

Performing an analysis of population data for selected countries using various functions for data manipulation, fitting, and visualization. It employs exponential and logistic growth models to fit population data for **INDIA** obtained from **World Bank Dataset**, explores the influence of outliers on the total population fit, and utilizes clustering analysis for exploring patterns in population-related indicators such as GDP growth.

## Introduction, Process and Exponential Growth Fitting for India

- Fitting exponential growth model to India's population data.
- Iterating to find appropriate start values for the fitting parameters.
- Plotting the data, initial fit, and final fit with the exponential growth model.

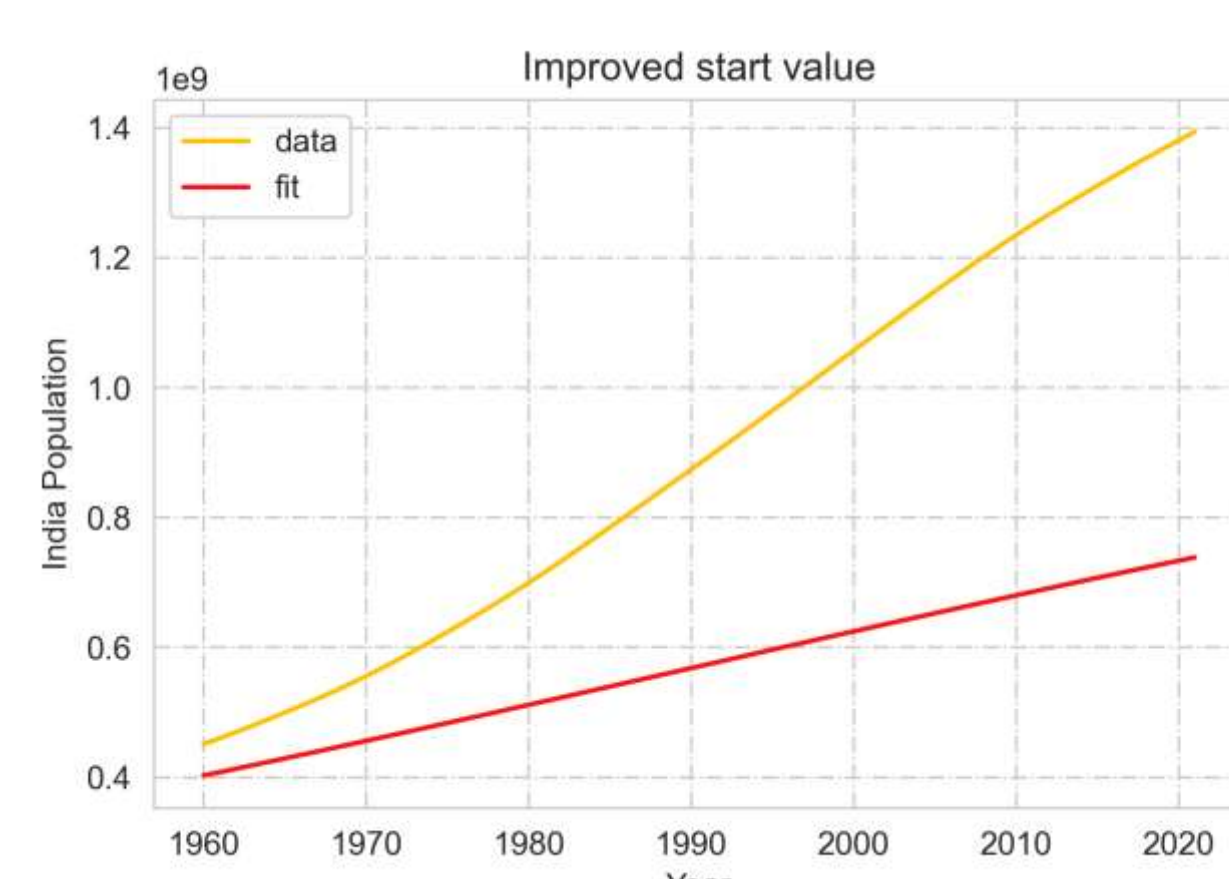
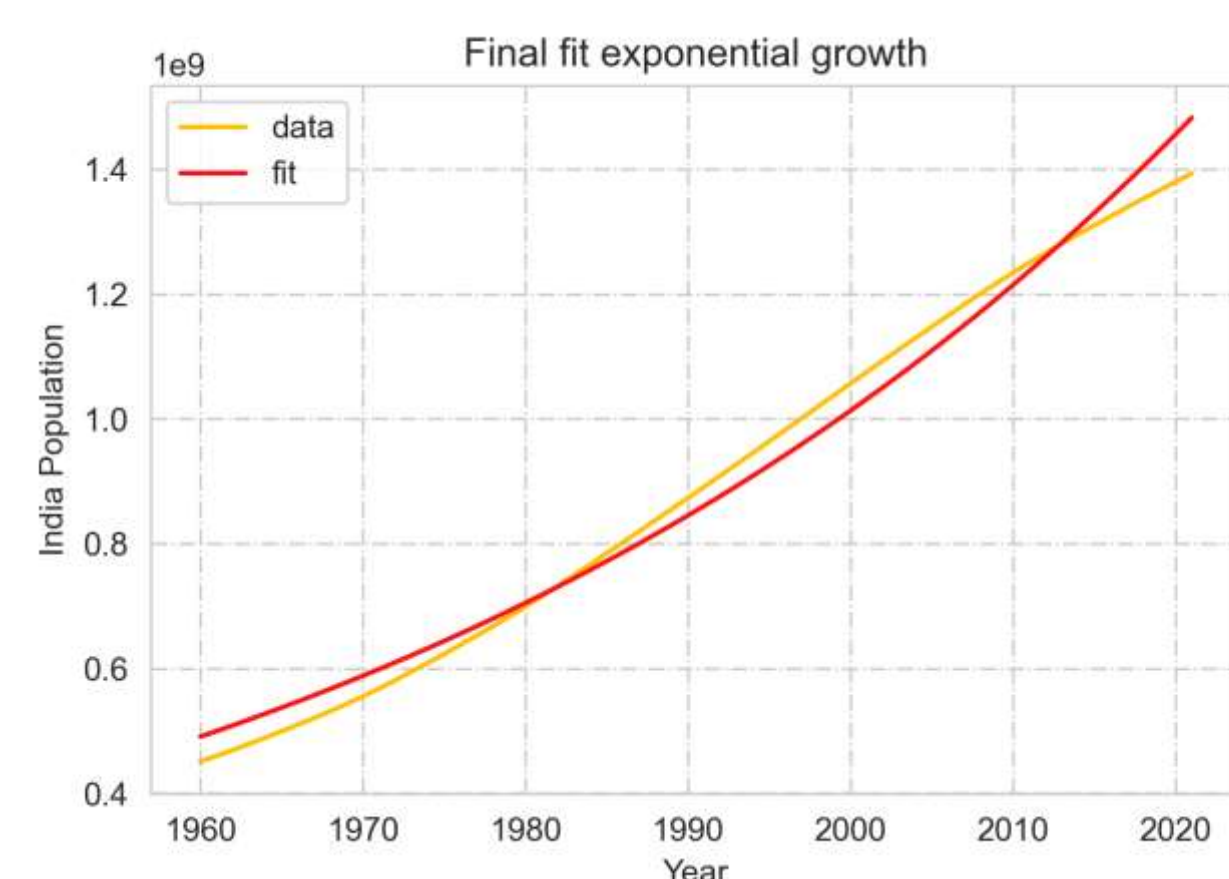
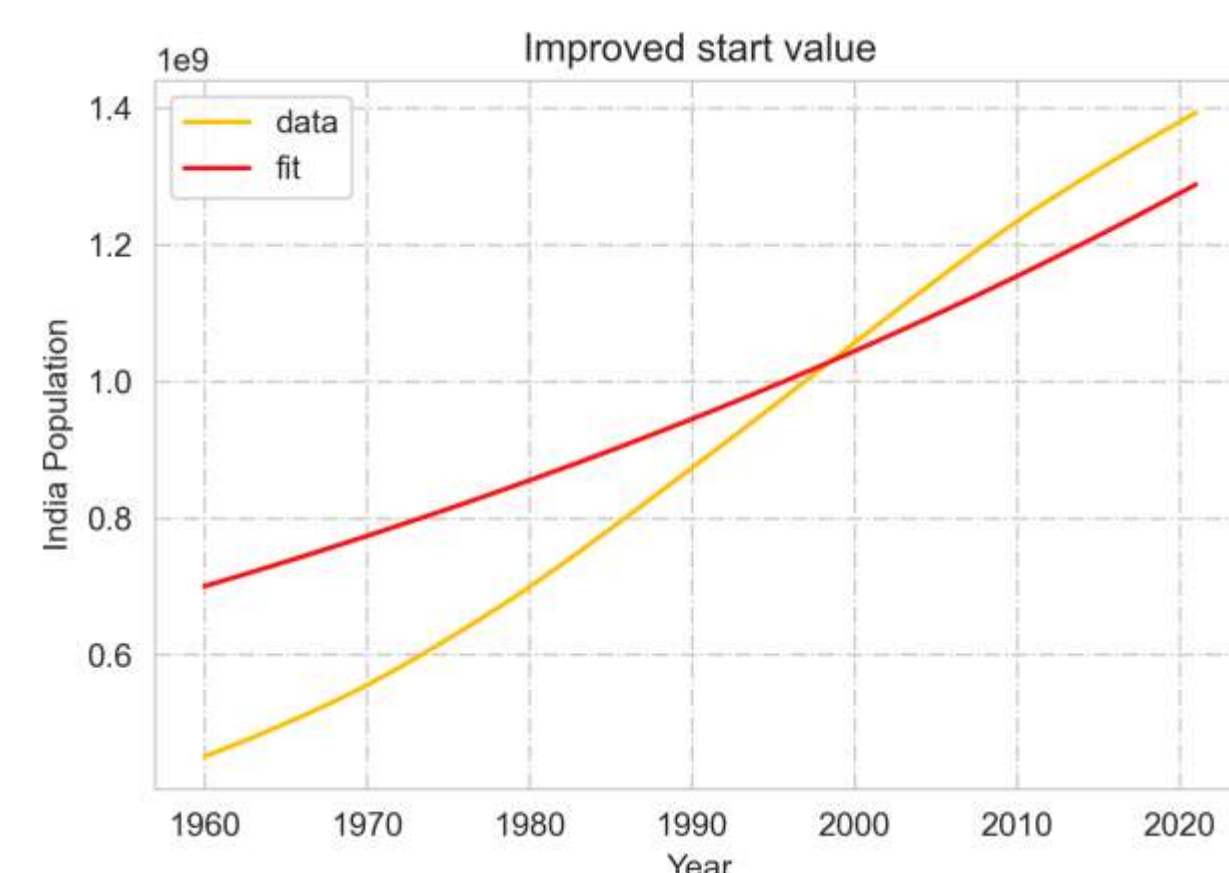
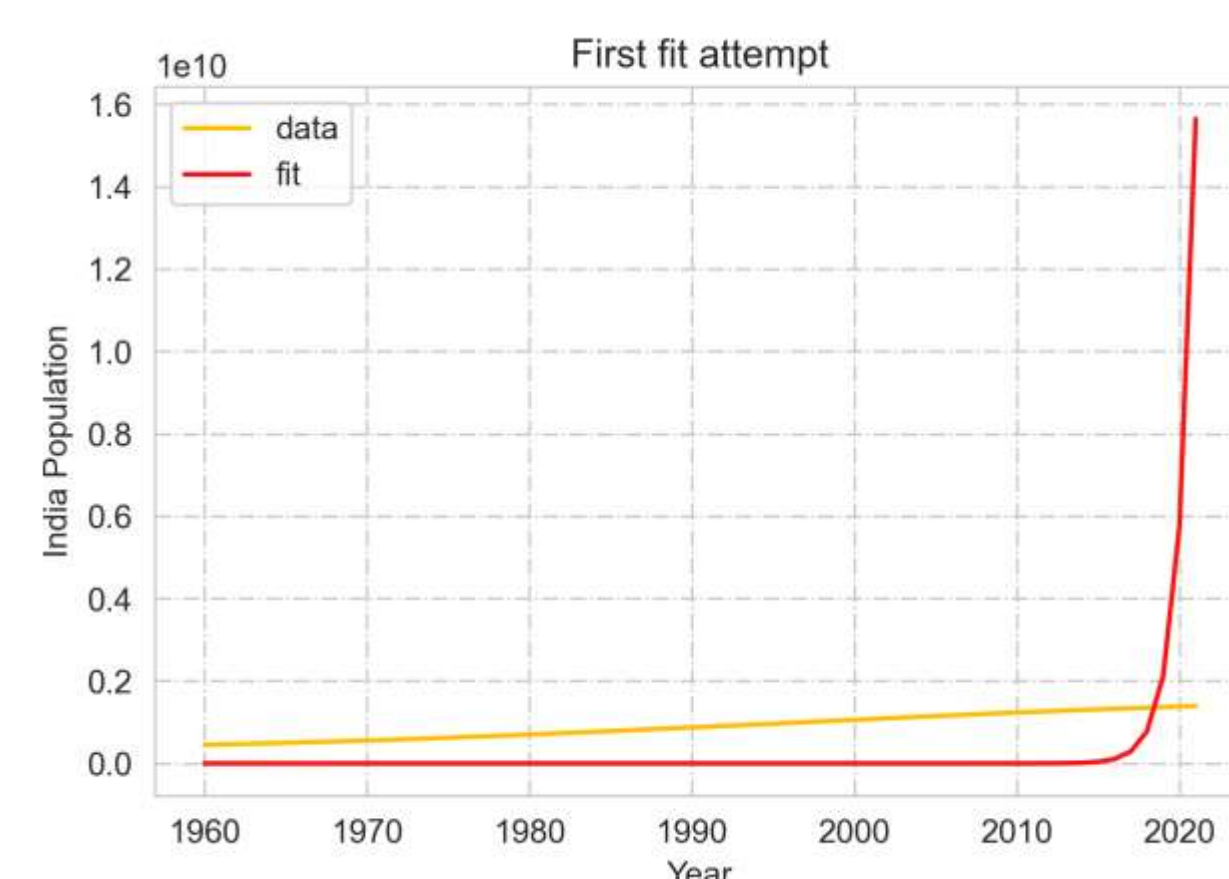
### PROCESS

