International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 8, pp 207-210, August-2021

https://doi.org/10.47001/IRJIET/2021.508043

Forecasting Total Fertility Rate (TFR) in the Dominican Republic Using a Machine Learning Algorithm

[1]Dr. Smartson. P. NYONI, [2]Tatenda. A. CHIHOHO, [3]Thabani NYONI

[1]ZICHIRe Project, University of Zimbabwe, Harare, Zimbabwe
[2]Independent Health Economist
[3]SAGIT Innovation Center, Harare, Zimbabwe

***Abstract* - In this research paper, the ANN approach was applied to analyze TFR in the Dominican Republic. The employed annual data covers the period 1960-2018 and the out-of-sample period ranges over the period 2019-2030. The residuals and forecast evaluation criteria (Error, MSE and MAE) of the applied model indicate that the model is stable in forecasting TFR in the Dominican Republic. The results of the study indicate that annual total fertility rates in the country are likely to remain around 2.5 births per woman over the out-of-sample period. Therefore, the authorities in the country are encouraged to continue improving accessibility of family planning services to adolescents and young adults to minimize adverse SRH outcomes.**

Keywords: ANN, Forecasting, Total fertility rate (TFR).

I. INTRODUCTION

Total fertility rate (TFR) is defined as the average number of children born to a woman throughout her lifetime if she were to pass through her childbearing age at the current age specific fertility rates. It is a standard measure of fertility of a population. Global fertility rates have been decreasing over the years from high to low fertility and this phenomenon is called fertility transition (Silva, 2008). The major drivers of fertility decline include improvement in human development indicators such as increased female education, female participation in labor force and use of modern contraception (Gubhaju, 2006). The aim of the study is to forecast total fertility rate in the Dominican Republic using a machine learning approach. The results of the study are expected to highlight the likely future trends of fertility in the country. This will assist in policy making, planning and in responding to the country's future health, education and employment needs.

II. METHODOLOGY

The Artificial Neural Network (ANN) approach, which is flexible and capable of nonlinear modeling; will be applied in this study. The ANN is a data processing system consisting of a large number of highly interconnected processing elements in architecture inspired by the way biological nervous systems of the brain appear like. Since no explicit guidelines exist for the determination of the ANN structure, the study applies the popular ANN (12, 12, 1) model based on the hyperbolic tangent activation function. This paper applies the Artificial Neural Network (ANN) approach in predicting annual total fertility rates in the Dominican Republic.

Data Issues

This study is based on annual total fertility rate (births per woman)in the Dominican Republic for the period 1960 – 2018.The out-of-sample forecast covers the period 2019 – 2030.All the data employed in this research paper was gathered from the World Bank online database.

III. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	A
Observations	47 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 8, pp 207-210, August-2021

https://doi.org/10.47001/IRJIET/2021.508043

Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function
Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.092978
MSE	0.096055
MAE	0.252391

