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Projection of Total Fertility Rate (TFR) In Yemen

[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 paper, the ANN approach was applied to analyze TFR in Yemen. 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 Yemen. The results of the study indicate that annual total fertility rates in Yemen are likely to be around 3.9 births per woman throughout the out-of-sample period. Therefore, the Yemen government is encouraged to prioritize sexual and reproductive health services to reduce adverse maternal and child health outcomes and promote women empowerment.**

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

I. INTRODUCTION

Yemen continues to be characterized by armed conflict, food insecurity, communicable diseases, economic downturn and deterioration of key public services (Tappis et al, 2020). The country currently needs urgent humanitarian response (OCHA, 2018). In 2018, close to 80% of the population in Yemen was in need of humanitarian aid and 10 % were internally displaced (OCHA, 2018; IOM, 2018). Yemen has recorded a decline in total fertility rate from 8.8 births per woman in 1990 to 3.8 births per woman in 2020 (Worldometer, 2020). Infant and under five mortality have also been decreasing over the years. In 2020, Yemen recorded an infant mortality of 42.0 infant deaths per 1000 live births and under five mortality of 53 deaths per 1000 live births (Worldometer, 2020). Although there is a remarkable improvement of health indicators, the persistence of the conflict in Yemen is a huge setback for development due to the ongoing destruction of key infrastructure. In this article we will discuss studies that have been done at regional level. Tappis et al (2020) examined how reproductive, maternal, newborn, child and adolescent health and nutrition (RMNCAH+N) services have been delivered since 2015, and identified factors influencing implementation of these services in three governorates of Yemen. Content analysis methods were applied to analyze publicly available documents and datasets published since 2000 as well as 94 semi-structured individual and group interviews conducted with government officials, humanitarian agency staff and facility-based healthcare providers and six focus group discussions conducted with community health midwives and volunteers in September–October 2018.The authors concluded that although health workers display notable resilience working in difficult conditions, challenges resulting from insecurity, limited functionality of health facilities, and challenges in importation and distribution of supplies limit the availability and quality of services. Based on ARIMA models, Nyoni (2019) forecasted total population in Yemen. The optimal ARIMA (10, 2, 0) model projected that total population in Yemen will continue to rise sharply in the next three decades and in 2050 Yemen's total population will be approximately 52 million people. Alosaimi (2019) predicted the utilization of maternal and child health services among reproductive-aged women in rural Yemen using Household Socioeconomic Indicators and utilized logistic regression. The study concluded that key maternal health indicators can be determined by socioeconomic indicators. Therefore, in planning maternal and child health interventions, considering disparities of care by socioeconomic factors should be taken into account. Pantazis et al (2018) analyzed trends in global fertility from 1950-2010 through the analysis of age-specific fertility rates. The study concluded that a country's demographic transition can be traced through time by membership in the different clusters, and regional patterns in the trajectories through time and with fertility decline are identified.

The aim of this paper is to project total fertility rate in Yemen using a machine learning algorithm. The results of the study are expected to reveal the likely future trends of fertility in the out of sample period. This will guide policy making and trigger an appropriate response to the health, education and employment needs of the people in Yemen.

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 Yemen.

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Data Issues

This study is based on annual total fertility rate (births per woman) in Yemen 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	E
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	0.052749
MSE	0.018309
MAE	0.107836

