels. More than 20% of the overall export earnings of developing countries is expected to be in this category.

The chart below shows the top 15 countries importing the highest amount of crude oil by 2020. The 15 listed countries purchased 84.5% of total crude oil imported by 2020 total expenditure. However, all these countries have spent less money on crude oil by 2020 due to falling prices. The decline in crude oil prices has been caused by various factors such as lower commodity prices, the global epidemic and the effect of the economic downturn and

the increase in sales of electric vehicles and the development of solar and wind power technologies.

Figure 1 Fifteen leading countries in oil imports by 2020



Source: <https://www.worldstopexports.com/crude-oil-imports-by-country>

Countries that have seen a decline in the cost of crude oil purchases from 2019 to 2020 include France (down -50.8%), Belgium (down -46.2%), Italy (down -44.5%), Taiwan (down -40.8%), Singapore (down -40.6%), Japan (down -40.5%), Spain (down -38.3%) and the United States (down -38.3%) (world leader, nd).

Many countries rely heavily on foreign oil exports, which could lead to instability in the country if shipments are delayed. Since oil is so strongly linked to industrial growth and boosting the country's standard of living, no government can afford to overlook it, irrespective of the role of domestic production. Producer nations rely on oil exports to help them finance their economies and improve their oil production activities.

Conversely, consumer countries want to reduce their dependence on productive countries by exchanging their goods to ensure a certain level of security and to develop new products that work instead of energy.

In addition, global trade in the oil industry continues to grow with the growth of corporate sector and national corporate trade. In order to solve stock losses, meet expanding demand, and address growing environmental problems, competition requires innovation, particularly technological innovation. Exploitation of oil is a source of riches and

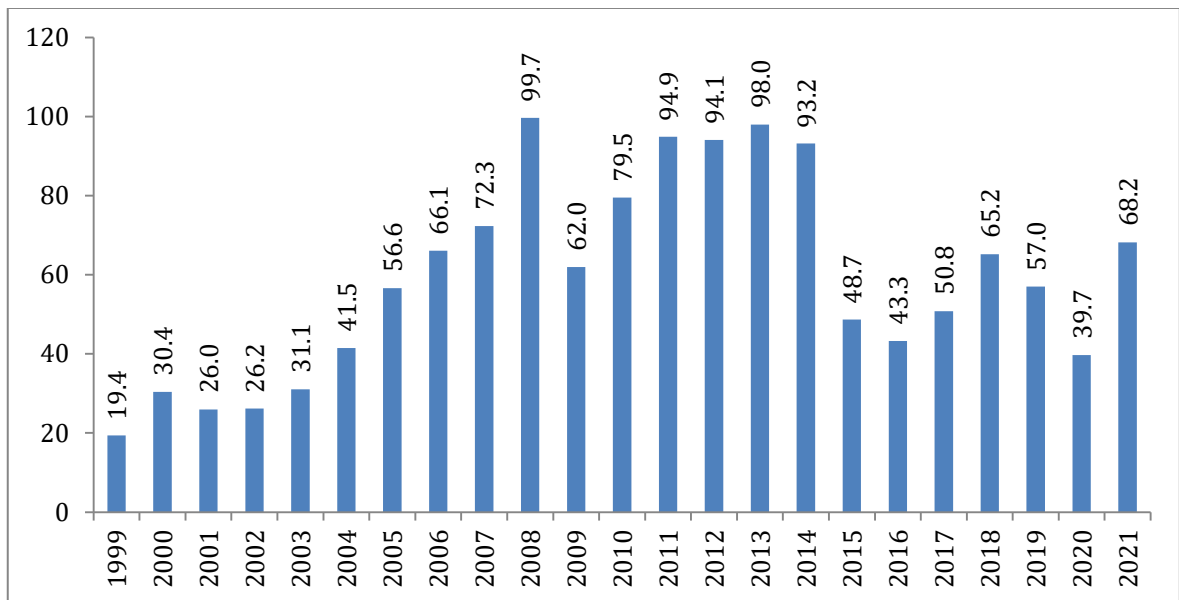
economic prosperity for interested countries, allowing them to diversify their operations and end the "oil period."

2.3.2 Impact of oil price on economic development

Oil prices often fluctuate day by day depending on a variety of factors such as environmental problems, demand issues, the global economy, wars, supply or other volatile factors in buying or producing countries.

In 2013, the closing price of crude oil was \$ 97.98. A year later, in 2014, the price dropped to \$ 93.17 (macrotrends, 2009). Figure 2 shows the change in the price of crude oil from 2000 to the present. Therefore, the decline in crude oil prices has been followed for a long time

Figure 2 Prices of World Crude Oil Price (WTI) in US Billions(\$)



Source: Official website of Macrotrends – The Premier Research Platform for Long Term Investors – URL: <https://www.macrotrends.net/2516/wti-crude-oil-prices-10-year-daily-chart>

For more than a century, oil has been one of the main sources of economic growth in the world, hence the term "black gold". Oil is commonly utilized in industrial shipping and manufacturing activities, either directly or indirectly. As a result, its volatility has a significant impact on the economy. Since no oil product can match the same standards at a cheaper cost, this influence is significant.

The main reason is the residual shale gas and oil in the United States. As a result, oil and gas prices have dropped dramatically. And many productive countries do nothing to

prevent overproduction. As recorded in 2014, OPEC countries have been consistently producing more than 32 million barrels per day, production grew by another 280 thousand barrels (History of OPEC, n.d.).

Next, we will look at the reasons why oil and gas prices have been so good in 2014.

Lowering oil prices:

1) Increased oil production

According to one estimate, worldwide oil output grew by 32.63 million barrels per day by 2018, bringing it to a new high of 100 million barrels per day. This is due to OPEC member states increasing their output by 420,000 barrels per day to 32.63 million barrels per day, allowing them to compensate for declines in Iran and Venezuela. (Katrenko, 2016).

2) OPEC international policy on new ways to produce oil. Another factor contributing to the decline in oil prices is OPEC countries' policy, particularly Saudi Arabia, which seeks to bring different oil producers from shale sand and tar to market, whose production costs are higher compared to conventional oil.

If shale oil production stops, demand will rise in ratio to supply in this method. Saudi Arabia is attempting to make extreme oil exploitation less viable by maintaining production at same level and declining to cut it. Due to OPEC's refusal to cut output when prices began to decrease, there was a glut of oil on the world market, causing prices to fall.

There are large shale reserves in the Africa, Venezuela, USA, Russia, Europe, Canada, and Asia. These parks will be able to meet the needs of the world for many years to come. These oils are extracted by injecting water with hydraulic fracturing in shale sand. The cost of producing shale oil is higher than that of conventional oil. In ordinary oil, operating costs are about US \$ 10 per barrel. Despite the decline in the number of shale oil resources in the United States, these products will face considerable difficulties for geostrategic and economic reasons.

Oil has never been so widely used, let alone oil. In addition, shale oil production has been more reactive to price changes than oil production because resources are depleted faster. Therefore, the opportunity to refine the products in the short term is with the shale oil producers. Therefore, if oil prices are already pushing certain companies to stop using shale oil without having a significant impact on the shale oil market, then inflation could quickly revitalize new mineral resources.

The high demand for supply leads to the fact that oil prices are declining. As a result, lower oil prices are leading to economic instability in developing countries. However, there is reason to believe that oil prices will rise over the medium term (\$ 50 per barrel). This price does not meet the needs of producer countries to fund their social peace policies through grants and donors. In addition, unless a major political crisis hampers oil supply, it will be extremely difficult for oil prices to rise to \$ 100. As a result, developing oil-producing countries need to reconsider their business models (Brent crude oil, 2015).

Low oil prices could weaken other exports, especially those whose oil makes up more than 10% of GDP, which is 75 percent of total exports. As a result, declining oil prices will include the need to reduce municipal costs and increase the shared tax burden on the economy, both by raising effective tariffs, for example, by raising the tax base and introducing oil taxes. new taxes and fees.

Rising social and political tensions will result in a vastly higher level of government spending in the budget, as well as a halt to tax reform. This will increase the risk of postponing the completion of oil reform changes and create a chance to raise the tax burden on oil output (Seven questions, 2014).

Another group of countries, including major oil producers such as Kuwait, the United Arab Emirates and Saudi Arabia, have significant savings that have made it possible for them to afford long-term oil prices. However, the larger the population, the greater the risk.

Finally, in countries where oil is one of the most important, but not unique, such as Kazakhstan, inflation will lead to economic depression and lower GDP, but will not lead to recovery for these countries.

Importing and exporting countries are some of the biggest beneficiaries of oil prices. This applies to the whole euro area: falling oil prices will reduce the euro decline (export products will be cheaper and, therefore, more competitive), without rising imports, black gold is not very important in the relevant countries.

The price of oil in euros has dropped by 7% in 2017. The main factor is the growth of the euro area, which is estimated at 0.2 points. However, there are catastrophic consequences: in view of the value of oil imported into Europe, long-term inflation could reduce inflation by 0.4 percent, which would mean inflation which severely damages the continent's economic stability (Energy Prices, 2014).

Therefore, we can say that oil prices have huge impact on the import and export economy and the global political situation.

2.4 Oil and Gas industry in India

2.4.1 Market Size

India is projected to be a great contributors to the increase of non-OECD fuel consumption worldwide. Crude oil purchases rose sharply to \$ 101.4 billion in 2019-20. As of 01 September 2021, the total volume of temporary refineries stands at 246.90 MMT and the IOC emerged as the largest domestic filter, with a capacity of 69.7 MMT (Ministry of Petroleum and Natural gas, 2020).

At FY20, India's crude oil production stands at 32.2 MMT. Crude oil production at 4.9 MMT at FY22 (April-May 2021) and 30.5 MMT at FY21. At FY20, crude oil sales rose to 4.54 mbpd from 4.53 mbpd on FY19. Natural Gas consumption is expected to reach 143.08 million tons (MT) by 2040. India's LNG acquisition stood at 33.68 bcm during FY20.

According to the International Energy Agency (IEA), natural gas consumption in India is expected to grow by 25 billion cubic meters (bcm), registering an annual growth rate of 9% by 2024.

According to the International Energy Agency (IEA), India's mid-term perspective on natural gas use remains strong due to growing infrastructure and environmentally friendly policies. Industrial buyers are expected to account for ~ 40% of India's growing demand. The need is also expected to be driven by sectors such as residential, transport and energy.

India's consumption of petroleum products grew by 4.5% to 213.69 MMT during the FY20 from 213.22 MMT in FY19. Total shipping of petroleum products increased to US \$ 35.8 billion per FY20 from US \$ 34.9 billion per FY19 each. Exports of petroleum products from India have increased from 60.54 MMT per FY16 to 65.7 MMT per FY20.

Exports of petroleum products from India to 56.8 MMT per FY21 from 60.5 MMT per FY16. As of December 31, 2020, Gas Authority of India Ltd. (GAIL) had the largest share (69.39% or 11,884 kms) of the country's natural gas pipeline network (17,126 kms) (Ministry of Petroleum and Natural gas, 2020).

2.4.2 Investments

According to the reports of the Department of Industry Promotion and Internal Trade Policy (DPIIT), FDI's entry into India's petroleum and natural gas sector stood at US \$ 7.96 billion between April 2000 and June 2021 (Ministry of Petroleum and Natural gas, 2020).

Listed below are some of the most significant investments and developments in the oil and gas industry:

In September 2021, Indraprastha Gas Limited (IGL) signed a memorandum of understanding with the South Delhi Municipal Corporation (SDMC) to build a garbage dump at the Delhi power station. India aims to trade 50% of its SPR (strategic fuel storage facilities) to raise funds and build additional storage tanks to reduce high oil prices. July 2021, IndianOil Petronas Pvt. Ltd. announced its plan to establish a new type of motor fuel sold in India to further expand its business operations in the country. In July 2021, the Indian Oil Corporation (IOC) announced the establishment of India's first crude hydrogen plant at the Mathur refinery to launch green hydrogen projects and projects in the oil and gas sector in the country.

In July 2021, the Oil & Natural Gas Corporation (ONGC) announced the use of Rs. 300 billion (US \$ 4.03 billion) on FY22 to increase oil and gas emissions. To expand beyond the natural gas business, July 2021, GAIL (India) Ltd. announced an investment of Rs. 5,000 crore (US \$ 670.18 million) to develop a renewable energy portfolio that directs at least 1 gigawatt capacity and build your own plants both compressed biogas and ethanol.

July 2021, Bharat Petroleum Corporation Ltd. (BPCL) announced plans to establish its first-generation ethanol production facility in Telangana for an estimated Rs. 1,000 crore (US \$ 134.04 million). In July 2021, the ONGC, an offshore oil company, and the NTPC announced a plan to boost India's offshore wind development and accelerate its presence in the renewable energy sector.

In June 2021, ONGC Videsh is in the process of raising \$ 525 million in foreign currency loans from a mix of domestic and overseas lenders to repay maturing bonds in the coming months. According to government data, India's natural gas production increased by 22.7% YoY in April 2021, according to Reliance Industries Ltd. and its partner, BP plc, have increased production in the KG-D6 area on the east coast. In February 2021, Petronet LNG announced plans to increase its Dahej terminal volume by 29% to 22.5 million tons per year (mtpa) to meet growing demand.

