

Projection of Total Fertility Rate (TFR) In Venezuela

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

¹ZICHIRE Project, University of Zimbabwe, Harare, Zimbabwe

²Independent Health Economist, Zimbabwe

³SAGIT Innovation Center, Harare, Zimbabwe

Abstract - In this research article, the ANN approach was applied to analyze TFR in Venezuela. 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 Venezuela. The results of the study indicate that annual total fertility rates in Venezuela are likely to generally increase in the out-of-sample period. Therefore, the authorities in Venezuela should focus on addressing adolescent and young adult challenges, create more demand for family planning services and channel more funds towards women empowerment program activities.

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

I. INTRODUCTION

Adolescent girls and young women’s sexual and reproductive health issues are increasingly becoming a global health challenge because of the high numbers of unintended pregnancies, STIs, unsafe abortions, and obstetric complications (Woog et al, 2015). About 13 million young women aged 15-19 years give birth each year representing 11% of the global births and 95% of childbirths occur in developing countries (UN, 2013). The aim of this paper is to project TFR in Venezuela using the multilayer perceptron neural network. The results of the study are expected to reveal the likely future trends of TFR in the country. This will assist in policy making and stimulate an evidence based response to the future health, education and employment needs of the people in Venezuela.

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 Venezuela.

Data Issues

This study is based on annual total fertility rate (births per woman) in Venezuela 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
Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function

Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.140737
MSE	0.097812
MAE	0.263944