Residual Analysis for the Applied Model

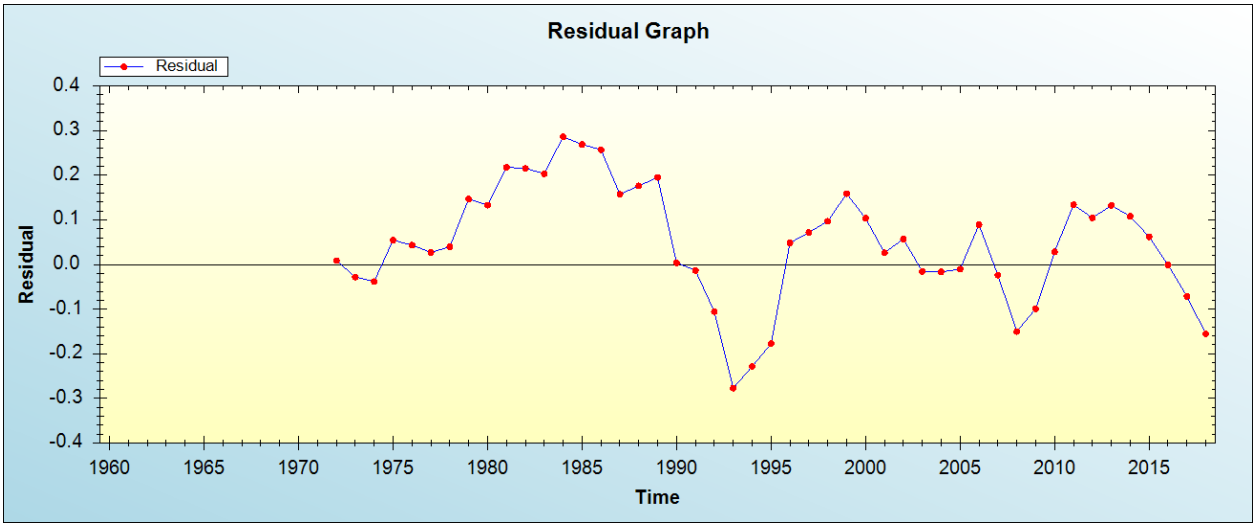

Figure 1: Residual analysis

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In-sample Forecast for E

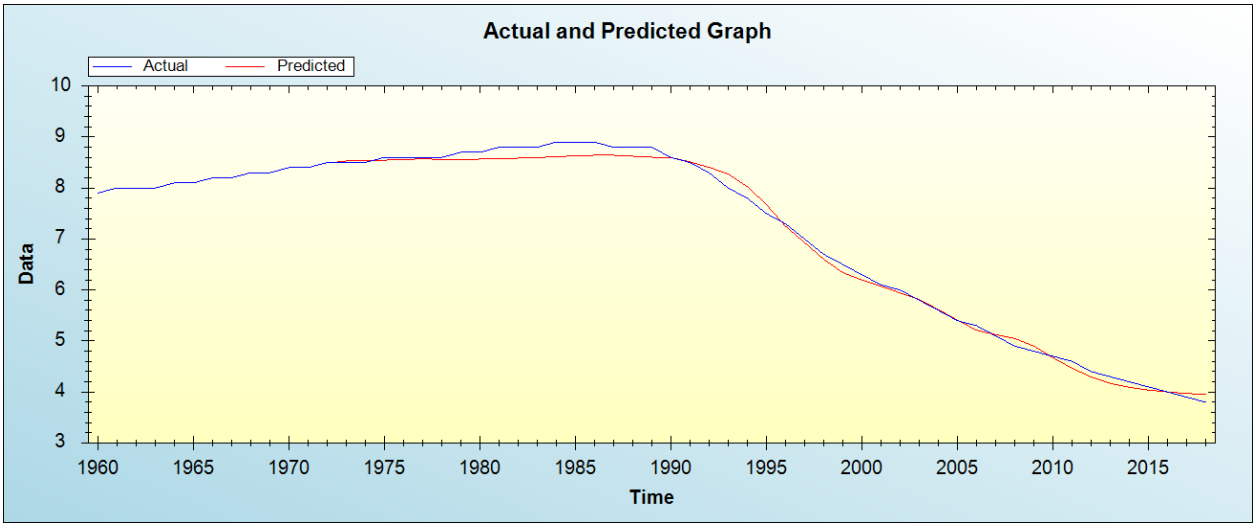

Figure 2: In-sample forecast for the E series

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

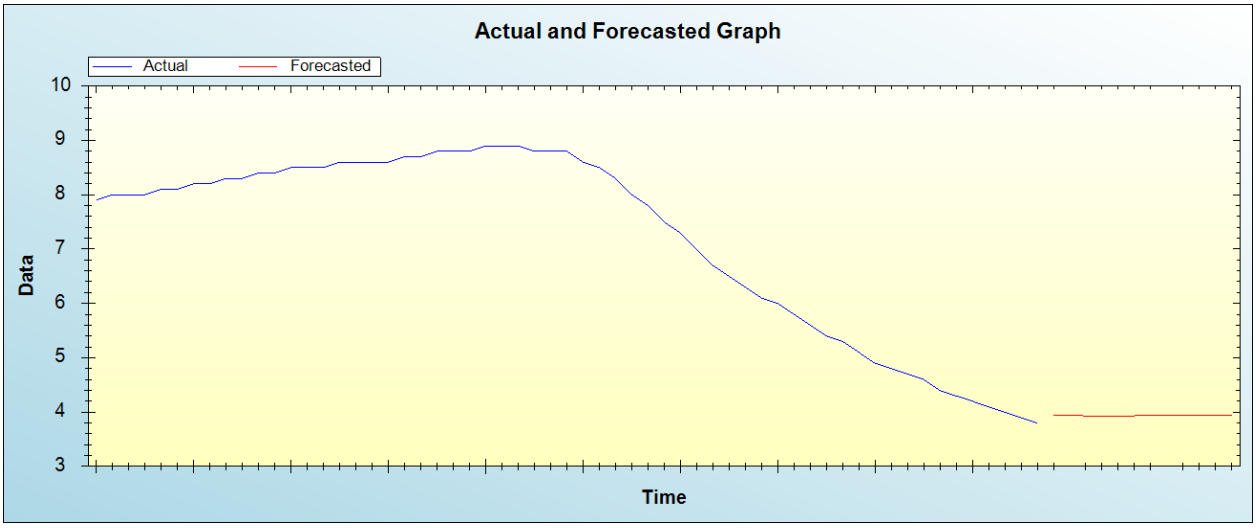

Figure 3: Out-of-sample forecast for E: actual and forecasted graph

Out-of-Sample Forecast for E: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Forecasted TFR values
2019	3.9435
2020	3.9381
2021	3.9331
2022	3.9310
2023	3.9304
2024	3.9326
2025	3.9341
2026	3.9340
2027	3.9340
2028	3.9362
2029	3.9360
2030	3.9355

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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 Yemen are likely to be around 3.9 births per woman throughout the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

The ongoing armed conflict in Yemen is a cause for concern especially for adolescent girls and women who have a right to access family planning services. The country's fertility transition is likely to be reversed in future if the war continues. In this study we proposed a machine learning algorithm to project total fertility rate in Yemen. The results indicate that annual total fertility rates in Yemen are likely to be