Government of India
Ministry of Statistics and Programme Implementation

National Sample Survey Office

Field Operation Division

A REPORT ON INTERNSHIP PROJECT

(2024)

PERIODIC LABOUR FORCE SURVEY(PLFS)

WHOLESALE PRICE INDEX(WPI)

SUBMITTED BY:

Sanskruti Sonawane

Masters of Applied Statistics (2023-2025)

Symbiosis Statistical Institute, Pune

ACKNOWLEDGMENT

(Sanskruti Sonawane)

Dated: 16-August-2024

Place: Bhopal

PREFACE

Statistics focuses on data analysis, including its collection, interpretation, presentation, and organization. It encompasses designing surveys and experiments, which involves planning data collection methods. I chose this internship to gain real-world experience and hands-on practice in a professional setting. The opportunity allowed me to explore my career path, embrace new challenges, and develop a range of new skills. Throughout my internship, my primary tasks included working as a data analyst, executing various activities, and evaluating their outcomes.

Internships offer valuable opportunities to attend meetings and events, interact with professionals, and build a network. This exposure has introduced me to useful resources and diverse professionals in my field, helping me secure references and explore new job opportunities. Additionally, having a professional mentor has been a significant benefit.

As a college student, I recognize the importance of a strong resume, which can be crucial for securing job positions. Internships are an excellent way for students to gain experience and enhance their resumes. I learned effective time management during my internship, understanding the importance of every minute in a fast-paced professional environment. Time management is crucial for attending meetings, meeting deadlines, making phone calls, and more. Internships provide foundational skills for future careers, and I chose this one based on our shared interests and potential career paths.

This internship allowed me to study and become acquainted with the Official Statistics system in India, including data collection, processing, analysis, publication, and dissemination. It also provided insight into the Indian Statistical Service and Subordinate Statistical Service, helping me consider a career in the field of Statistics.

This report reflects my firsthand experience working with the National Sample Survey Office (Field Operations Division) in Bhopal over two months. The preparation of this report was facilitated by interactions with officials and a supportive work environment. This internship was my first experience working in an office setting.

(Sanskruti Sonawane)

CONTENT

CHAPTER 1

Ministry of Statistics and Programme Implementation

The Ministry of Statistics and Programme Implementation, established as an independent ministry on October 15, 1999, was formed by merging the Department of Statistics and the Department of Programme Implementation. It has two main wings: the National Statistical Office (NSO), which includes the Central Statistical Office (CSO), Computer Centre , and National Sample Survey Office (NSSO), and the Programme Implementation Wing, which oversees various national programs like the Twenty Point Programme and Infrastructure Monitoring.

The Ministry emphasizes the quality and coverage of the statistics it releases, drawing from administrative sources, surveys, and censuses conducted by both central and state governments. Surveys are conducted using scientific sampling methods, with data collected by dedicated field staff. The Ministry also adheres to international standards, such as the IMF's Special Data Dissemination Standards (SDDS), maintaining an 'Advance Release Calendar' and participating in global discussions on statistical methodologies. The Indian statistical system is recognized as one of the best globally, with the Ministry contributing significantly to international statistical practices and standards.

Under the Ministry of Statistics and Programme Implementation (MoSPI), the primary departments responsible for managing India's statistical system and program implementation are:

National Statistical Office (NSO)

The NSO is the central agency within MoSPI that coordinates and oversees the country's statistical activities. It ensures the reliability, consistency, and accuracy of the statistical data produced and disseminated across India.

Central Statistical Office (CSO): A vital unit within the NSO, the CSO is responsible for the compilation and publication of national accounts, including GDP estimates, economic statistics, and other data critical for policy-making and economic analysis. The CSO's work supports the government's understanding of economic trends and helps in planning national policies.

National Sample Survey Office (NSSO): The NSSO conducts large-scale sample surveys to collect extensive socio-economic data from across the country. These surveys cover a broad spectrum of topics, such as employment, consumer expenditure, health, and education. The data provided by the NSSO is crucial for evaluating the socio-economic conditions of various population groups and informs both policy decisions and academic research.

Computer Center: The Computer Center provides the IT infrastructure and support necessary for the ministry's statistical operations. It ensures the secure processing, storage, and dissemination of data, enabling efficient handling of vast datasets and timely production of statistical reports.

Programme Implementation Wing

This wing of MoSPI focuses on monitoring and implementing various national programs and projects. It ensures that these initiatives are executed efficiently and achieve their intended objectives.

Twenty Point Programme Division: Responsible for monitoring the implementation of the Twenty Point Programme, which includes various initiatives aimed at poverty alleviation, social justice, and improving the quality of life. The division tracks progress and ensures that the objectives of the program are being met across the country.

Infrastructure Monitoring and Project Monitoring Division: This division oversees the progress of key infrastructure projects and major government initiatives. It monitors timelines, budgets, and the overall execution of these projects, ensuring that they are completed as planned and contribute to national development.

Member of Parliament Local Area Development Scheme (MPLADS) Division: Manages the MPLADS, a scheme that allows Members of Parliament to recommend and fund development projects in their respective constituencies. The division ensures that these projects are implemented effectively and benefit the local communities.

National Sample Survey Office (NSSO)

The National Sample Survey Office (NSSO) is a key component of the National Statistical Office (NSO) under the Ministry of Statistics and Programme Implementation (MoSPI). It is responsible for conducting large-scale surveys to collect socio-economic data across India. The NSSO is organized into four main divisions, each with specific functions:

Survey Design and Research Division (SDRD): The SDRD is responsible for designing the surveys and ensuring the methodological rigor of the data collection process. This includes developing sampling frameworks, survey schedules, and questionnaires. The division also conducts pilot studies and research to refine survey methodologies, ensuring that the data collected is accurate and representative of the population.

Field Operations Division (FOD): The FOD is the operational arm of the NSSO, responsible for the actual data collection in the field. It has a wide network of regional and sub-regional offices across the country, which deploy field staff to collect data from households, establishments, and other entities. The division ensures that the data is collected in a timely and consistent manner, adhering to the survey design developed by the SDRD.

Data Processing Division (DPD): Once the data is collected, the DPD takes over to process and analyze the information. This division is responsible for data entry, validation, tabulation, and processing. It ensures that the data is clean, accurate, and ready for analysis. The DPD uses advanced statistical and IT tools to manage large volumes of data efficiently, producing the final datasets that are used for reporting and analysis.

Coordination and Publication Division (CPD): The CPD is responsible for coordinating the various activities within the NSSO and ensuring that the final data products are published and disseminated effectively. This division manages the release of survey reports, statistical publications, and other data outputs. It also coordinates with other divisions, government agencies, and stakeholders to ensure that the NSSO's work aligns with national priorities and that the data is accessible to policymakers, researchers, and the public.

Field Operations Division

The Field Operations Division (FOD) of the National Sample Survey Office (NSSO) is responsible for managing and overseeing the fieldwork involved in conducting surveys. Its primary role is to plan and supervise data collection activities across different regions of India. The division deploys trained field staff to collect data from households, establishments, and other sources, ensuring that this data is gathered consistently and accurately in line with established methodologies. The FOD also coordinates with regional offices to monitor field operations, address any issues that arise during data collection, and provide feedback to improve the process. This division plays a crucial role in ensuring the reliability and representativeness of the data collected for NSSO surveys.

CHAPTER 2

The Field Operations Division (FOD) of the National Sample Survey Office (NSSO) plays a pivotal role in conducting large-scale data collection and surveys across India. It focuses on gathering reliable statistical data on various socio-economic aspects, which supports informed policy-making and national planning. The FOD ensures the accuracy and comprehensiveness of data used to understand and address India's diverse economic and social challenges.

Ongoing Schemes of NSSO

Household Consumption Expenditure Survey (HCES)
HCES collects detailed information on the consumption patterns and expenditure of households. It provides insights into how households allocate their spending across various goods and services. This data is crucial for understanding living standards, poverty levels, and the impact of price changes on consumption.

Annual Survey of Unorganized Sector Enterprises (ASUSE)
ASUSE gathers data on the unorganized sector, which includes small and informal enterprises. The survey covers aspects such as business performance, employment levels, and financial conditions. It helps in assessing the contribution of the unorganized sector to the economy and understanding its challenges.

Time Use Survey (TUS)
TUS collects data on how individuals allocate their time across different activities, such as work, household chores, and leisure. It provides valuable insights into daily routines, work-life balance, and the distribution of unpaid labor. This data is useful for understanding socio-economic patterns and making informed policy decisions.

Agricultural Survey
This survey provides data on various aspects of agriculture, including crop production, land use, and farm conditions. It aims to assess agricultural productivity and the economic conditions of farming communities. The data supports agricultural planning, rural development, and policy-making.
UFS creates a comprehensive frame for urban surveys and censuses. It collects data on urban areas, including housing conditions, infrastructure, and demographic details. This survey supports urban planning and helps in updating urban population data for various surveys and studies.

Consumer Price Index (CPI)

CPI measures the average change in prices paid by consumers for a basket of goods and services. It tracks inflation and helps in understanding the cost of living. CPI data is used for adjusting wages, pensions, and for economic policy-making.

Revenue and Price Census (RPC)

RPC collects data on revenue and pricing across different sectors. It provides insights into price trends and revenue generation in various industries. This information is useful for economic monitoring and for setting policies related to pricing and revenue management.

Periodic Labour Force Survey (PLFS)

PLFS gathers comprehensive data on labor force participation, employment, and unemployment. It provides insights into the labor market, including trends in job creation and workforce dynamics. The survey is essential for understanding labor market conditions and formulating employment policies.

Annual Survey of Industries (ASI)

ASI collects detailed data on industrial production, employment, and financial performance of industrial units. It helps in assessing the industrial sector's contribution to the economy and provides information on production trends and economic performance of industries.

Wholesale Price Index (WPI)

WPI measures changes in the prices of wholesale goods and commodities. It provides an indication of inflationary trends at the wholesale level and reflects price movements in the economy. WPI data is used for economic analysis and policy-making related to price stability.