The fit might not align well with the actual data, suggesting the need for adjustments in the model parameters.

Adjusting start values improves the alignment of the fit with the actual data.

The final fit is obtained by optimizing parameters of exponential growth model.

Adjusting start values improves the alignment of the logistic growth fit with the actual data.



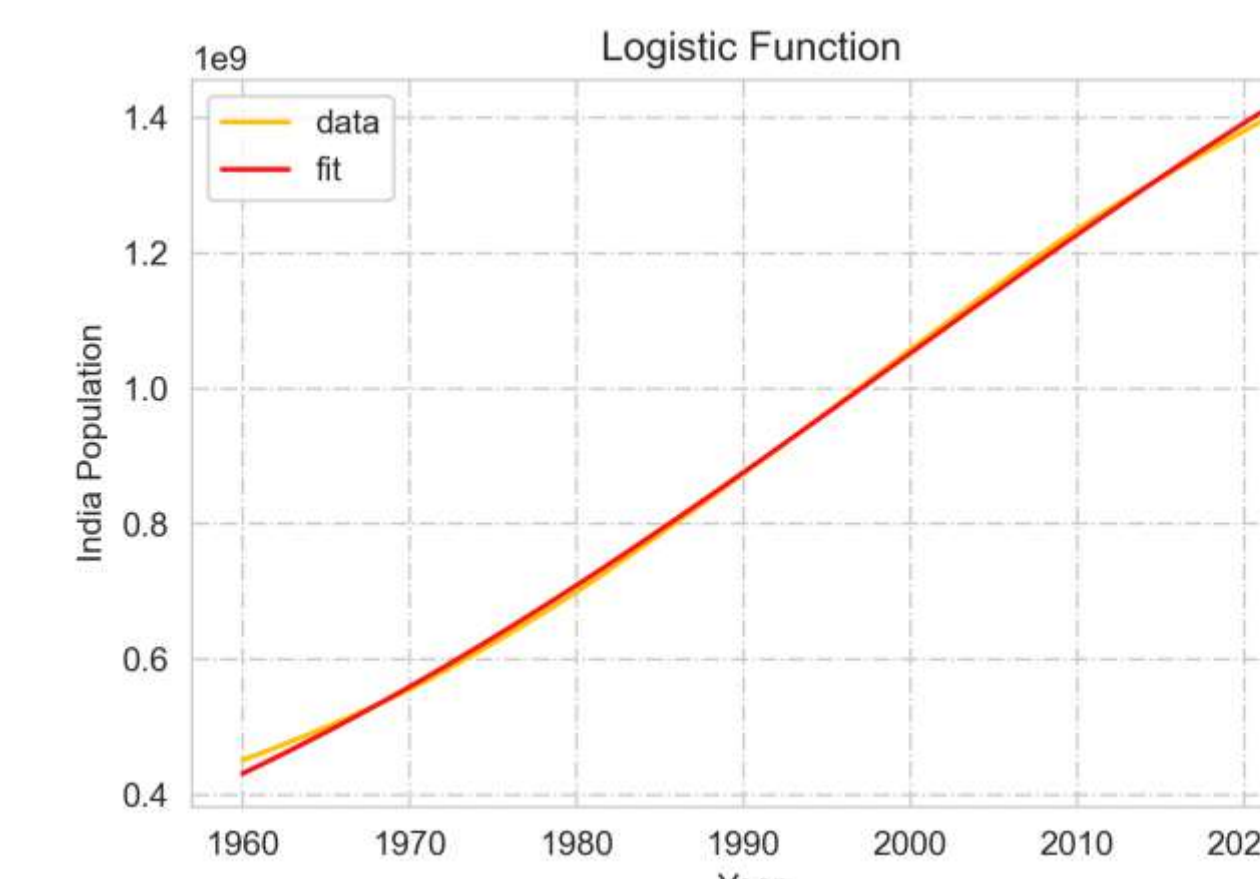
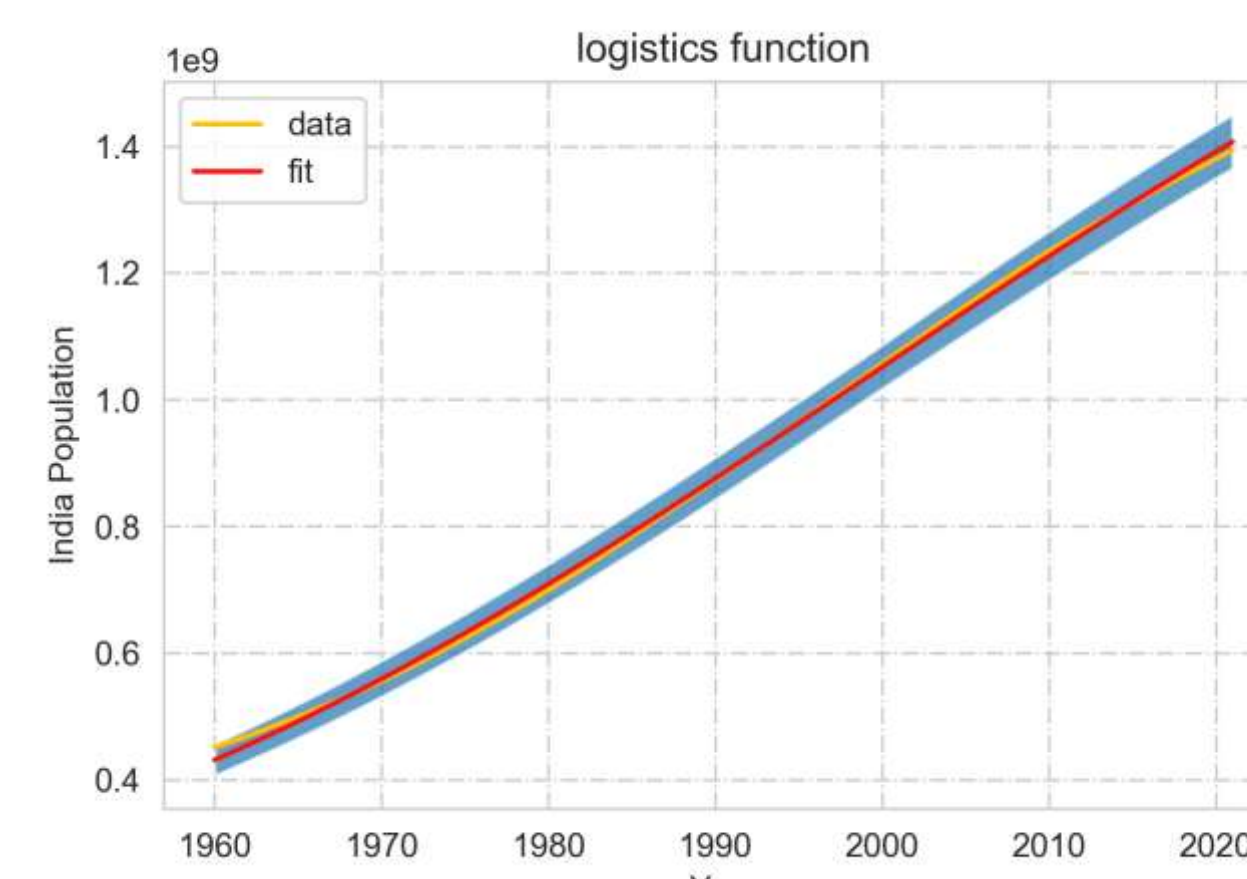
# Population and GDP Growth Analysis

