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Exploratory Data Analysis on Indian economy using Python

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Abstract: ***The research aims to study the dataset of overall country's economy considering factors such as GDP (gross domestic product), FDI (foreign direct investment), import value, export value and to analyse the data using exploratory data analysis technique. The data analysis is done using Python. The mentioned parameters are compared and analysed using statistical tools and visual analysis. Since Python is a high-level language, they give more feasible approach to the statistical analysis. Technically for data computing and plotting statistical analysis were tested by scatter plotting. The data are compared and plotted in graphs using python. GDP growth of India from the year 1960 to 2020 were analysed and studied in the form of graph. Variations of parameters like FDI, Trade balance, Export, import with respect to GDP were analysed from the year 1960 to 2020. State-wise GDP contribution for top 5 and least 5 states were discussed from the year 2012 to 2019. Sector-wise FDI contribution were studied for various important sectors were studied from the year 2013 to 2017. Line graph, Scatter plot, Bar graphs were used to interpret the data and analysis results.***

Keywords: Exploratory data analysis, Scatter plot, linear plot, Economy, Python, Correlation

I. INTRODUCTION

GDP (gross domestic product) measure of country's economy. This study mainly deals with the analysis of country's economy. In that analysis GDP has a separate significance. With that GDP, the overall growth and productivity of the nation is found. Other than that, the growth of GDP, indicates the health status of an economy of the nation will be seen. So, GDP plays a vital role in country's economy as well as people's economic growth. Foreign direct investment (FDI) is also the factor for analysing country's growth. It also plays a major role in economic growth. FDI is defined as that the company will directly takes ownership on business entities. In FDI, the foreign companies will directly invest on other companies. So, this helps in the growth of the country's economy. It has certain features and significance. Since foreign companies are investing on other country. So, they are opening new jobs and the other country's economy also increases. This is one of the reasons for the growth of country's economy. We are comparing those GDP and FDI using python for analysing and visualizing. GNI (gross national income) is also one of the factors for analysing country's growth. GNI is the sum of a country's GDP (gross domestic product) plus net income from abroad. GNI (gross national income) is also one of the factors for analysing country's growth. GNI is the sum of a country's GDP (gross domestic product) plus net income from abroad. GNI is used to track the wealth of the nation from year to year. GNI is also the best indicators of people living standard in a country.

Polina LEMENKOV studied the geographical data Mariana trench west Pacific Ocean is considered. The following data are compared such as geomorphic shape, bathymetric depths and geographic located. These data are compared and analysed using python. The python libraries used here are NumPy, pandas and matplotlib. For better data visualization, data analysis is done using python [1]. Kabita Sahoo et al. studied the datasets to analyse the exploratory data. Here the datasets of amazon related to reviews of electronic gadgets are compared and analysed using python. These data are well interrupted using pandas, NumPy and matplotlib using python [2]. Polina LEMENKOV studied the datasets of a Philippine trench are considered. Here the datasets are compared and analysed using statistical analysis using R programming and python programming. Here bar graphs and charts are plotted using python libraries such as matplotlib. Here they compared certain key factors of Philippines trench and analysed those factors using python [3]. Parag Verma et al. studied the datasets of GDP are considered to detect the country's growth and fall during covid 19 crisis. During covid 19, Indian share market price and gold, silver rates are increased. Here the datasets of those different sectors of GDP are compared and analysed using python. The graphs and charts are plotted using matplotlib and pandas, R programs are also used for further data visualization using python [4]. Noor Ashikin Othman et al. studied the datasets of crude oil are considered to predict the future GDP of Malaysia economy. Here the datasets are taken from world bank commodity price data. Using the data provided, the current economy is analysed and the future growth is predicted using python. For plotting graphs and other charts phyton libraries such as matplotlib is used [5].

Venuste Ntakirutimana et al. studied the datasets of Rwanda's GDP (gross domestic product) are considered to predict whether the growth of Rwanda economy depends on other countries or not. Here the trading data of Rwanda economy is compared and analysed using python to predict future growth of the country's economy. Here graphs and charts are plotted and python libraries such as matplotlib, NumPy and pandas are used for better data visualization [6]. In this study the datasets of tour of foreign people to India is considered to analyse the travel trends. This also aims in considering the GDP of India. The above datasets are compared and analysed using python to predict the travel trends and distribution trends. The graphs and charts are plotted using phyton library matplotlib and analysed using python for better data visualization [7].

II. METHODOLOGY

Data for the process is collected in different Microsoft Excel files of format xlsx from the standard websites. The xlsx file is converted into csv format and then imported in Python using 'Pandas' library. Pandas 'dropna' method is used to drop rows with no data. Scatter plot for desired values were drawn by importing 'matplotlib' library. Bar plot for desired values were drawn by importing 'matplotlib' library. Results of the plotted data were interfered to identify the correlation and its type. Main parameters that were analysed are GDP growth, FDP as the function of GDP growth, FDI as the function of export value, FDI as the function of import, FDI as the function of trade balance value, % of GDP.

III. RESULT AND DISCUSSION

A. Analysis of FDI, GDP, Export, Import, Trade balance values.

Figure 1 shows the GDP of India from 1960-2019. GDP of India from 1960 to 2000 was not rapid in comparison with the GDP growth after 2000. GDP of India grows rapidly after 2000. Also, from the data it is interpreted that the Indian GDP is not a smooth curve while it if fluctuating up and down. In between the year 2000-2020 the curve increases rapidly which is due to the educational, technological, scientific development among people.