India's major oil stores such as Barat Petroleum and Hindustan Petroleum have announced plans to increase the capacity of their stores in rural areas by 2021. In February 2021, the ONGC announced that by May 2021, it would increase natural gas emissions from the KG basin block to 2.5-3 million cubic meters per day. In February 2021, the government launched important oil and gas projects in Assam, such as the INDMAX Unit at Indian Oil's Bongaigaon Refinery, the second tank of Oil India Limited in Madhuban, Dibrugarh and the 'Gas Printing Station' in Hebeda Village, Makum and Tinsukia. They are far away from Dhemaji in Assam.

In February 2021, the government launched important oil and gas projects such as the Ramanathapuram - natural gas pipeline - Thoothukudi and the Petroleum Extraction Unit at Chennai Petroleum Corporation Limited, Manali. February 2021, IndianOil Corp. Ltd. signed a 'statement of intent' with Greenstat Hydrogen India Pvt. Ltd. to establish a Hydrogen value chain beauty center and other related technologies such as hydrogen storage, fuel cells, etc.

Foreign investors will have the opportunity to invest in US \$ 300 billion projects in India as the country looks to reduce its dependence on oil purchases by 10% by 2022, according to Mr. (Department of Petroleum and Natural Gas, 2020).

2.4.3 Government Initiatives

Some of the major efforts by the Government of India to improve the oil and gas sector are as follows (Department of Petroleum and Natural Gas, 2020):

In September 2021, the Indian government approved an oil and gas project worth Rs. 1 lakh crore (US \$ 13.46 billion) in northeastern India. These projects are expected to be completed by 2025. In September 2021, India and the US agreed to increase their power cooperation by focusing on emerging oil. This was followed by a conference of US-India Strategic Clean Energy Partnership (SCEP) ministers.

In July 2021, the Department of Industrial Development and Internal Trade (DPIIT) approved a directive that allows 100% foreign direct investment (FDI) under the PSU oil and gas line. In July 2021, the Minister of Road and Highway, Mr. Nitin Gadkari has opened India's first liquefied natural gas (LNG) facility in Nagpur, Maharashtra.

In July 2021, India split crude imports by announcing its first shipment from Guyana scheduled for next month. The move also marks the future direction of expanded cooperation with Guyana in the oil and gas sector. In June 2021, the government

announced the sale of state-of-the-art ONGC and OIL, a state-owned oil and gas power plant to boost hydrocarbon production. In February 2021, the Prime Minister Mr. Narendra Modi has announced that the Indian government is planning to invest Rs. 7.5 trillion (US \$ 102.49 billion) in oil and gas infrastructure over the next five years.

In the Union's 2021 budget, the government has set aside Rs. 12,480 crore (US \$ 1.71 billion) for direct transmission of LPG (liquefied petroleum gas) and Rs. 1,078 crore (US \$ 147.31 million) to support stock at BCPL / Assam Gas Cracker Complex. In the Union's 2021 budget, the Minister of Finance has announced that he will provide one million LPG connections under the Pradhan Mantri Ujjwala Yojana (PMUY) program.

The Department of Petroleum and Natural Gas has released a draft LNG policy aimed at increasing the national capacity for renewable LNG capacity from 42.5 million tonnes per annum (mtpa) to 70 mtpa by 2030 and 100 mtpa by 2040.

The Department of Petroleum and Natural Gas has issued a long-term Ethanol Purchase Policy under the 'Integrated Ethanol Petroleum Program (EBP)' (dated 11 October 2019), which includes long-term alternatives to purchasing ethanol, alternatives. with long-term purchase contracts, how to set prices and other topics.

As per the Union budget for 2019-20, the Indian 'Kayakave Kailasa' Scheme, the Department of Petroleum and Natural Gas has empowered SC / ST entrepreneurs in the provision of bulk LPG transport. State power companies, Bharat Petroleum, Hindustan Petroleum and the Indian Oil Corporation, plan to spend US \$ 20 billion on expanding refinery to add units by 2022. The government plans to establish about 5,000 biogas compressed (CBG) plants by 2023. The government plans to invest 2.86 billion in oil and gas production upstream to double the production of natural gas at 60 bcm and to dig more than 120 exploration wells by 2022.

2.4.4 Oil and gas imports of India

India relies heavily on crude oil and LNG imports by 82.8% crude on crude oil and 45.3% on natural gas / LNG (Route U. The total export revenue is US \$ 63.305 billion in fiscal year. -2017–18 as a result of imports of crude oil India has produced 35.2 million tons of crude oil production by traditional crude oil production and 204.9 million tons of petroleum products India similarly produced 31.7 bcm of natural gas in the region against 58.1 bcm. In 2019, India was the fifth largest LNG importer. [Shale boom lowers] The

price of LNG is linked to the crude oil prices available on the world market (Craft Oil: The Lesser Known Side of America's Energy Industry, nd).

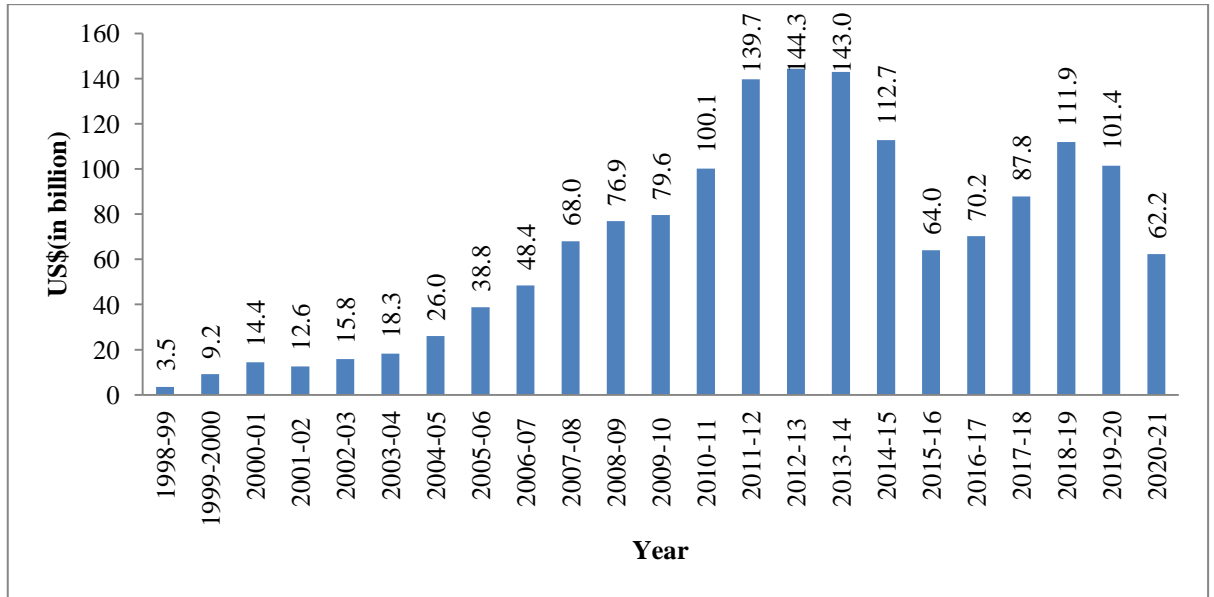
India is the second largest importer of crude oil and its products after China. By 2019, the US will be a supplier of LPG, crude oil, LNG and products from shale oil production (Trump Can Use 'Nuclear Option' to Make Saudi Arabia Pay for Oil War, 2018). The cost of producing Shale oil in the US could be the highest value of crude oil in international trade as most of its production is used internally instead of imported from other countries (The future of fully renewable energy is possible, 2018).

Due to the shortage of sufficient oil resources, India should rely heavily on crude oil purchases soon until its renewable energy resources such as wind, water, biomass and solar are used sufficiently to achieve energy security by changing the use of petroleum products. They also play a major role in air pollution (OPEC Loses its grip on oil prices, nd). In extreme cases like this, India should play a major role in the crude oil trade globally as a crude oil producer by using its limited crude oil production base to reduce the price of crude oil set by OPEC + and Big Oil (Wells, strings, and wheels, nd). International crude oil prices vary widely due to small differences between demand and supply globally (Everything has changed: Oil and the end of OPEC, n.d.). In order to be a crude oil producer, India must double the rate of crude oil extraction designed for continuous extraction in developed oil reserves and extract crude oil only occasionally when crude oil prices exceed the pre-drilling value instead of continuous oil extraction. (What is expected of OPEC in 2019, nd).

Also, India and China as major importers of oil, both countries must co-operate to benefit equally while trading in international oil markets in order to reduce crude oil prices and eliminate OPEC oil prices, etc. (Sahgal ram, n.d.). In general, the price of crude oil and the price of gold reflect the opposite styles in international trade (that is, while one increases the other decreases). India should also buy crude oil in the futures market by hedging for gold.

India's crude oil imports were reported at 62.25 billion US \$ in the year 2020-21. This records a decrease from the previous number of 101.38 billion US \$ for the year 2019-20. The data reached an all-time high of 144.29 billion US \$ 2012-2013 and a record low of 3.52 billion US \$ in 1998-1999.

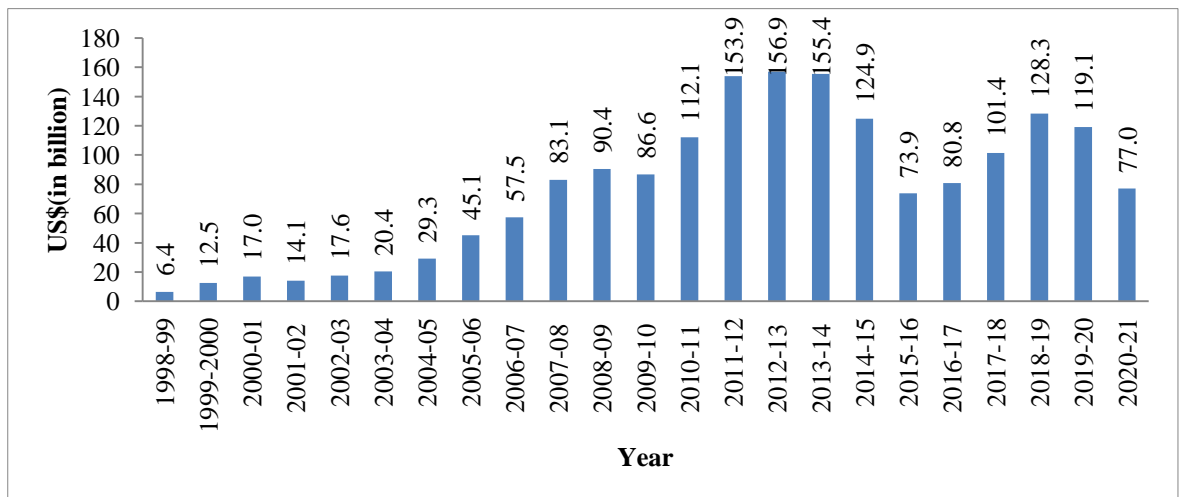
Figure 3 Crude oil import of India



Source: Petroleum Planning & Analysis Cell, Ministry of Petroleum & Natural Gas, Government of India - URL - https://www.ppac.gov.in/content/212_1_ImportExport.aspx

India’s import of petroleum products including crude oil was reported at 77.02 billion US \$ in the year 2020-21. This records a decrease from the previous number of 119.07 billion US \$ for the year 2019-20. The data reached an all-time high of 156.88 billion US \$ 2012-2013 and a record low of 6.41 billion US \$ in 1998-1999.