ID No.: 22071343

[https://github.com/muhammadoomer1live/AP1\\_Assignment3](https://github.com/muhammadoomer1live/AP1_Assignment3)

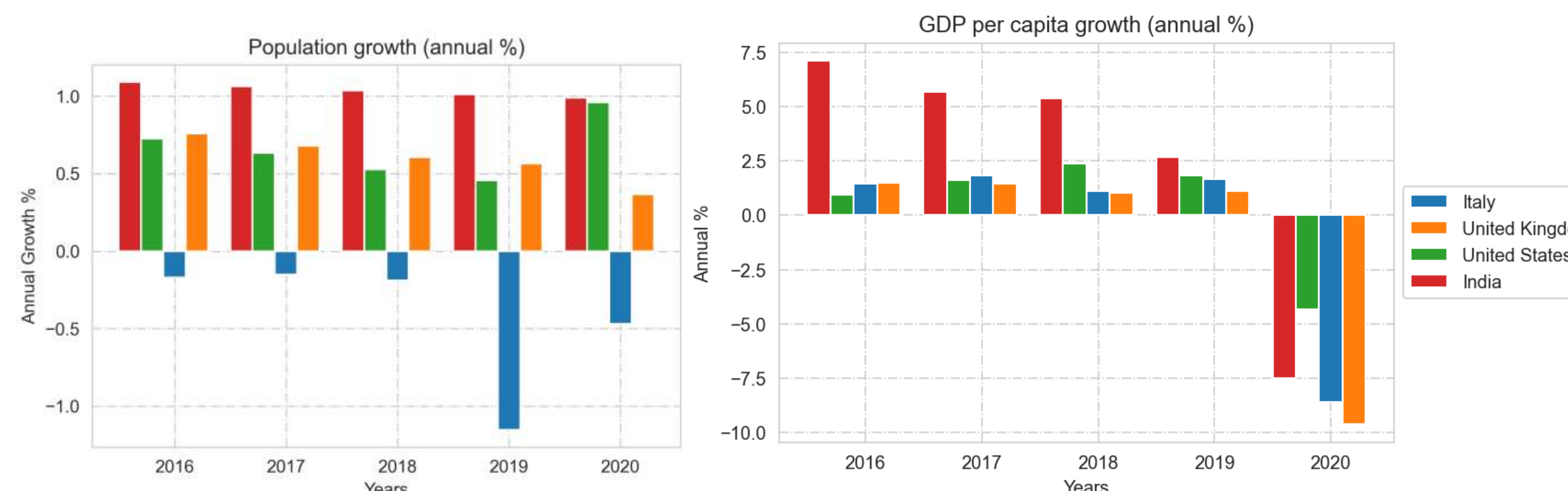
## Logistic Growth Fitting for India

- Fitting logistic growth model to India's population data.
- Determines turning year, population in 1990, and refines fitting parameters.
- Plotting the data and the logistic growth fit.