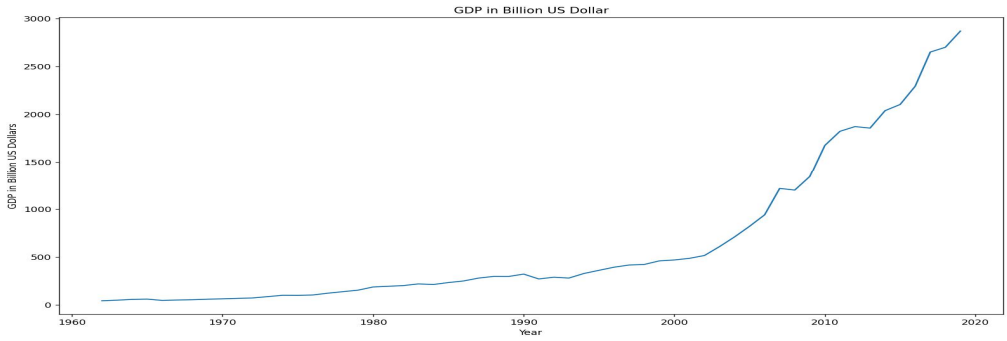

Figure 1: GDP of India from 1960 to 2020

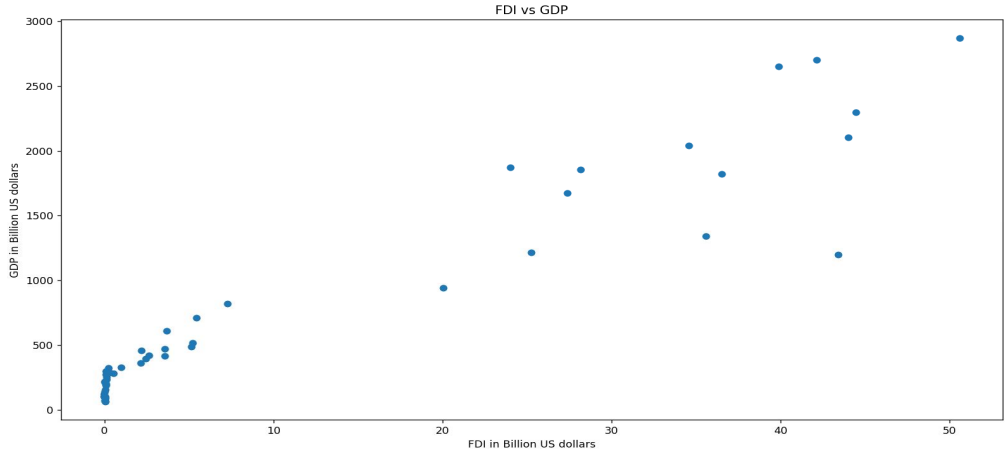

Figure 2: Scatter plot between FDI of India and GDP of India

Figure 2 shows correlation between Foreign direct investment and GDP of India. Foreign Direct Investment of India has a positive correlation with GDP of India. On drawing an imaginary line from the origin point we can observe that the data points are nearly equal to that straight line with a positive slope. It is inferred that the GDP growth of India increases with increase in Foreign direct investment. At the initial stages of GDP development, the FDI and GDP are same point and perfectly correlated.

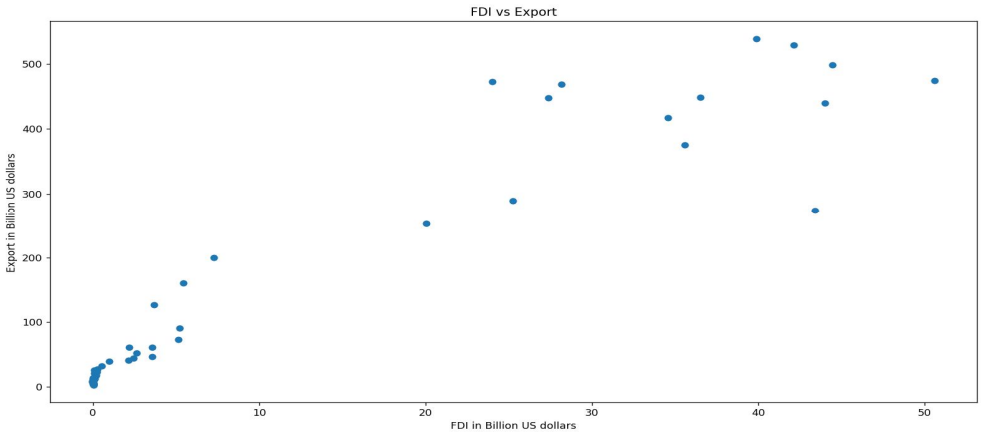

Figure 3: Scatter plot between FDI of India and Export of India

Figure 3 shows correlation between Foreign direct investment and Export of India. Indian export enhances with Foreign Direct Investment. Since FDI is positively correlated with Indian Export. Scatter plot of FDI vs Indian export is similar to the scatter plot obtained in GDP vs FDI which in inferred that the value of GDP increases with Export value of India. At initial stages of FDI in India the export and FDI are equal since they are perfectly correlated near the origin.

Figure 4 shows correlation between Foreign direct investment and import of India. Indian export enhances with Foreign Direct Investment. Indian import enhances with Foreign Direct Investment. Since FDI is positively correlated with Indian import. Increasing the number of Import will greatly increase the foreign investment in India.

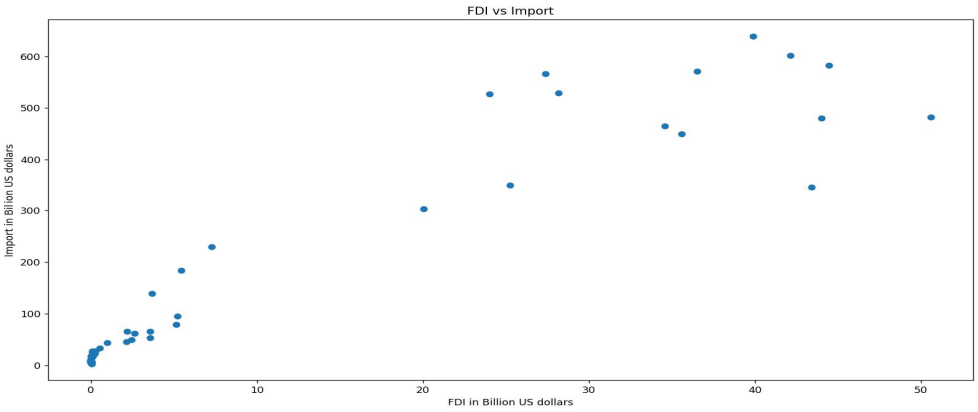

Figure 4: Scatter plot between FDI of India and Import of India

Figure 5 shows correlation between Foreign direct investment and Trade balance of India. Indian export enhances with Foreign Direct Investment. As mentioned above both Import and Export of India is positively correlated with Foreign Direct Investment. Import has a higher hand with rising FDI than import. Since FDI is negatively correlated with Trade balance (Export value – Import value).