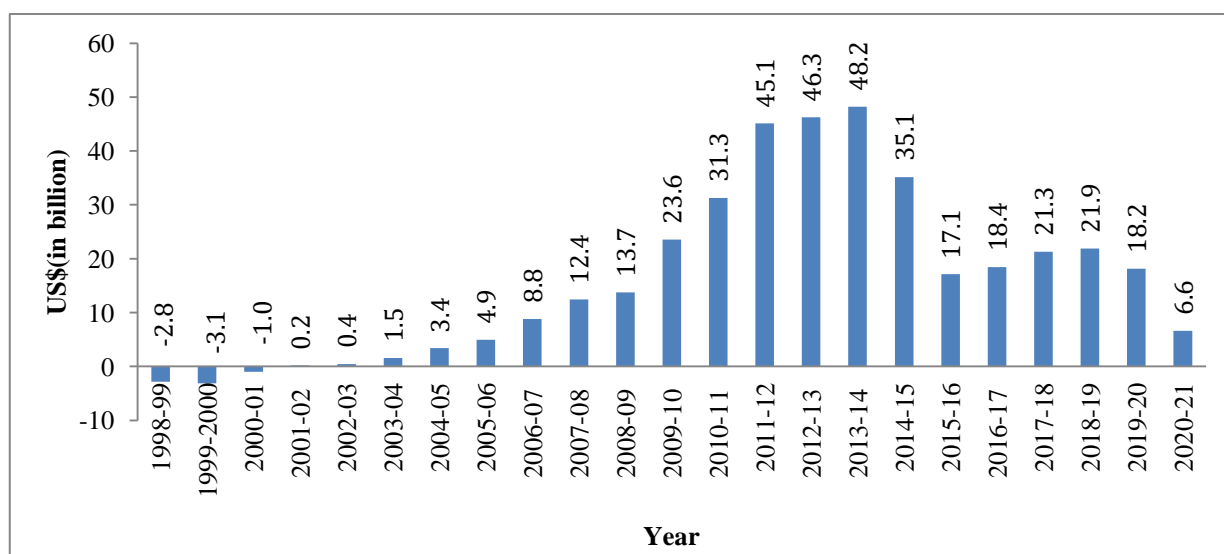
Figure 4 Petroleum product’s import of India



Source: Petroleum Planning & Analysis Cell, Ministry of Petroleum & Natural Gas, Government of India - URL - https://www.ppac.gov.in/content/212_1_ImportExport.aspx

2.4.5 Oil & other petroleum product's exports of India

Figure 5 Oil & other petroleum product's export of India



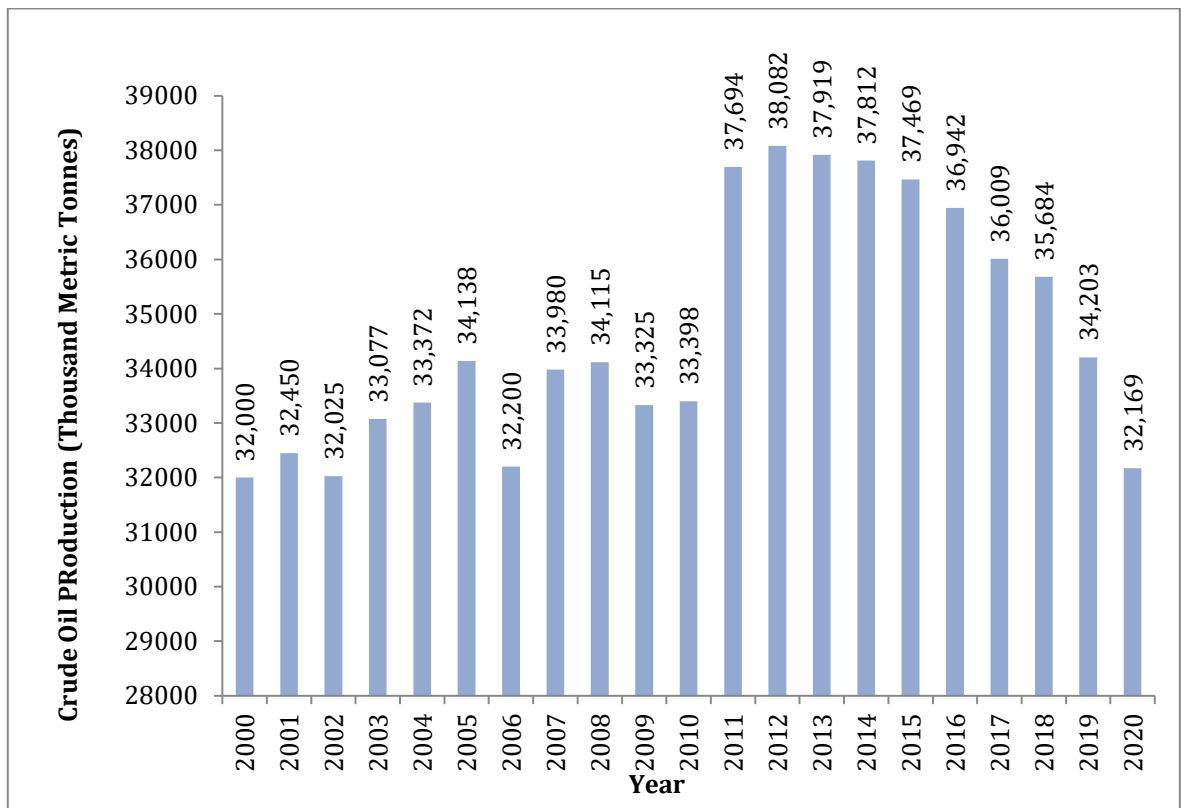
Source: Petroleum Planning & Analysis Cell, Ministry of Petroleum & Natural Gas, Government of India - URL - https://www.ppac.gov.in/content/212_1_ImportExport.aspx

India's petroleum product's exports were reported at 6.64 billion US \$ in the year 2020-21. This records a decrease from the previous number of 18.44 billion US \$ for the year 2019-20. The data reached an all-time high of 48.20 billion US \$ in 2013-2014 and a record low of -3.10 billion US \$ in 1999-2000.

2.4.6 Production of Oil in India

India's crude oil productions were reported at 0.030 billion metric tonnes in the year 2020-21. This records a decrease from the previous number of 0.032 billion metric tonnes for the year 2019-20. The data reached an all-time high of 0.038 billion metric tonnes from the year 2010-11 to 2013-2014 and a record low of 0.030 billion metric tonnes in 2020-21.

Figure 6 Crude oil Production



Source: Petroleum Planning & Analysis Cell, Ministry of Petroleum & Natural Gas, GovernmentofIndia-URL-

https://www.ppac.gov.in/content/146_1_ProductionPetroleum.aspx

2.4.7 Consumption of Oil in India

India is the third largest supplier of crude oil in the world, following the United States and China (Gensets add less than half the amount of energy included, 2014). The country accounted for 4.81% of the world's total oil consumption in 2016-17. The average volume of crude oil consumption in India increased from 160.77 MMT in 2008–09 to 251.93 MMT in 2017–18 with a CAGR of 4.59%. High-speed diesel oil accounted for 39.3% of total consumption of all petroleum products in 2017-18, followed by liquefied petroleum gas (11.3%), petroleum coke (12.4%), naphtha (6.1%) and petrol (12.7%). In 2016-17, the country consumed 1.41 percent of the world's total natural gas supply. The fertilizer industry (27.78 percent), power generation (22.77 percent), and transportation are the largest users of natural gas (16.25 percent). Natural gas is used for both energy and non-

energy purposes (60.68 percent and 39.32 percent, respectively) (Cost of oil and gas pipeline production, n.d.).

After coal, the second and third largest sources of electricity produced in India are crude oil and natural gas. Crude oil accounted for 10.34% and natural gas accounted for 8.7% of total electricity generated in 2017–18 (Cost of oil and gas drilling costs, n.d.). As of 31 March 2021, the total capacity of India-based power stations was 24,924 MW, which is approximately 6.5% of the total installed capacity. Many of these gas-based power stations are operational due to a shortage of natural gas. Diesel is the smallest source of electricity for India. The total installed capacity of diesel-based power plants in the Indian energy sector is 927.89 MW which accounts for 0.3% of the total installed capacity (Business Standard India, Press Trust of India. 2021).

In addition to the DG sets of resource sector, there are more than 90,000 MW DG sets (over a range of 100 kVA capacity) with backup capacity of approximately 36 per cent of the total total installed in the Indian resource sector (Workman, Daniel, 2020). "Crude Oil Import by Country". Observatory for Economic Complexity. Retrieved 27 June 2021.] In addition, there are many DG sets with a capacity of less than 100 kVA to provide emergency power supply during power outages in all sectors such as industrial, commercial, domestic and agricultural (Yousaf, Shamsheer, 2011).

India's electricity sector accounted for 24.28% of the country's natural gas production in 2016–17 (Cost of oil and gas cylinder production, n.d.). In addition, at least one KL per million kWh (approximately one million tons / year) of oil as the second fuel is used by coal-fired power stations to implement low load capacity.

2.4.8 Foreign trade

India is the second largest importer of oil after China and relies heavily on imported crude oil (Explained: Why oil and gas production in India declines, 2021). The volume of crude oil imports increased from 132.78 MTs during 2008-09 to 220.43 MTs in 2017-18. Despite dependent on imports, India has built up adequate processing capability to create a variety of petroleum products throughout time. As a result, India has become a complete petroleum product producer. Petroleum product exports climbed from 38.94 million tons in 2008-09 to 66.83 million tons in 2017-18. In 2017–18, exports of 35.46 MT of petrol

products were down 2.28 percent from the previous year. Natural gas imports climbed by 9.44 percent from 8.06 billion cubic meters in 2008-09 to 19.87 billion cubic meters in 2017-18(Energy Statistics 2019, n.d.).

India relies on 82.8% of crude oil and 45.3% of natural gas / LNG. The total export output is \$ 63.305 billion for the 2017–18 financial year due to crude oil imports (ONGC gas price for an inch to \$ 1.82, down below \$ 4 in Reliance-BP, 2021). India has produced 35.2 million tons of oil products through traditional crude oil production and the consumption of petroleum products is 204.9 million tons. Similarly India has produced 31.7 bcm of natural gas in the region against the use of 58.1 bcm (India launches first auction of test blocks under new licensing policy, Economic Times, 2018).

2.4.9 Macroeconomic Indicators affecting production of Oil

2.4.9.1 Inflation

In the economy, inflation is the rise in the average price of goods and services in the economy over time. If the standard price rises, each currency unit buys fewer goods and services. As a result, inflation is also a reflection of the erosion of inflation - the loss of real value in the trading environment and the account unit in the economy. The main measure of inflation is the rate of inflation, the conversion of the annual percentage rate to the normal price index (usually the consumer price index) over time.

The effects of inflation on the economy are varied and can be both positive and negative. The negative effects of inflation include real depreciation of cash and other commodities over time, uncertainty about future inflation that could weaken investment and savings, and if inflation is sufficiently rapid, as a consumer begins to accumulate due to price concerns. will increase in the future. Positive outcomes include ensuring that major banks can adjust interest rates (aimed at reducing recession), and encouraging investment in non-financial projects (Pankaj Bhattacharjee, 2013).

There are two types of inflation - the Whole sale price index (WPI) and the Consumer price Index (CPI). WPI can be interpreted as an indication of the price paid by a manufacturer for their installation. CPI is the amount of money needed to buy a given basket of used goods and services (Pankaj Bhattacharjee, 2013).

2.4.9.2 Gross Domestic Product (GDP) growth or Economic Growth

GDP is considered all as part of the highly committed stock market performance also used for real economic growth and jobs. The result shows that in the economy as GDP proposes a decision to help the stock market grow and boost shareholders' confidence at the top, through emerging economies. GDP is one of the most important factors in the economy investigating the state of our economy. helps the decision of the investor and companies regarding their strategies should accept the right decision effectively and adopt the policy. A study by Levine and King (1993) is the first to discuss the relationship between economic growth and financial development the use of national context. It equates equally with the percentage increase in real GDP. This effect is strong compared to the rest of the era Levine and Beck (2004) this relationship between economic growth and stock price has been researched through (Fama, 1990; Ainous, 2018; Henry, 2013; Barbiero et al., 2019).

The term GDP refers to the amount of money produced by the people of a country in the domestic economy. Change in the national Gross Domestic Product (GDP) from the period (usually a year) to the next. The rate of economic growth indicates how much GDP has grown or decreased by the green dollars or rupee prices or the currency of that country. It is considered one of the most important steps in the economy of good and bad.

So,

$$\text{Growth rate} = \{(GDP_{\text{year2}} - GDP_{\text{year1}}) / GDP_{\text{year1}}\} * 100 \quad (3)$$

Formula 3 Growth Rate

GDP growth rate is a very important indicator of economic health. As it grows, so does business, jobs and personal income. If there is a decline, businesses will stop investing in new purchases and hire new employees, waiting to see if the economy will improve. This can easily depress the economy and consumers may have less money to spend on purchases. If the rate of GDP growth is actually deteriorating, it means that the country's economy is heading towards a recession (Pankaj Bhattacharjee, 2013).

2.4.9.3 Interest rate

Interest rate is almost the highest interest rate minus the inflation rate. According to Hsu et al., (2013) The interest rate is the interest rate that a debtor owes to a lender against spending. Previous research has determined that a different researcher has used a different interest rate. Barakat et al., (2016) this previously assigned study assumes that stock prices

and interest rates are negatively correlated. When the bank deposit rate increases, people will transfer their money to the bank from the money market this will lead to a decrease in demand for shares. When the deposit rate decreases, the opposite will happen.

2.4.9.4 Foreign direct investment

FDI is a major and sees the great foundations of economic development. In general, FDI is the revenue, transfer and facilitation of skills, access to administrative and organizational access to global markets and skills. To achieve, the inflow of foreign currency is the effect that we take on foreign direct investment (FDI) (Ahmed et al., 2012).

Foreign Direct investment is the investment and other assets in the country's economy by foreign companies. This indicates that an investment will not only be long-term, but will also allow the investor to have direct control over the work of the receiving company.

Naturally, this needs considerable - and major - ownership. The size of this fixed share varies by country, but it always exceeds 10% of the company's market capitalization. With such indication, the investor is able to exert effective control over the recipient company's operations (Boddenwyn, J.J., 1983).