Residual Analysis for the Applied Model

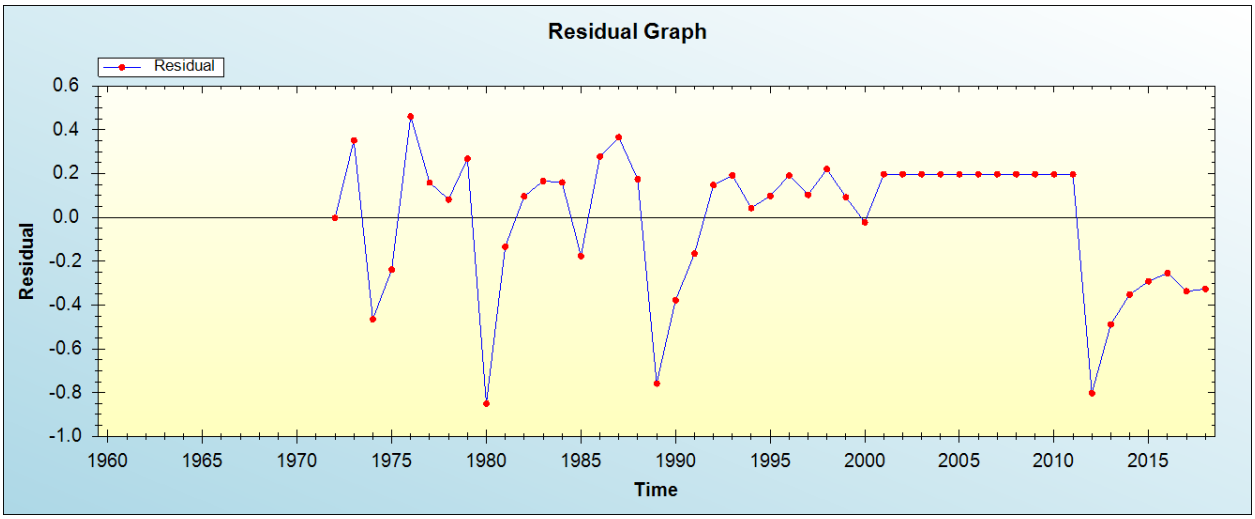

Figure 1: Residual analysis

In-sample Forecast for A

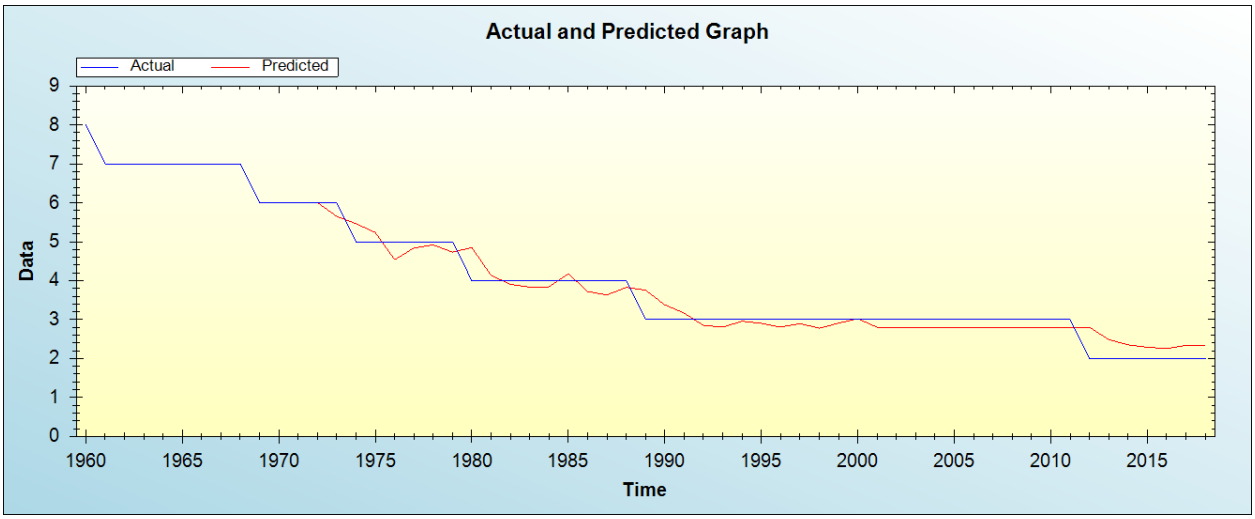

Figure 2: In-sample forecast for the A series

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 5, Issue 8, pp 207-210, August-2021
https://doi.org/10.47001/IRJIET/2021.508043

