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

ISSN (online): 2581-3048

Volume 5, Issue 8, pp 327-330, August-2021

https://doi.org/10.47001/IRJIET/2021.508071

Forecasting Total Fertility Rate (TFR) In Namibia

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

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

***Abstract* - In this research article, the ANN approach was applied to analyze TFR in Namibia. 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 Namibia. The results of the study indicate that annual total fertility rates in Namibia are likely to remain around 3.4 births per woman over the out-of-sample period. Therefore, the Namibian government is encouraged to focus on addressing challenges being faced by adolescents and young adults in accessing sexual and reproductive (SRH) services and to channel more resources towards women empowerment program activities.**

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

I. INTRODUCTION

Namibia is a developing country which is largely desert with a total population of 2.6 million inhabitants (UNFPA, 2019). Total fertility rate has declined from 6.4 births per woman in 1969 to 3.2 births per woman in 2019 (UNFPA Namibia, 2019). The country has made significant progress in reducing maternal and infant mortality. However maternal mortality ratio remains high around 195 maternal deaths per 100 000 live births (UNFPA Namibia, 2019). Several factors have been noted to cause maternal deaths and they include shortage of skilled personnel, proximate factors and HIV related deaths (UNFPA Namibia, 2019). Infant mortality has been on a downward trend from 143.99 deaths per 1000 live births in 1950 to 27.25 infant deaths per 1000 live births in 2020 (Worldometer, 2020). This reflects the government's commitment in tackling maternal and child health problems through immunization programs, exclusive breastfeeding of babies for at least 6months, management of childhood illnesses, basic obstetric and essential newborn care.

There are limited previous studies which have focused on examining fertility and prediction of fertility rates in the region. Metwally et al (2019) conducted an interventional study in Egypt to provide community based support and empowerment to women in childbearing period to seek optimal prenatal, natal and postnatal healthcare. The study passed through three stages over three and a half years; pre-interventional assessment of awareness (n = 1000), educational interventions targeting the health providers and all women in childbearing period in their communities (n = 20,494), and post-intervention evaluation of change in awareness of their rights for prenatal, natal and postnatal care (no = 1150). The study findings indicated that more work is needed in order to achieve the targeted reduction of maternal mortality. Moreira et al (2019) described the reasons for nonuse of contraception among women with demand for contraception not satisfied in low and middle-income countries (considering both overall countries and various subgroups of women). A descriptive analysis of the reasons for nonuse of contraceptive methods was performed among sexually active women with demand for contraception not satisfied. The prevalence of each reported reason was also evaluated according to marital status, woman's age and schooling, area of residence, wealth index, and parity. The study results indicated that on average, 40.9% of women in need of contraception were not using any contraceptive methods to avoid pregnancy. The most prevalent reasons for nonuse of contraceptives were "health concerns" and "infrequent sex," but the prevalence of each reason varied substantially across countries. A secondary analysis of data from a study conducted to monitor the implementation of a UNFPA package of interventions directed to improve SRH in young people of Sierra Leone was done by Labat et al (2018). The study was a household quantitative survey with open ended questions used to illustrate and complete the analysis. The study indicated that there is a need to reach out to the 40% of young people who are sexually active and neither pregnant nor with pregnancy desire, and are not using condom or contraception.

The aim of this study is to forecast fertility rates in Namibia using a machine learning approach. The results of the study are expected to reveal likely fertility trends in the out of sample period. This will guide policy, planning and allocation of resources for health, education and employment creation.

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

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

ISSN (online): 2581-3048

Volume 5, Issue 8, pp 327-330, August-2021

https://doi.org/10.47001/IRJIET/2021.508071

activation function. This paper applies the Artificial Neural Network (ANN) approach in predicting annual total fertility rates in Namibia.

