

DV Assignment 1

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September 2023

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1 Introduction

Gross Domestic Product (GDP) is a fundamental measure of a country's economic performance. It quantifies the total value of all goods and services produced within a nation's borders during a specific period, typically a year or a quarter. GDP is divided into three sectors:

1. Primary Sector: This sector involves natural resource extraction and agriculture. It encompasses activities like farming, mining, forestry, and fishing.
2. Secondary Sector: The secondary sector includes manufacturing and industry. It involves the transformation of raw materials into finished products, such as factories producing goods or construction projects.
3. Tertiary Sector: The tertiary sector covers services and involves non-material production. It includes professions like healthcare, education, finance, and entertainment, contributing significantly to modern economies.

2 Brief Dataset Description and Preprocessing

Our dataset pertains to India's GDP, spanning from the financial year 1951-52 to 2012-13. This dataset encompasses information such as GDP (in Crores), GDP growth rates, and detailed sectoral breakdowns, including agriculture, industry, mining and quarrying, manufacturing, and services, along with their respective growth rates. It's noteworthy that our dataset was meticulously cleaned and contained no missing values. In our analysis, we performed various calculations, such as determining the contributions of the primary, secondary, and tertiary sectors to the GDP. Additionally, we endeavored to identify the primary contributor to the GDP and later sought to fit the best cubic polynomial for the data as well.

3 Trends in GDP

3.1 Value of GDP - The Simplistic Barchart

We desire to examine the appearance of our GDP. Figure 5 illustrates India's GDP over recent years, with the curve on the chart representing the most accurate cubic polynomial fit to the provided data. This shows that the GDP of India is growing rapidly.

3.2 GDP Projections

Based on the provided data spanning from 1951 to 2012, we aim to forecast future developments in the coming years.

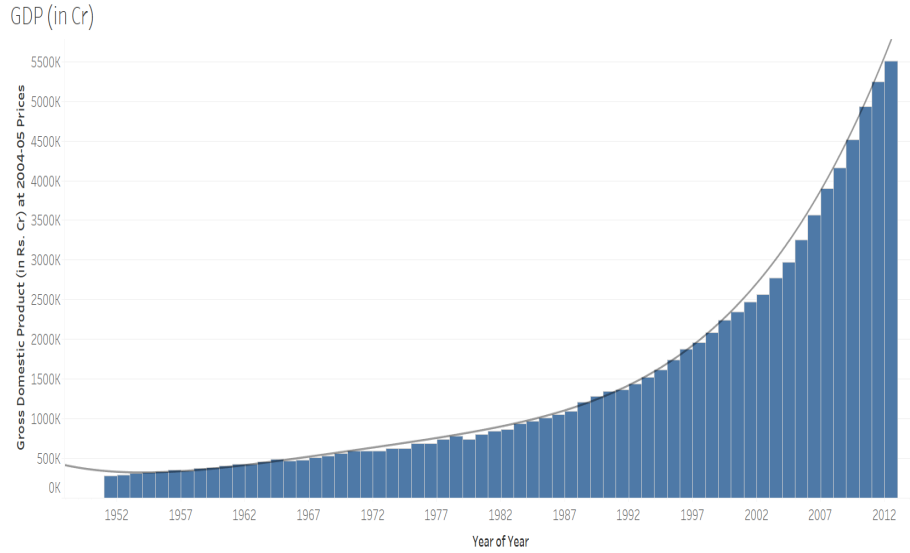


Figure 1: GDP Barchart (in Cr) and best fit cubic polynomial

the stacked area chart (figure 2) below depicts the GDP distribution across primary, secondary, and tertiary sectors. In the right half, you'll discover projections for the sectors' future growth. This indicates that the service sector will assume a prominent role in the upcoming years, contributing to overall GDP growth.

3.3 Growth in GDP - barchart

By visualizing the year-wise percentage growth of GDP, we can identify significant fluctuations and potential influencing factors. From that, we can conclude the effects of different economic policies introduced on the overall growth of the GDP for respective years. This can be better understood via visualizations showing the change in %growth of GDP

Figure 3 employs a bar chart to represent the percentage growth in GDP over the financial years. Dark blue hue colors are used to indicate substantial and positive growth, while shades of orange are employed to signify a decrease in growth.