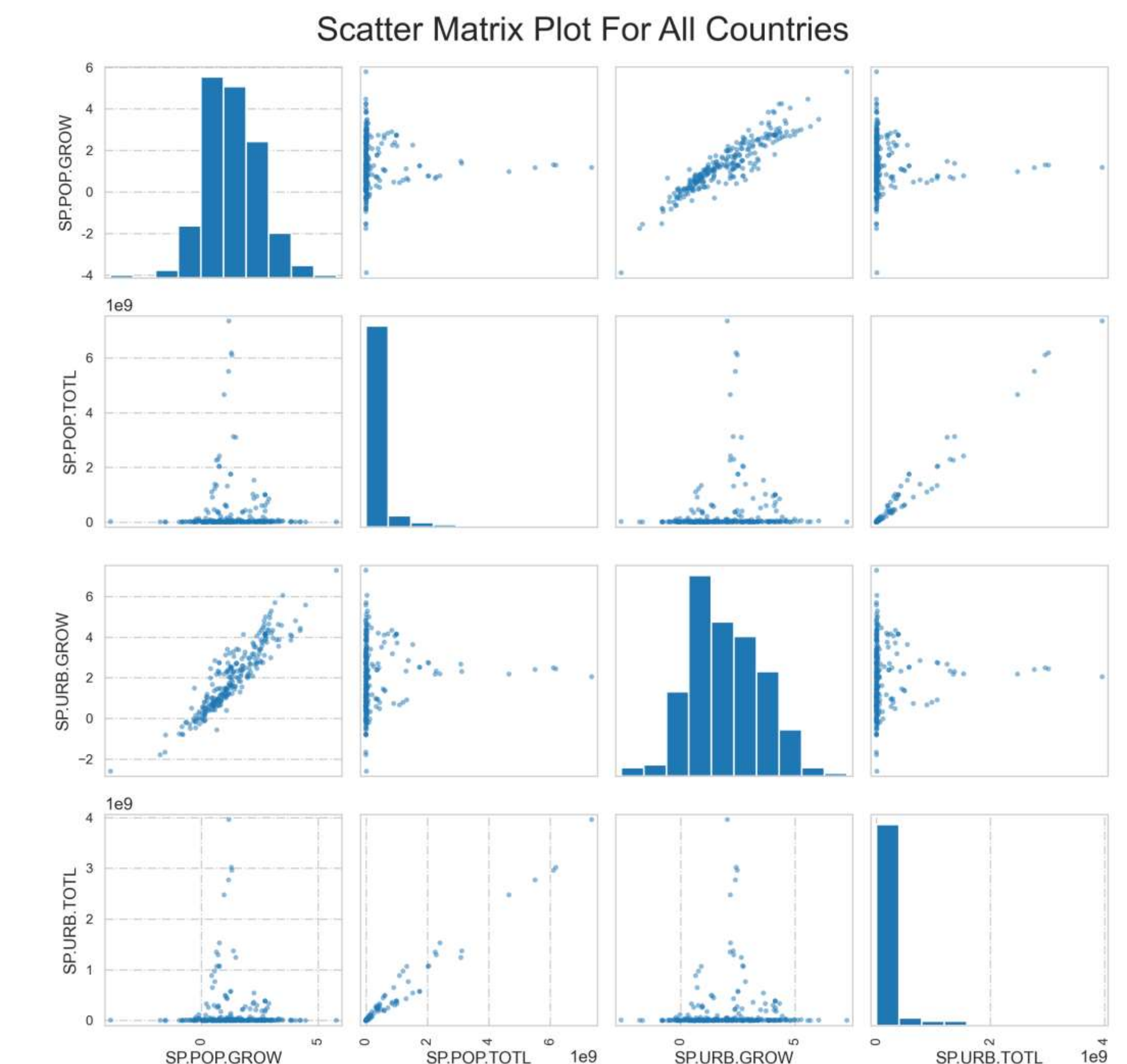


## Population Growth, GDP per Capita Growth (Annual %) for Italy, UK, US, India

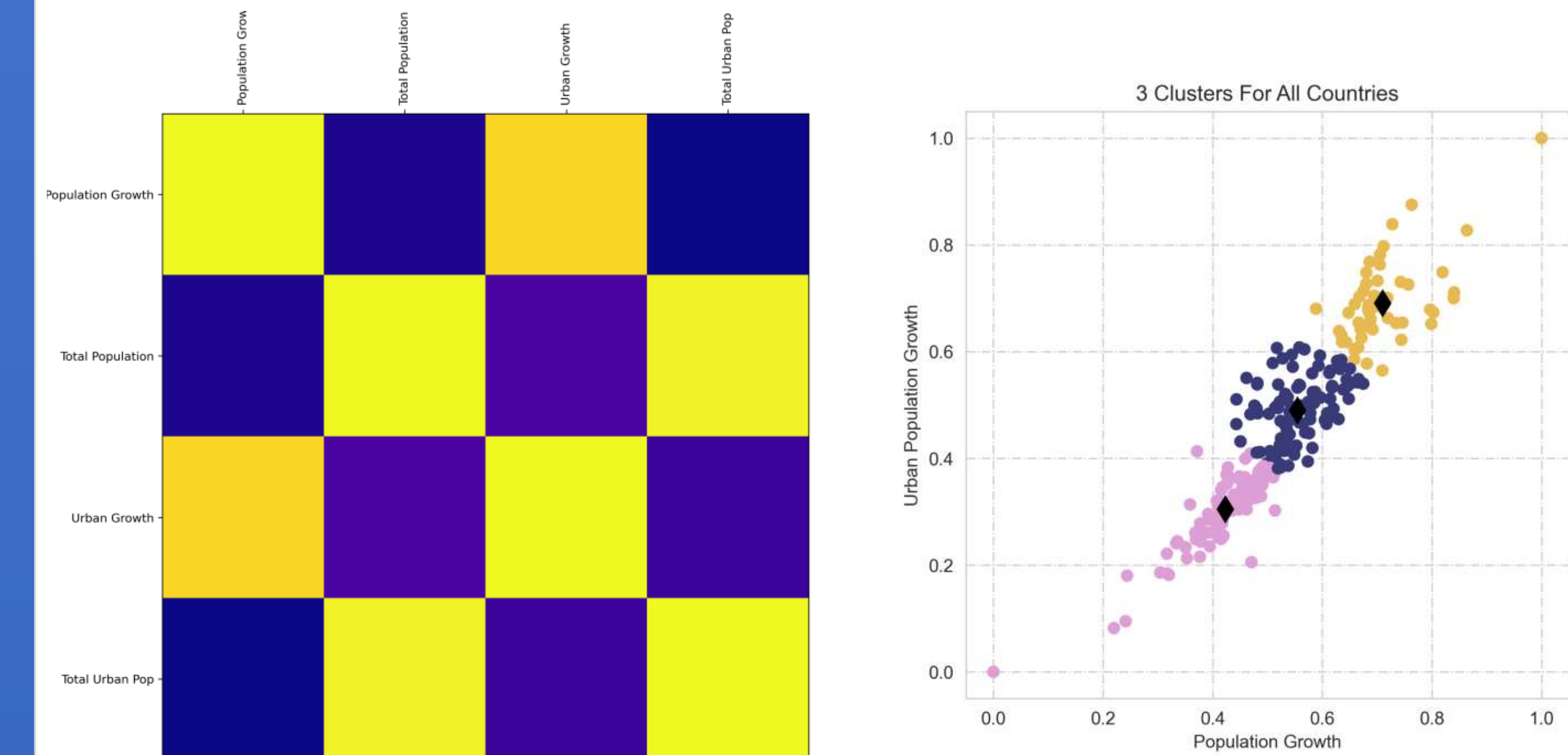
- Retrieving data and Plotting a bar chart for population growth (annual %), GDP per capita growth (annual %) for Italy, UK, US, India for the years 2016-2020.
- The chart shows consistent growth of 5 to 7% with the exception of 2019 and 2020 due to Covid-19.



Performing k-means clustering on normalized data, evaluates silhouette scores, showing positive correlation



Plotting scatter matrix and a scatter plot showing clusters based on population growth and urban population growth.



## Conclusion

- This successfully performs data manipulation, fitting, and visualization for population-related analyses.
- The exponential growth and logistic growth models provide insights into India's population dynamics.
- Handling outliers improves the accuracy of the polynomial fit for total population data.
- Clustering analysis reveals patterns in population-related indicators for selected countries.