An important condition for attracting foreign investors is the transfer of foreign technology and other new external features. The main source of foreign investment is direct investment, as it is considered a major source of capital investment.

Foreign direct investment is not as burdensome as the external debt of the state, while ensuring global economic integration. Direct investment is a major factor in building market relations. If you are investing directly:

- Corporate business activity is improving
- New industries and new forms of production emerge
- Reduced production costs
- Commercial markets and export opportunities for businesses are growing.

Foreign trade activities have a significant impact on the domestic market environment, as they force competing companies to produce and sell high-quality international market goods (Denisia, 2010).

In regions with a changing economy and highly trained workers, the presence of high-tech international companies in the country helps to reduce the tendency and desire of skilled workers to move to higher-paid countries.

2.4.9.5 Unemployment

One of the biggest economic problems is unemployment. It stands out for the number of people who are currently unemployed but busy looking for work. The total number of workers and non-workers includes the concept of working capacity. The main indicator is the state of unemployment at some point your level. It is calculated as the average number of unemployed people and the total number of employees. The index is defined as a percentage. Unemployment is a complex issue. The various types of unemployment are as follows:

Frictional, which appears in the 1-3 job search period. As a rule, it happens when the population is almost fully employed (U.S. Bureau of Labor Statistics, n.d.). The lack of structural functions as a result of technical improvements in industry. It alters the labor market by allowing employees who have left one industry to find work in another.

Seasonal unemployment is influenced by the release season, as seen by industry swings. That is, the volume of demand, or the need for a given amount of work, varies depending on the time period.

Unemployment associated with the recession. It appears that declining demand for goods has led to a decrease in jobs, a reduction in productivity. Market equality is achieved through wage cuts, and then given to the working class, which can go to other sectors of the national economy (Farmer, Roger E. A., 2001).

The institution, from which there is no complete and transparent information about the market situation for both households and entrepreneurs. Occurs when the labor market is not working.

Thus, unemployment reflects the number of powerful citizens in the country who are seeking employment. The causes of unemployment are different.

2.4.9.6 Gross National Product

GNP is the amount of all final goods and services produced by ordinary citizens of India and measured in market prices, per year.

GNP refers to all economic outcomes produced by ordinary citizens of a nation, whether located within the national or international borders (Mankiw, N. G., 2000). The

macroeconomic variable which takes into account the following additions and subtractions is known as Gross National Product (GNP). It is, therefore, defined as follows:

$GNP \equiv GDP + \text{Factor income earned by the domestic factors of production employed in the rest of the world} - \text{Factor income earned by the factors of production of the rest of the world employed in the domestic economy}$ (Mankiw, N. G., 2000).

Hence, $GNP \equiv GDP + \text{Net factor income from abroad}$

(Net factor income from abroad = Factor income earned by the domestic factors of production employed in the rest of the world – Factor income earned by the factors of production of the rest of the world employed in the domestic economy).

2.4.9.7 External Debt

Foreign government debt is a loan to cover a budget deficit outside the home country: funds, from other countries, private banks, foreign companies and financial institutions, outsiders.

Foreign borrowing occurs when the sale of government securities abroad or by obtaining direct funds. The amount of foreign debt consists of loans to development agencies, foreign authorities, bank loans, and credit providers [Brauninger].

If the money is used for these reasons like obtaining external debt helps to improve financial resources and increase demand for its manufacturing goods and services. Foreign earnings can also be utilized to repay earlier loans and interest, pay for imported items, cover financial budget obligations, and make social payments.

Debt repayment and loan interest payments, on the other hand, result in a drop in GDP in the sector, which could otherwise be used to further the country's economic development (Clements, R. Bhattacharya and T.Q. Nguyen, 2003).

3 PESTEL Analysis of Oil and gas Industry

3.1 Political factors

It is well-known that political statements and international tensions could have a profound effect on the oil and gas industry. For example, tensions between the USA and Iran could easily affect global oil prices. It could also affect oil supply as the Strait of Hormuz (near Iran) is important for global oil supply. Uncertainty in the Middle East could easily affect the oil and gas industry. Therefore, the USA maintains very close relations with a few partners in the region, especially Egypt and Saudi Arabia. However, many analysts say that the USA's confidence in the Middle East oil is slowly declining.

OPEC (Organization of Petroleum Exporting Countries) co-ordinates and compiles the petroleum policies of its member states (OPEC, 2021). The existing member states are Iran, Equatorial Guinea, Iraq, Kuwait, Saudi Arabia, Venezuela, Libya, United Arab Emirates, Algeria, Nigeria, Congo, Angola, and Gabon. Interestingly, some countries like Nigeria and Venezuela may like to see oil prices rise because of their fragile economic situation, while others are less productive. It should also be noted that all of these countries have different policies, laws, and domestic laws that affect the oil and gas industry separately.

It is fair to say that Qatar left OPEC in 2018 ending a long-term 60-year membership. Some analysts say the decision is politically motivated, while others say it was a business venture as the country deviated from the oil industry with the intention of dividing the economy.

3.2 Economic factors

The world's largest oil producers are the USA, Russia, Saudi Arabia, Iraq, Canada, China, the United Arab Emirates, Iran, Brazil, and Kuwait. The major gas producing countries are USA, Russia, Iran, Canada, Algeria, Qatar, Norway, China, Saudi Arabia, and the United Arab Emirates (Worldometer, 2021).

The world's largest oil producers are the USA, China, India, Japan, Russia, Saudi Arabia, Brazil, South Korea, Canada, and Germany. The slowdown in the domestic economy in any of these countries often has an impact on the oil and gas industry. For example, oil prices fell in the first week of August 2021 as growth in factory activity in China slowed

sharply (Aljazeera, 2021). Instead, economic growth drives the use of oil and gas worldwide. In the exporting African countries, economic growth has long been driven by the oil and gas industry.

The oil and gas industry supports millions of jobs worldwide. However, the industry is complex, and it has both positive and negative impacts on other industries. For example, high oil prices are good for the oil industry, while they are a challenge for many others. People who own car owners will suddenly have to pay higher prices which may result in lost revenue to them. On the contrary, falling prices are bad news for oil companies, while they are good for many other industries.

3.3 Social factors

Exploring social aspects is the next step in analyzing PESTEL for the oil and gas industry (petroleum). Oil consumption has skyrocketed in the last few years in many developing and developing countries as these nations have seen the emergence of new middle class nations. Without a doubt, Brazil, India, Russia, and China are the world's largest oil-producing countries. More and more people are buying cars and using different means of transportation during the holidays to increase the demand for oil.

Global oil and gas companies need to understand the cultural and social conditions of the countries in which they operate. Many analysts advise that they should invest in local relationships and apply local market knowledge. This should help them develop local skills that not only support local people but also enhance their business reputation.

3.4 Technological factors

It is widely known that the oil and gas industry is responding slowly to new technological advances. However, thanks to digitalization, many companies are now investing heavily in big data and statistics, Industrial Internet of Things (IIoT), cloud computing, AI and machine learning, robots and drones, 5G networks , and collaboration tools (Huawei, 2021). Using these technologies may increase their efficiency and make them more profitable.

3.5 Environmental factors

The climate and the seasons drive the demand for oil and gas. For example, oil consumption increases during the summer travel seasons, while demand for gas increases

in winter as gasoline is used. On the other hand, adverse weather conditions sometimes interfere with oil and gas extraction operations. It is worth mentioning that many people are now days of following the friendly oils and avoiding the 'dirty' fossil fuels.

3.6 Legal factors

Understanding the legal environment is an important factor in PESTEL's analysis in the oil and gas industry (petroleum). Different countries have different actions that control the oil and gas industry e.g. Petroleum Act in the UK, Federal Oil and Gas Royalty Management Act, Resource Conservation and Recovery Act in the USA, and Petroleum and Natural Gas Rules in India. It is safe to say that some countries have more than one law. Some countries allow foreign companies to buy local oil and gas companies, while others impose certain restrictions on ownership.

4 Practical Part

4.1 Analysis of macroeconomic indicators of Indian economy

India has one of the fastest growing economy in the Asia. The observed growth was due to 100% Foreign Direct Investment allowed by government of India in various segments of the oil & gas Industry which includes natural gas, petroleum products and refineries.

Globally, India is expected to become one of the largest contributors to the growth of non-OECD petroleum consumption. However, India's economic growth is largely dependent on the growth of oil and gas production as the ratio of profits from the Oil & gas Industry to the GDP of India was 0.66% in the year 2018 (Statista.com).

Therefore, the thesis assess the impact of macroeconomic indicators on oil production of India for the period from 2001-2020. Macroeconomic indicators such as Unemployment, Inflation, Gross Domestic Product, Interest rate ,Gross National Product are used for the purpose of analysis.

4.1.1 Gross Domestic Product of India

The Indian economy is a middle income developing mixed economy ("Indian Economic policy: View: India needn't worry about the 'middle-income trap,'" n.d.). Indian economy is the world's 6th largest economy by nominal GDP. It is the third largest economy in terms of purchasing power parity (Silver, 2020). According to International Monetary Fund,

India has been ranked 145th in terms of nominal GDP and 122th in terms of GDP(PPP) on the basis of per capita Income (World Economic Outlook Database: October 2021", 2021). The GDP of India has been increased by 4.2 times from the year 2001 to 2014. India's GDP was \$485.44 billion in the year 2001 which has been increased by \$2039.13 billion in the year 2014, the difference of \$1553.69 billion was occurred due to population growth by 0.22 billion. The increase in amount of GDP is also occurred because of increase in GDP per capita of \$1122 billion during the year 2001-2014. The annual GDP growth rate was 4.82% in 2001 which is increased to 7.41% in 2014. India's contribution in world's GDP was around 2.6 in 2014 (India, 2019).

The GDP per capita is \$452 billion in 2001 and \$1574 billion in 2014. This indicates that GDP per capita has been increased by \$1122 billion (India GDP per capita 1960-2020, n.d.). The annual growth of GDP per capita is 8.57% in 2014 and 1.86% in 2001.

India's GDP is increased by \$2870.5 billion (by 40.77%) in the year 2019 from \$2039.13 billion in the year 2014, the change of \$831.37 billion was lead by population growth of 0.07 billion and due to increase in GDP per capita by \$527 billion. The annual GDP growth rate is 4.04% in 2019 which is lower as compare to preceding year from 2014 to 2018. The share of India in world's GDP is 7.09% in 2019.

GDP per capita in India increased by \$527 billion from \$1574 billion in 2014. The GDP per capita is \$2101 billion in the year 2019 which is increased by 33.48% for a period of 2014-2019 (India GDP per capita 1960-2020, n.d.). The annual growth of GDP per capita is 5.20% in 2019 which is lower as compare to 2014.

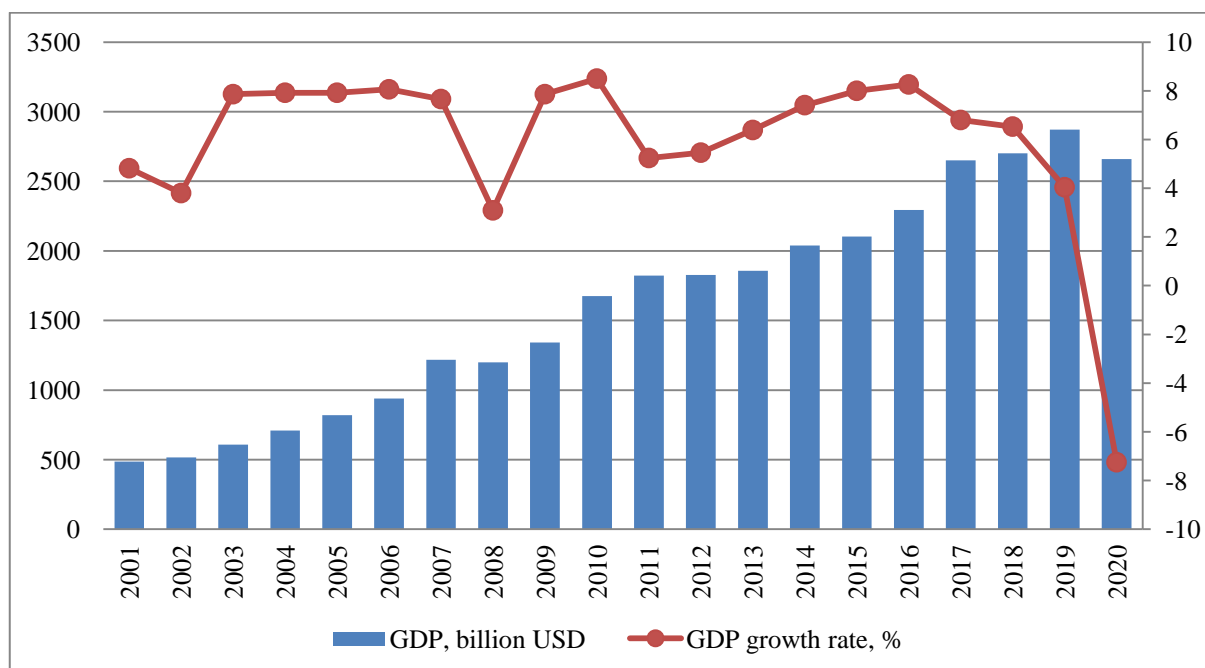
From 2001 to 2007, India's GDP is constantly increasing. However, the GDP has been decreased to \$1198.9 billion in the year 2008 as compare to 2007 where the GDP was \$1216.74 billion. The GDP has been decreased by 1.47% in 2008. Moreover, the annual GDP growth rate is also declined by 3.09% from 7.66% in 2007. The decrease in GDP was mainly driven by the financial crisis which was eventually brought in control in the time span of 2011 to 2016. the country's growth rate is stabilized at 5-8% due to high prices of oil and metals as well as significant enlargement of the country's economy.