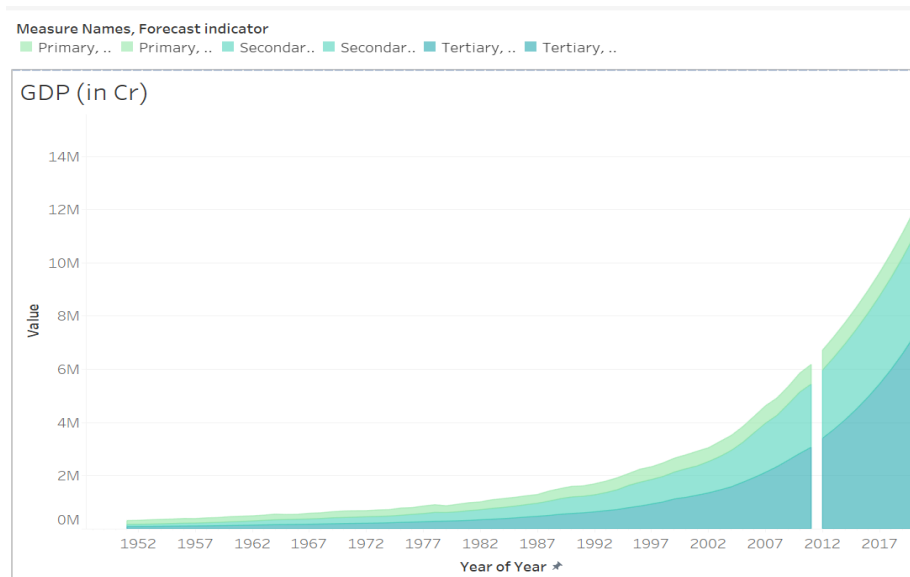


Figure 2: Area Chart with Stacked Distribution: Depicting the estimated GDP distribution alongside the forecasted distribution.

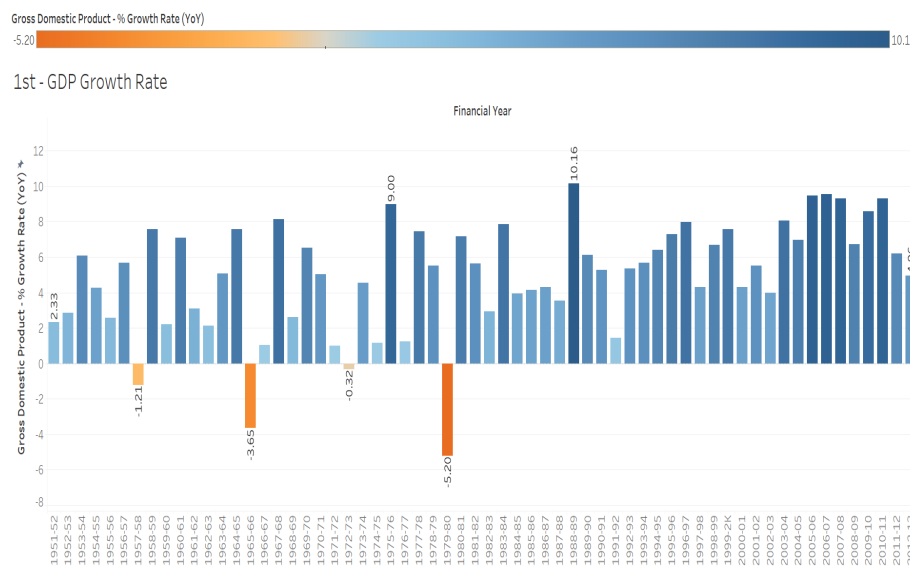


Figure 3: GDP Growth Rate: Barchart

3.3.1 Observations

Negative Growth Trends:

- **Financial Year [1957-1958]:** This period was marked by severe droughts in several parts of India, which adversely affected agricultural production. The agricultural sector was a significant contributor to the economy at that time.
- **Financial Year [1965-1966]:** The mid-1960s saw the effects of two consecutive years of severe droughts. This had a major impact on agricultural output and subsequently on the overall economy
- **Financial Year [1979-1980]:** This was another year marked by a severe drought, leading to a sharp decline in agricultural production. Additionally, there were global economic challenges, including high oil prices and high inflation because of the adverse condition in Iran

Positive Growth Trends:

- **Financial Year [1988-1989]:** The above visualization reveals an intriguing peak in the year 1988-1989. This significant surge can be attributed to several concurrent factors. It is worth noting that during this period, there was a notable increase in government investments in key sectors, coupled with a surge in foreign direct investments. Additionally, favorable economic policies and global market conditions played a pivotal role in fostering a conducive environment for economic growth. The concerted efforts in infrastructure development and strategic initiatives in the industrial sector also contributed to this remarkable upturn in GDP growth.

4 Trends in Sectors

4.1 Trends in Agriculture

In the visualizations below, the x-axis corresponds to the financial years, while the y-axis indicates the contributions of Agriculture to GDP. The size and color of the elements reflect the GDP amounts. It's evident that, in general, the amounts are on the rise.