Figure 6 shows the percentage of import in GDP of India from 1970-2019.Percentage of import in India's GDP steadily increases from 1960 to 2010. But after 2010 the import values significantly decrease; it displays good sign in economic growth and growth in GDP of the country. Figure 7 shows the percentage of export in GDP of India from 1970-2019.Percentage of import in India's GDP steadily increases from 1960 to 2010. But after 2010 the import values significantly decrease; it notifies India's expansion of foreign market expansion is not swift in comparison with its GDP growth.

Figure 5: Scatter plot between FDI of India and Trade balance of India

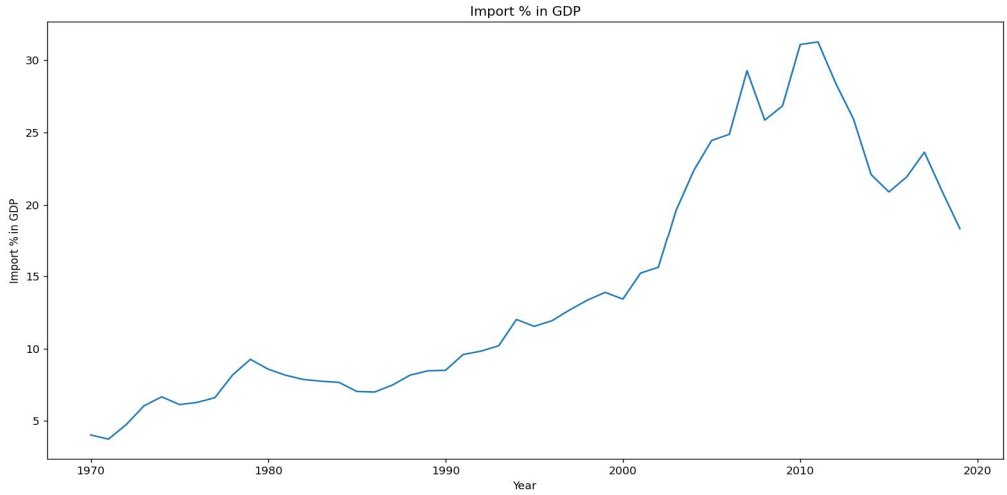

Figure 6: Percentage of import in GDP of India

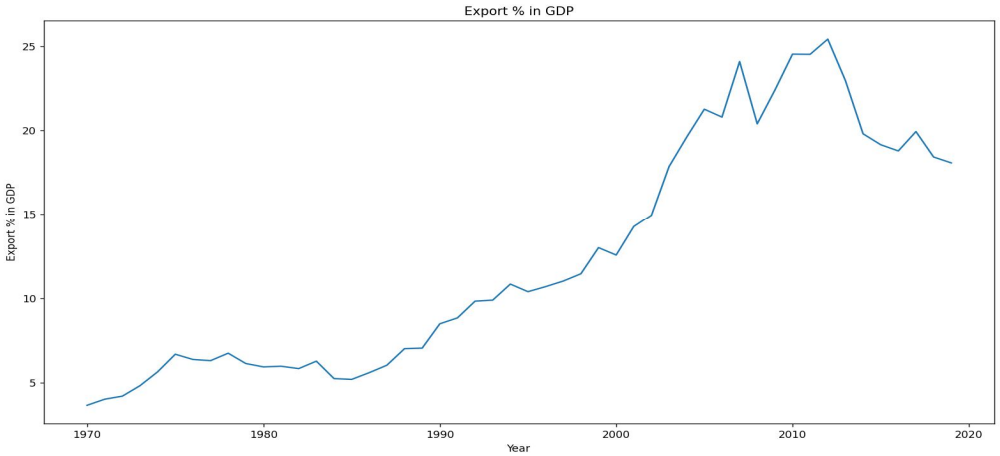

Figure 7: Percentage of export in GDP of India

From the year 2012 to 2019 the five states Maharashtra, Tamil Nadu, Gujarat, Uttar Pradesh, Karnataka are the five states which have highest State Domestic Product. Above data signifies these are the states contributing more in the India's GDP growth. From the year 2012 to 2019 the five states/union territories Andaman and Nicobar Islands, Mizoram, Arunachal Pradesh, Sikkim, Nagaland are the five states which have lowest State Domestic Product. It signifies that these are the states to concentrated more economically. From the year 2013 to 2017 Automotive sector, Service sector, Trading sector, Hotel & Tourism, Telecommunication, Power generation sector, computer software and hardware.

B. Analysis of State wise GDP Growth Contribution in India

For effective analysis of state wise GDP contribution, top five states and least five states data points were taken and presented in the form of bar graph. Some of the major conclusions were drawn based on the results of the graph obtained.