In 2017-2018, GDP growth rate has been decreased by 6.8% and 6.53% respectively which is due to demonetization introduced by the Government of India.

The GDP growth rate again decreased by 4.04% in 2019 which is the slowest growth rate Indian economy has witnessed in past six years. The economic growth has been declined due to dwindling consumer demand, slowing Private Investment and global slowdown (GDP growth slows down to 4.5% in Q2, hits more than 6-year low, 2019).

In 2020, the GDP growth rate has been declined by -7.25%. This is the biggest drop India has registered since its independence in 1947. The impact of Covid-19 pandemic on India's economy resulted into negative GDP growth rate of country (Gill, 2021).

Figure 7 Gross Domestic Product of India



Source: The World Bank Group,

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

As per World bank, Asian Development Bank and International Monetary Fund's projections, India is going to become the fastest growing major economy in the world during the period of 2021-24.

As per the survey conducted by Union Minister for finance & corporate affairs Smt. Nirmala Sitharaman, the Indian economy is estimated to grow by 9.2% in real terms in financial year 2021-22 (Summary of the economic survey 2021-22, 2022).

4.1.2 Gross National Product of India

The GNP of India has been increased by 4.16 times from the year 2001 to 2014. India's GNP was \$485.44 billion in the year 2001 which has been increased by \$2021 billion in

the year 2014, the difference of \$1535.56 billion was occurred due to population growth by 0.22 billion. The increase in amount of GNP is also occurred because of increase in GNP per capita of \$1110 billion during the year 2001-2014. The annual GNP growth rate was 5.02% in 2001 which is increased to 7.49% in 2014 (India GNI Per Capita 1960-2020, n.d.).

The GNP per capita is \$450 billion in 2001 and \$1560 billion in 2014. This indicates that GDP per capita has been increased by \$1110 billion (India GDP per capita 1960-2020, n.d.). The annual growth of GNP per capita is 2.63% in 2014 and 2.27% in 2001.

India's GNP is increased by \$2894.03 billion (by 40.77%) in the year 2019 from \$2021 billion in the year 2014, the change of \$873.03 billion occurred due to the same reason of increase in the population of 0.07 billion and due to increase in GNP per capita by \$560 billion. The annual GNP growth rate is 4.16% in 2019 which is lower as compare to preceding year from 2014 to 2018.

GNP per capita in India increased by \$560 billion from \$1560 billion in 2014. The GDP per capita is \$2120 billion in the year 2019 which is increased by 35.90% for a period of 2014-2019 (India GNP per capita 1960-2020, n.d.). The annual growth of GNP per capita is 5.47% in 2019 which is higher as compare to 2014.

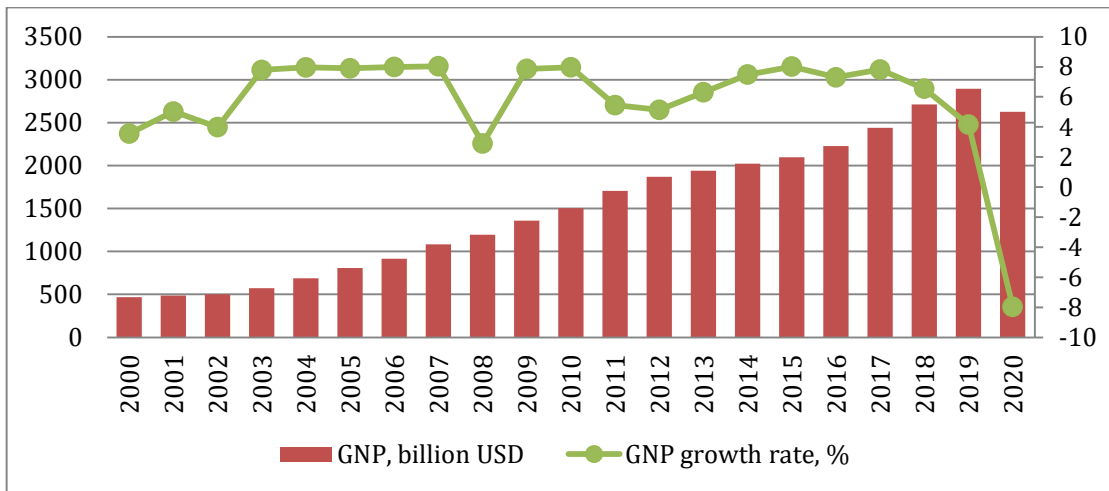
From 2001 to 2007, India's GNP is constantly increasing. The GNP has been increased to \$1195.03 billion in the year 2008 as compare to 2007 where the GNP was \$1081.97 billion. The GNP has been increased by 10.45% in 2008 as compare to 2007. Moreover, the annual GNP growth rate is declined by 5.14% from 8.04% in 2007. The decrease in GNP occurred due to the impact of the global financial crisis. From 2011 to 2016, the country's growth rate is stabilized at 5-8% due to high prices of oil and metals as well as significant enlargement of the country's economy.

In 2016-2017, GNP growth rate has been decreased by 7.3% and 7.82% respectively which is due to demonetization introduced by the Government of India.

The GNP growth rate again decreased by 4.16% in 2019 which is the slowest growth rate Indian economy has witnessed in past ten years. The economic growth has been declined due to dwindling consumer demand, slowing Private Investment and global slowdown.

In 2020, the GNP growth rate has been declined by -7.97%. This is the biggest drop India has recorded.

Figure 8 Gross National Product of India



Source: The Macrotrends URL:-

<https://www.macrotrends.net/countries/IND/india/gnp-gross-national-product>

The impact of Covid-19 pandemic on India's economy resulted into negative GNP growth rate of country. Due to Covid-19, the government of many countries including Indian government declared lockdown which led to decrease in production of products in the country and resulted into negative GNP growth rate.

4.1.3 Inflation in India

According to analysts, the average inflation rate should be between 3 and 5% per annum. To calculate the index, it is determined by a set of goods and services, consisting of 510 items. Price status is determined by the choice between trading businesses and the service sector for different types of ownership. The analysis includes all regional institutions, other cities, the capital, and regional institutions (Andrianov V. Inflation and its controls // Marketing, 2006).

From 2001 to 2005, inflation was stable at 3-4%. However, the inflation rate has been increased in the year 2002. The inflation was at 4.25% at the end of 2005. There is a declining trend in inflation during 2003-2004 which was the result of structural changes in the macroeconomic framework due to liberalization. Beside this, the better supply response improved financial and real economy, effective monetary policy and focus on fiscal consolidation helped in bringing down inflation.

In 2005, the actual inflation rate in India has been higher which is around 4.25%. After 2005, there can be seen an increasing trend in inflation during 2006-2010. The inflation has been increased to 5.80% in 2006. The inflation rate was 6.37%, 8.35% in the year q1 2007 & 2008 respectively.

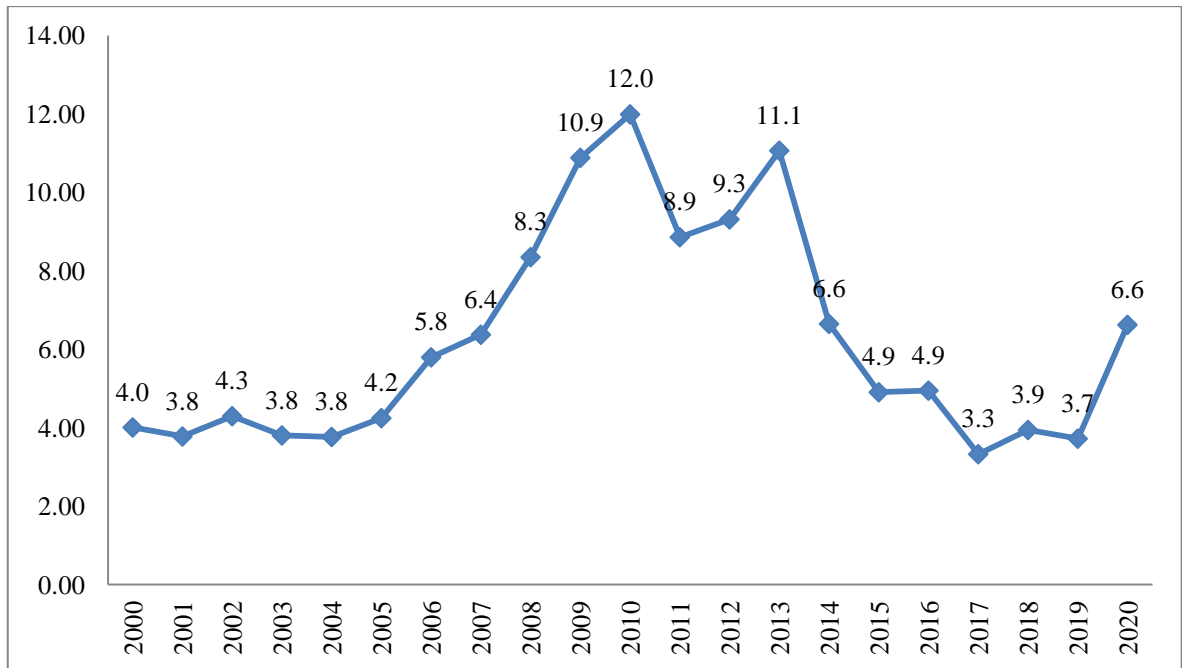
The Indian economy grew by 8.24% on an average between 2004-05 and 2009-10. The growth rate of 8.24% is witnessed by India due to the better performance and growth rate of service sector. From 2006-2008, India has recorded growth rates of above 9% which inturn increased the per capita income, as inflation was around 6% during 2006-2007. There is an increase in aggregate demand due to rise in income and it became difficult for supply side to match the increasing demand in short run. Along with increase in demand, the prices of food and fuel also increased in 2008 which further led to increase in inflation rate.

In 2009, there was a drought in India which was followed by uneven rainfall in 2010. These uncertain events and increase in aggregate demand resulted into rise in food prices which made inflation to rise by double digits. As of result of that the inflation has been increased by 10.88% (by 2.53%) in the year 2009 and 11.99% in the year 2010 which is the highest as compare to all years (Inflation over decades, 2011).

The inflation came down to single digit at 8.86% in 2011 due to the decrease in the prices of cereals, wheat, vegetables, onions, eggs, meat & fish (Food inflation drop to single digit at 9.5 pc, 2011).

In 2012, the rate of inflation has been increased to 9.31%. The inflation rate again increased by 11.06% in 2013. Despite of rise in income, the inflation rate increased in 2013 due to the increase in prices of eggs, meat, fish, vegetables and milk. The prices of all these food items increased beyond double digits as the prices of meat & fish recorded an increase of 17% (Biswas, 2013).

Figure 9 Inflation in India



Source: The World Bank Group,
<https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=IN>

The reason behind increase in the prices of food items is food rots. In India, large amount of food has been rotten because of insufficient & low quality storage facilities which leads to shortage of food in off-peak season (Biswas, 2013).

Beside this, it has been become expensive for farmers to grow food due to rise in prices of electricity, diesel and fertilizers which in turn increases the price of food items (Biswas, 2013).

The increased fuel and mineral prices are also one of the important reason behind the rise in inflation in 2013 (Biswas, 2013). The inflation rate has been decreased by 6.65% during the year 2014 due to falling global crude oil prices and decline in food inflation by 1.4% ("India inflation rate falls to five year low," 2014).

Inflation indicated a declining trend during the year 2015 and stood at 4.91% because of decline in International food, oil and commodity prices (Bhalla, 2015).

From 2016-2019, the inflation has showed declining trend. The rate of inflation was 4.95%, 3.33%, 3.95%, 3.72% in the year 2016, 2017, 2018 & 2019 respectively. In November 2017, the consumer price inflation was 3.3% which is lower as compare to 11.5% in November 2013. The food prices also come down sharply which helped in

bringing the inflation down in the year 2017. Further, government has reduced its fiscal deficit by 3.5% in 2016-17 from 4.5% in 2013-14 (India rises amid falling inflation, 2017). During 2018, the inflation rate increased by 0.62% and stood at 3.95% was moderate. Brent crude has increased by around 15% in 2018 and the rupee as well as dollar reversed their falling trend during this period.