CHAPTER 3

Analysing Gender Disparities in Workforce Participation: A Comprehensive Study of Male and Female Employment Rates with Forecasting and Sectoral Analysis

Introduction

The Periodic Labour Force Survey (PLFS) is a critical initiative conducted by the National Sample Survey Office (NSSO) under the Ministry of Statistics and Programme Implementation (MoSPI). It provides a comprehensive analysis of India's labor market by capturing a wide range of labor market indicators, focusing on aspects such as employment patterns, unemployment rates, and labor force participation rates. The survey offers valuable insights into both formal and informal sectors, playing a pivotal role in assessing labor market conditions over time and supporting policymakers in addressing labor-related issues.

The PLFS is designed with a rigorous methodology to ensure accuracy and representativeness. It employs a broad sampling approach to cover various demographics and regions, providing a nuanced view of employment and unemployment trends. The survey's detailed data collection and analysis make it an indispensable tool for researchers, economists, and policymakers, enabling informed decisions based on a thorough understanding of labor market dynamics.

Objective

The PLFS aims to provide detailed information on labor market dynamics, including employment status, unemployment rates, and labor force participation. It covers topics related to the labor market, such as job types, working conditions, and demographic details of the workforce.

The PLFS is conducted periodically, with surveys typically carried out annually and quarterly. This regularity allows for the tracking of labor market trends over time and provides timely data for policy-making and economic analysis.

Frequency and Coverage

The survey employs a combination of direct interviews and data collection methods to gather information from households across the country. It uses a stratified random sampling approach to ensure that the data is representative of different regions, socio-economic groups, and employment sectors.

PLFS collects data on key indicators such as:
- Employment Status: Information on employment, including full-time, part-time, and informal sector jobs.
- Unemployment Rates: Measures of unemployment and underemployment, helping to assess the health of the labor market.
- Labor Force Participation Rate (LFPR): The proportion of the working-age population actively participating in the labor force.

The PLFS follows rigorous methodological standards to ensure data accuracy and reliability, including standardized questionnaires, detailed fieldwork protocols, and extensive training for field staff. The data collection process is designed to minimize biases and errors, providing a robust dataset for analysis.

Data Source

The Periodic Labour Force Survey (PLFS) data in India is primarily sourced from the National Statistical Office (NSO), which functions under the Ministry of Statistics and Programme Implementation (MOSPI). This comprehensive survey provides crucial insights into labor force indicators such as employment, unemployment, and labor force participation rates across the country. Conducted through a stratified multi-stage sampling design, the PLFS ensures data representation at both national and state levels, covering rural and urban areas. The data is published in detailed reports and is accessible through the National Data Archive (NAD) for researchers and policymakers, offering a robust foundation for labor market analysis in India.

Analysis:
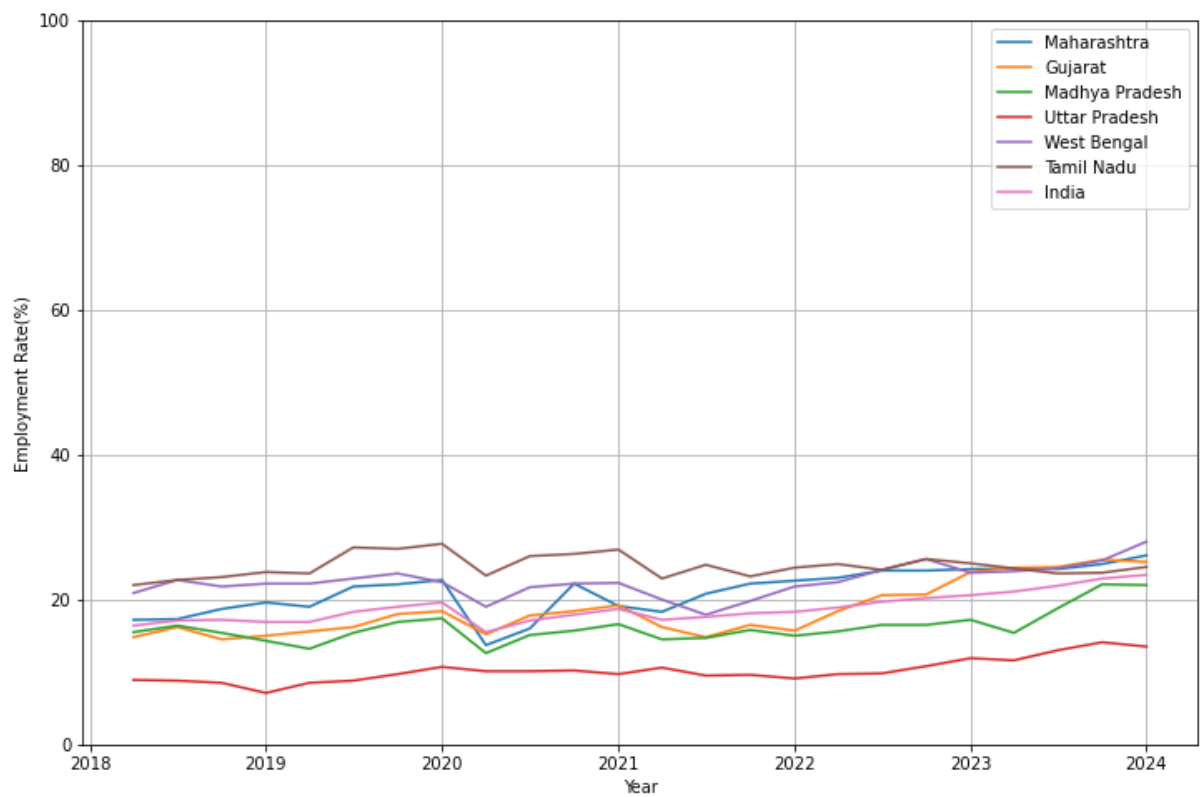
Fig. 1. Time plot of quarterly urban workforce participation rate estimates for male persons of age 15+ years from April-June, 2018 to January-march, 2024 for the major Indian states as well as at all India
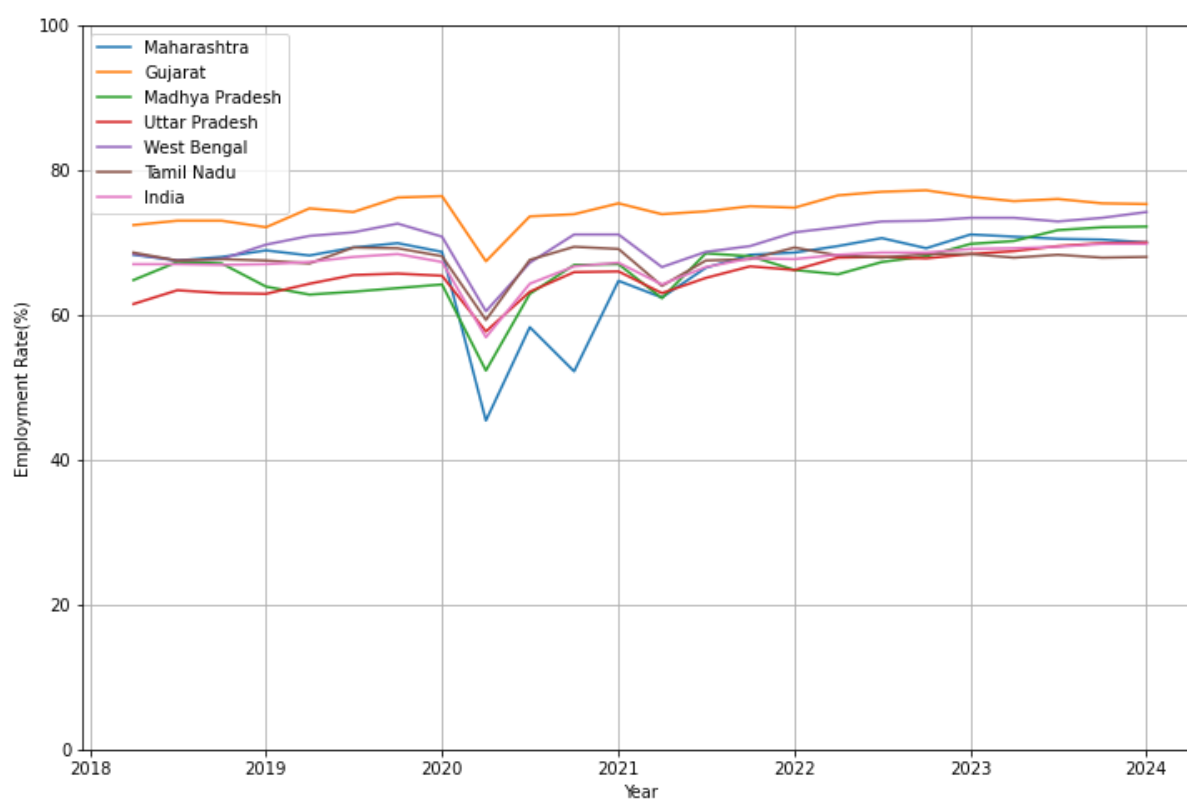
Fig. 2. Time plot of quarterly urban workforce participation rate estimates for Female persons of age 15+ years from April-June, 2018 to January-march, 2024 for the major Indian states as well as at all India.

Interpretation:

• The significant disparity between male and female workforce participation highlights ongoing gender inequalities in the labor market, necessitating targeted policies to enhance female employment opportunities and remove barriers.

• The temporary decline in employment due to COVID-19, followed by a return to pre-COVID levels, demonstrates the labor market's resilience but underscores the need for continued support to address lingering effects and ensure sustainable recovery.

• The variation in employment among states reflects differing regional economic conditions, responses to the pandemic, and structural factors influencing employment.

• States with more robust economic structures and recovery strategies, such as Gujarat, were better able to mitigate the pandemic's impact on employment.

