

Total Fertility Rate (TFR) Forecasting In Algeria

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Abstract - In this paper, the ANN approach was applied to analyze TFR in Algeria. 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 Algeria. The results of the study indicate that annual total fertility rates in Algeria are likely to decline slightly over the out-of-sample period. Therefore, the Algerian government is encouraged to address sexual and reproductive health (SRH) challenges being faced by adolescent girls and women to improve access to family planning services in order to further reduce unintended pregnancies and other adverse SRH outcomes.

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

I. INTRODUCTION

Globally, sexual and reproductive health problems are among the leading causes of mortality and morbidity among adolescent girls and women (November & Sandall, 2018; Black et al, 2016; Nove et al, 2014). Many developing countries are experiencing conflicts poverty, hunger, and poor health infrastructure which negatively impacts on sexual and reproductive health and rights for women. Civil conflicts have displaced thousands of people in war zones putting adolescent girls and women at risk of physical and sexual abuse which result in unwanted pregnancies, STIs and mental trauma. Pregnancy and child birth among adolescents are associated with a higher risk of adverse maternal and neonatal health outcomes compared to women aged 20-24 (Chandra-Mouli et al, 2015). High adolescent birth rates lead to rapid growth of the young population Sub-Saharan Africa and this results in persistent economic burden and perpetuates poverty (Shahabuddin et al, 2016).

Algeria has witnessed a decline in fertility rates over the past decades from 6.3 births per woman in 1985 to 3.1 births per woman in 2020 (Worldometer, 2020). The country has recorded a similar pattern for infant and under five mortality rates. Infant mortality decline from 163.01 infant deaths per 1000 live births in 1950 to 18.4 infant deaths per 1000 live births in 2020 (Worldometer, 2020) reflecting significant improvement in maternal and child health programs. There are few previous studies that have examined fertility rates in the country and region. Genus (2020) examined the determinants of trends wanted and unwanted fertility in SSA using fixed-effects regressions of country-level data. Data came from 103 DHS surveys in 25 countries in SSA with at least two DHS surveys between 1989 and 2019. The study revealed that Women's education and family planning programs are found to be the dominant determinants of fertility decline and their effects operate by reducing both wanted and unwanted fertility. Coast et al (2019) examined early adolescent understandings and experiences of sexual and reproductive health (SRH) in Ethiopia and Rwanda, drawing on a multisite qualitative research study with 10- to 12-year-old and 14- to 15-year-old male and female adolescents and a range of adult participants. The study indicated that there was need for program designers and implementers to address the role of underlying social norms in a more strategic and context-specific way to help young people navigate their sexual and reproductive lives.

Based on a cross-sectional study, Renzaho et al (2017) assessed factors associated with comprehensive categories of sexual and reproductive health, including sexual behaviors; sexual education and access to contraceptive services; family planning; prevention of STDs; sexual consent as a right; gender based violence; as well as HIV testing, counseling, disclosure and support. The study concluded that there is need to address barriers and ensure a comprehensive and harmonized sexual and reproductive health system that is youth friendly and takes into account local socio-cultural issues.

The aim of this study is to forecast TFR in Algeria using an artificial neural network approach. The results of the study are expected to reveal likely fertility trends in the out of sample period to facilitate planning and resource allocation towards health sector, 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 activation function. This paper applies the Artificial Neural Network (ANN) approach in predicting annual total fertility rates in Algeria.

Data Issues

This study is based on annual total fertility rate (births per woman) in Algeria 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	0.050910
MSE	0.022471
MAE	0.122002