The visualization (figure 4) reveals a steady decrease in the agricultural sector's GDP contribution over time, consistent with findings in the literature. This trend is attributed to the increasing contributions of industries and services, which naturally led to a reduced share of agriculture.

4.2 Trend in Service Sector - Line Chart

The aim of this visualization is to present a comprehensive view of the trends in India's service sector from the financial year 1951-2013. The visualization intends to provide a clear and visually engaging representation of how the service

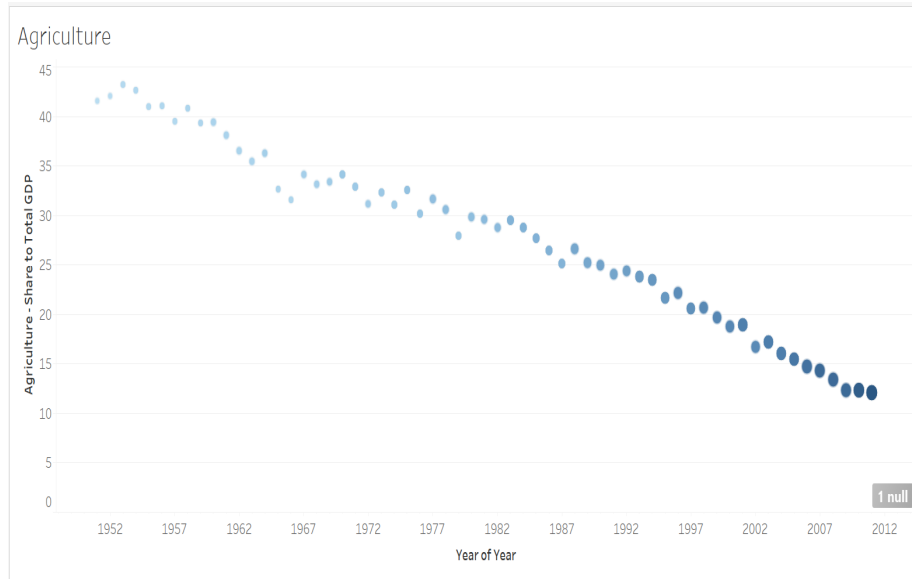


Figure 4: Chart for Trend in Agriculture Sector

sector evolved over this extended period.

Description

The visualization consists of a line chart with two distinctive visual channels to convey information about the service sector's performance.

X-axis: Financial Year

Y-axis: GDP Share of Service Sector.

Channels

- The color of the line graph signifies the growth rate of the service sector YoY. The color-coded lines allow viewers to immediately discern periods of growth (green) and contraction (red) in the service sector.
- The thickness of the line segments corresponds to the GDP contribution of the service sector in crores for each financial year. Thicker lines indicate higher contributions, while thinner lines represent lower contributions.

4.2.1 Inference

1. The overall upward trend in the line and its thickness reflects the transformation of India's economy from one that was heavily dependent on agriculture and manufacturing to one where the service sector plays an increasingly significant role.



Figure 5: Line Chart for Trend in Service Sector

2. We can see from the graph, the increase of growth rate with time. Initially, it had a relatively small share of the GDP/growth rate, but in the mid-1990s, it started to grow consistently, as reflected in the changing green color in the visualization. This growth was fueled by economic reforms, globalization, and increasing demand for services.

4.3 Trend in Manufacturing

In the visualizations below, the x-axis corresponds to the financial years, while the y-axis indicates the contribution of Manufacturing to GDP. The size and color of the elements reflect the GDP amounts. It's evident that, in general, the amounts are on the rise.

The visualization (figure 6) shows a gradual uptick in the Manufacturing sector's contribution to GDP over time, which appears to be approaching a plateau, mirroring what we've encountered in the literature. The surge in manufacturing growth in India can be attributed to Industrial Policy Reforms, particularly those in 1956 and 1991, alongside the adoption of export-oriented growth strategies and technology transfer.

