

**PREDICTION OF FERTILITY MEASURES
FOR INDIA: A COMPARATIVE
ANALYSIS**

ABSTRACT OF THESIS

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ABSTRACT

Reducing the fertility rate of the population can have many advantages in various areas, including economic, social, health, and environmental aspects. These advantages are particularly evident when fertility transitions from high to moderate levels, as is the case in many developed and developing countries. However, policymakers need to address potential challenges, such as an aging population, by implementing policies that support sustainable economic growth, healthcare, and social services. By doing so, the positive impacts of fertility decline can be maximized, leading to a more prosperous and balanced society. Predicting future fertility declines involves understanding the complex interplay of economic, social, cultural, and political factors.

The secondary data based on fertility rates like the birth rate (BR), general fertility rate (GFR), and total fertility rate (TFR) were collected from the sources "indiastat.com" and "<https://www.macrotrends.net/countries/IND/india/fertility-rate>". This dataset covers annual BR, GFR, and TFR values from 1995 to 2020 for India.

The subject of this thesis is to compare the group method of data handling type artificial neural network (GMDH-type ANN) model with univariate time series models (viz., moving average, Holt's, autoregressive, and autoregressive integrated moving average) for the prediction of BR, GFR, and TFR. For this purpose, all univariate time series forecasting techniques were performed in R software, and the GMDH-type ANN technique was performed in GMDH Shell version 3.8.9 software. The result showed that the GMDH-type ANN model is superior to all univariate time series models for the prediction of India's fertility rates on the basis of the lowest values of root mean squared error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE), and scatter index (SI). Thus, the GMDH-type ANN model was more appropriate for

the forecasting of India's BR, GFR, and TFR for the next 10 years, and the results indicated that the all-fertility rates will decline in the upcoming years. The government will use the information regarding the prediction of fertility rates to allocate the forthcoming resources and also make decisions for people's welfare.

This thesis has five chapters and the work done in these chapters are discussed below:

Chapter 1; *Introduction and Related Concepts.* This chapter presents a brief overview of the outlines of this research such as the study area under research, objectives of the research, review of literature, materials, and methods.

Chapter 2; *Prediction of India's Birth Rate, General Fertility Rate, and Total Fertility Rate using different time series forecasting techniques.* In this chapter, the best model of the univariate time series technique was determined based on time series forecasting error measures for the prediction of fertility rates. This study found that the ARIMA model was more accurate with the lowest values of RMSE, MAE, MAPE, and SI for the prediction of BR, GFR, and TFR.

Chapter 3; *Construction of GMDH-type ANN model for the prediction of Birth Rate, General Fertility Rate, and Total Fertility Rate: A case study of India.* In this chapter, the model equations were constructed using a GMDH-type ANN deep learning algorithm for predicting the BR, GFR, and TFR for India, and the results found that the actual values and predicted values are accurately the same. Hence, this study proved that the GMDH-type ANN model has a more powerful predictive ability for predicting fertility rates as compared to other univariate time series forecasting techniques.

Chapter 4; *Comparative analysis of the GMDH-type ANN model with the ARIMA model for predicting India's fertility rates.* In this chapter, a comparative study has been carried out to depict the predictive supremacy of GMDH-type ANN and ARIMA technique for predicting fertility rates. The study found that the GMDH-type ANN

model is superior to all ARIMA models, with the lowest values of RMSE, MAE, MAPE, and SI for the prediction of India's fertility rates. Thus, the GMDH-type ANN model was more appropriate for the prediction of India's BR, GFR, and TFR for the next 10 years and the results indicated that the all-fertility rates will decline in upcoming years.

Chapter 5; *Ten-year forecasting of Birth Rate, General Fertility Rate, and Total Fertility Rate for India using GMDH-type ANN model.* In this chapter, India's fertility rates were forecasted for the next 10 years (i.e., 2021–2030) using the GMDH-type ANN model. The study found that the GMDH-type ANN technique is more appropriate for non-linear data, including BR, GFR, and TFR. Therefore, this model improves fertility rate forecasting accuracy to guide policy decisions in India.