Forecasting the April-June 2024 Quarter Using the Grey Model:

Female

State	Forecasted Value	RMAPE
Maharashtra	26.096044	7.944733
Gujarat	25.453048	8.606048
Madhya Pradesh	19.154863	6.617701
Uttar Pradesh	13.196817	7.197537
West Bengal	24.807016	5.889524
Tamil Nadu	24.484645	5.549603
India	22.349133	4.557455

Male

State	Forecasted Value	RMAPE
Maharashtra	70.081040	7.385117
Gujarat	76.703585	1.532124
Madhya Pradesh	71.481530	3.488071
Uttar Pradesh	70.263078	1.719086
West Bengal	73.949496	2.543076
Tamil Nadu	68.199595	1.801642
India	69.452751	2.245697

Table 1&2. Urban workforce participation for male & female of age 15+ years for the quarter April-June, 2024 along with Relative Mean Absolute Percentage Error.

Interpretation:

• The female workforce participation rates for April-June 2024 are likely to vary between 13% and 26% approximately.

• Higher female participation rates are observed in Maharashtra and Gujarat.

• Lower female participation rates are seen in Uttar Pradesh and Madhya Pradesh.

• RMAPE values for female forecasts range from 4.56% to 8.61%.

• The lowest RMAPE, indicating higher forecast accuracy, is observed for the national average and Tamil Nadu, suggesting more reliable forecasts for these regions.

• The male labor force participation rates for April-June 2024 are likely to range from 68% to 77% approximately.

• Gujarat shows the highest forecasted male participation rate.

• Tamil Nadu has the lowest male participation rate among the states.

• RMAPE values for male forecasts are notably low, ranging from 1.53% to 7.39%.

• Gujarat and Uttar Pradesh show very low RMAPE, indicating very high forecast accuracy.

• Other states also exhibit relatively accurate male forecasts, with slight variations in RMAPE

Summary

Female participation forecasts vary significantly, with Maharashtra and Gujarat showing the highest rates, and Uttar Pradesh and Madhya Pradesh the lowest. Tamil Nadu and the national average provide the most reliable predictions. Male participation forecasts are consistently high, with Gujarat leading in both forecasted values and accuracy. Overall, male forecasts are more accurate and reliable. In summary, male labor force participation forecasts are more consistent and accurate than female forecasts, with improved reliability for national averages and states like Tamil Nadu and Gujarat.

Given the significant disparity observed between male and female employment rates in the quarterly historical and even forecasted or future values for April-June, we will now conduct an in-depth study focusing specifically on female workforce participation across all of India. This study will analyze data to explore the downfall of female employment, examining trends and patterns at national levels. The goal is to gain a comprehensive understanding of the factors influencing the low female workforce participation rate.

Focusing on Female workforce Participation Rate:

Comparative Analysis in Female Workforce Participation Rate in Rural Vs Urban in India.

Female workforce participation rate Comparison: Rural vs Urban in India
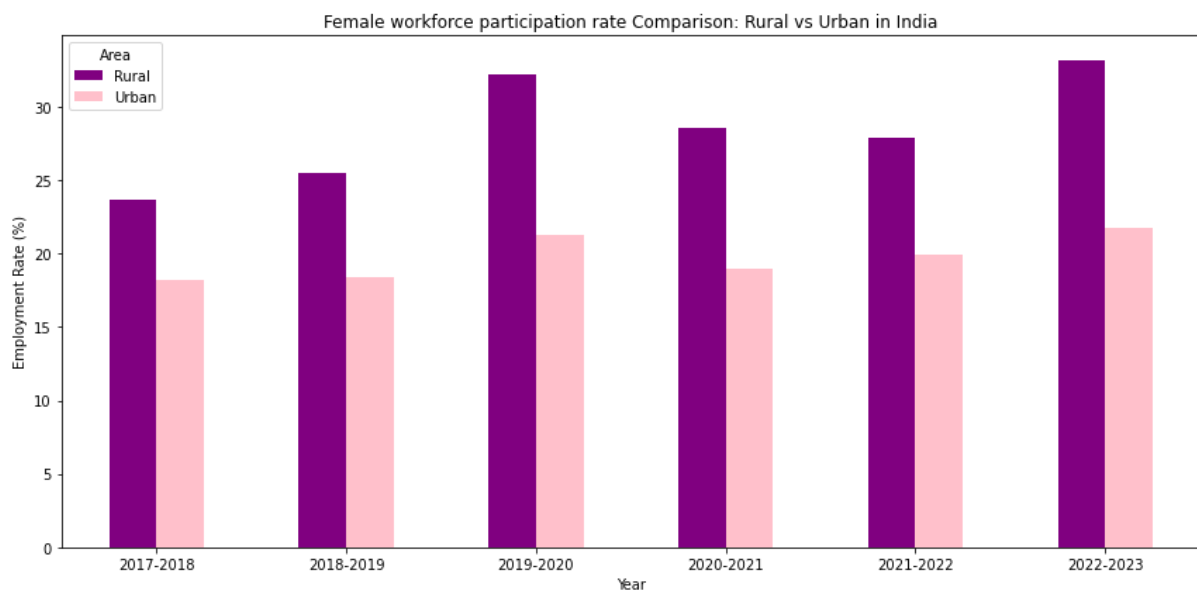
Interpretation:

• The graph shows that rural values have consistently been higher than urban values across the years.

• The gap between rural and urban values has been increasing over time.

• The percentage difference highlights how much more the rural value is compared to the urban value each year.

• This trend suggests that rural areas might be experiencing more growth or benefiting from factors that urban areas are not.

• The growing difference over time indicates a substantial and increasing disparity between rural and urban areas.

• However, Urban areas offer more formal and stable employment opportunities, which may attract fewer women due to higher competition and specific skill requirements.

• The higher cost of living in urban areas may limit women's ability to participate in the workforce unless they secure well-paying jobs.

• Rural areas often have more informal and flexible work options, such as self-employment and casual labor, which are more accessible to women.

• Limited infrastructure, such as affordable childcare, in urban areas can restrict women's participation in the labor market.

12

Female Rural and Urban Employment Rate for Year 2023-2024 in India using Holts Winter smoothing Method:

Historical and Forecasted Employment Rates for Rural and Urban Areas
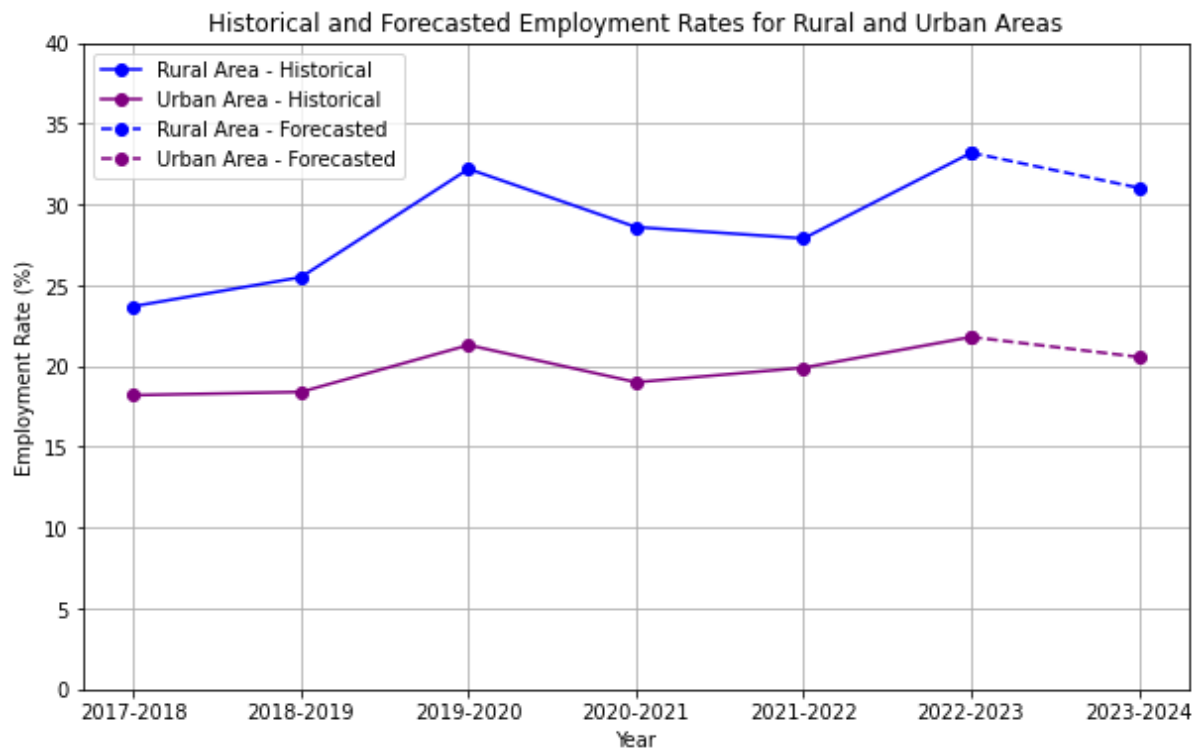
Root Mean Square Error:

```
Forecasted Employment Rate for Rural Area for 2023-2024: 31.02999997504
644
Forecasted Employment Rate for Urban Area for 2023-2024: 20.55999991399
0005
RMSE for Rural Area Forecast: 2.1700000249535627
RMSE for Urban Area Forecast: 1.2400000860099958
```
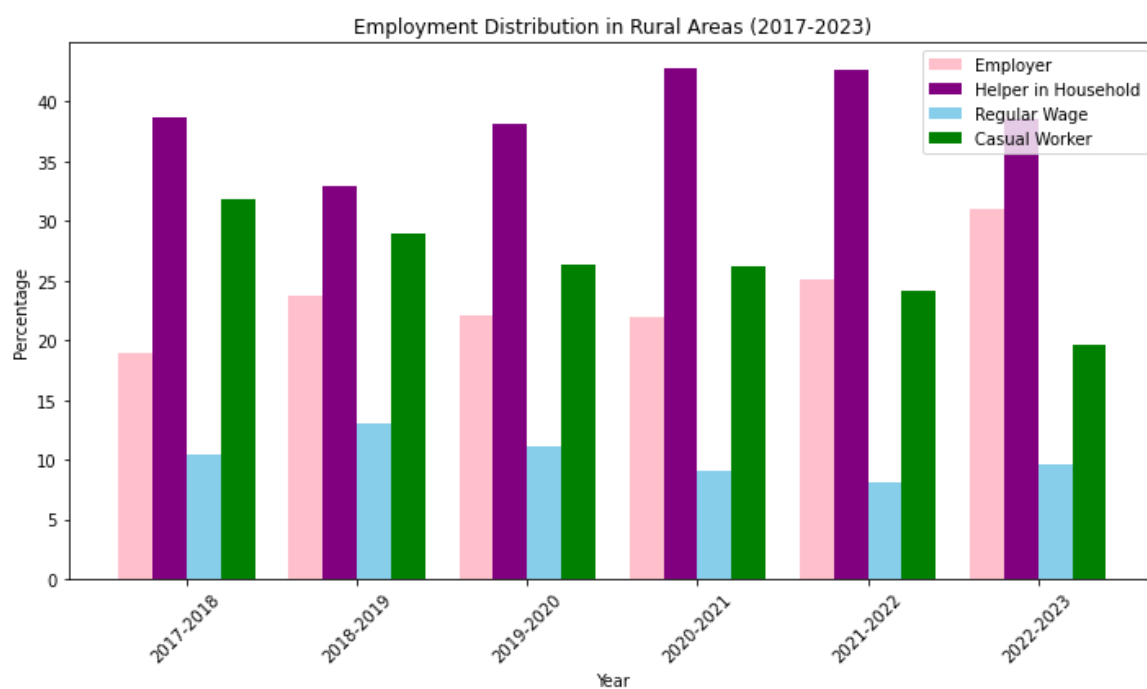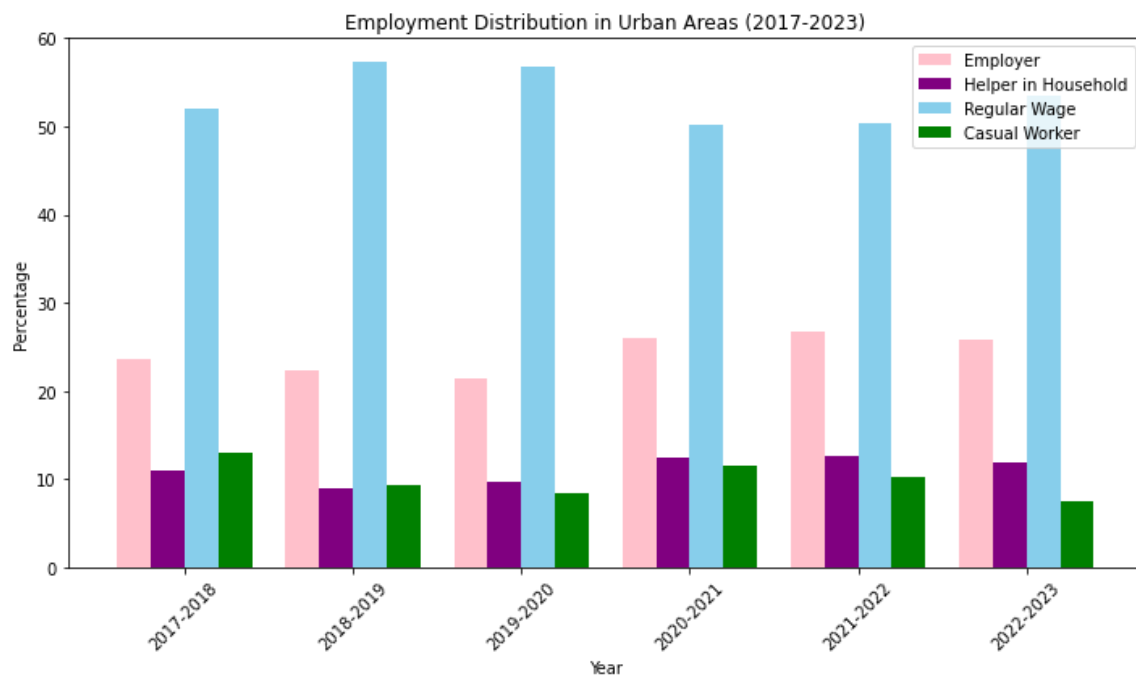
Interpretation:

• The line graph shows that rural employment rates have generally been higher than urban rates from 2017-2018 to 2022-2023, with rural rates fluctuating but increasing overall, while urban rates have remained relatively stable with slight variations.

• For the 2023-2024 period, the forecasted employment rate is likely to be 31.03% for rural areas and 20.56% for urban areas, indicating that rural employment is expected to remain higher than urban employment.

• RMSE values are 2.17 for rural and 1.24 for urban forecasts, reflecting that the forecast models are reasonably accurate, with the urban forecast showing slightly better accuracy.

• The forecast confirms the persistent disparity between rural and urban employment rates, with rural areas anticipated to continue having higher employment rates. The low RMSE valu es suggest that the predictions are probably reliable for the upcoming period.

The data reveals a concerning trend: the female workforce is growing more rapidly in rural areas compared to urban areas. This growing disparity highlights a serious issue that needs to be addressed. Moving forward, we will conduct a detailed analysis to understand the specific sectors in which females are employed in both rural and urban areas. This analysis will help us identify the underlying factors contributing to this trend and inform targeted interventions to bridge the gap.

Sectoral Distribution of Female Workforce in Rural and Urban Areas of India:

The PLFS data categorizes female workers into three sectors: self-employed, regular wage, and casual labour. The self-employed category is further divided into employer and helper in household. The bar graph presented aims to compare the sectors in which rural and urban females are employed. This comparison will help to identify the types of work that contribute to the higher workforce participation of rural females compared to their urban counterparts.

Employment Distribution in Urban Areas (2017-2023)

Employment Distribution in Rural Areas (2017-2023)

Interpretation:

• Rural women are predominantly self-employed, with many working as helpers in households, followed by casual workers and then employers.

• Limited formal employment opportunities in rural areas lead women to engage in informal and home-based work.

• A significant percentage of rural women participate in casual labor, often in agriculture or seasonal work, due to the need for flexible but unstable income sources.

• The lowest participation among rural women is in regular wage employment, reflecting the scarcity of formal job opportunities in rural regions.

• Urban women are primarily engaged in regular wage employment, especially in formal sectors like education, healthcare, and services.

• Better access to education and skill development in urban areas drives the higher engagement of urban women in formal jobs.

• Urban women have minimal participation in self-employment, particularly as helpers in households, and very low involvement in casual labor.

• Urban women often prioritize stable, formal employment, leading to a lower overall workforce participation rate compared to rural women.

• The higher workforce participation of rural women is due to their involvement across all three employment sectors, despite the informal nature of their work.

• Urban women's workforce participation is lower because they mainly focus on regular wage employment, reflecting a preference for stable and formal job opportunities.

• Urban women preferring only regular wage jobs and facing difficulty in securing these positions often results in higher unemployment rates. Additionally, the lack of non-agricultural sector opportunities in urban areas further limits employment options for women.

CONCLUSION

The analysis shows a clear difference in workforce participation between men and women across various Indian states for the April-June 2024 quarter. Forecasts suggest that female participation will likely be range from 13% to 26%, with higher rates in Maharashtra and Gujarat, and lower rates in Uttar Pradesh and Madhya Pradesh. The accuracy of these forecasts is strong, with RMAPE values between 4.56% and 8.61%. The national average and Tamil Nadu show the most reliable predictions. For men, participation rates are expected to be between 68% and 77%, with Gujarat leading in both forecasted values and accuracy. Tamil Nadu shows the lowest rates, and the RMAPE values for men range from 1.53% to 7.39%, indicating high reliability.

The significant gender gap in workforce participation highlights ongoing inequalities in the labour market. This gap was made worse by the temporary decline in employment due to COVID-19. Although employment has returned to pre-COVID levels, ongoing support is needed to ensure a sustainable recovery. The pandemic's impact varied across states, reflecting different regional economic conditions and recovery strategies, with Gujarat showing stronger resilience.

The forecast also shows that female workforce participation is growing faster in rural areas compared to urban areas. The predicted rates are higher in rural areas (31.03%) than in urban areas (20.56%), indicating a growing gap. While urban forecasts are more accurate based on RMSE values, the trend of increasing female employment in rural areas requires further analysis. Further, this analysis should look into the specific sectors where the women are employed.

Considering these trends, there is a need to address the lower workforce participation of urban women through targeted interventions. The analysis emphasizes the importance of policies that support female employment, particularly in urban areas where participation is lower than in rural areas. Understanding where and how women are employed, especially in urban settings, is crucial for developing strategies to boost female participation and close the gap between urban and rural areas.

CHAPTER 4

Analysing and Forecasting the Wholesale Price Index: A Focus on Primary Articles and Its Impact on the General WPI

Introduction

The Wholesale Price Index (WPI) is a crucial economic indicator that measures the average change in the prices of a basket of goods at the wholesale level. It provides insight into the cost trends for goods before they reach the retail market, reflecting the price movements experienced by businesses in the supply chain. The WPI is an essential tool for understanding inflationary pressures, guiding monetary policy, and analysing economic conditions.

Major Groups in WPI

The WPI typically includes several major categories:

- Primary Articles: These encompass raw materials and essential goods like food and minerals.
- Fuel and Power: This category includes energy products such as oil, gas, and electricity.
- Manufactured Products: This includes processed goods and industrial products.

Among these, primary articles often have a significant impact on the general WPI due to their fundamental role in the economy. Price fluctuations in primary articles can ripple through the supply chain, affecting overall price levels and economic stability.

Objective

The primary objective of this project is to analyse the trends and forecasting of the WPI, with a particular focus on the primary articles group. The analysis will examine historical trends, assess the impact of primary articles on the general WPI, and provide forecasts for the next 12 months. By evaluating these trends, the project aims to offer insights into how changes in the primary articles group can influence broader economic conditions.

Data Source

The Wholesale Price Index (WPI) data in India is primarily sourced from the Office of the Economic Adviser under the Ministry of Commerce and Industry. This office publishes the WPI data monthly, covering key commodity groups such as primary articles, fuel and power, and manufactured products. The data is accessible through the official website in various formats, making it a reliable source for researchers and analysts. Additionally, the Reserve Bank of India (RBI) also provides WPI data in its statistical bulletins, offering further insights into economic trends.