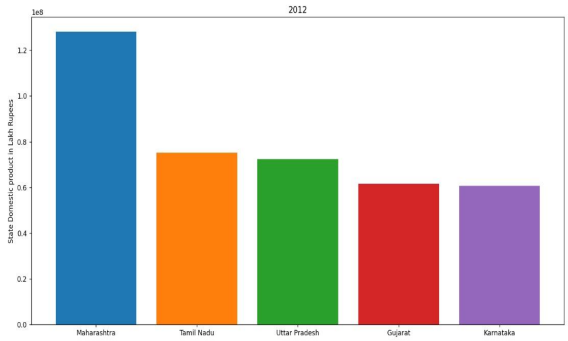

Figure 8(a): Top 5 State wise GDP contribution in 2012

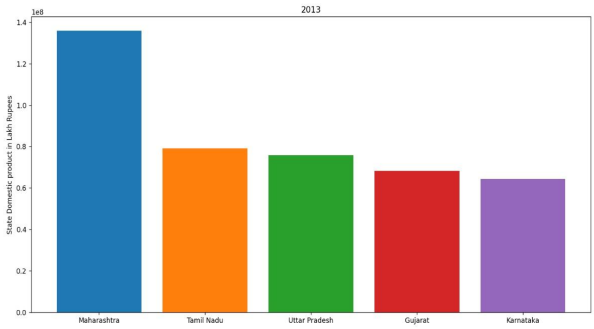

Figure 8(b): Top 5 State wise GDP contribution in 2013

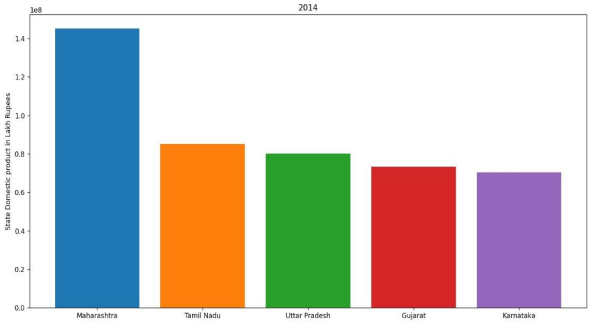

Figure 8(c): Top 5 State wise GDP contribution in 2014

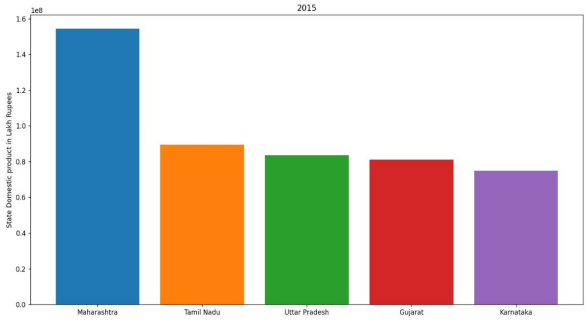

Figure 8(d): Top 5 State wise GDP contribution in 2015

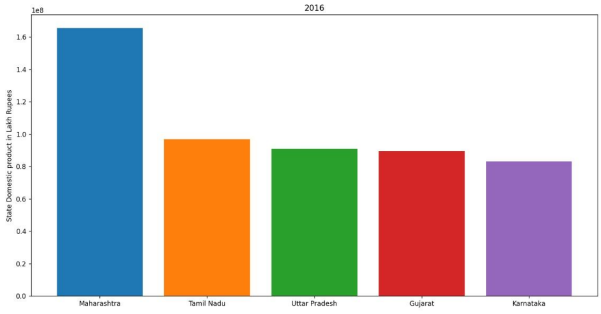

Figure 8(e): Top 5 State wise GDP contribution in 2016

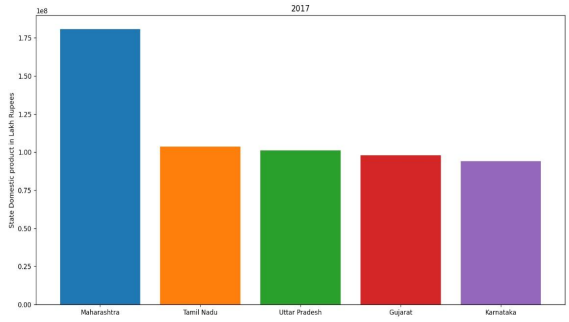

Figure 8(f): Top 5 State wise GDP contribution in 2017

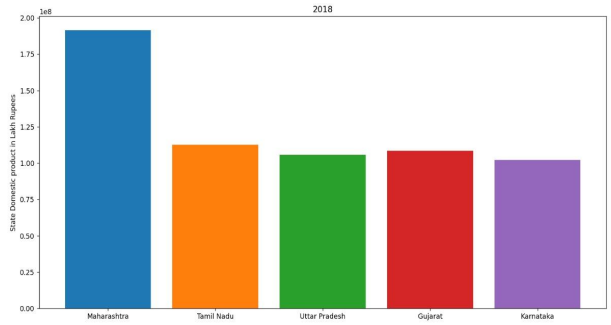

Figure 8(g): Top 5 State wise GDP contribution in 2018

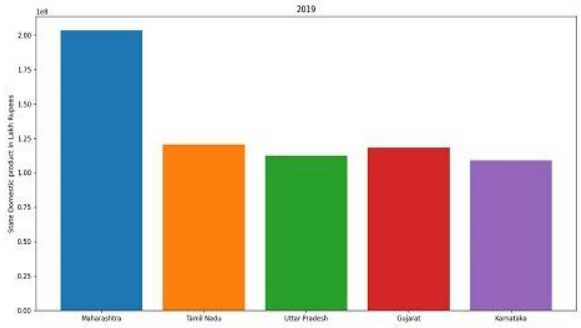

Figure 8(h): Top 5 State wise GDP contribution in 2019

Figures 8(a) to 8(h) represent the state-wise GDP contribution of the First five largely contributing states Maharashtra, Tamil Nādu, Uttar Pradesh, Gujarat, and Karnataka. It is inferred from the graph that Maharashtra and Tamil Nadu stand first two positions from the year 2012-2019 in which the average contribution of the two states were 1.75 and 1.12 respectively. Similarly, Karnataka stands in the fifth position in GDP contribution with an average value of 1.00. The remaining states Uttar Pradesh and Gujarat are fluctuating up and down. From the year 2012 to 2017 the GDP contribution of Uttar Pradesh is greater than Gujarat while after the year 2017 the GDP of Gujarat gradually increases and becomes greater than Uttar Pradesh.

