ARTICLE

Exploring the Socioeconomic Determinants of Population and Economic Indicators Using Machine Learning and Time Series Analysis

K. G. Suresh,* Juby Thomas,** Vishnu Achutha Menon*** & Sateesh Kumar T K****

Abstract

This study applies machine learning techniques to investigate the relationships between demographic and economic indicators in India from 1960 to 2023. Data preprocessing involved addressing missing values using median imputation and deriving essential features, including the young dependency ratio, old dependency ratio, and urban population percentage, to capture key demographic dimensions. Stationarity was assessed using the Augmented Dickey-Fuller (ADF) test. A Gradient Boosting Regressor (GBM) with TimeSeriesSplit was implemented to model predictive relationships and determine feature importance. Dependent variables included total, male, female, and working-age population groups, as well as GDP per capita, while independent variables comprised urbanization, dependency ratios, GDP deflator, and working-age percentage. Results reveal that urban population percentage and young dependency ratio are consistently critical predictors across multiple population-related targets. For instance, urbanization has the highest feature importance for total population (0.2603) and female population (0.2834), while GDP per capita is the strongest predictor for the male population (0.3370). The young dependency ratio plays a pivotal role in determining working-age population dynamics (0.3155) and

*   Former Professor & Vice Chancellor, Makhanlal Chaturvedi National University of Journalism & Communication, Makhanpuram, Opposite M.P. State Shooting Academy, Bishankhedi, Bhopal, Madhya Pradesh – 462044, kgsure@gmail.com
**   Associate Professor, Department of Media Studies, Kristu Jayanti College (Autonomous), Bengaluru, India – 560067, juby@kristujayanti.com
***   Assistant Professor & Head, Department of Communication and International Studies, Institute for Educational and Developmental Studies, Noida, Gautam Buddha Nagar, Uttar Pradesh, India – 201301, vishnuachuthamenon@gmail.com
****   Assistant Professor, Department of Commerce, Kristu Jayanti College (Autonomous), Bengaluru, India – 560067, sateeshtk@kristujayanti.com