Items Included in Primary Articles

A. Food Articles: Food grains include cereals such as paddy, wheat, jowar, bajra, maize, barley, and ragi, and pulses like gram, arhar, moong, masur, urad, peas/chawali, and rajma. Fruits and vegetables consist of vegetables such as potato, sweet potato, onion, tapioca, ginger (fresh), peas (green), tomato, cauliflower, brinjal, okra (lady finger), cabbage, carrot, radish, cucumber, pointed gourd, bitter gourd, bottle gourd, beans, pumpkin, and drumstick, and fruits like banana, mango, apple, orange, cashew nut, coconut (fresh), papaya, grapes, pineapple, guava, litchi, lemon, sapota, mosambi (sweet orange), pomegranate, amla, jackfruit, pear, almonds, and walnut. Milk includes just milk, while eggs, meat, and fish comprise egg, fish-inland, fish-marine, mutton, beef and buffalo meat, poultry chicken, and pork. Condiments and spices are black pepper, chillies (dry), turmeric, cardamom, ginger (dry), betelnut/arecanut, cumin, garlic, coriander, and tamarind. Other food articles are tea, coffee, betel leaves, and sugarcane.

B. Non-Food Articles: Fibres include raw cotton, raw jute, mesta, raw wool, raw silk, and coir fibre. Oil seeds are groundnut seed, rape & mustard seed, cotton seed, copra (coconut), gingelly seed (sesamum), linseed, castor seed, niger seed, safflower (kardi seed), sunflower, and soybean. Other non-food articles comprise hides (raw), skins (raw), tanning materials, tobacco, gaur seed, raw rubber, industrial wood, and fodder. Floriculture includes rose, jasmine, and marigold.

C. Minerals: Metallic minerals are bauxite, chromite, zinc concentrate, manganese ore, iron ore, copper concentrate, and lead concentrate. Other minerals consist of phosphorite, limestone, garnet, and sillimanite.

D. Crude Petroleum & Natural Gas: Crude petroleum includes crude petroleum, while natural gas consists of natural gas.

Prophet model

Model Preparation

To prepare a model for forecasting with Facebook's Prophet, it's crucial to properly train and test the model to ensure its accuracy and reliability. Prophet is designed for handling time series data with strong seasonal patterns and holidays. The preparation involves several key steps:

Data Formatting: Prophet requires the input data to be in a specific format, with columns named ds for dates and y for the target variable. Ensuring that the data is clean, correctly formatted, and includes all relevant time periods is essential.

Train-Test Split: To evaluate the model's performance, the data should be divided into training and testing sets. The training set is used to fit the model, while the testing set is reserved for validating the model's accuracy. A common practice is to use the most recent data as the test set.

Model Training: Fit the Prophet model on the training data, allowing it to learn the underlying patterns, trends, and seasonal effects. Customizations such as adding holidays or adjusting seasonalities can be made to improve the model's fit.

Model Testing: After training, evaluate the model's performance on the test set. This involves generating forecasts and comparing them against actual values to assess accuracy using metrics such as RMSE or MAPE.

Analysis:

Line Graph of Major WPI groups:
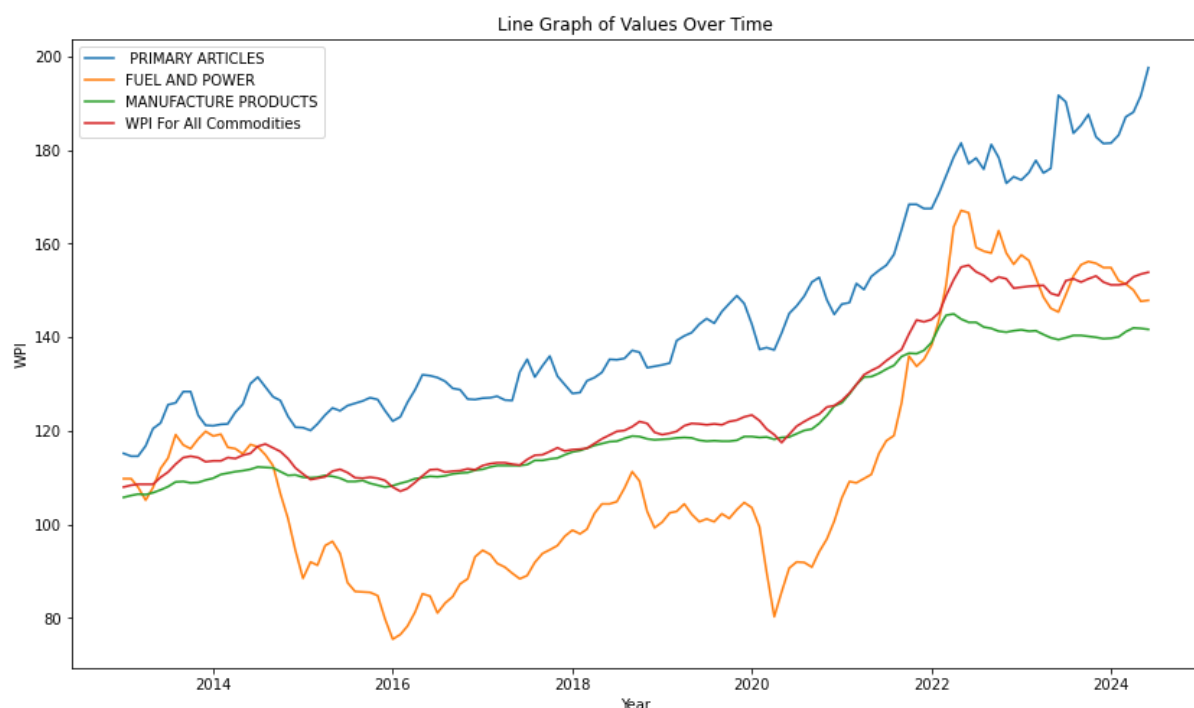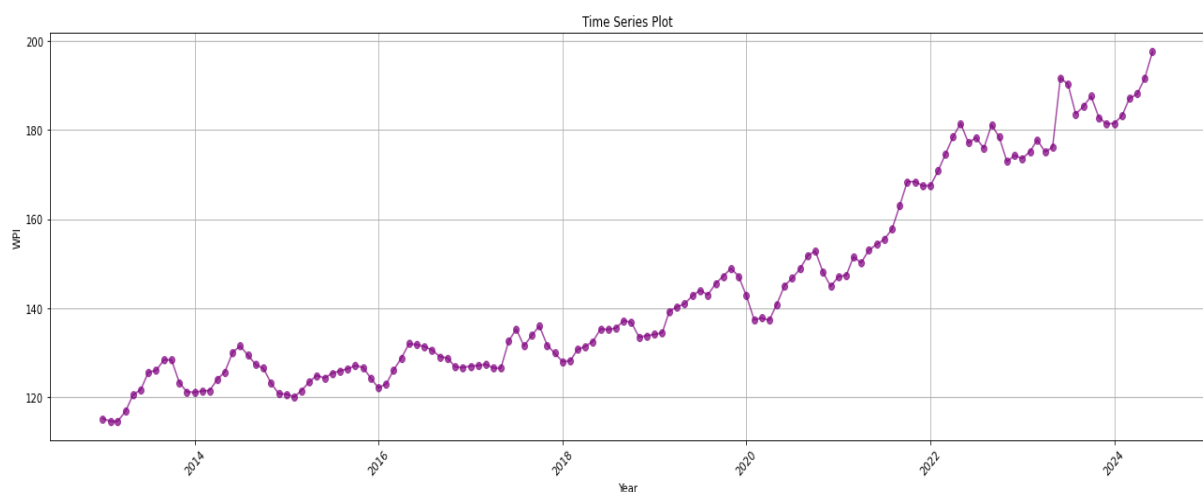

Interpretation:

• The upward trend in the Primary Articles line suggests rising prices for essential commodities such as food grains, fruits, and raw materials, indicating inflationary pressures in this category.

• The Fuel and Power line is lower and shows troughs, reflecting volatility in fuel prices, which are influenced by global oil prices, geopolitical events, and supply-demand dynamics.

• The lower position of Fuel and Power indicates that, despite fluctuations, prices in this category have not experienced the same sustained upward pressure as Primary Articles.

• The Manufactured Products category typically includes finished goods like textiles and machinery. A stable or lower trend here suggests more moderate inflation or price stability compared to Primary Articles.

• The General WPI, which represents overall price levels, likely falls between the lines of Primary Articles and Fuel and Power, indicating that while there is inflation in primary goods, it is moderated by the lower or stable prices in other categories.