Beside this, the major cause moderate inflation was fall in the prices of food products. The prices of vegetables, pulses and sugar were continuously falling. However, the prices of cereals were expected to increase as the government of India declared a significant hike in Minimum Support Prices for Kharif crops but the prices of cereals have witnessed decline in October 2018. Annual inflation growth rate for cereals was 2.77% between April 2018 to October 2018 which is the lowest from previous year 2016-17 (Kishore, 2018).

The decline in inflation rate occurred in the year 2019 mainly due to low food inflation which was between the range of -2.6% to 3.1% (Prices and Inflation - Union Budget, 2019).

In 2020, there is an increase in inflation by 6.62%. As food inflation has been main reason behind the rapid increase in inflation since August 2019. Although, vegetable prices have decreased since the beginning of 2020 which led to price pressure on other food products like meat, fish, oils, cereals etc. and the price of these products increased and kept food inflation high in 2020. Apart from this, there is an impact of Covid-19 on inflation as supply chain disruptions due to local lockdowns in India resulted in supply bottlenecks and pushed up costs for manufacturers as well as for retailers which further lead to rise in Price (Netherl et al., n.d.).

4.1.4 Unemployment in India

According to Census Economic Information Center, the employed population in the Republic of India was 0.465 billion people in December 2020 which is lower as compare to 0.498 billion people in December 2019 (India Employed Persons, 1970-2022/CEIC Data, n.d.).

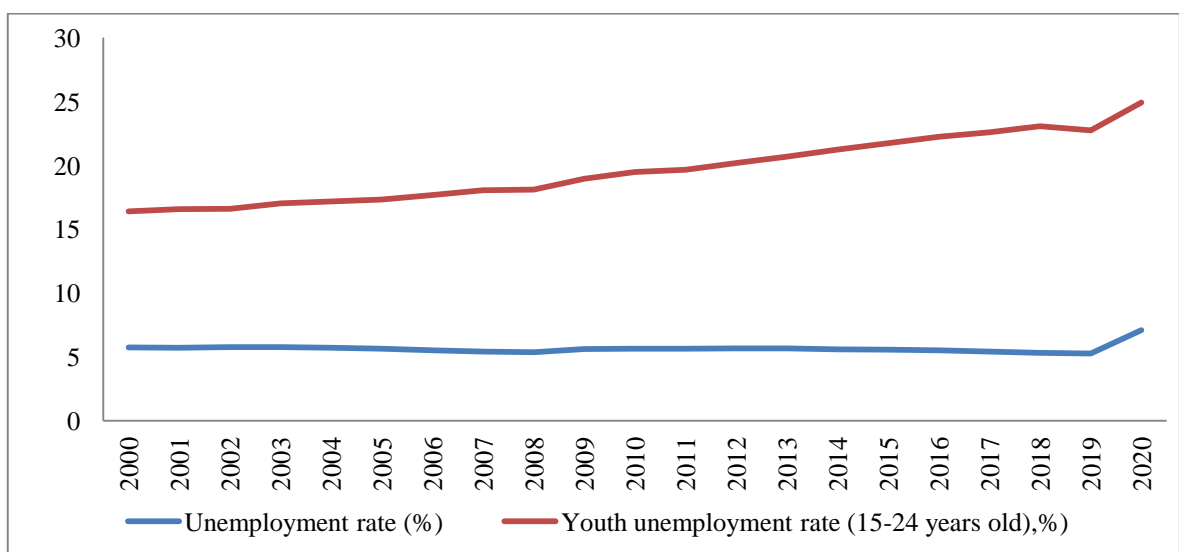
India experiences various forms of unemployment like natural, seasonal and cyclical unemployment. There are a number of factors which causes unemployment such as the insufficient demand in the labor market by speciality or qualifications, the job seeker

doesn't have opportunity to find a job. Seasonal demand is noticeable in construction and agricultural sectors.

The unemployment rate in India was 7.11% in 2020. The analysis of macroeconomic indicators indicates the annual increase in the unemployment rate in the country. During the period from 2001 to 2020, the unemployment rate remain constant. Not only in 2002 but also in 2003 the unemployment rate was 5.77% which is the highest among the years from 2001 to 2019. Nevertheless, there is a subsequent decrease in this indicator and in 2007 it reached to the level of 5.41%. In 2008, the stagnation in India at the level of 5.36% is noted. Therefore, over the previous 20 years, an increase in the unemployment rate has not been seen, except for the year 2020. The unemployment rate rose to 7.11% in 2020 which is highest as compare to preceding 20 years.

The bulk of the unemployed population lives in the well-developed cities of India while the remaining unemployed population lives in rural areas of India. According to Centre for Monitoring Indian economy Pvt. Ltd., there are 7.8% people who are unemployed in urban areas of India in December 2020. There are 6.7% unemployed people in rural areas of India. In urban areas, 6.5% male are unemployed and 20.8% female are unemployed in December 2020 whereas in rural areas, 5.9% male are unemployed and 13% female are unemployed. This indicates that the large amount of unemployed population resides in urban areas of India.

Figure 10 Unemployment rate of India



Source: The World Bank Group, <https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS>

In other words, India's urbanization processes are accompanied by a rise in the labor force in cities as a result of increased rural-urban migration patterns, as well as an increase in the total number of unemployed in the urban population structure.

The share of men was 5.4% (unemployment, male (% of female labor force) (modeled ILO estimate)-India/Data, n.d.) and the share of women was 4.9% in total unemployed people on the basis of gender (unemployment, female (% of female labor force) (modeled ILO estimate)-India/Data, n.d.). Moreover, the share of young people (15-24 years old) was 23.05% in the year 2018 which has been increased to 24.90% in the year 2020.

According to Indian government, India had 31million jobless people in 2018. Assam's situation was not good in terms of unemployment. As per statistics provided by the state skill employment and entrepreneurship the total number of employed people who registered in the state were 19,63,376. Out of them 16,65,866 were educated or skilled ones and 2,97,510 were unskilled people. Moreover, the highest number of unemployed people has registered their names in Guwahati which was around 3 lakhs. The main cause of unemployment in India is lack of skill based education in schools and colleges. The Indian education system is primarily focused on the quality and knowledge and written examination as compare to practical based tasks. Due to lack of practical knowledge, students find themselves lacking in confidence and skills while facing interview after completion of graduation (Deka, 2021).

The unemployment rate was the highest of 7.11% in the year 2020 due to the Covid-19 crisis which has led to a severe economic loss of the country. Due to Covid-19, the government implemented lockdown as a result of that factories were shut down and people became unemployed.

4.1.5 Interest rate of Central Bank of India

The base rate is a key monetary policy tool of the National Bank, which allows to control the interest rate of other banks in the financial market. By setting the base rate, the National Bank determines the target market rate for the short-term target bank to achieve the goal of ensuring price stability over the medium term.

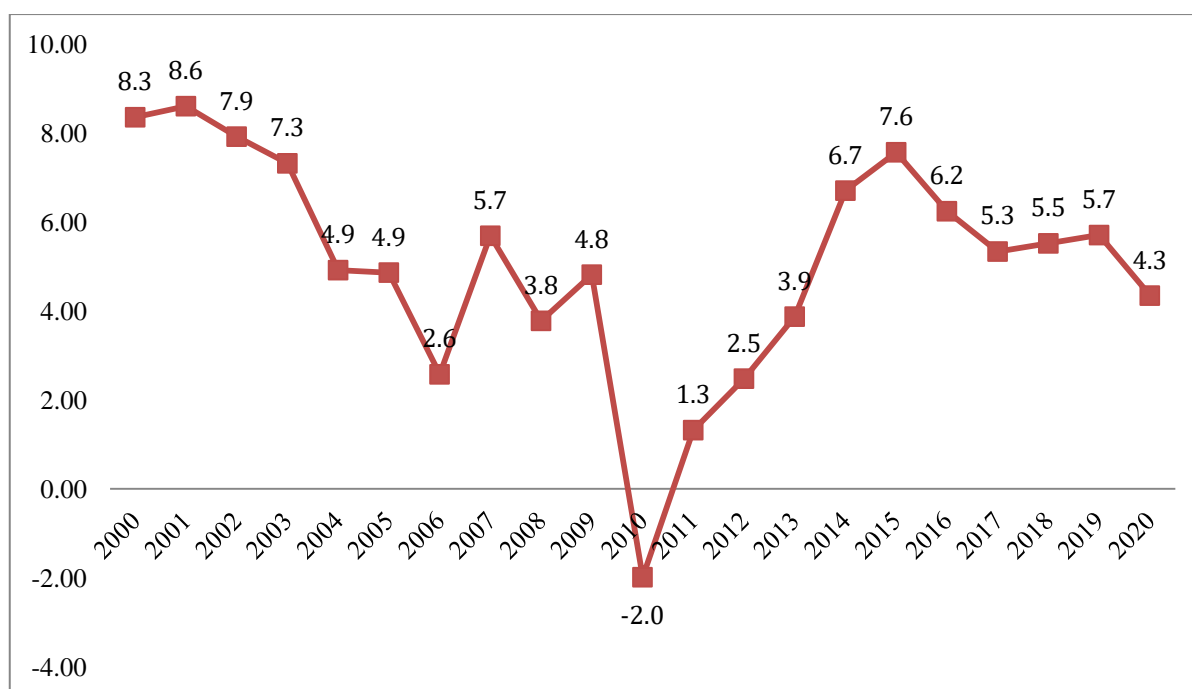
Changes in the base rate have an impact on inflation, as well as the financial market interest rate and the exchange rate. An increase in the base rate, for example, causes the financial market's interest rate to rise, as well as the financial market's financial costs to

rise, influencing people's and businesses' spending decisions. as well as financial savings Inflation is reduced through reducing spending and boosting savings. Furthermore, rising inflation leads to the strengthening of the national currency, which leads to lower inflation. At the same time, a change in the base rate has a medium-term impact on inflation, but it has a limited short-term impact.

From 2001-2020, the interest rate of 8.59% was recorded in 2001 which is the highest in the last 20 years. The interest rate has shown a decline in the trend since the period 2002-2013. The interest rate increased by 6.70% and 7.56% in 2014 and 2015 respectively. Interest rates have started to decline since 2016. It has been steadily declining during the 2017-2020 period. By 2020, the interest rate was 4.34% which was the lowest 20 years ago. The Central Bank of India has kept interest rates low by 2020 due to underlying volatility in the oil market, expected high and strong inflation, while still having uncertainties related to the global and global epidemic, and time. for mass vaccination. The Reserve Bank of India is constantly monitoring the external and internal situation and, if necessary, will easily adjust its monetary policy. The Reserve Bank of India has all the necessary skills and tools to ensure financial stability and is ready to make sound decisions in the event of a major global economic downturn.

The change in interest rate is shown in below chart.

Figure 11 Interest rate of India



Source: The World Bank Group, <https://data.worldbank.org/indicator/FR.INR.RINR>

5.1.6 Oil and gas production in India

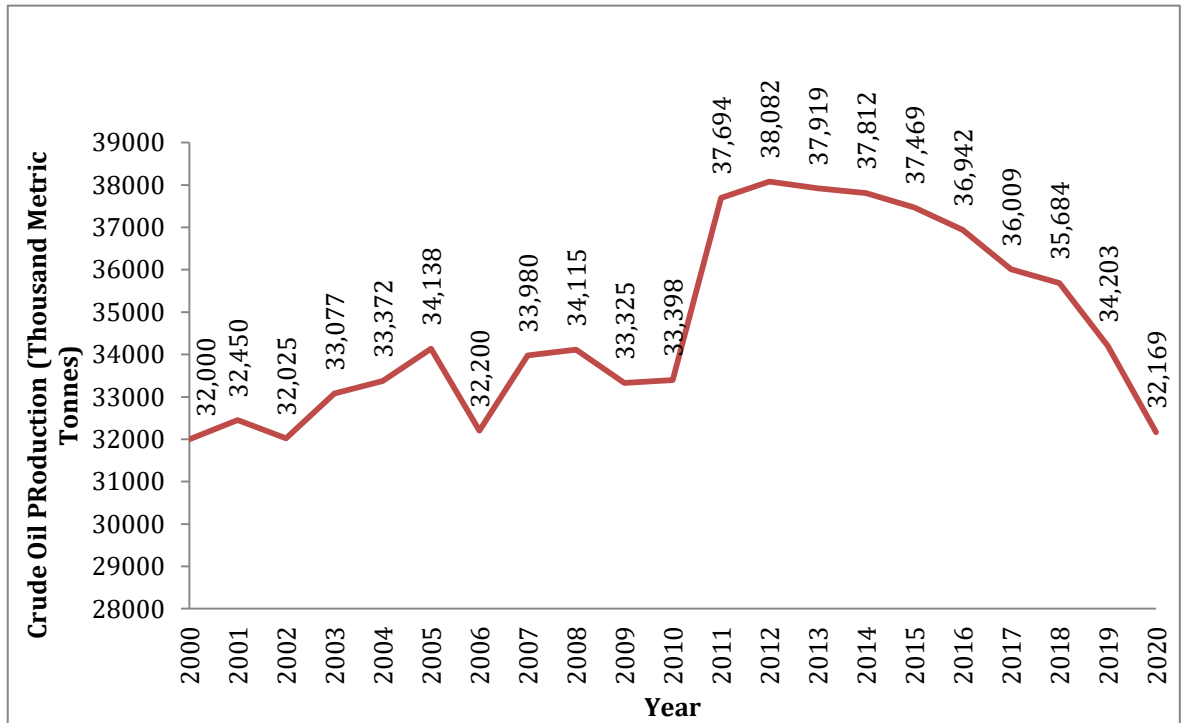
India 's crude oil production has declined slightly in recent years (Explained: Why India' s oil and gas production declined, "2021). India's crude oil production was recorded at 0.038 billion tons in 2011, 2012 and 2013. In 2014, Indian companies produced 0.038 billion tons of crude oil. India produces 0.036 billion crude oil by 2018. India holds 0.92% of global oil production in 2016-18. Natural gas production was 31.73 billion cubic meters in 2017-18, growing by 60.86% over the year a previous one. India accounted for 0.77% of global gas production in 2016-17. In recent years, the country has been producing small amounts of crude oil and natural gas (Explained: Why India Produces Lower and Lower Oil, 2020).