Data Issues

This study is based on annual total fertility rate (births per woman) in Namibia 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	N
Observations	47 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12
Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function
Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.077023
MSE	0.018750
MAE	0.121568

Residual Analysis for the Applied Model

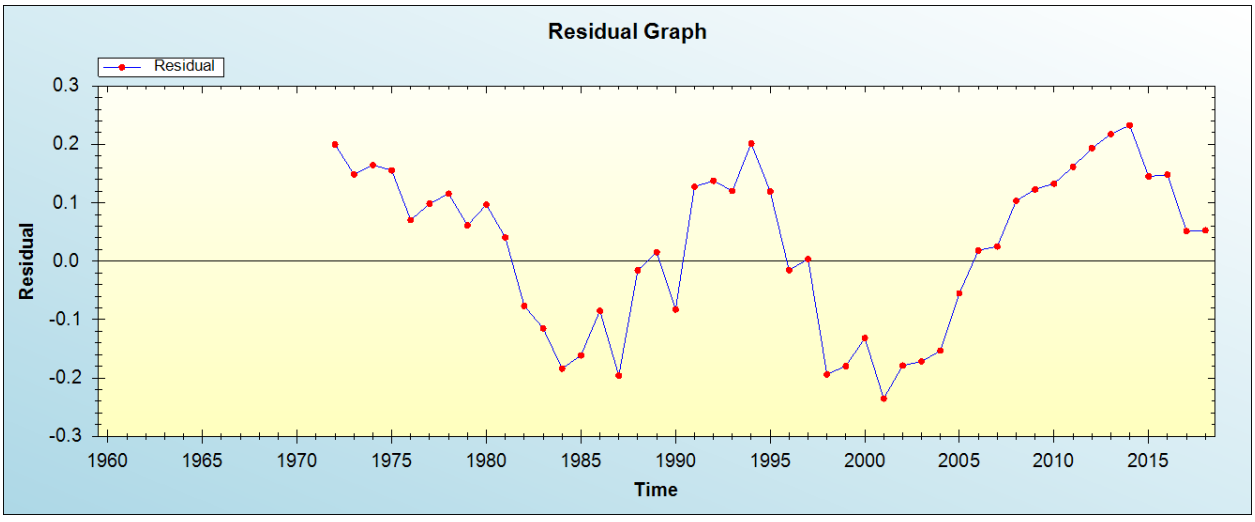

Figure 1: Residual analysis

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 5, Issue 8, pp 327-330, August-2021
https://doi.org/10.47001/IRJIET/2021.508071