• The combination of these trends highlights the significant impact of rising primary goods prices on the overall inflation, with the volatility in Fuel and Power contributing to the fluctuations observed in the General WPI.
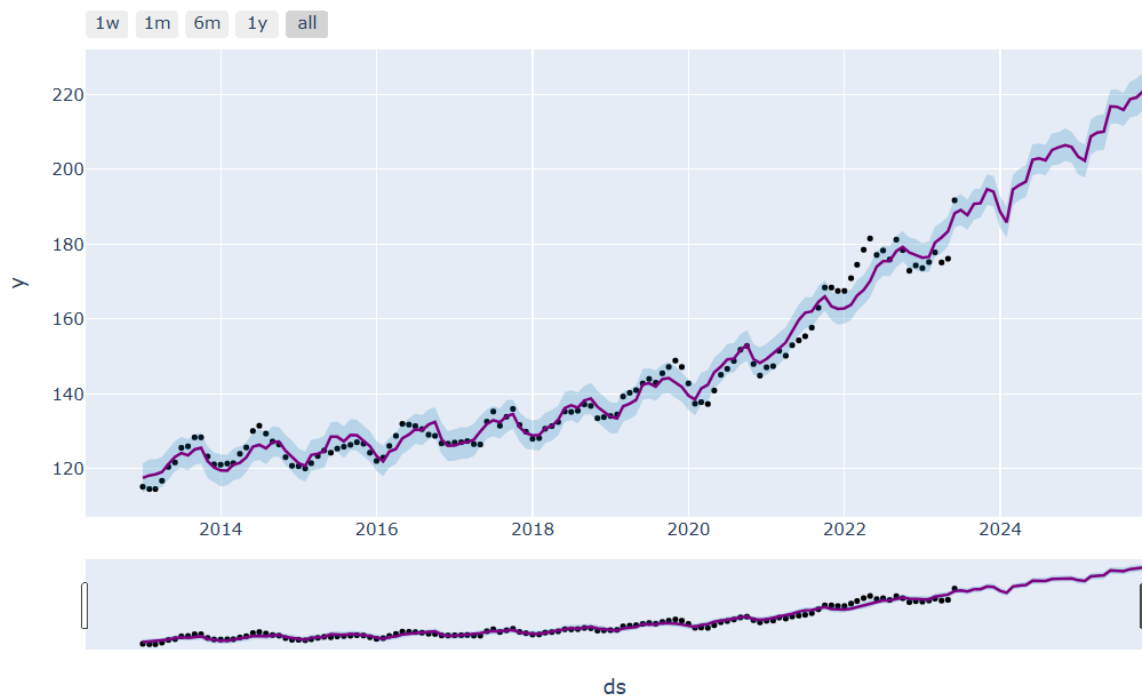
Primary Articles WPI:

Time Series Plot for Wholesale Price Index of Primary Articles:

Interpretation:

• The graph shows an upward trend of values over time from 2014 to 2024.

• The values fluctuate with a seasonal pattern, showing peaks and troughs throughout the year.

**Wholesale Price Index for Primary Articles from July 2024-June 2025:**

Wholesale Price Index of Primary Articles for next 12 months:

	ds	yhat	yhat_lower	yhat_upper
139	2024-07-31	202.412217	198.280824	206.581072
140	2024-08-31	205.156031	200.946059	209.293112
141	2024-09-30	205.854080	201.910575	210.143078
142	2024-10-31	206.438032	202.420219	210.671647
143	2024-11-30	205.920000	201.476640	210.349159
144	2024-12-31	203.342101	199.183922	208.070312
145	2025-01-31	202.262134	197.842528	206.570324
146	2025-02-28	208.751406	204.245508	212.861891
147	2025-03-31	209.808326	205.313022	214.246016
148	2025-04-30	210.040318	205.738657	214.408968
149	2025-05-31	216.772896	212.340403	221.474181
150	2025-06-30	216.659702	212.017519	221.228765

Interpretation:

• The values in the table show an upward trend with some fluctuations.

• The range of possible values (represented by yhat_lower and yhat_upper) becomes wider over time, indicating increasing uncertainty in the predictions.

• There appears to be a seasonal pattern with higher values in the later part of the year (October to December) and lower values in the early part (January to March).

• The data covers the period from July 2024 to June 2025.

Trend and Seasonality:
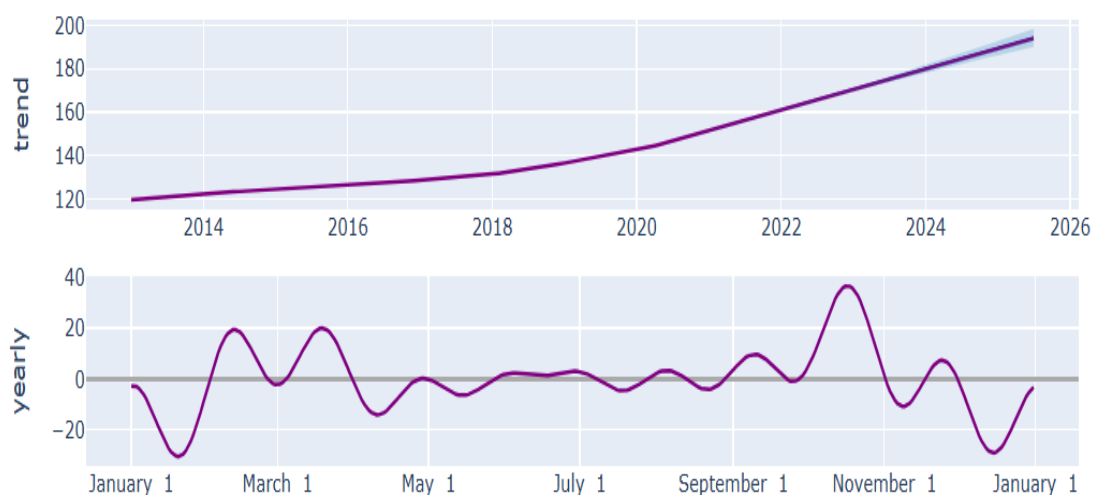
Interpretation:

• The chart shows values increasing from 2014 to 2024, and this rise is expected to continue through 2026.

• The data exhibits a seasonal pattern characterized by recurring peaks and troughs throughout the year.

• The dip in January could be due to a post-holiday slowdown, where economic activity reduces following the festive season.

• Agricultural cycles may also contribute to the January dip, especially if the primary articles include products that experience reduced supply or lower prices after peak harvest periods.

Inflation Rate of Primary Articles from July 2024-June 2025:

Month	Previous Year WPI	Forecasted WPI	Inflation Rate (%)	Inflation Rate Upper (%)	Inflation Rate Lower (%)
July 2024	190.3	202.41	6.36	8.60	4.30
August 2024	183.6	205.16	11.74	13.96	9.58
September 2024	185.3	205.85	11.09	13.30	8.85
October 2024	187.6	206.44	10.04	12.30	7.72
November 2024	182.8	205.92	12.65	14.81	10.20
December 2024	181.4	203.34	12.10	14.35	9.75
January 2025	181.5	202.26	11.44	13.83	8.94
February 2025	183.2	208.75	13.95	16.43	11.39
March 2025	187.1	209.81	12.14	14.41	9.64
April 2025	188.1	210.04	11.66	14.06	9.24
May 2025	191.6	216.77	13.14	15.46	10.63
June 2025	197.6	216.66	9.65	11.80	7.22

Interpretation:

• The Inflation rate would probably range from 6.36% to 13.95% between July 2024 and June 2025.

• Inflation rate is expected to be volatile, with highs in August and November 2024 and February 2025.

• Upper and lower bounds of inflation rate indicate a range of possible outcomes.

• Overall, the Inflation Rate is expected to rise during the forecast period.

• In the prediction of the inflation rate for primary articles, the error in the forecasted values is approximately **8.77%.**

Time Series Plot for General Wholesale Price Index:

Time Series Plot
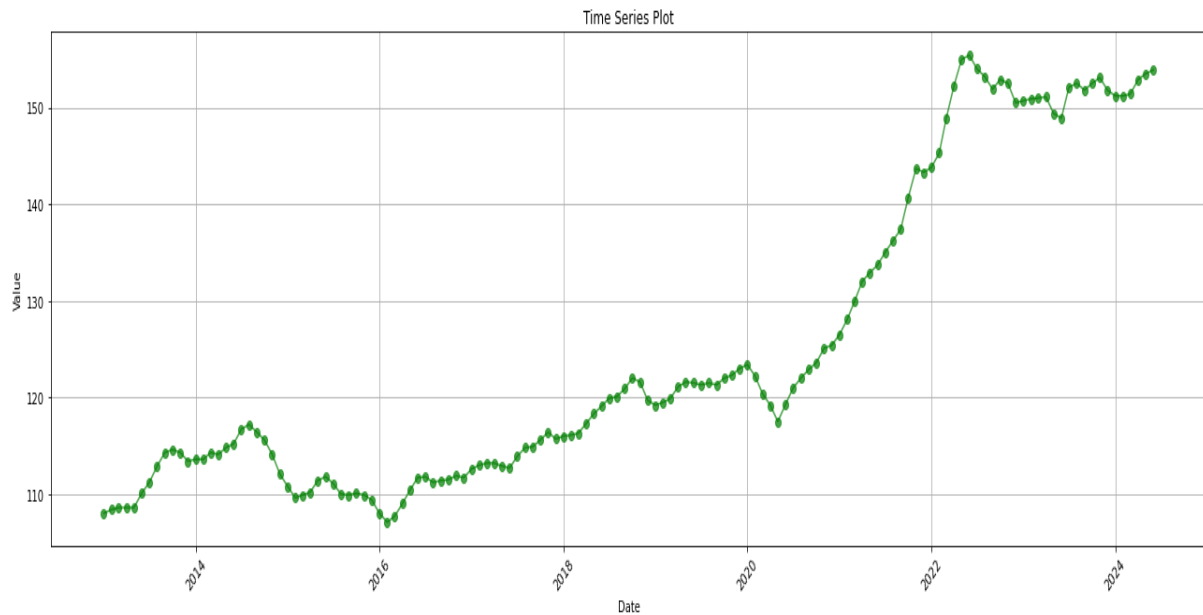
Interpretation:

• The graph shows an upward trend in General Wholesale Price Index (WPI) from 2014 to 2024.

• There are fluctuations around the overall upward trend, indicating seasonal variations.

• The amplitude of these fluctuations appears to have increased in recent years.

