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Utilizing Empirical Evidence to Address Adolescent Fertility in Congo

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***Abstract* - This study uses annual time series data on adolescent fertility rate for Congo from 1960 to 2020 to predict future trends of adolescent fertility rate over the period 2021 to 2030. The forecast evaluation criteria of the applied model indicate that the ANN (12, 12, 1) model is stable. The neural network model projections revealed that adolescent fertility will remain very high in the entire forecast period. Therefore, we encourage the Congolese government to implement strategies such as awareness campaigns, promotion of girl child education, promote respect and uphold women's rights and fund empowerment programs for youths.**

Keywords: ANN, Forecasting, adolescent fertility rate.

I. INTRODUCTION

Teenage pregnancy is among the top causes of maternal mortality worldwide (WHO, 2020; Ajala, 2014). Several previous researchers established that complications which occur during pregnancy and child birth include anemia, obstetriche morrhage, preterm delivery, low birth weight and malnutrition (Harrington *et al.* 2021; Grønvik & Fossgard, 2018; Pradhan *et al*. 2018; Woog & Kagesten, 2017;Sama *et al.* 2017; Raman *et al.* 2015). Poverty reduction and improvement in the education system are considered as effective interventions which can help prevent and reduce teenage pregnancy especially in developing regions (Herrera *et al.* 2019). As highlighted during the 1994 conference on population and development, addressing gender imbalances and eliminating harmful practices that promote child marriages will have a huge impact on the reduction of adolescent pregnancy (UN, 2016; UN, 2015; UN, 1995). The 3rd sustainable development goal target 3.7.2 focuses on the improving accessibility and affordability of sexual and reproductive health services especially to adolescents (UN, 2020; WHO, 2019; UNICEF, 2018; UN, 2016; UN, 2015). Comprehensive SRH services that must be offered to adolescents and other eligible people include SRH education, HIV testing and counselling services. Adolescent pregnancy is still a big health problem in Congo. The country's adolescent fertility dropped from 137 births per 1000 women aged 15-19 in 1960 to 108 births per 1000 women aged 15-19 in 2020 (World Bank, 2020). This paper applies a machine learning algorithm to forecast future trends of adolescent fertility for Congo. The results of this study are expected to highlight future trends of adolescent fertility in the out of sample period. This will trigger an appropriate national response to the problem of teenage pregnancy through adequate allocation of resources to teenage pregnancy prevention programs.

II. METHODOLOGY

The Artificial Neural Network (ANN) approach, which is flexible and capable of nonlinear modelling; 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 adolescent fertility rate for Congo.

Data Issues

This study is based on annual adolescent fertility rate in for the period 1960 – 2020. The out-of-sample forecast covers the period 2021 – 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

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Table 1: ANN model summary

Variable	C
Observations	49
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	0.006268
MSE	0.098891
MAE	0.238924