ONGC develops KG-DWN-98/2 block at Krishna Godavari basin with capex of about US \$ 5.07 billion (approximately INR 340 billion) leading to local oil production up to 25 million tons and natural gas 45 billion. (www.ETEnergyworld.com, 2020) .Capex operates for about US \$ 11 per barrel of oil (BOE) per unit for total oil and gas production. The oil fields in the state of Rajasthan emerge as the largest producer of oil and gas (Bilal Abdi, 2018).

India has exported 159 rigs and dug up 545 production wells during 2017-18 which ranks fifth in the world but oil and gas production is not in line with excavated resources ("Indian PNG Statistics 2017-18," n.d.).

India plans to produce 15 million tons / year of pressed biogas (CBG), neutral fuel, by 2023 (www.ETAuto.com, 2019). CBG replaces imported CNG in the form of LNG.

Figure 12 Volume of oil and gas production of India



Source:- Petroleum Planning & Analysis Cell, Ministry of Petroleum & Natural Gas, Government of India - URL - https://www.ppac.gov.in/content/146_1_ProductionPetroleum.aspx

India is the second largest oil importer outside China and relies heavily on imported crude oil (BP, 2020). Total crude oil exports increased from 132.78 MTs during 2008-09 to 220.43 MTs between 2017-18. Despite dependent on imports, India has built up adequate processing capability to create a variety of petroleum products throughout time. As a result, India has become a complete petroleum product producer. Petroleum product exports climbed from 38.94 million tons in 2008-09 to 66.83 million tons in 2017-18. In 2017-18, exports of 35.46 MT of petrol products were down 2.28 percent from the previous year. Natural gas imports climbed by 9.44 percent from 8.06 billion cubic meters in 2008-09 to 19.87 billion cubic meters in 2017-18. (Energy Statistics 2019, n.d.).

India relies on 82.8% of crude oil and 45.3% of natural gas / LNG (India is looking for new energy sources as global oil prices rise, n.d.). The total export output is 63.305 billion US dollars in the 2017-18 financial year due to crude oil imports (Sharma, 2019). India has produced 35.2 million tons of oil products through traditional crude oil production and

the consumption of petroleum products is 204.9 million tons. Similarly India has produced 31.7 bcm of natural gas in the region against the use of 58.1 bcm ("Indian PNG Statistics 2017-18," n.d.).

4.1.6 Importing countries of crude oil by India

In 2020, India was the world's third largest importer. For crude oil exports, the country spent an estimated 4.84 lakh crore (US \$ 64 billion) in 2020. The 15 main suppliers of crude oil exports to India in 2020 were the nations listed below (Daniel, 2020).

Table 3 Importing countries of crude oil by India

Rank	Country	Import value
1	Iraq	\$14.9 billion
2	Saudi Arabia	\$12.5 billion
3	United Arab Emirates	\$7.8 billion
4	Nigeria	\$5.3 billion
5	United States	\$3.7 billion
6	Kuwait	\$3.3 billion
7	Venezuela	\$2.3 billion
8	Mexico	\$2.2 billion
9	Angola	\$1.4 billion
10	Qatar	\$1.3 billion
11	Kazakhstan	\$1.3 billion
12	Brazil	\$1.2 billion
13	Oman	\$944.6 million
14	Russia	\$927.2 million
15	Malaysia	\$914.8 million

Source :- Worlds Top Exports URL:- <https://www.worldstopexports.com/crude-oil-imports-by-country>

4.2 Regression Analysis

4.2.1 Linear Regression Model of GDP

Table 4 Regression Model of GDP

Model 1: OLS, using observations 2000-2020 (T = 21)
Dependent variable: Crude Oil Production

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	32292.6	911.813	35.42	<0.0001	***
GDP	1.52159	0.521171	2.920	0.0088	***

Mean dependent var	34669.74	S.D. dependent var	2206.497
Sum squared resid	67217284	S.E. of regression	1880.891
R-squared	0.309690	Adjusted R-squared	0.273357
F(1, 19)	8.523847	P-value(F)	0.008792

Source: Own processing with Software of Gretl

The regression analysis is as follows:

Estimated Econometric Model $y = 0.03206 + 1.52159 x$.

We can say here that if the GDP(billion US\$) is increasing by 1 billion US\$, the crude oil production will increase by 1.52159 thousand Metric tonnes.

Co-efficient of determination (R^2) is 0.309690 of variability in crude oil production which is explained by GDP, while the remaining is still unexplained. Here, the crude oil production is affected by 30.97% by the changes in independent variable called GDP.

Hypothesis Testing

H0: There is no impact of Gross Domestic Product on production of crude oil in India.

H1: There is an impact of Gross Domestic Product on production of crude oil in India.

Annova Test

The significance value of F is 0.008792 which is less than 0.05. Therefore, the null hypothesis is rejected and alternate hypothesis is accepted. This indicated that there is an impact of Gross Domestic Product on production of crude oil in India.

4.2.2 Linear Regression Model of GNP

Table 5 Regression Model of GNP

Model 2: OLS, using observations 2000-2020 (T = 21)
Dependent variable: CrudeOilProduction

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	32287.6	896.719	36.01	<0.0001	***
GNP	1.55767	0.522245	2.983	0.0076	***
Mean dependent var	34669.74		S.D. dependent var	2206.497	
Sum squared resid	66320074		S.E. of regression	1868.296	
R-squared	0.318904		Adjusted R-squared	0.283057	
F(1, 19)	8.896203		P-value(F)	0.007650	

Source: Own processing, Software: Gretl

The regression analysis is as follows:

Estimated Econometric Model $y = 32287.6 + 1.55767x$.

Through this model we can understand that if GNP is increasing by one billion US\$, so the crude oil will increase by 1.55767 thousand tons.

Co-efficient of determination (R^2) is 0.318904 of variability in crude oil production which is explained by GDP, while the remaining factors still unexplained. Here, the crude oil production is affected by 31.89% by the changes in independent variable called GNP.

Hypothesis Testing

H0: There is no impact of Gross National Product on production of crude oil in India.

H1: There is an impact of Gross National Product on production of crude oil in India.

Annova Test

Here, there is an impact of Gross National Product on production of crude oil in India. As the null hypothesis has a value of 0.007650 which is less than 0.05 then it is rejected.

4.2.3 Linear Regression Model of Inflation

Table 6 Regression Model of Inflation

Model 4: OLS, using observations 2000-2020 (T = 21)
Dependent variable: CrudeOilProduction

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	33303.9	1192.24	27.93	<0.0001	***
Inflationrate	219.507	175.748	1.249	0.2268	
Mean dependent var	34669.74		S.D. dependent var	2206.497	
Sum squared resid	89984515		S.E. of regression	2176.242	
R-squared	0.075874		Adjusted R-squared	0.027236	
F(1, 19)	1.559963		P-value(F)	0.226840	

Source: Own processing, Software:- Gretl

The regression analysis is as follows:

Estimated Econometric Model $y = 0.03321 + 219.507x$.

The above model explains that if the inflation rate will increase by 1 percent the crude oil production will be increased by 219.507 thousand tons.

Co-efficient of Determination is 0.0758 of variability in crude oil production is explained by inflation, while the remaining is still unexplained. Here, the crude oil production is affected by 7.58% by the changes in independent variable called inflation.

Hypothesis Testing

H0: There is no impact of Inflation on production of crude oil in India.

H1: There is an impact of Inflation on production of crude oil in India.

Annova Test

Here, there is no impact of Inflation on production of crude oil in India. As the null hypothesis has a value of 0.22 which is more than 0.05 then it is accepted.

4.2.4 Linear Regression Model of Unemployment rate

Table 7: Regression Model of Unemployment rate

Model 6: OLS, using observations 2000-2020 (T = 21)
Dependent variable: CrudeOilProduction

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	45419.0	7437.53	6.107	<0.0001	***
Unemploymentrate	-1901.57	1313.09	-1.448	0.1639	

Mean dependent var	34669.74	S.D. dependent var	2206.497
Sum squared resid	87693242	S.E. of regression	2148.356
R-squared	0.099405	Adjusted R-squared	0.052005
F(1, 19)	2.097159	P-value(F)	0.163875

Source: Own processing, , Software:- Gretl

The regression analysis is as follows:

Estimated Econometric Model $y = 45419.0 - 1901.5x$.

The model explains that if there is one percent increase in unemployment rate, the crude oil production will be impacted negatively by 1901.57 thousand metric tones.

Co-efficient of determination(R^2) is 0.0994 of variability in crude oil production is explained by unemployment rate, while the remaining factor is still unexplained. Here, the crude oil production is affected by 9.94% by the changes in independent variable namely unemployment rate.

Hypothesis Testing

H0: There is no impact of Unemployment on production of crude oil in India.

H1: There is an impact of Unemployment on production of crude oil in India.

Annova Test

Here, there is no impact of unemployment on production of crude oil in India. As the null hypothesis has a value 0.16 is more than 0.05 then it is accepted.

4.2.5 Linear Regression Model of Interest rate

Table 8: Regression Model of Interest rate

Model 7: OLS, using observations 2000-2020 (T = 21)

Dependent variable: Crude Oil Production

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	35401.1	1107.14	31.98	<0.0001	***
Interest rate	-145.169	197.341	-0.7356	0.4709	

Mean dependent var	34669.74	S.D. dependent var	2206.497
Sum squared resid	94676057	S.E. of regression	2232.252
R-squared	0.027692	Adjusted R-squared	-0.023482
F(1, 19)	0.541142	P-value(F)	0.470944

Source: Own processing, Software Gretl

The regression analysis is as follows:

Estimated Econometric Model $y = 35401.1 - 145.169x$.

The estimated Econometric Model explains that if the Interest rate increases by 1 percentage the crude oil will be impacted negatively by 145.169 thousand tons.

Co-efficient of determination (R^2) is 0.0276 of variability in crude oil production is explained by interest rate, while the remaining is still unexplained. Here, the crude oil production is affected by 2.76% by the changes in independent variable called interest rate,

Hypothesis Testing

H0: There is no impact of Interest rate on production of crude oil in India.

H1: There is an impact of Interest rate on production of crude oil in India.

Annova Test

Here, there is no impact of Interest rate on production of crude oil in India. As the null hypothesis has a value of 0.47 which is more than 0.05 then it is accepted.

4.3 Correlation analysis

Table 9: Correlation analysis of macroeconomic indicators and crude oil production

	Crude oil production	GDP	GNP	Inflation rate	Interest rate	Unemployment rate
Crude oil production	1					
GDP	0.5586	1				
GNP	0.5661	0.9961	1			
Inflation rate	0.2615	0.1098	0.1129	1		
Interest rate	-0.1581	0.2291	0.2031	-0.7194	1	
Unemployment rate	-0.3150	0.0163	0.0216	0.0722	-0.0136	1

Source: Own processing

From the analysis, it has been observed that there is a moderate positive correlation between GDP and crude oil production as the value of r is 0.5586. GNP and crude oil production are moderately positively correlated with r value of 0.5661. There is very low correlation between inflation rate and crude oil production as the r value is 0.2615.

Further, there is a negative correlation of -0.1581 between interest rate and crude oil production. The unemployment rate and production of crude oil are negatively correlated as both the variables have r value of -0.3150.