• The WPI reached a sudden peak in 2020-2022, which may be attributed to factors such as the COVID-19 pandemic and related supply chain disruptions

General Wholesale Price Index from July 2024-June 2025:
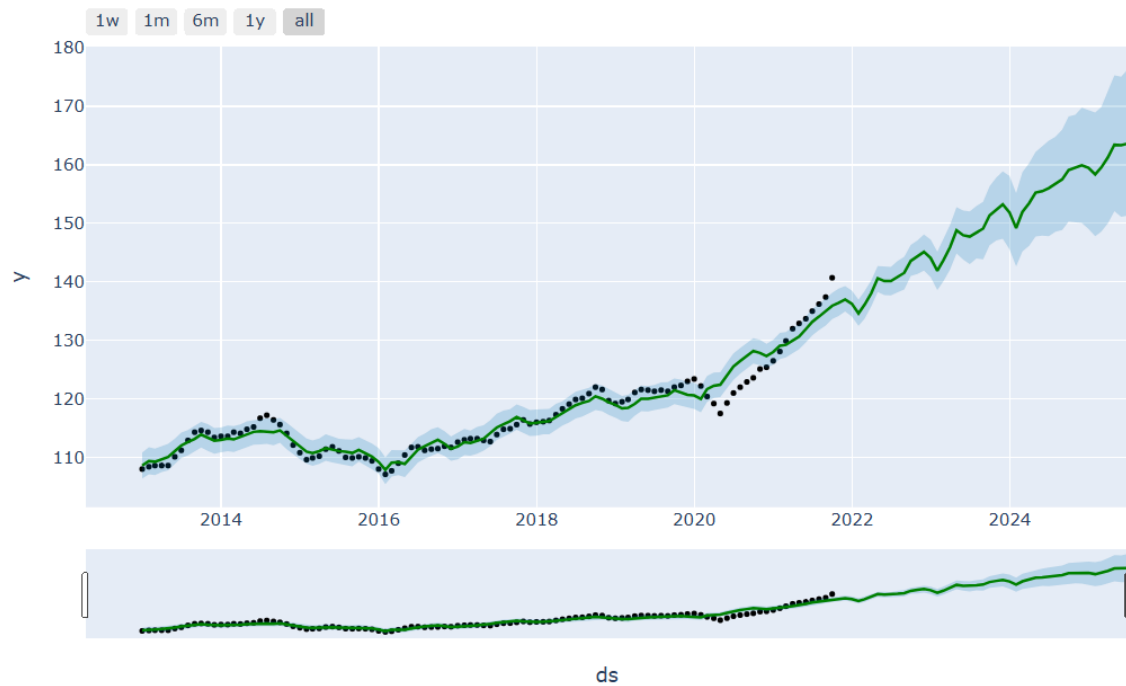
General Wholesale Price Index next 12 Months:

	ds	yhat	yhat_lower	yhat_upper
139	2024-07-31	156.802388	148.558847	164.829820
140	2024-08-31	157.515498	148.848489	165.994838
141	2024-09-30	159.134665	150.303880	168.263154
142	2024-10-31	159.553871	150.121411	168.580896
143	2024-11-30	159.914078	150.068151	169.750446
144	2024-12-31	159.493707	149.039160	169.436600
145	2025-01-31	158.369797	147.791638	168.941113
146	2025-02-28	159.547006	148.589610	169.859735
147	2025-03-31	161.283124	150.008640	172.582596
148	2025-04-30	163.464463	152.080702	175.305451
149	2025-05-31	163.362217	151.137519	175.058093
150	2025-06-30	163.626905	151.338982	176.287485

Interpretation:

• The predicted values indicate a steady increase in the general WPI, with the index likely to be rising from 156.80 in July 2024 to 163.63 by June 2025.

• The confidence intervals widen slightly over time, suggesting increasing uncertainty in the forecasts as the prediction horizon extends.

• A notable peak is expected in April 2025, with the WPI forecasted to reach 163.46, continuing the upward trend observed in previous months.

• The range of possible values, indicated by the lower and upper bounds, reflects the potential variability, with the lower bound consistently staying above 148, and the upper bound reaching up to 176.29 by June 2025.

Trend And Seasonality:
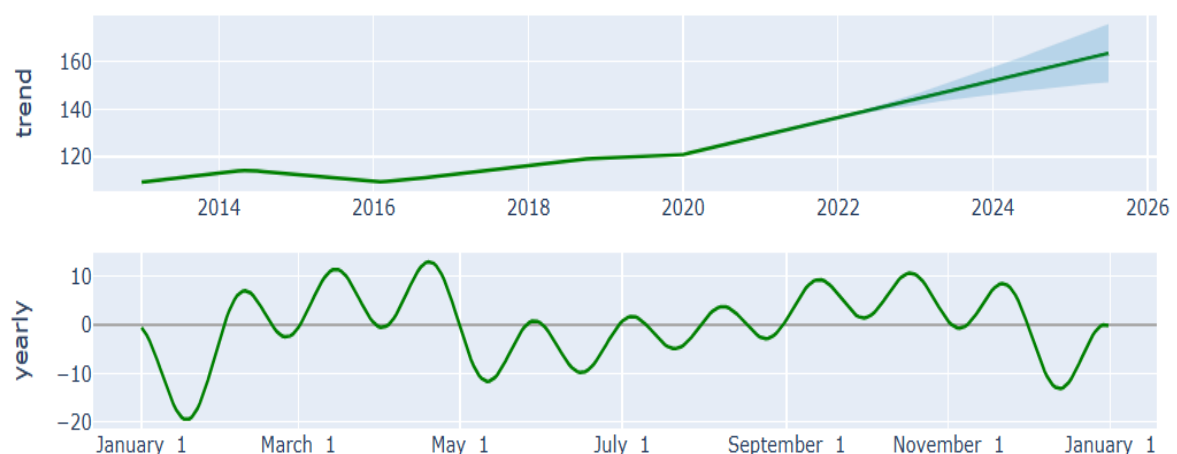
Interpretation:

• The trend chart shows a consistent upward trend in values from 2014 to 2026.

• The data showcases a seasonal pattern with a trough in January, a subsequent peak from February to April, a trough from May to August, and another peak lasting until December.

• These seasonal fluctuations could be attributed to factors such as agricultural cycles, festive seasons, weather conditions, and consumer spending patterns.

• The interplay of the upward trend and seasonal variations results in a fluctuating pattern of values over time.

**Inflation Rate for all Commodities from July 2024-June 2025:**

Month	Previous Year Value	Forecasted Value (yhat)	Inflation Rate (yhat)	Inflation Rate (yhat_lower)	Inflation Rate (yhat_upper)
July 2024	152.1	156.802388	3.09%	-2.32%	8.36%
August 2024	152.5	157.515498	3.29%	-2.39%	8.83%
September 2024	151.8	159.134665	4.83%	-0.99%	10.84%
October 2024	152.5	159.553871	4.62%	-1.56%	10.53%
November 2024	153.1	159.914078	4.45%	-1.98%	10.87%
December 2024	151.8	159.493707	5.07%	-1.82%	11.60%
January 2025	151.2	158.369797	4.73%	-2.25%	11.72%
February 2025	151.2	159.547006	5.52%	-1.73%	12.34%
March 2025	151.4	161.283124	6.53%	-0.92%	13.97%
April 2025	152.9	163.464463	6.91%	-1.28%	14.98%
May 2025	153.5	163.362217	6.41%	-1.64%	14.86%
June 2025	153.9	163.626905	6.29%	-1.51%	15.04%

Interpretation:

• The inflation rate is likely to fluctuate between a minimum of 3.09% and a maximum of 6.91% throughout the period from July 2024 to June 2025 from previous year

• The highest points of inflation are expected to occur in March and April of 2025.

• The range of potential inflation rates, represented by the upper and lower bounds, becomes wider as we move closer to the end of the forecast period, indicating increased uncertainty.

• Despite short-term fluctuations, there is a general upward trajectory predicted for the WPI inflation rate over the entire forecast period.

• In the prediction of the General WPI, the error in the forecasted values is approximately **4.39%.**

Comparative Analysis:

Inflation Rates Comparison: Primary Articles vs General WPI
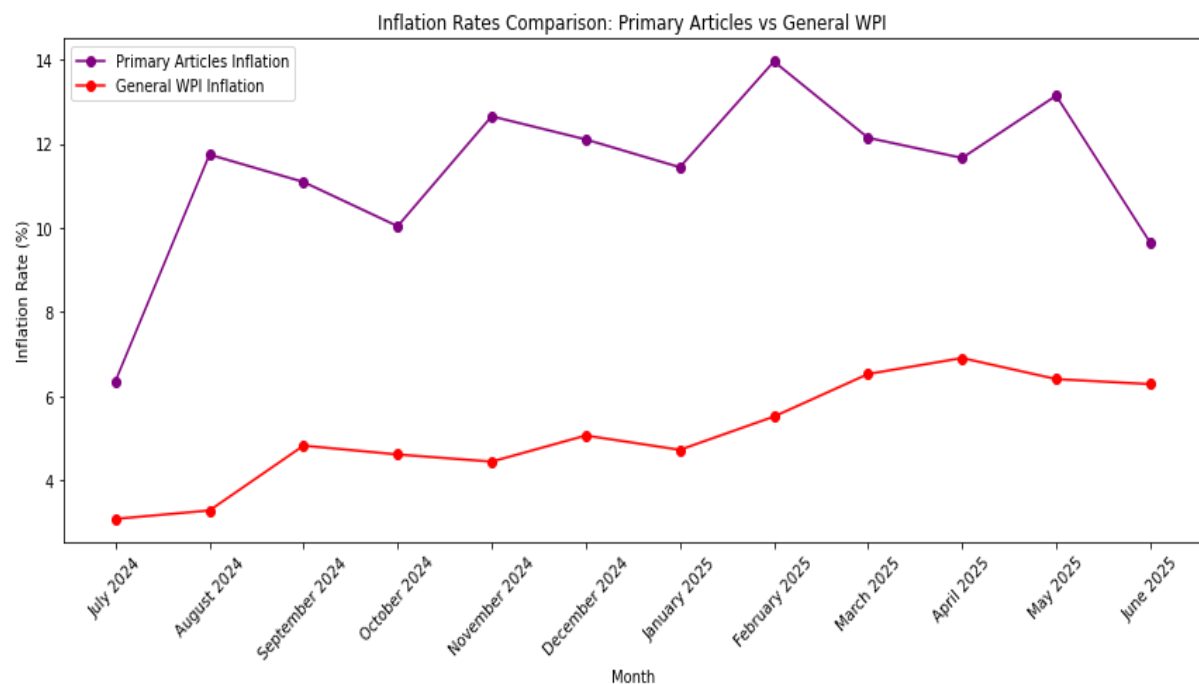
Interpretation:

• Primary articles, including essential goods and raw materials, significantly impact the general WPI. Price changes in these primary goods can drive up costs for other commodities and services, affecting the overall WPI inflation rate.

• The influence of primary articles on the general WPI appears stronger compared to other groups, indicating that their price fluctuations are more impactful.