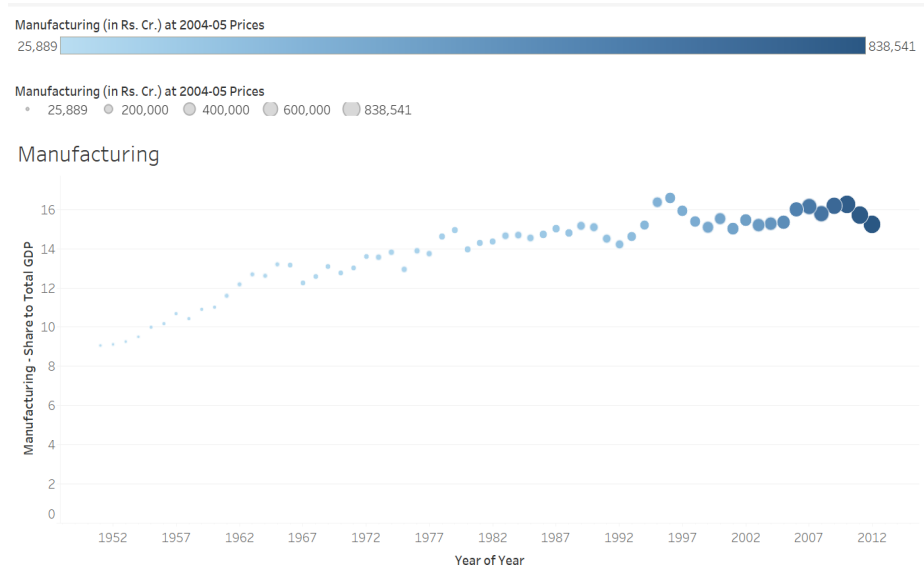


Figure 6: Trend in Manufacturing

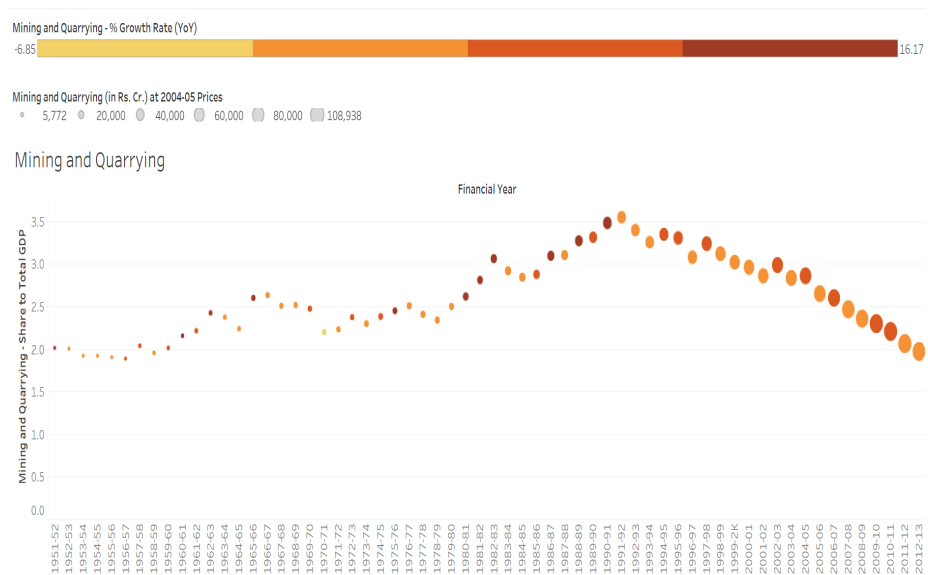


Figure 7: Trends in Mining and Quarrying

4.4 Trend in Mining and Quarrying Share and Growth rate

4.4.1 Key Observations

1. Trend in Contribution:

- On average Increase from [1951-1992]: On average a notable upward movement along the y-axis is observed from the year 1951 to 1992. This indicates an increase in the share of Mining and Quarrying in the GDP and the growth of these sectors in India. This trend is particularly evident in [1991-1992] when the shares of these sectors reached their peak values.
- On average Decrease from [1992-2012]: On average a decreasing trend is observed from the year 1992 to 2012. It can be observed that the contribution from these sectors is even less than what was initially in the year 1951. So in total, the contribution has decreased for these sectors.

2. **Size of Circles:** The size of the circles consistently increases over the years, indicating a positive trend in the actual contribution in value(crores) of the Mining and Quarrying sector to the GDP. This suggests a steady expansion of the sector even though the share-wise contribution is decreasing.

3. **Color Variation:** The color spectrum, representing the percentage growth in Mining and Quarrying, shows an interesting pattern. While there is a general tendency towards mid-dark brown, suggesting growth, there are instances where the hue leans slightly towards orange(especially at the tail years). This could imply periods of slower growth.

5 Comparison in Trend of Different Economic Sectors

5.1 Historical Trends in YoY Growth Rates of India's Major Sectors (1951-2013)

The aim of this visualization is to try to compare the growth rates of India's 3 Major Sectors Primary, Secondary and Tertiary the data for which are given in the dataset. The chart may reveal periods of high growth, stability or slow-downs in each sector, offering insights into the influence of government policies and global economic conditions.