Residual Analysis for the Applied Model

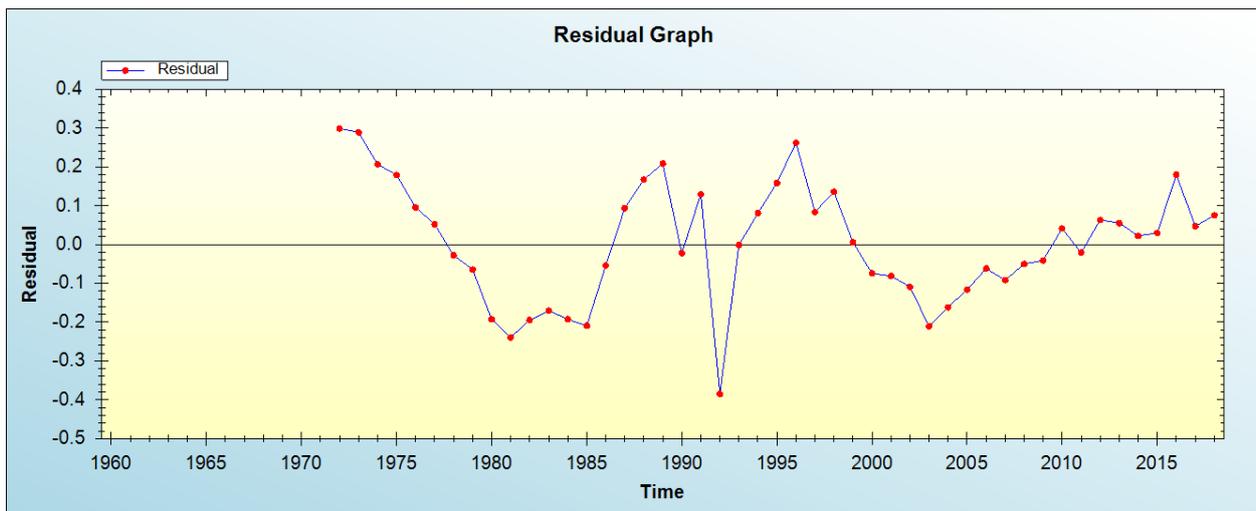


Figure 1: Residual analysis

In-sample Forecast for A

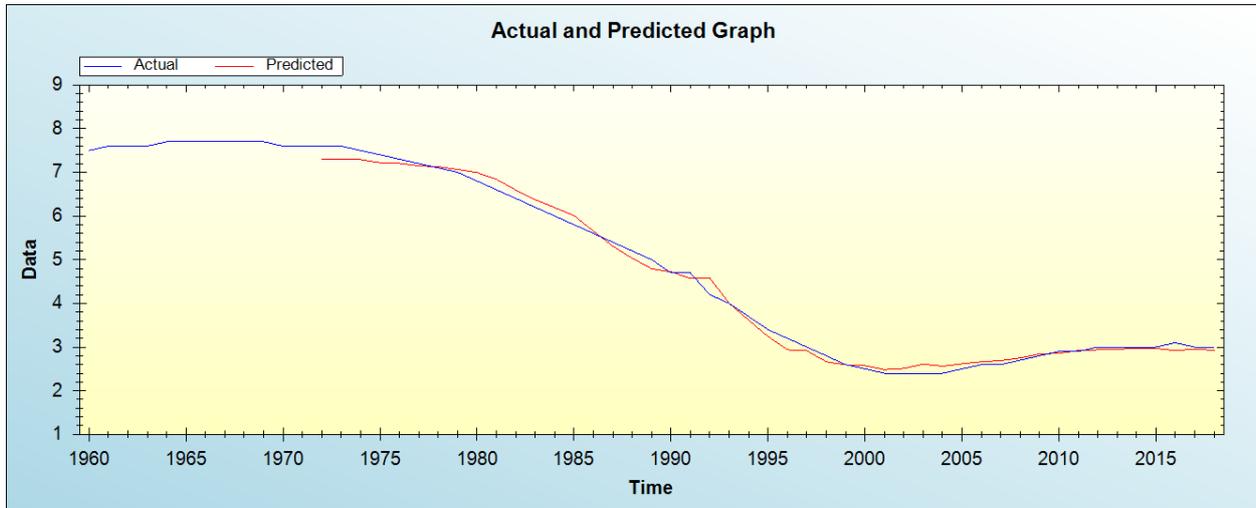


Figure 2: In-sample forecast for the A series

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

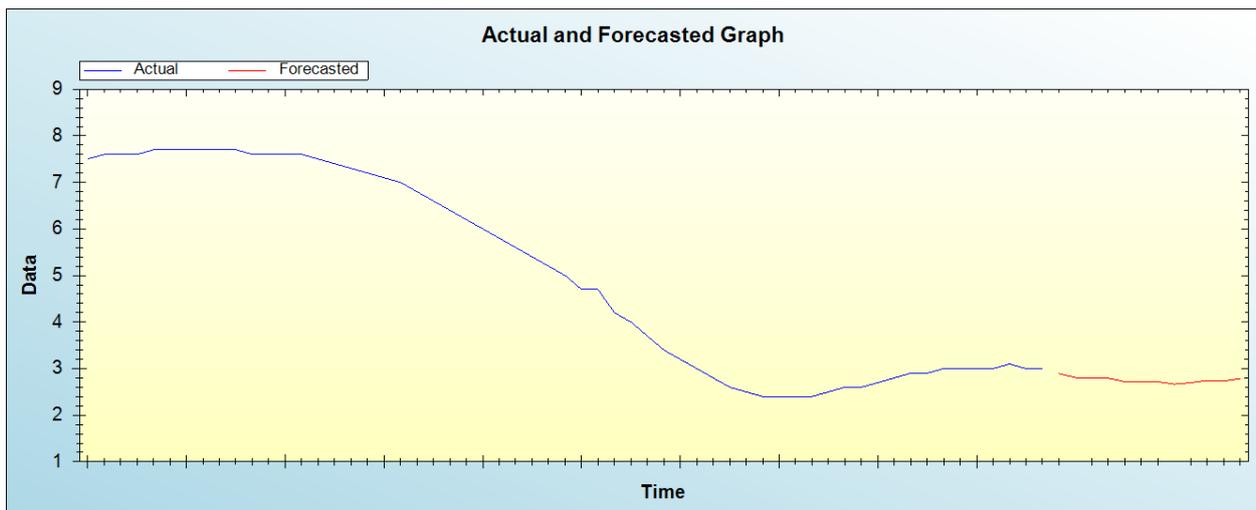


Figure 3: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Forecasts
2019	2.8922
2020	2.8073
2021	2.8041
2022	2.7952
2023	2.7191
2024	2.7257
2025	2.7212
2026	2.6646
2027	2.6971
2028	2.7463
2029	2.7362
2030	2.7852

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 Algeria are likely to decline slightly over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Prediction of fertility is critical for mobilization of resources for health, education, housing and employment. Various methods have been applied; however machine learning techniques have been under-utilized especially in developing countries. In this paper we applied the artificial neural network approach to forecast fertility rates in Algeria and the findings revealed that annual total fertility rates in Algeria are likely to decline slightly over the out-of-sample period. Therefore, we encourage the government to address SRH challenges being faced by adolescent girls and women to improve access to family planning services in order to further reduce unintended pregnancies and other adverse sexual and reproductive health outcomes.

