

Forecasting Total Fertility Rate in Suriname

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Abstract - In this research article, the ANN approach was applied to analyze TFR in Suriname. 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 Suriname. The results of the study indicate that annual total fertility rates in Suriname are likely to be around 3 births per woman over the out-of-sample period. Therefore, the authorities in the country should address pertinent challenges being faced by adolescents and young adults in accessing family planning services and fund empowerment programs for women.

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

I. INTRODUCTION

Child marriage is a violation of fundamental human rights that has a negative impact on the girls’ sexual, mental, physical and well-being (UNICEF, 2015; UNFP, 2012a). Approximately 45% of women aged 20-24 are married before they reach the legal age of majority (UNICEF, 2014b). It has been noted that child marriage and pregnancy are the major risk factors of maternal and child mortality in low and middle income countries (Wadlar, 2012). Despite the visibility of family planning programs in developing countries, many adolescent girls and women face many obstacles in accessing family planning services (STAG, 2017; Alkema et al, 2013). About 214 million women in developing countries in need of contraception do not use any contraceptive method (Guttmacher Institute, 2017). The aim of this paper is to project TFR in Suriname using a machine learning algorithm. The findings of this paper are expected to reveal the likely future trends of fertility in the out of sample period. This will facilitate planning and the nation’s response to the future health, education and employment requirements.

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 Suriname.

Data Issues

This study is based on annual total fertility rate (births per woman) in Suriname 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	0.103867
MSE	0.803244
MAE	0.178353