• Monitoring primary articles' inflation rates is crucial as they can signal changes in the general WPI. This information helps businesses, policymakers, and economists anticipate broader economic trends and make informed decisions.

• Understanding the impact of primary articles on the general WPI aids in policy formulation. If primary articles drive inflation, targeted policies can stabilize these prices and reduce their effect on overall inflation.

• The correlation between primary articles and the general WPI highlights the interconnected nature of economic components, providing insights into broader economic trends and helping manage inflationary pressures.

In summary, your observation suggests a significant relationship between the inflation rates of primary articles and the general WPI, indicating that fluctuations in primary articles' prices can substantially influence the overall inflation rate of the WPI. This relationship underscores the importance of tracking primary articles' inflation as a key economic indicator.

Correlation Matrix:

Scatter Plot of PRIMARY ARTICLES vs WPI For All Commodities

Correlation Matrix

Comparison between WPI of Primary Articles and General WPI
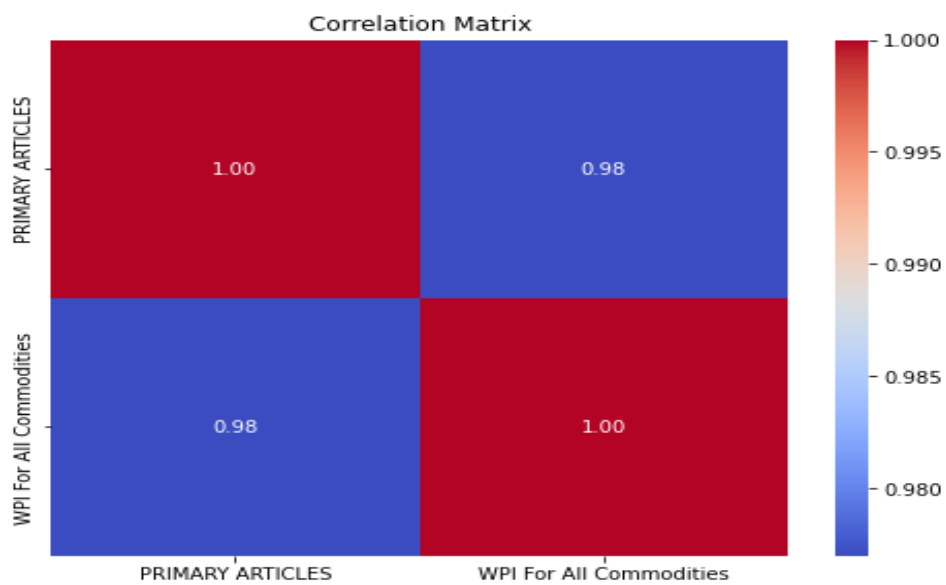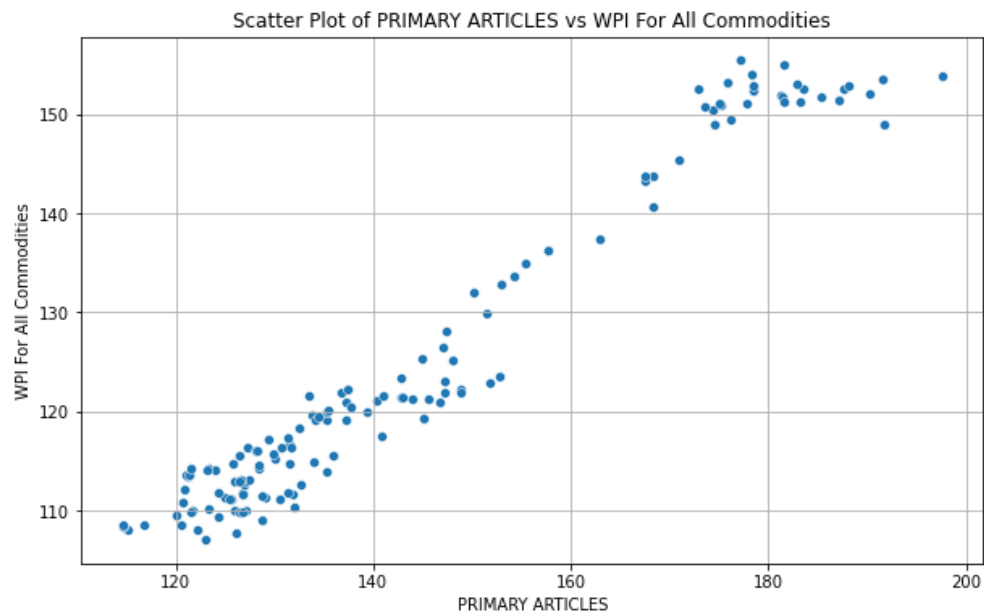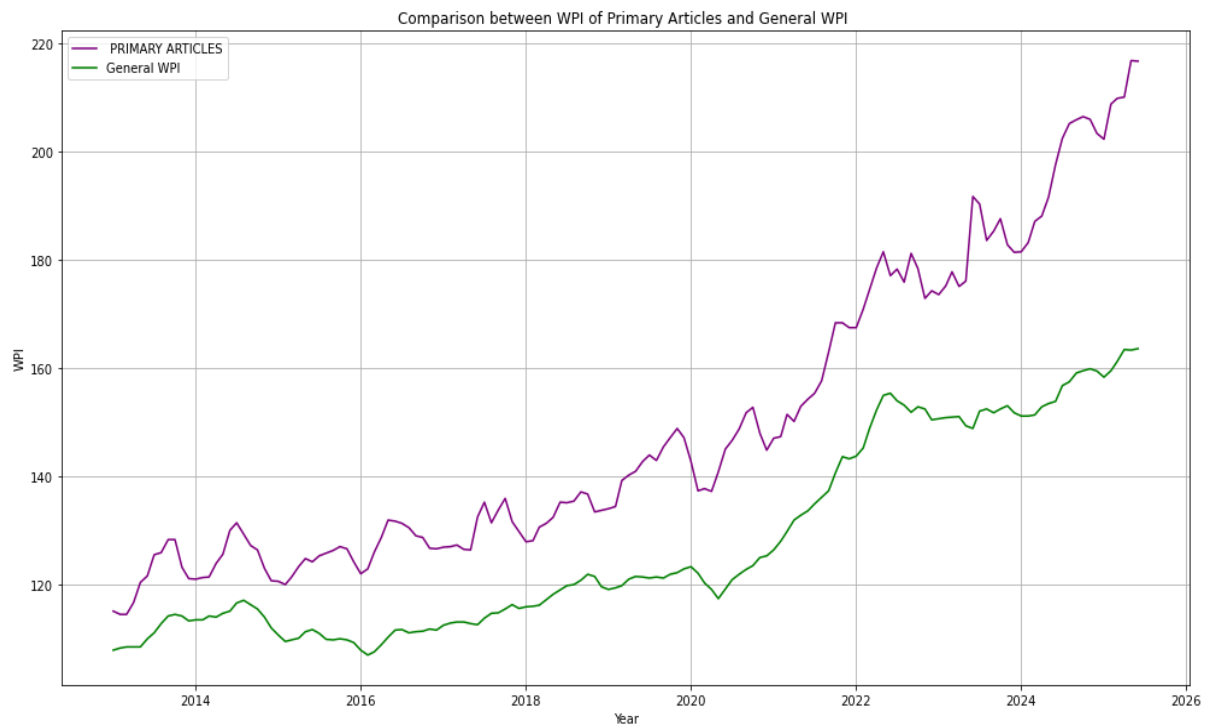
Interpretation:

• Statistically, a strong positive correlation exists between WPI of primary articles and General WPI, with a correlation coefficient of 0.98. This indicates a high degree of association between the two variables.

• The scatter plot visually reinforces this positive relationship, displaying a upward trend in the data points.

• It's crucial to remember that correlation does not necessarily imply causation. While the statistical evidence suggests a strong relationship, other factors might influence both primary articles WPI and WPI For All Commodities.

• The line graph illustrates the trends of WPI of primary articles and General WPI over time from approximately 2014 to 2024.

• Both WPI of primary articles and General WPI exhibit an overall upward trend throughout the period.

• The WPI for Primary Articles shows higher volatility, characterized by more pronounced peaks and troughs. In contrast, the General WPI exhibits relatively smoother fluctuations with only slight peaks and troughs. However, the fluctuations observed in the General WPI closely follow the patterns seen in the Primary Articles WPI. This means that whenever there is a notable peak or trough in the Primary Articles WPI, a corresponding, though less intense, peak or trough is visible in the General WPI. Essentially, the General WPI reflects the broader trends of the Primary Articles WPI, though with reduced intensity.

CONCLUSION

In this project, we analysed the trends and forecasts for the Wholesale Price Index (WPI), focusing on Primary Articles and General WPI from 2014 to 2026. The Primary Articles WPI demonstrates an upward trend with seasonal fluctuations, indicating rising prices for essential commodities such as food grains and raw materials. Forecasts suggest that this trend will continue, with increasing inflation rates projected between July 2024 and June 2025. The forecasted inflation rate for Primary Articles carries a significant error margin of approximately 8.77%, highlighting some uncertainty in predictions.

The General WPI, on the other hand, shows a consistent upward trend with notable fluctuations. Forecasts indicate a steady increase in the General WPI, reflecting ongoing inflationary pressures, with a peak expected in April 2025. The forecast error for General WPI is approximately 4.39%, suggesting a relatively moderate level of forecast accuracy compared to Primary Articles. This moderate accuracy is crucial for understanding broader inflation trends.

The analysis reveals a significant impact of Primary Articles on the General WPI. As prices for primary goods rise, they drive up costs for general commodities, affecting the overall inflation rate. This correlation underscores the importance of monitoring primary articles' inflation rates as they are a leading indicator of changes in the General WPI. Understanding this relationship can help policymakers, businesses, and economists make informed decisions about pricing, production, and inflation control strategies. Effective policies targeting primary articles could help stabilize these prices and mitigate broader inflationary pressures. Overall, the project emphasizes the interconnected nature of different economic components and the need for accurate forecasts to manage inflation effectively.