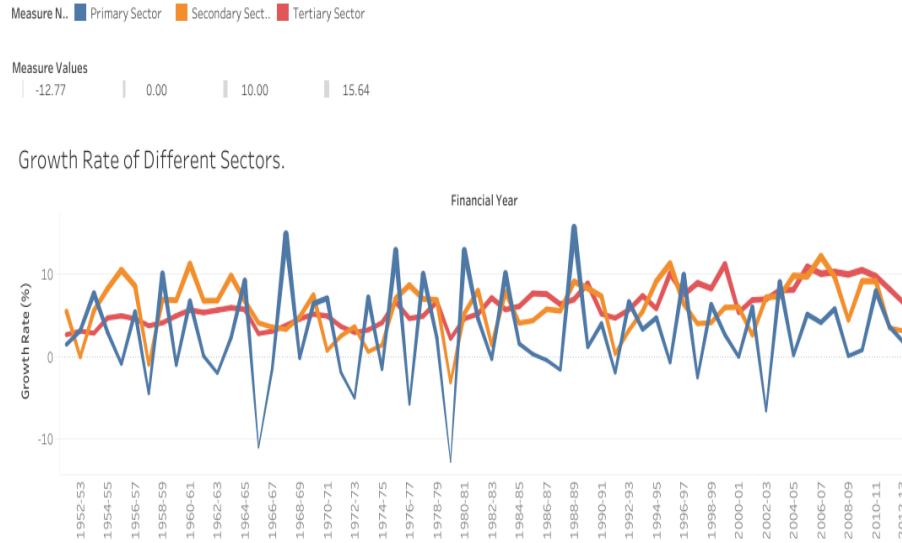


Figure 8: Sectorial Growth Rates

5.1.1 Visualization

Description

The visualization (figure 8) is a line chart which provides a visual representation of the changing economical landscape of India over the decades. The channel, thickness is used to show the magnitude of the growth rate to make it visually appealing. Viewers can easily compare the growth rates of the 3 sectors and observe how they interact and evolve over time.

X-axis: The Financial Year

Y-axis: The Growth Rate (%)

- The Blue Line represents Primary sector
- The Yellow Line represents Secondary sector.
- The Red Line represents Tertiary sector.

5.1.2 Key Insights

1. Trend in Primary Sector:

- In the early years i.e 1950s and 1960s, the primary sector, which includes agriculture and allied activities was the dominant contributor to India's GDP.
- The growth rate in this sector experienced significant fluctuations due to factors like monsoons, agricultural policies, and technological advancements like the Green Revolution.

- Over time, the share of the primary sector in GDP started declining as India underwent industrialization and urbanization.

2. Trend in Secondary Sector:

- The industrial sector, which includes manufacturing and mining, showed relatively steady growth during the 1950s and 1960s as India emphasized industrial development through various policies.
- Growth in this sector was influenced by factors like investment in infrastructure, industrial policies and global economic conditions.
- The industry sector's growth rate often correlated with government policies and economic reforms.

3. Trend in Tertiary Sector:

- The service sector, including trade, finance, IT and other services started gaining prominence in the 1980s and 1990s
- The growth rate in the service sector was largely driven by factors such as globalization, technological advancements and the rise of information technology industry.
- India's service sector experienced rapid growth in the late 20th and early 21st centuries contributing significantly to GDP.

Comparison of Growth Rates of Manufacturing and (Mining & Quarrying)

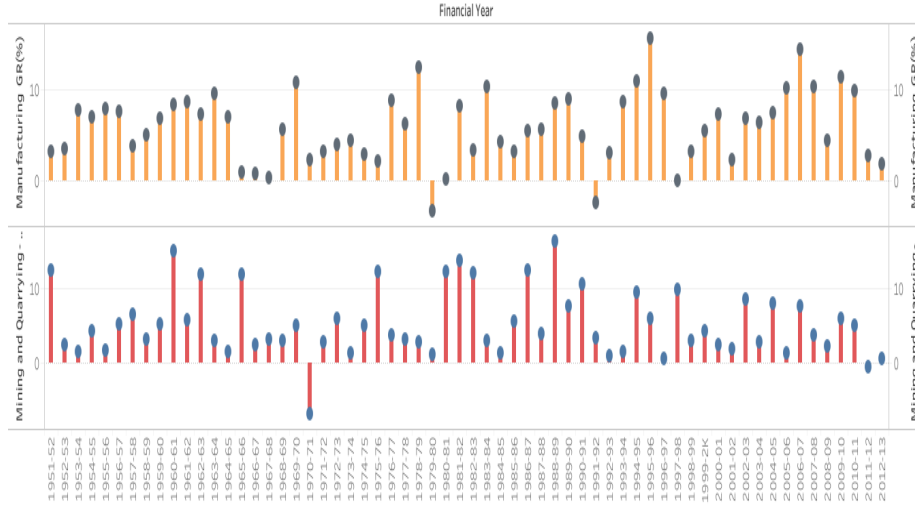


Figure 9: Lollipop Chart

5.2 Decades of Development: Tracing India's Industrial Sector Evolution

5.2.1 Evolution of India's Industry Sector: A Comparative Analysis of Manufacturing and (Mining & Quarrying) from 1951 to 2013

The aim of the visualizations is to provide insights into how the sub-sectors of the Industry sector evolved over time.