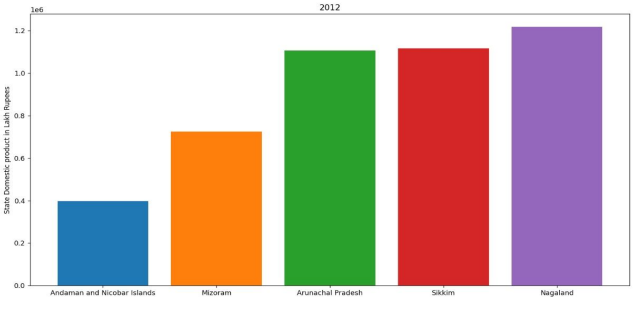

Figure 9(a): Least 5 State wise GDP contribution in 2012

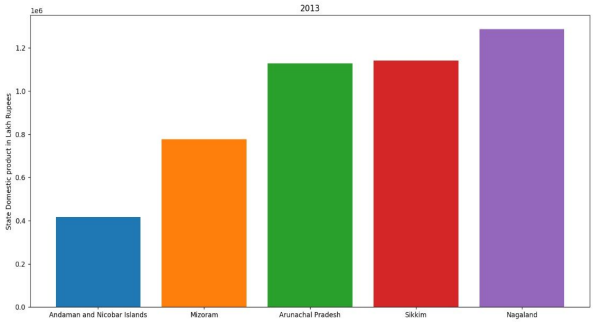

Figure 9(b): Least 5 State wise GDP contribution in 2013

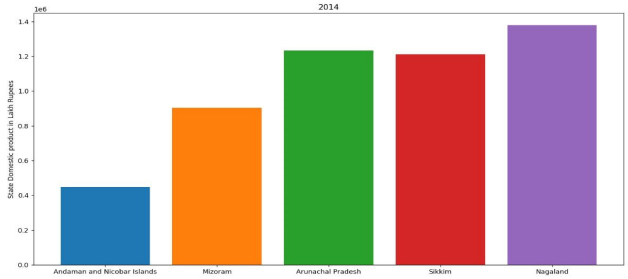

Figure 9(c): Least 5 State wise GDP contribution in 2014

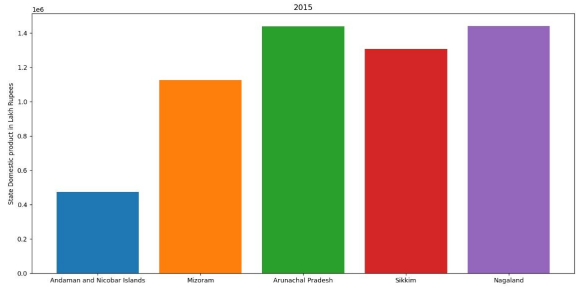

Figure 9(d): Least 5 State wise GDP contribution in 2015

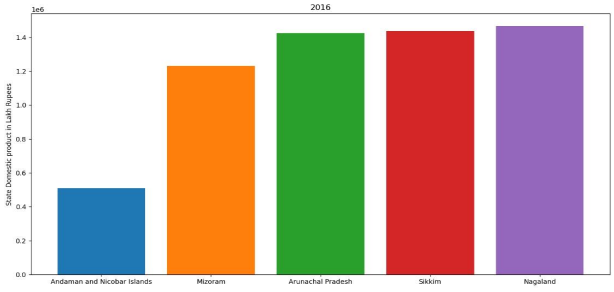

Figure 9(e): Least 5 State wise GDP contribution in 2016

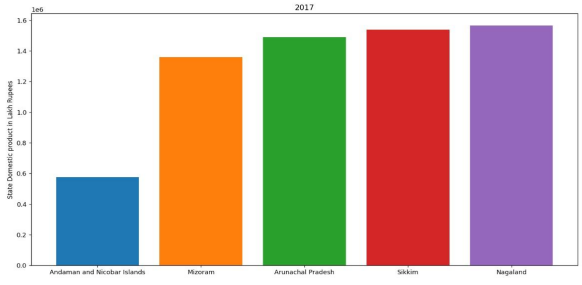

Figure 9(f): Least 5 State wise GDP contribution in 2017

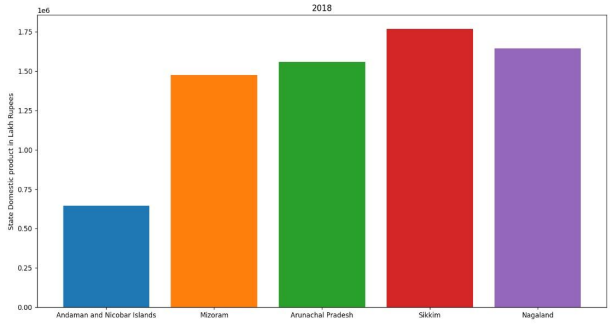

Figure 9(g): Top 5 State wise GDP contribution in 2018

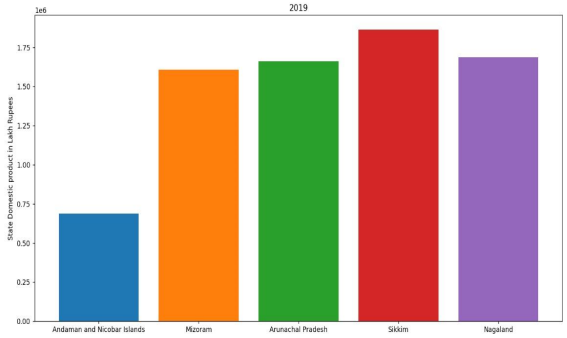

Figure 9(h): Top 5 State wise GDP contribution in 2019

Figures 9(a) to 9(h) gives the state-wise GDP contribution of least five states of India Andaman and the Nicobar Islands, Mizoram, Arunachal Pradesh, Sikkim, and Nagaland. Andaman and Nicobar Islands are the least contributing states of India where in the year 2012 and 2013, the GPD of the state remained the same; after 2013, GDP started increasing from 0.4 to 0.6 value. Mizoram has a constant value of increasing self-GDP from 2012 to 2019, in which the values increase from 0.6 value to 1.75 value. The GDP of Arunachal Pradesh fluctuates over time. The state GDP is constant for the first two years while it starts increasing at the end of 2012 and attains the maximum value in the year 2015 and starts depleting from 2015 to 2019 compared to the state of Sikkim. Sikkim has a constant development of GDP from the value of 1.0 to 1.75. Nagaland has a low GDP growth rate compared to Sikkim, and it also remains the same value in the initial years and increases slowly.