In-sample Forecast for N

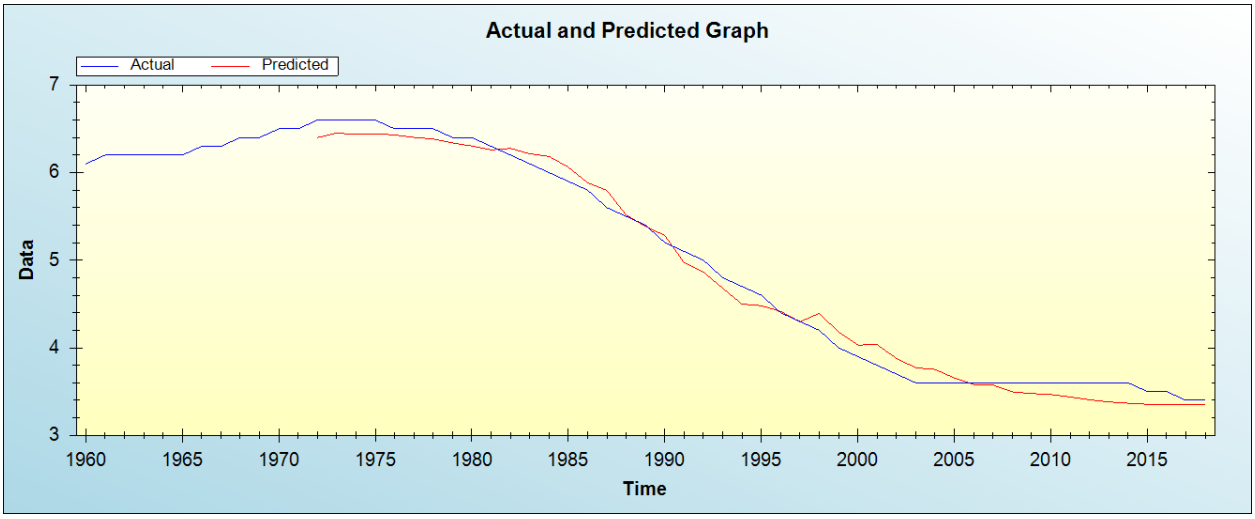

Figure 2: In-sample forecast for the N series

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

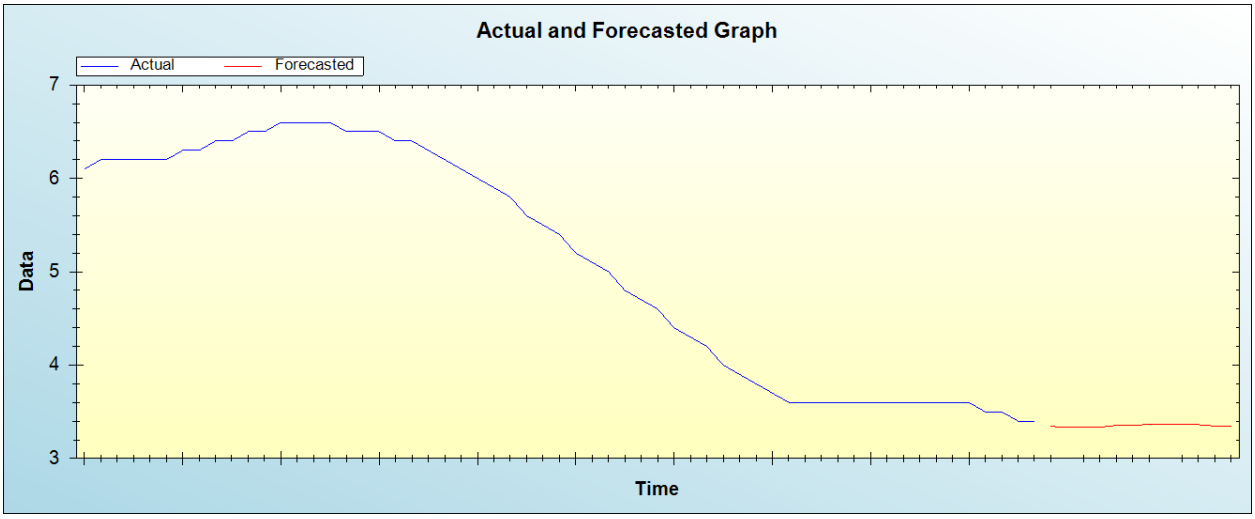

Figure 3: Out-of-sample forecast for N: actual and forecasted graph

Out-of-Sample Forecast for N: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Forecast
2019	3.3433
2020	3.3365
2021	3.3388
2022	3.3342
2023	3.3552
2024	3.3514
2025	3.3674
2026	3.3666
2027	3.3617
2028	3.3622
2029	3.3479
2030	3.3480

ISSN (online): 2581-3048
Volume 5, Issue 8, pp 327-330, August-2021
https://doi.org/10.47001/IRJIET/2021.508071

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 Namibia are likely to remain around 3.4 births per woman over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

High maternal and infant mortality rates as well as high fertility rates characterize Namibia this is partly due to high numbers of teenage pregnancies which lead to adverse maternal and child health outcomes. In this paper we proposed a machine learning technique to predict TFR in Namibia. The ANN model projections indicate that annual total fertility rates in Namibia are likely to remain around 3.4 births per woman over the out-of-sample period. Therefore, the Namibian government is encouraged to focus on addressing challenges being faced by adolescents and young adults in accessing sexual and reproductive health (SRH) services and to channel more resources towards women empowerment program activities.

REFERENCES

[1] Worldometer (2020). Namibia demographics. https://www.worldometers.info
[2] UNFPA (2019). REPUBLIC OF NAMIBIA Sexual and Reproductive Health and Rights 2019, pp1-4.

Citation of this Article:

Dr. Smartson. P. NYONI, Tatenda. A. CHIHOHO, Thabani NYONI, "Forecasting Total Fertility Rate (TFR) In Namibia" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 8, pp 327-330, August 2021. Article DOI https://doi.org/10.47001/IRJIET/2021.508071

****