4.4 Elasticity

Table 10: Calculations of Elasticity of Variables

Formula Used	Variables	Mean of Variables	dy/dx	Elasticity
$E = \frac{dy}{dx} \cdot \left(\frac{\bar{x}}{\bar{y}} \right)$	CrudeOilProduction	34670		
	GDP	1562	1.52	0.069
	GNP	1529	1.56	0.069
	Inflationrate	6.222	219.51	0.039
	Interestrates	5.038	-145.17	-0.021
	Unemploymentrate	5.653	-1901.57	-0.310

- From the analysis, it has been found that the elasticity of GDP is 0.069. If the GDP is increasing by 1% the crude oil production is increasing by 0.069%. If the GDP is increasing by 100% the production of oil will increase by 6.9%
- The elasticity of GNP is 0.069. If the production. If the GNP is increasing by 1% the production of crude oil is increasing by 0.069%. If the GNP is increasing by 100% the production of crude oil will increase by 6.9%.
- The elasticity of inflation rate is 0.039. If the inflation rate is increasing by 1% the production of crude oil is increasing by 0.039%. If the inflation is increase by 10% the production of crude oil will increase by 3.9%.
- From the analysis, it has been found that the elasticity of Interest rate is -0.0210. If the interest rate will increase by 1% the crude oil production will decrease by 0.021%. If the interest rate will increase by 10% The production of crude oil will change by -2.10% . If the interest rate will decrease by 100% the crude oil production will increase by 2.10%.
- As per analysis, the elasticity of unemployment rate is -0.32584. If the unemployment rate will increase by 1% the production of crude oil will change negatively by 0.32% .If the unemployment will decrease by 10% the crude oil production will increase by 3.25%.

5 Results and Discussion

The main aim of this thesis is to analyse and discuss about the role of macroeconomic indicators in India's economy and to assess the impact of macroeconomics indicators on the production of oil in India. The thesis also finds out the relationship between macroeconomic indicators and the production of oil in India.

India's economic progress is dependent on the oil and gas industry to a larger extent. It is one of India's eight key industries, and it has a substantial influence on the decisions made by other critical sectors of the economy. In 2015-16, India's total petroleum export value increased to US\$ 17.1 billion, up from US\$ 18.2 billion in 2019. Crude oil imports increased significantly from US\$ 70.72 billion in 2017 to US\$ 111.9 billion in 2018-19, having a significant impact on India's GDP.

5.1 Analysis of Indian economy with focus on its macroeconomic indicators

The thesis analysed selected macroeconomic indicators of India which include Gross Domestic Product, Gross National Product, Unemployment, Inflation and Interest rate. The economy of India is rapidly growing every year as the GDP of India indicates increasing trend from period of 2009-2019. India's GDP showed tremendous growth from 2001 to 2014 despite of global financial crisis in 2008.

From 2001 to 2007, India's GDP is constantly increasing. From 2011 to 2016, the country's growth rate is stabilized at 5-8% due to high prices of oil and metals as well as significant enlargement of the country's economy. In 2017-2018, GDP growth rate has been decreased by 6.8% and 6.53% respectively due to demonetization introduced by the Government of India.

In 2020, the GDP growth rate has been declined by -7.25% due to Covid-19 pandemic.

India's GNP is constantly increasing from the year 2001 to 2007. However, the annual GNP growth rate is declined by 5.14% from 8.04% in 2007 due to the impact of the global financial crisis. From 2011 to 2016, the country's growth rate is stabilized at 5-8% due to high prices of oil and metals.

In 2016-2017, GNP growth rate has been decreased by 7.3% and 7.82% respectively which is due to demonetization. The GNP growth rate again decreased by 4.16% in 2019 because of dwindling consumer demand, slowing Private Investment and global slowdown. The impact of Covid-19 pandemic on India's economy resulted into negative GNP growth rate of country at -7.97% in 2020.

The inflation rate in India is high despite of the various measures taken by Reserve Bank of India. From 2001 to 2005, inflation remained at a relatively stable level in the range of 3-4%. However, there is a declining trend in inflation during 2003-2004 which was the result of structural changes in the macroeconomic framework due to liberalization. Beside this, the better supply response improved financial and real economy, effective monetary policy and focus on fiscal consolidation helped in bringing down inflation.

There can be seen an increasing trend in inflation during 2005-2010. In 2009, there was a drought in India which was followed by uneven rainfall in 2010. These uncertain events and increase in aggregate demand resulted into rise in food prices which made inflation to rise by double digits.

The inflation came down to single digit at 8.86% in 2011 due to the decrease in the prices of cereals, wheat, vegetables, onions, eggs, meat & fish. In 2012 and 2013, inflation rate increased as the prices of food items increased beyond double digits due to the problem of food rots. The increased fuel and mineral prices are also one of the important reason behind the rise in inflation in 2013.

Inflation indicated a declining trend during the year 2014 & 2015 because of decline in International food, oil and commodity prices. From 2016-2019, the inflation has showed declining trend. During 2018, the inflation rate increased by 0.62% and stood at 3.95% was moderate. The decline in inflation rate occurred in the year 2019 mainly due to low food inflation which was between the range of -2.6% to 3.1%.

In 2020, there is an increase in inflation by 6.62% because of food inflation as well as there is an impact of Covid-19 on inflation as supply chain disruptions due to local lockdowns in India resulted in supply bottlenecks and pushed up costs for manufacturers as well as for retailers which further lead to rise in Price.

The country experiences different types of unemployment such as natural, seasonal and cyclical unemployment. There are a number of factors which causes unemployment such as the insufficient demand in the labor market by speciality or qualifications, the job seeker doesn't have opportunity to find a job. Seasonal demand is noticeable in construction and agricultural sectors.

During the period from 2001 to 2019, the unemployment rate remain constant. Over the previous 20 years, an increase in the unemployment rate has not been seen, except for the year 2020. The unemployment rate rose to 7.11% in 2020 which is highest as compare to preceding 20 years.

From 2001-2020, the interest rate of 8.59% was recorded in 2001 which is the highest in the last 20 years. By 2020, the interest rate was 4.34% which was the lowest 20 years ago.

5.2 The present scenario of the oil industry in India

Oil and gas sector is one of the important sector in India as it plays vital role in development of economy of country.

India 's crude oil production has declined slightly in recent years. India's crude oil production was recorded at 0.038 billion tons in 2011, 2012 and 2013. In 2014, Indian companies produced 0.038 billion tons of crude oil. India produces 0.036 billion crude oil by 2018. India holds 0.92% of global oil production in 2016-18. Natural gas production was 31.73 billion cubic meters in 2017-18, growing by 60.86% over the year a previous one. India accounted for 0.77% of global gas production in 2016-17.

From 2001-2019, the production of oil and gas condensate increased 1.06 times. Crude oil production was 0.036 billion tons in the year 2017 and 2018 respectively. In 2018, the crude oil production decreased by 2.7% as compare to 2016.

The production of crude oil further decreased by 0.034 billion tons in 2019 and it again decreased by 0.032 billion tons in 2020 due to the impact of covid-19.

The profit from oil and gas sector to India's GDP was 1.17% in 2008 and it decreased to 0.66% in 2013. However, the large public sector companies of oil and gas industry ensures that their contribution to the country's economy remain significant. In 2018, the ratios of profits from the oil and gas sector to India's GDP was 0.66% (India - oil and gas sector profits to GDP ratio 2018, n.d.). This indicates that oil and gas sector is important in terms of strengthening the economy of country. Moreover, the government allowed 100% foreign direct investment for development of oil and gas sector.

5.3 Exporting countries of crude oil to India

India was the third largest importer in the world by 2020. The country spent an estimated 4.84 lakh crore (US \$ 64 billion) on 2020 for crude oil exports. As on 2020, the top 5 countries exporting crude oil to India includes Iraq (\$14.9 billion), Saudi Arabia (\$12.5 billion), United Arab Emirates (\$7.8 billion), Nigeria (\$5.3 billion) and United States (\$3.7 billion) (Daniel, 2020).

5.4 The relationship between macroeconomic indicators and the oil and gas industry was analysed.

The regression analysis was performed on data collected for a period of 2001 to 2020 with a view to identify if there is a relationship among the dependent variable Volume of oil and gas production and the independent variables: GDP, GNP, Inflation rate, Unemployment rate, Interest rate of Reserve Bank of India. The data has been analysed using Excel.

As per result of the regression analysis, unemployment has a strong impact on production of crude oil in India as it has the regression value of 98.97% which is highest as compared to other macroeconomic indicators. A percent increase in unemployment will cause a 98.97% increase in the volume of oil and gas production, *ceteris paribus*.

In terms of correlation analysis, there is a negative correlation between dependent variable crude oil production and independent variables such as interest rate & unemployment rate. The results from T-test and Anova indicated that there is an impact of GDP, GNP, inflation, interest rate and unemployment rate on production of crude oil in India.

6 Conclusion

The production of crude oil is an important factor for the development of Indian economy. After United States and China, India is the third largest consumer of crude oil in the world. The country accounted 4.81% of total world oil consumption in the year 2016–17. India's economic progress is dependent on the oil and gas industry to a larger extent. It is one of India's eight key industries, and it has a substantial influence on the decisions made by other critical sectors of the economy. India's economic growth is closely dependent upon its energy demand. Thus, the requirement for oil and gas is estimated to grow more which makes the sector attractive for investment. Moreover, the government of India has allowed 100% Foreign Direct Investment in many segments of the Industry such as natural gas, petroleum products and refineries etc.

India's consumption of petroleum products grew by 4.5% to 213.69 million metric tons during the year 2020 from 213.22 million metric tons in 2019. The export of petroleum

products by India increased to US\$ 35.8 billion in the year 2020 from US\$ 34.9 billion in the year 2019. Here, it should be noticed that a significant portion of petroleum products are exported by India to other countries.

The thesis examines the impact of macroeconomics indicators on oil production of India and it also identifies the relationship between macroeconomic indicators and crude oil production. From the analysis, it has been found that the economy of India is rapidly growing from the period of 2001 to 2019 as the GDP and GNP showed increasing trend from 2001 to 2019. The present scenario of the oil and gas Industry in India includes the Indian economy is dependent on oil Industry as India is the third largest importer in the world by 2020. The country spent an estimated 4.84 lakh crore (US \$ 64 billion) on 2020 for crude oil imports.

Beside import of crude of oil, India exports petroleum products to other countries which got affected by Covid-19. The spread of Covid-19 imposed restrictions on the activities of oil companies which led to a decrease in oil production, decrease in investment and a decrease in employment in the industry.

India's crude oil production has declined slightly in recent years. India's crude oil production was recorded at 0.038 billion tons in 2011, 2012 and 2013. In 2014, Indian companies produced 0.038 billion tons of crude oil. India produces 0.036 billion crude oil by 2018. India holds 0.92% of global oil production in 2016-18. Natural gas production was 31.73 billion cubic meters in 2017-18, growing by 60.86% over the previous year. India accounted for 0.77% of global gas production in 2016-17.

Considering that there is a trend which boosts development of oil production in the country, a regression analysis was conducted in order to assess the impact of macroeconomic indicators such as GDP, GNP, Inflation, Unemployment and Interest rate on the volume of oil and gas production. The results show that unemployment has the greatest impact on oil and gas production among five variables which is followed by Inflation and GDP. However, the unemployment rate and Interest rate are negatively correlated with production of crude oil in India.

The scope of further research includes the following:

- The research can be done by identifying relationship between other macroeconomic indicators and oil industry.
- The researcher can study the oil industry of other countries and can compare it with Indian oil industry.

The Indian economy is expected to grow continuously in order to develop its oil and gas Industry as well as to convert into developed country from developing country. It is necessary to consider other macroeconomic indicators for assessing the relationship between crude oil production and macroeconomic indicators.

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8 Appendix

Appendix 1 Data for Regression and Correlation analysis

Year	Crude Oil Production (Thousand Metric tonnes)	GDP (billion US \$ nominal)	GNP (billion US \$ nominal)	Inflation rate (%)	Interest rate (%)	Unemployment rate (%)
2000	32000	468.39	467.08	4.01	8.34	5.75
2001	32450	485.44	485.44	3.78	8.59	5.73
2002	32025	514.94	500.2	4.3	7.91	5.77
2003	33076.8	607.7	573.89	3.81	7.31	5.77
2004	33371.996	709.15	687.28	3.77	4.91	5.72
2005	34138.069	820.38	809.09	4.25	4.86	5.65
2006	32200.425	940.26	916.98	5.8	2.57	5.52
2007	33980.117	1216.74	1081.97	6.37	5.68	5.41
2008	34114.679	1198.9	1195.03	8.35	3.77	5.36
2009	33325.308	1341.89	1358.35	10.88	4.81	5.61
2010	33398.44	1675.62	1505.74	11.99	-1.98	5.65
2011	37693.818	1823.05	1704.43	8.86	1.32	5.65
2012	38082.19011	1827.64	1870.99	9.31	2.47	5.66
2013	37919.08499	1856.72	1941.12	11.06	3.87	5.67
2014	37812.18372	2039.13	2021	6.65	6.7	5.6
2015	37469.08821	2103.59	2097.6	4.91	7.56	5.56
2016	36941.75147	2294.8	2226.42	4.95	6.23	5.51
2017	36008.82868	2651.47	2439.59	3.33	5.33	5.41
2018	35684.33088	2701.11	2714.03	3.95	5.51	5.33
2019	34203.26608	2870.5	2894.03	3.72	5.7	5.27
2020	32169.26506	2660.24	2625.44	6.62	4.34	7.11

Source: Compiled by the author based on data from MacroTrends, Petroleum Planning and Analysis Cell and The World Bank,