5.2.2 Visualization - 1

Description

The lollipop chart (figure 9) compares the growth rates of Manufacturing and Mining in India from 1951 to 2013. The chart consists of two sets of lollipops, one for (Manufacturing and quarrying) and one for Mining, with each lollipop representing a specific year. By comparing the lengths of the lollipops for Manufacturing and Mining side by side, viewers can quickly assess the relative performance of these two sectors over time.

X-axis: Financial Year

Y-axis: Manufacturing and (Mining & Quarrying) Growth Rates (%)

5.2.3 Comparative Analysis

- Manufacturing growth rates might show a more consistent upward trajectory, reflecting India's emphasis on industrialization and economic reforms.
- Mining and quarrying growth rates may have more pronounced variations due to resource constraints, market dynamics, and environmental factors.
- The liberalization and economic reforms of the 1990s likely led to increased growth in manufacturing.
- Like manufacturing, you might observe fluctuations in the growth rates of mining and quarrying, with some periods of expansion and others of contraction.

5.3 From Farms to Factories: India's Economic Transformation

The aim of this visualization is to visualize and analyze the changing economic landscape of the country over this extended period. This type of visualization allows us to track the relative contributions of these sectors to India's overall economic growth and development.

5.3.1 Visualization -2

Description

The multiple line chart (figure 10) shows the changes in the GDP share of Agriculture, Industry and Manufacturing in India over a period of more than six decades from 1951-2013. Each line is represented by a different colored line. The thickness of the line also indicates the magnitude of percentage share to the GDP.

X-axis: Financial Year

Y-axis: Share of GDP in (%)

- The Yellow Line represents Agriculture sector.
- The Grey Line represents Industry sector
- The Pink Line represents Manufacturing sector.

5.3.2 Key Insights

- In the early decade 1960s, the Agriculture sector had the largest share of India's GDP. This is indicative of India's primarily agrarian economy during that period.
- In the 1970s and 1980s there was a noticeable increase in the share of industry in GDP. This period witnessed significant Industrialisation.

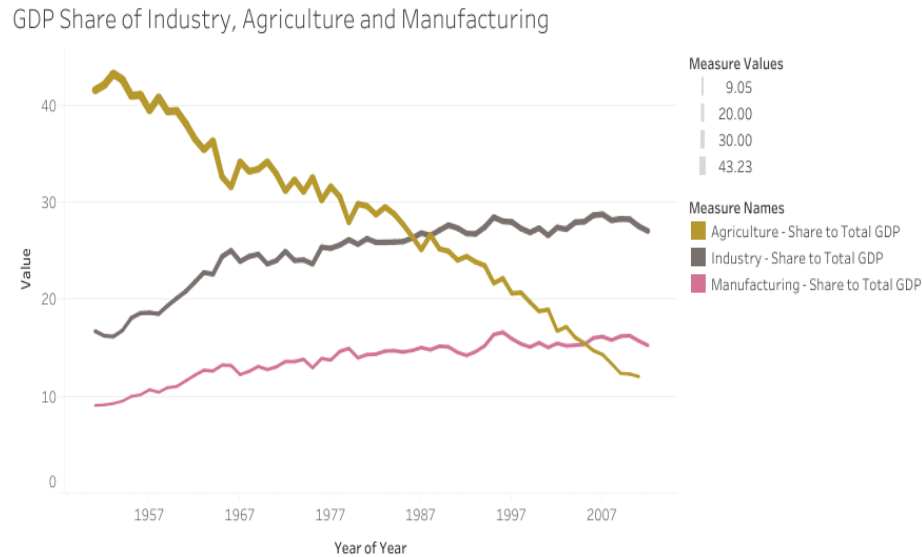


Figure 10: GDP share of Industry, Agriculture and Manufacturing

- In the 1990s and 2000s a significant trend in the graph is the increasing share of Manufacturing in the GDP, surpassing the share of Agriculture in mid 2000s. Shows the decline in the share of Agriculture in GDP. This indicates a shift away from agriculture-centric livelihoods and a growing urbanization.