C. Analysis of Sector-wise FDI in India

Foreign direct investment dramatically influences the economic growth of a nation. As seen in the earlier discussion, it is found that FDI is inversely proportional to the trade balance and directly proportional to the export and import values. Analysing all the sectors predominantly involved in the growth of FDI in India is necessary. The bar graph presented the analysis of majorly contributing sectors towards FDI growth from 2013 to 2017.

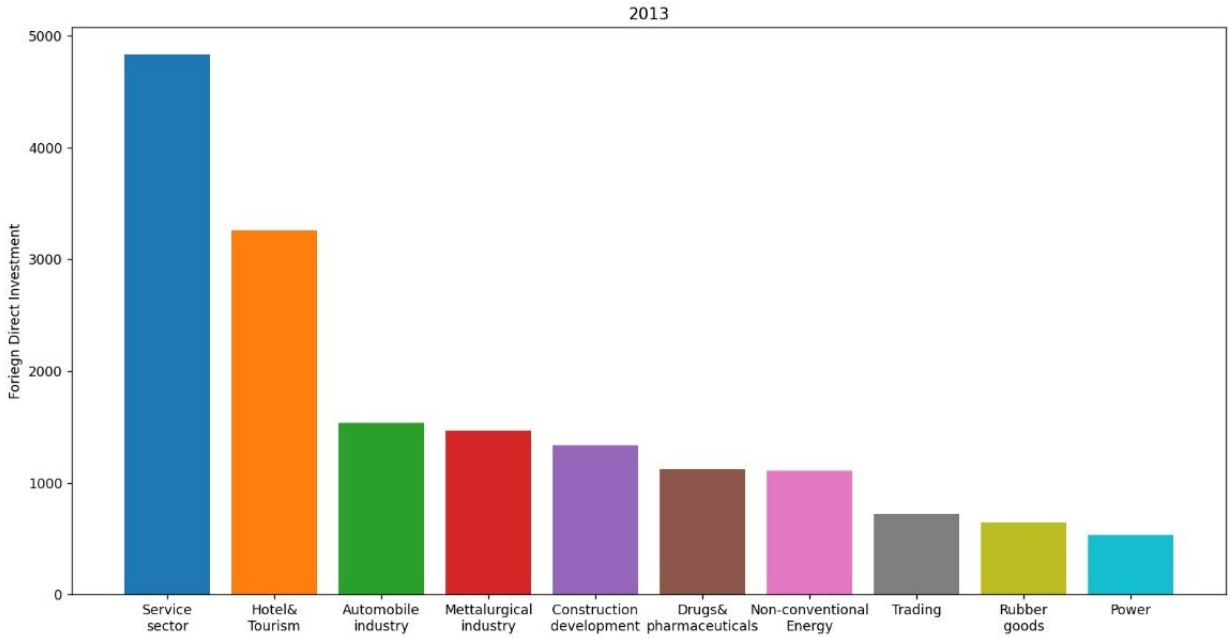

Fig 10: Sector-Wise FDI Growth Contribution in the year 2013

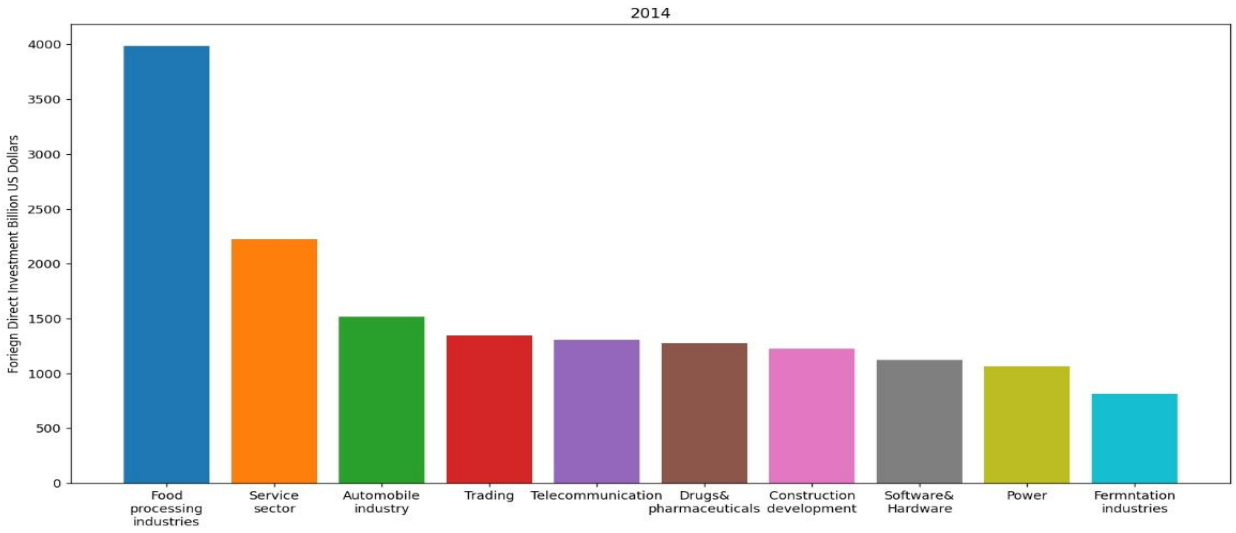

Fig 11: Sector-Wise FDI Growth Contribution in the year 2014

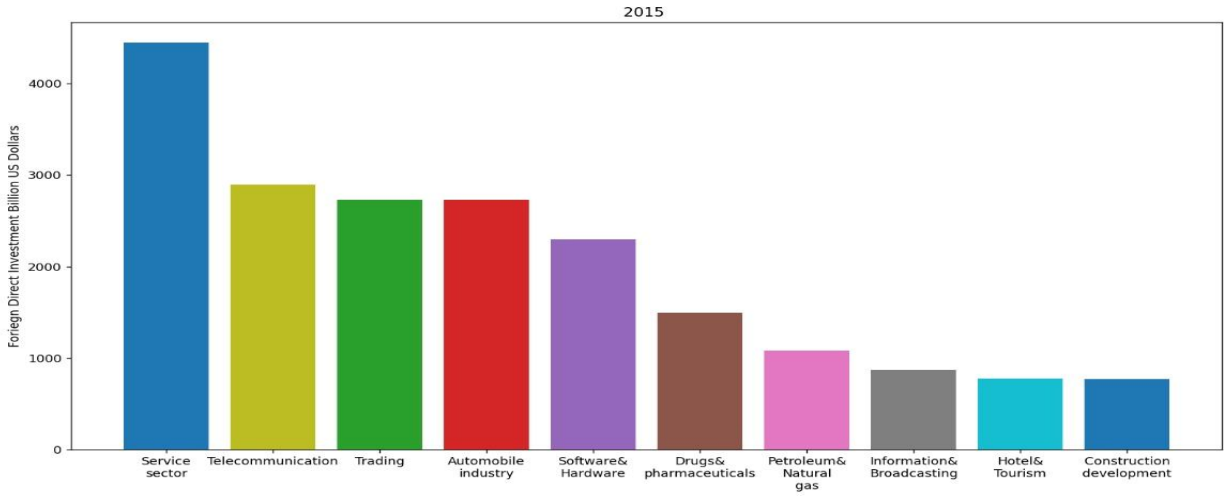