Residual Analysis for the Applied Model

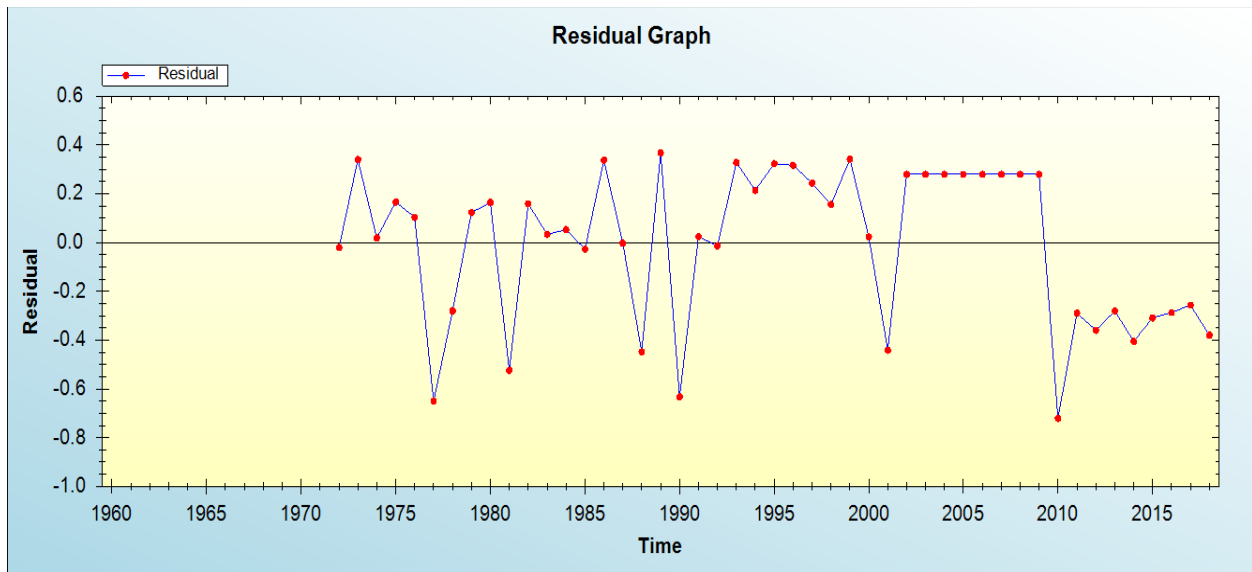


Figure 1: Residual analysis

In-sample Forecast for A

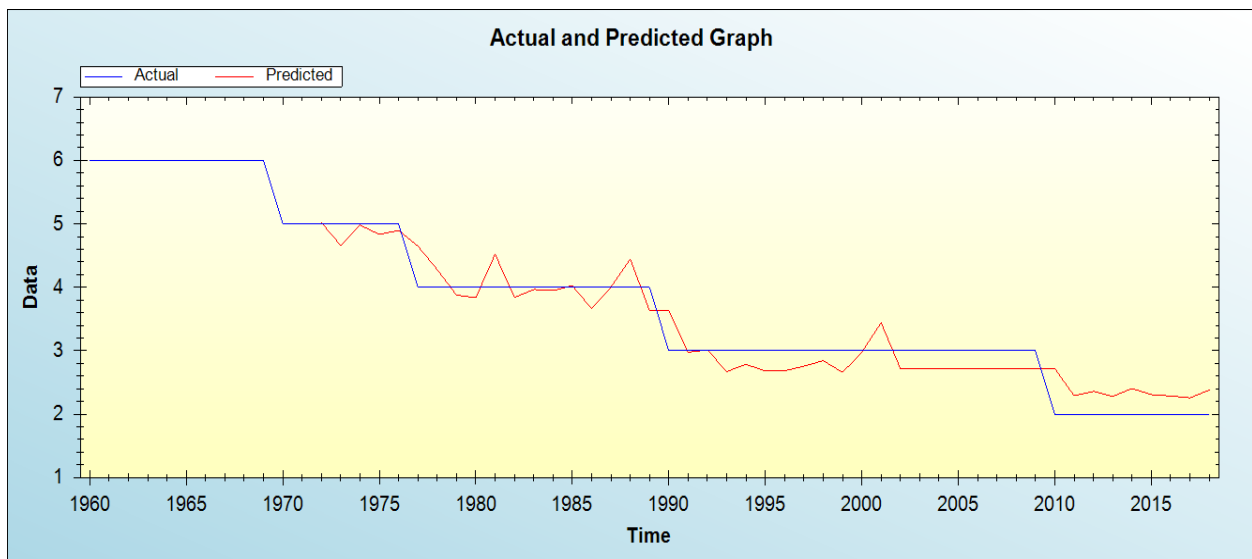


Figure 2: In-sample forecast for the A series

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

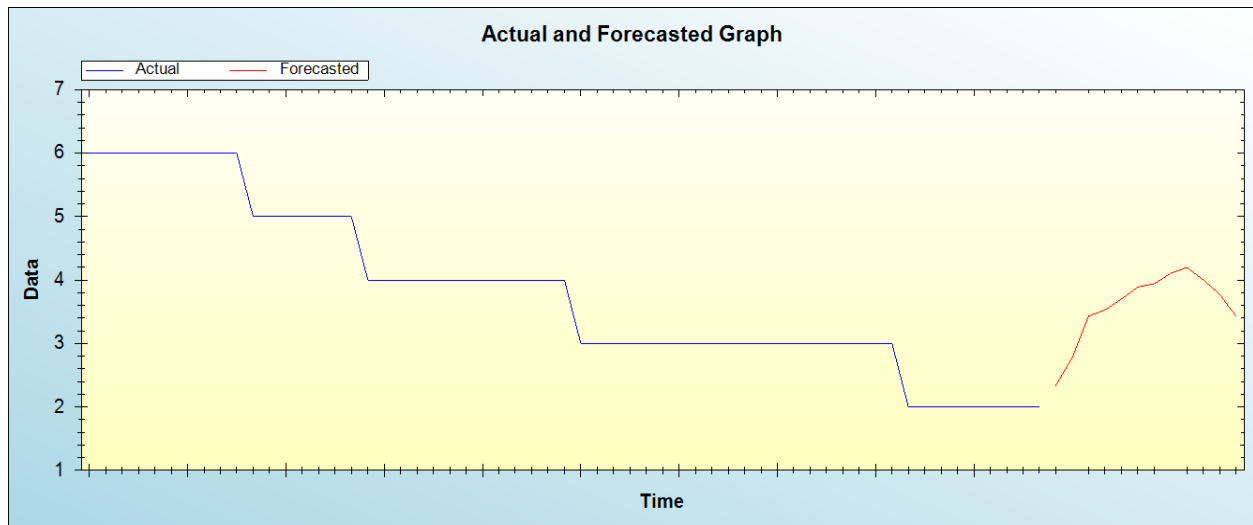


Figure 3: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Forecasts
2019	2.3376
2020	2.7755
2021	3.4308
2022	3.5276
2023	3.6979
2024	3.8885
2025	3.9390
2026	4.1035
2027	4.1968
2028	4.0006
2029	3.7759
2030	3.4314

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 Venezuela are likely to generally increase over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

In this paper we proposed an artificial neural network approach to project total fertility rate in Venezuela. The findings of the study revealed that annual total fertility rates in Venezuela are likely to generally increase over the out-of-sample period. Therefore, the government must focus on addressing adolescent and young adult challenges, create more demand for family planning services and channel more funds towards women empowerment program activities.

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