around 3.9 births per woman throughout the out-of-sample period. Therefore, the Yemen government is encouraged to prioritize sexual and reproductive health services to reduce adverse maternal and child health outcomes and promote women empowerment.

REFERENCES

[1] Hannah Tappis., Sarah Elaraby., Shatha Elnakib., Nagiba A. Abdulghani AlShawafi., Huda BaSaleem., Iman Ahmed Saleh Al-Gawfi., Fouad Othman., Fouzia Shafique., Eman Al-Kubati., Nuzhat Rafique and Paul Spiegel (2020). Reproductive, maternal, newborn and child health service delivery during conflict in Yemen: a case study, Conflict and Health (2020) 14:30 https://doi.org/10.1186/s13031-020-00269-x
[2] OCHA (2018). Current Emergencies. Geneva: United Nations Office for Coordination of Humanitarian Affairs. Available from: https://www.unocha.org/where-wework/current-emergencies.
[3] OCHA (2018). Humanitarian Needs Overview 2018. Available from: https://www. unocha.org/sites/unocha/files/dms/yemen_humanitarian_needs_overview_ hno_2018_20171204.pdf.
[4] IOM Yemen Displacement Tracking Matrix 2018. Available from: https:// www.globaldtm.info/yemen. Accessed 1 Dec 2018. 12. OCHA Financial Tracking Service. Available from: https://fts.unocha.org.
[5] Worldometer (2020). Yemen demographics. https://www.worldometers.info

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