Fig 12: Sector-Wise FDI Growth Contribution in the year 2015

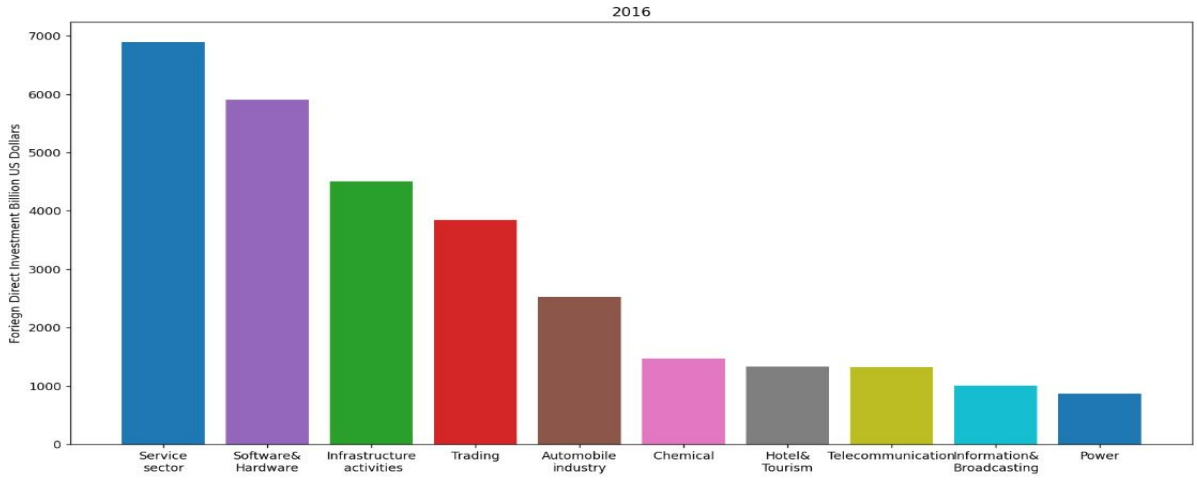

Fig 13: Sector-Wise FDI Growth Contribution in the year 2016

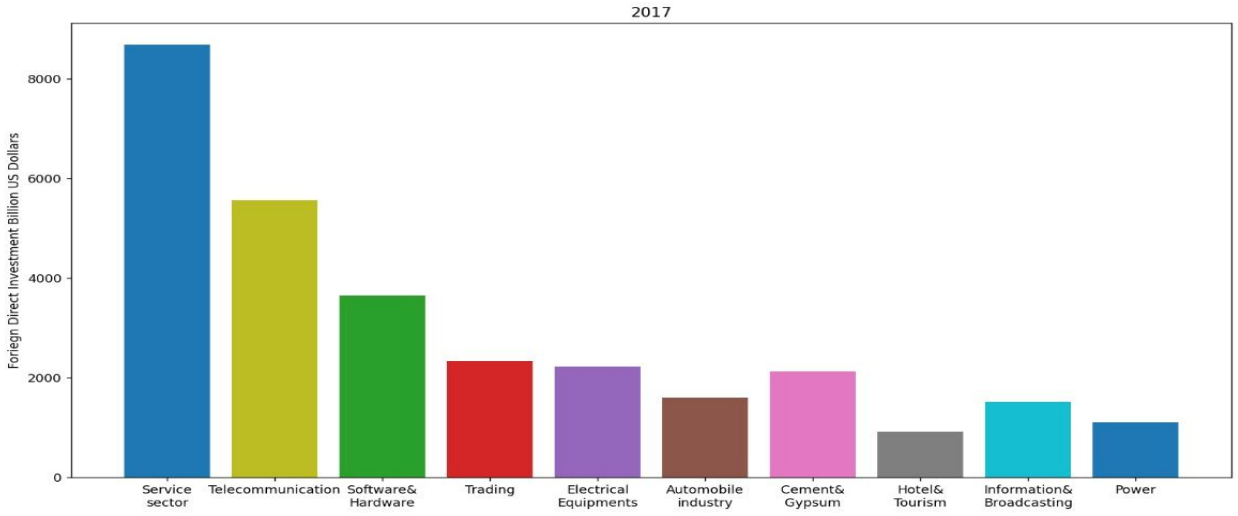

Fig 14: Sector-Wise FDI Growth Contribution in the year 2017

Figures 10 to 14 give the sector-wise FDI bar plots of Foreign direct investments from 2013 to 2014. Significant sectors which involve improvising the foreign direct investments were the Food processing industry, service sector, Automobile industry, Trading, Telecommunication, Drugs and pharmaceuticals, Construction development, Software and hardware, Power, Fermentation and industry, and Rubber goods, Metallurgical industry.