The graph as a whole reflects India's journey from being primarily agrarian to a more diverse and industrialized economy. It also highlights the impact of policy changes and economic reforms on the composition of India's GDP

5.4 Sectoral Composition and Year-to-Year Growth Trends

Upon analyzing the dataset, it becomes evident that the shifting dominance among the primary, secondary, and tertiary sectors holds significant implications for economic trends. To better comprehend this dynamic, we can construct a visualization which indicates the % shares of each major sector to the GDP simultaneously for each financial year. For this we can create a pie chart and some individual line plots for each sector for better understanding.

The pie charts (figure 11) show the composition of the GDP based on the contribution from different sectors for different financial years. Also the line plots shows the change of the %contribution of the sector seperately through which the trends for each sector can be observed.

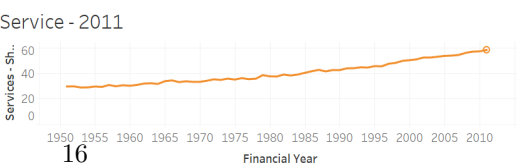
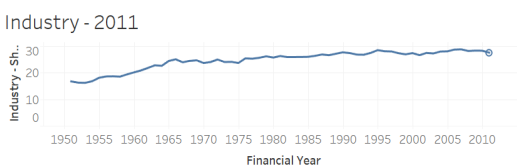
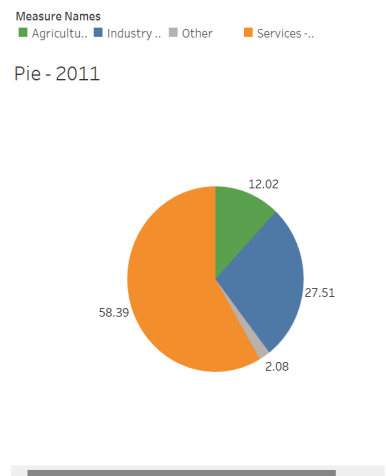
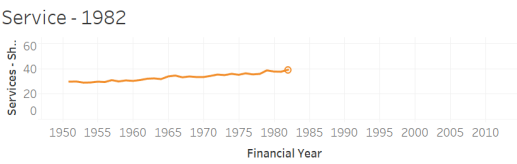
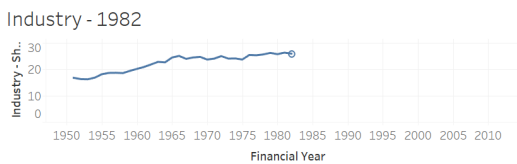
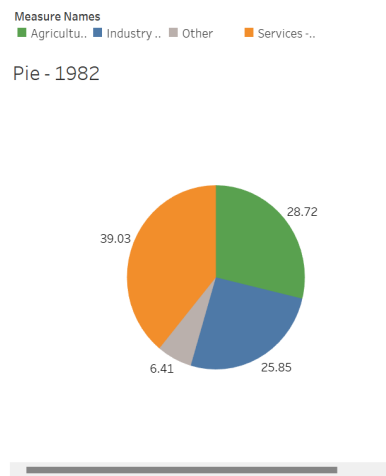
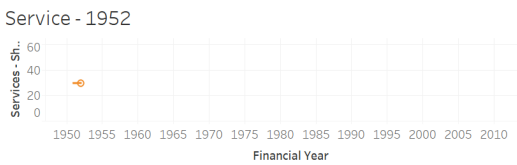
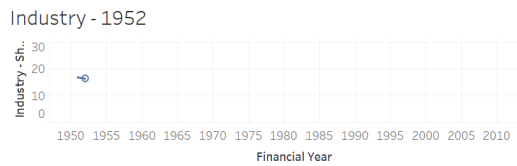
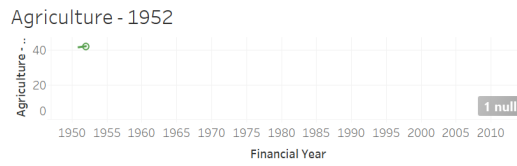
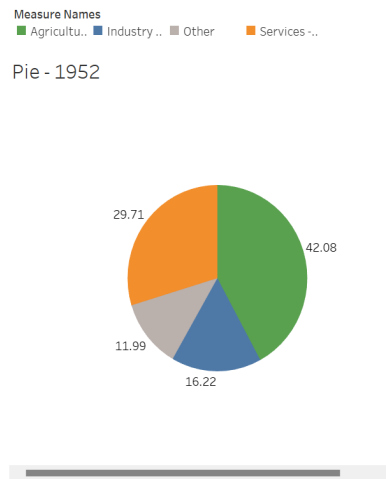


Figure 11: Sectoral Piecharts per Years

5.4.1 Insights:

- In the initial years, the primary sector held the highest share, averaging around 43%.
- Subsequently, all the sectors has almost equal shares of around(30-35%)
- In the later years, the tertiary sector saw a continuous increase in its share, surpassing the secondary sector. The share of the tertiary sector reaches a high of about 55% at the very end.