Residual Analysis for the Applied Model

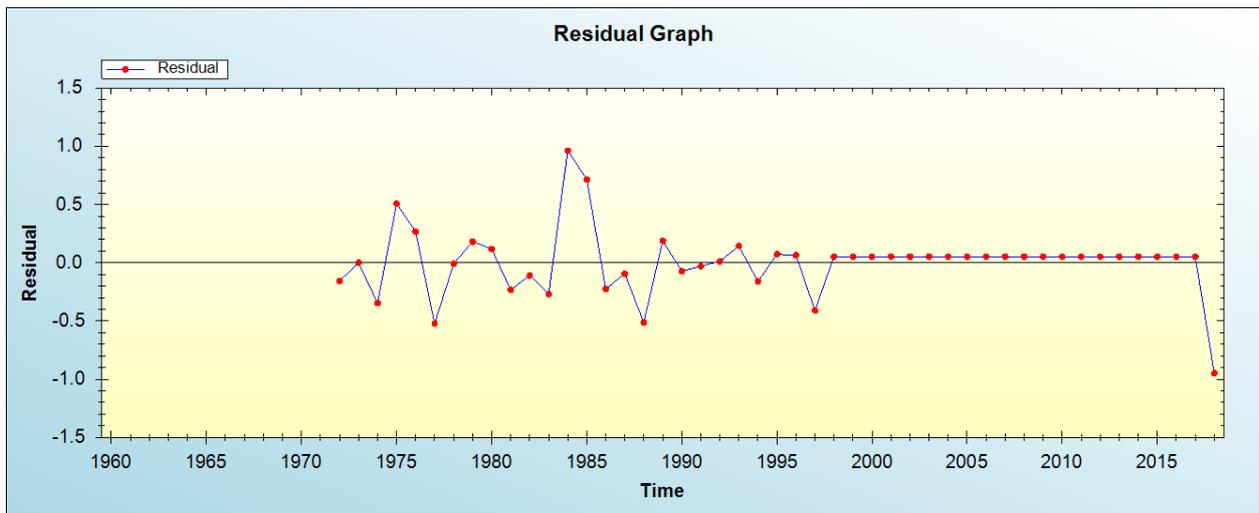


Figure 1: Residual analysis

In-sample Forecast for A

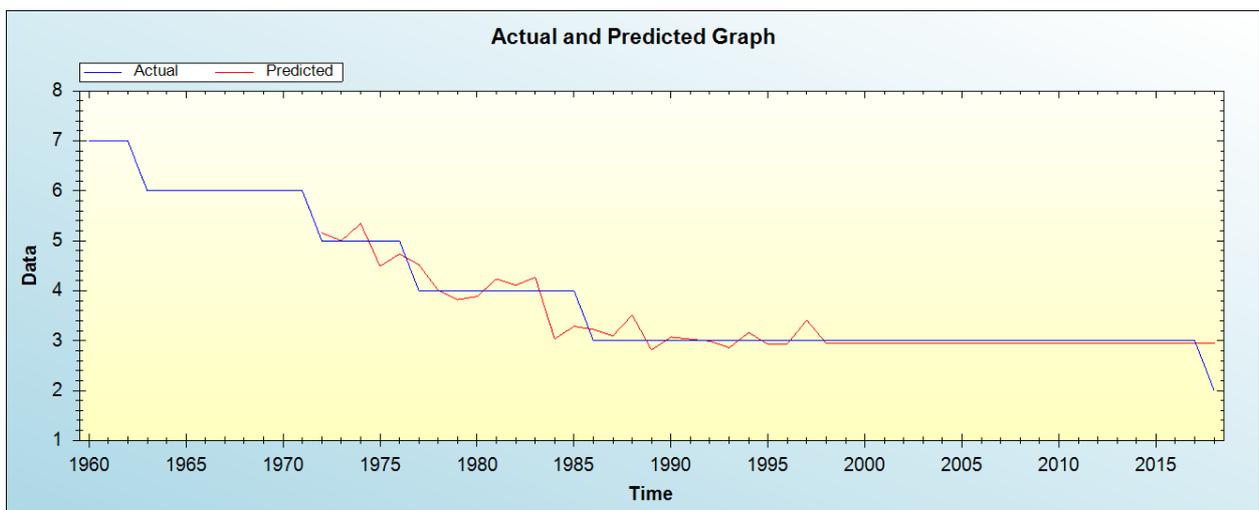


Figure 2: In-sample forecast for the A series

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

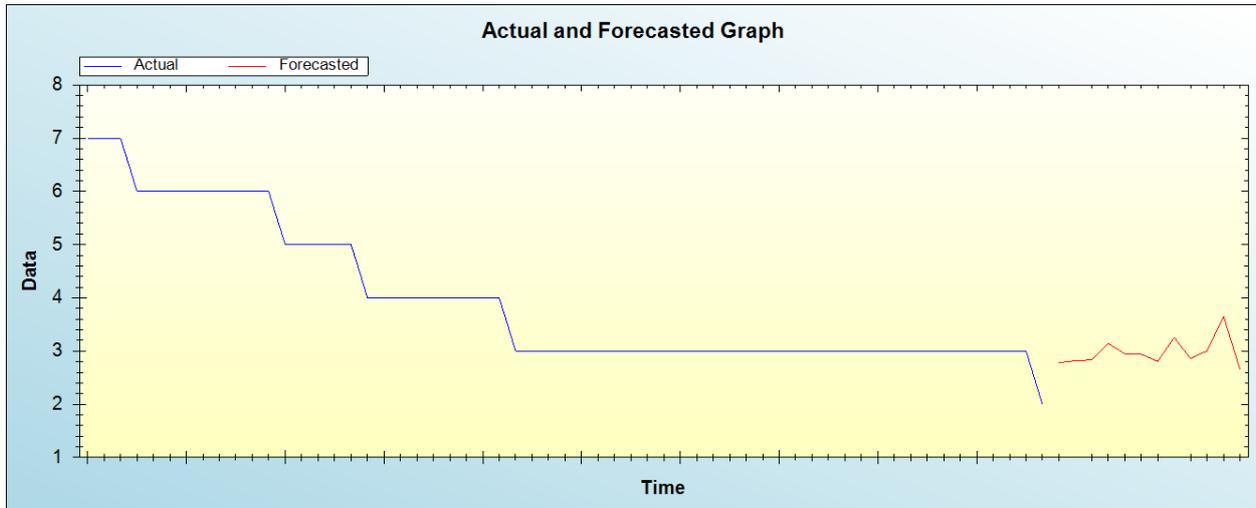


Figure 3: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Forecasts
2019	2.7811
2020	2.8210
2021	2.8336
2022	3.1422
2023	2.9481
2024	2.9379
2025	2.8051
2026	3.2555
2027	2.8564
2028	3.0064
2029	3.6517
2030	2.6546

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 Suriname are likely to be around 3 births per woman over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Child marriages in developing nations are still occurring and are a violation of children’s rights. Lack of comprehensive SRH knowledge among adolescents and young women needs to be addressed in order to prevent adverse maternal and child health outcomes. In this paper we apply a machine learning technique to predict total fertility rates in Suriname. The results of the study showed that annual total fertility rates in the country are likely to be around 3 births per woman over the out-of-sample period. Therefore, the authorities in Suriname should address pertinent challenges being faced by adolescents and young adults in accessing family planning services and fund empowerment programs for women.

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