1) In 2013, the Service sector contributed majorly towards the FDI while the power sector contributed the least. Hotels and tourism are the second most sector involved in FDI development. All other sectors contribute nearly equal toward the FDI.

2) In 2014, the Food processing industries had the highest FDI while the fermentation industries had the least FDI. The second highest FDI sector in the Service sector. In 2013 and 2014 automobile sector contributed the third position in FDI development.

3) In 2015, the service sector occupied the first position with construction development at least once. The automobile sector has started losing its third position due to the development of electric and hybrid vehicles. Instead of the automobile sector, trading occupies the third position, while telecommunication occupies the second.

4) In 2016, the Service sector held the top position while the power sector held the last. Software and hardware contribute to the second sector in FDI, and Infrastructure activities occupy the third position.

5) In 2017, slight variations were made, but the automobile sector has gone to the sixth position while the service sector, telecommunication, Software and hardware hold the top ranks.

IV. CONCLUSION

Analysis of the Indian Economy is done in Python with the help of inbuilt modules Pandas and matplotlib. Analysis was done by correlating terms such as GDP, FDI, Import, and Export and comparing some parameters using a line plot. Study of the influence of various sectors on FDI growth was studied with the help of bar graphs. It is found that FDI growth is positively correlated with GDP, Import, and Export parameters. In contrast, a negative correlation is found with the Trade balance, which indicates the export is small compared to import. In order to achieve a positive correlation between the Trade balance and FDI exporting a more significant number of goods from India is appreciable; on the other hand, reducing the import will also help to achieve the positive correlation.

V. ACKNOWLEDGMENT

Datasets were taken from Macrotrends website, Kaggle website, Reserve bank of India website.

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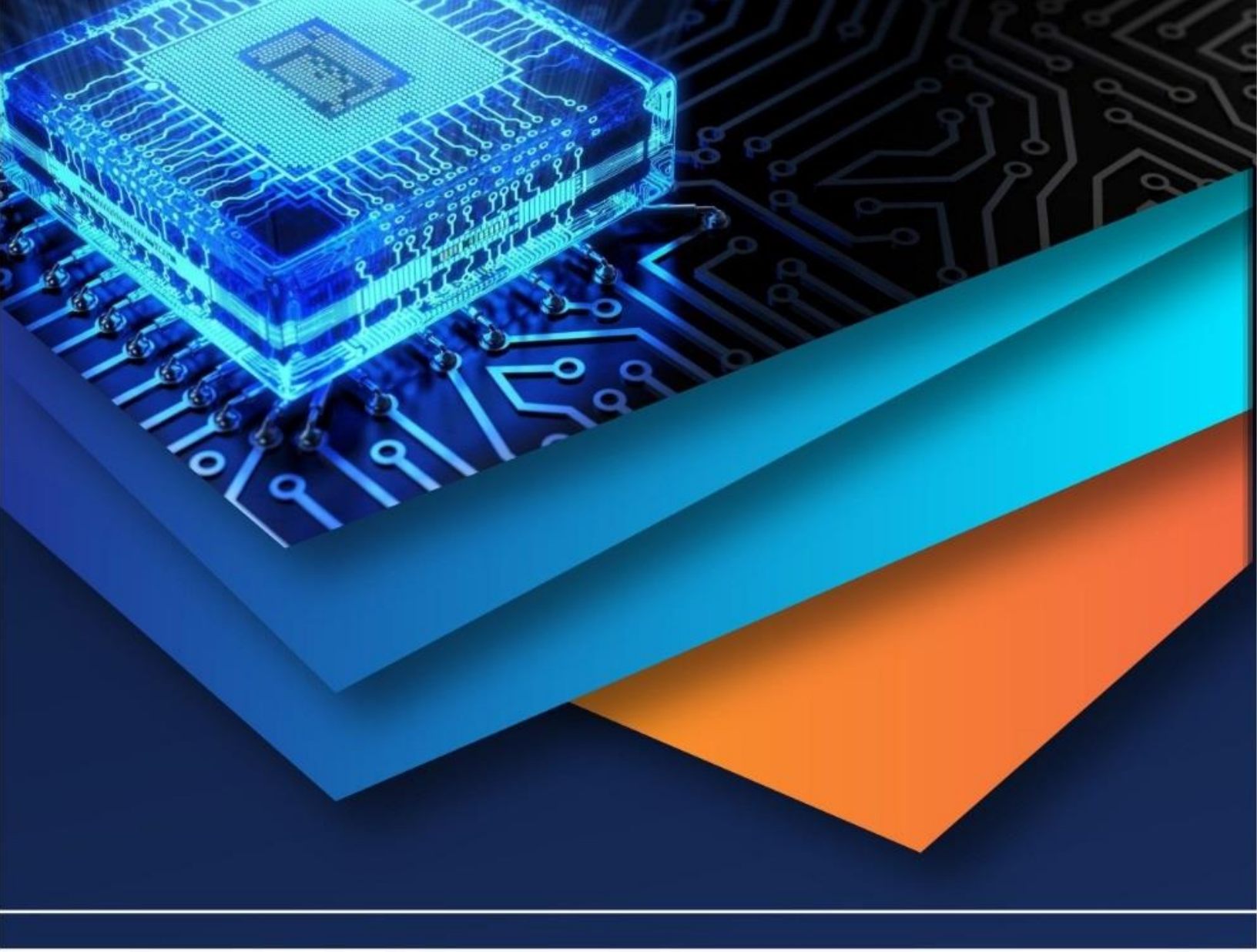

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