5.4.2 Trends:

- The primary sector's dominance decreased over time, while the secondary sector experienced a temporary surge before declining.
- The tertiary sector exhibited a consistent upward trend, indicating a growing influence on the economy.

5.4.3 implications:

- This dynamic interplay among sectors highlights the adaptive nature of the economy, with different sectors assuming leadership roles at different points in time
- The steady rise of the tertiary sector suggests a long-term shift towards a more service-oriented economy.

The above trends are also confirmed when we observe which major sector dominates with respect to the contribution to total GDP for each financial year separately.

- **Sectoral Dominance Transition Over Time: Primary, Secondary, and Tertiary Sector Shares (1950-2020)**

Figure 12 indicates the sector which contributed the most for each financial year.

- From this we can also observe the same trend that in the initial years, the primary sector commands the highest share, averaging around 43%. This dominance, however, experiences a gradual decline in subsequent years. Then secondary sector emerges as the frontrunner in the years where its contribution is about 36-37%. In the later years, the tertiary sector's prominence begins to ascend. It steadily gains ground, surpassing the secondary sector's share and continuing on an upward trajectory. The average share of the tertiary sector stands at approximately 45%, indicating a growing trend that holds promise for the future.

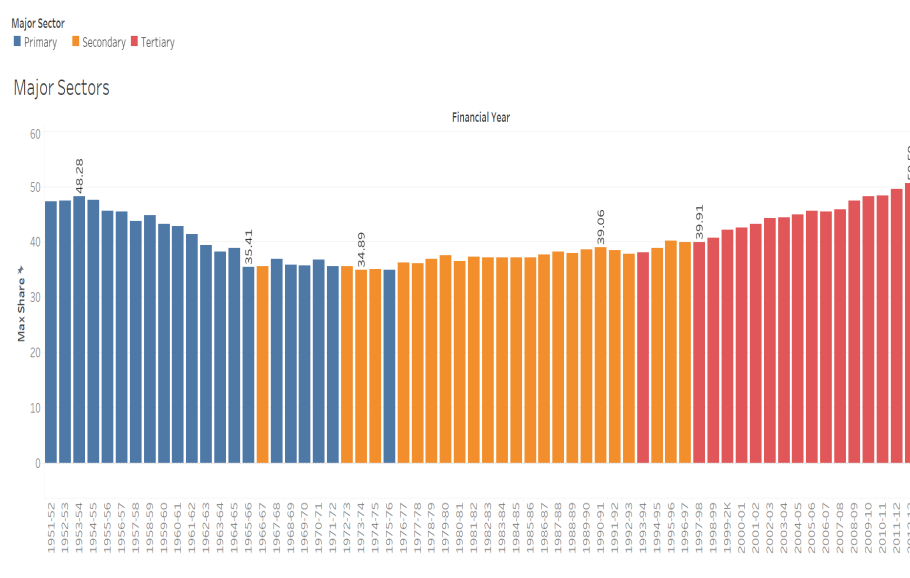


Figure 12: Major Sector: Bar Chart

- Its interesting to note that in the middle years from around 1973 to 1994 secondary sector is the most dominant even though its shares are only about 36-37% which is approximately one third of the total and also its pretty close to other sectors too as seen from the piecharts.

6 Contributions of each team member

- Deep conducted an analysis of GDP growth, examining it in relation to both the actual GDP value and the contribution value (in crores) from each sector. This analysis involved the creation of a GDP value bar chart and a stacked area chart. Furthermore, Deep conducted individual trend analyses for the agriculture and industry sectors, using scatter plots for each.
- Ricky performed an analysis of GDP growth, focusing on the growth rate of GDP, which was visualized using a growth-rate bar chart. Additionally, Ricky conducted a trend analysis for the mining-quarrying sector, represented by a scatter plot. Ricky also undertook an examination of the relative sector-wise contributions to GDP, presenting this data through pie charts and a dominant sector bar chart.
- Ashish conducted an analysis of the year-over-year (YoY) growth rates of major sectors, illustrating the data with a growth rate line chart. He also compared the manufacturing and mining sectors using lollipop plots. He

analysed the trend of Service Sector with a unique line chart. Furthermore, Ashish performed a comparative analysis of the Industry and Agriculture sectors, presenting the findings through line charts for each sector.