Out-of-Sample Forecast for A: Actual and Forecasted Graph

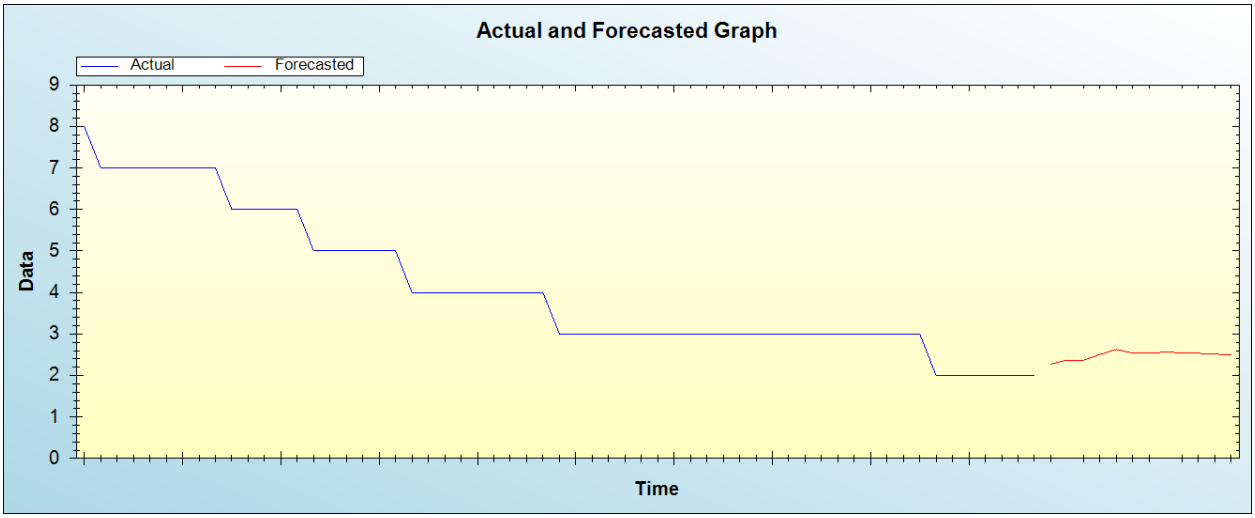

Figure 3: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Forecasts
2019	2.2788
2020	2.3717
2021	2.3663
2022	2.5066
2023	2.6259
2024	2.5404
2025	2.5344
2026	2.5638
2027	2.5456
2028	2.5351
2029	2.5173
2030	2.4890

The main results of the study are shown in table 1. It is clear that the model is stable as confirmed by evaluation criterion as well as the residual plot of the model shown in figure 1. It is projected that annual total fertility rates in the Dominican Republic are likely to hover around 2.5 births per woman over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Total fertility rates in the Dominican Republic have declined over the years and the country currently has low infant and child mortality rates. In this paper we proposed an artificial intelligence technique to project TFR in the country. The results indicated that annual total fertility rates in the Dominican Republic are likely to remain around 2 births per woman over the out-of-sample period. Therefore, the authorities in the country are encouraged to continue improving accessibility of family planning services to adolescents and young adults to minimize adverse sexual and reproductive (SRH) outcomes.

ISSN (online): 2581-3048
Volume 5, Issue 8, pp 207-210, August-2021
https://doi.org/10.47001/IRJIET/2021.508043

REFERENCES

[1] Worldometer (2020). Paraguay demographics. https://www.worldometers.info
[2] Tashya de Silva (2008). Low Fertility Trends: Causes, Consequences and Policy Options, IHP Working Paper Series Number 1, pp 1-27.
[3] Gubhaju B (2006). "Fertility Transition in Asia: An Overview of Levels and Trends", paper presented at the Seminar on the Fertility Transition in Asia: Opportunities and Challenges, UNESCAP, Bangkok, Thailand. 18-20, December.
[4] De Silva, W. I. (2001). A Population Projection of Sri Lanka: For the New Millennium, 2001-2101: Trends and Implications, Institute for Health Policy, Colombo.

Citation of this Article:

Dr. Smartson. P. NYONI, Tatenda. A. CHIHOHO, Thabani NYONI, "Forecasting Total Fertility Rate (TFR) in the Dominican Republic Using a Machine Learning Algorithm" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 8, pp 207-210, August 2021. Article DOI https://doi.org/10.47001/IRJIET/2021.508043

****