Residual Analysis for the Applied Model

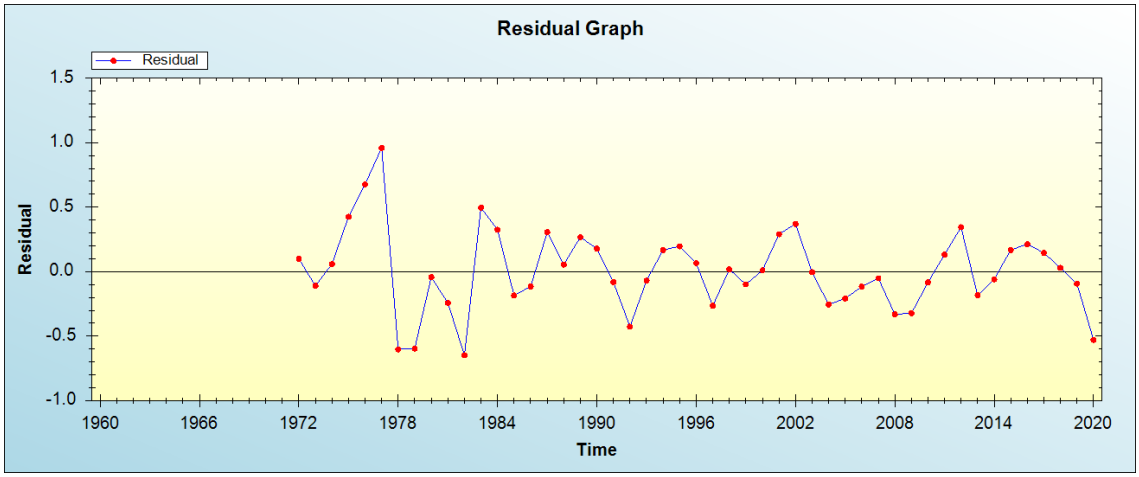

Figure 1: Residual analysis

In-sample Forecast for C

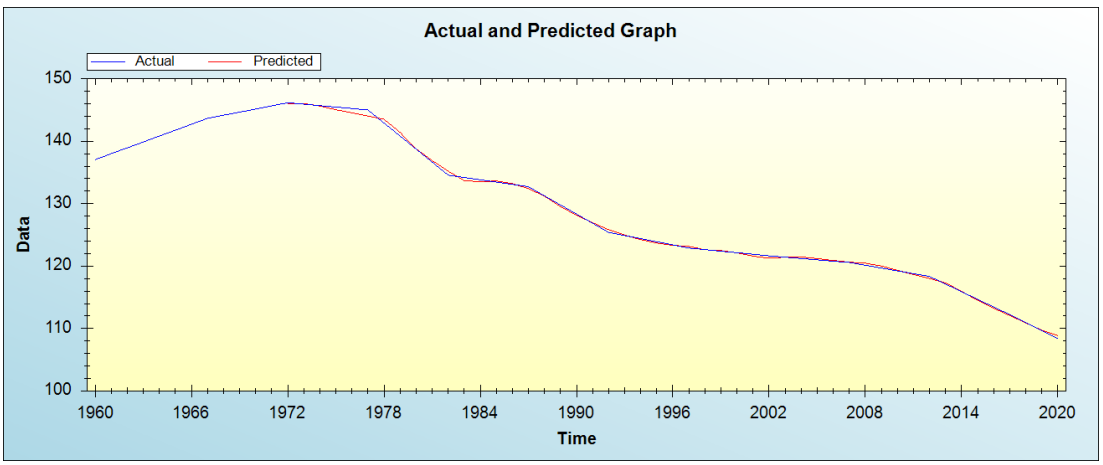

Figure 2: In-sample forecast for the C series

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

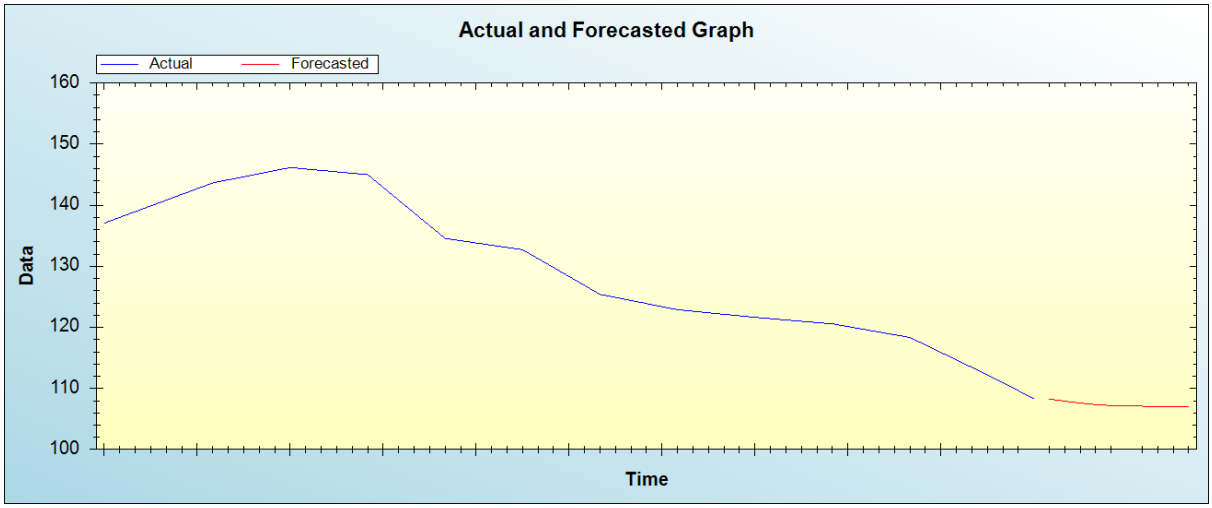

Figure 3: Out-of-sample forecast for C: actual and forecasted graph

Out-of-Sample Forecast for C: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Predicted adolescent fertility rate
2021	108.2679
2022	107.9240
2023	107.5963
2024	107.3553
2025	107.2033
2026	107.1179
2027	107.0953
2028	107.0558
2029	107.0073
2030	106.9751

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 adolescent fertility rate will remain very high in the entire forecast period.

IV. POLICY IMPLICATION & CONCLUSION

Adolescent pregnancy is still a big health problem in Congo. The country's adolescent fertility dropped from 137 births per 1000 women aged 15-19 in 1960 to 108 births per 1000 women aged 15-19 in 2020. The prevalence of adverse pregnancy outcomes remains very high requiring prompt government attention. Pregnancy and child birth complications such as anemia, obstetric hemorrhage, obstructed labor, preterm delivery, low birth weight and malnutrition have been reported in this country. Prevention of adolescent pregnancy remains a priority for this government hence intervention strategies should include poverty reduction among other solutions. This study applied a machine learning technique to forecast future trends of adolescent fertility for Congo. Our findings indicate that adolescent fertility will remain very high throughout the out of sample period. Therefore, the Congolese government must implement strategies such as awareness campaigns, promotion of girl child education, promote respect and uphold women's rights and fund empowerment programs for youths.

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