REFERENCES

- [1] Worldometer (2020). Algeria demographics. <https://www.worldometers.info>
- [2] Black RE., Levin C., Walker N., Chou D., Liu L., Temmerman M., DCP3 RMNCH Authors Group (2016). Reproductive, maternal, newborn, and child health: key messages from disease control priorities 3rd edition. *Lancet*. 2016; 3(388): 2811–24. [https://doi.org/10.1016/S0140-6736\(16\)00738-8](https://doi.org/10.1016/S0140-6736(16)00738-8). PubMed PMID: 27072119
- [3] November L., & Sandall J (2018). ‘Just because she’s young, it doesn’t mean she has to die’: exploring the contributing factors to high maternal mortality in adolescents in eastern Freetown; a qualitative study. *Reprod Health*, 15(1):31
- [4] Nove A., Matthews Z., Neal S., Camacho AV (2014). Maternal mortality in adolescents compared with women of other ages: evidence from 144 countries. *Lancet Glob Health*, 2(3):e155–64
- [5] Chandra-Mouli V., Svanemyr J., Amin A., Fogstad H., Say L., Girard F., & Temmerman M (2015). Twenty years after international conference on population and development: where are we with adolescent sexual and reproductive health and rights? *J Adolesc Health*, 56:1–6.
- [6] Shahabuddin A., Nöstlinger C., Delvaux T., Sarker M., Bardají A., De Brouwere V., & Broerse JE (2016). What influences adolescent girls’ decision-making regarding contraceptive methods use and childbearing? A qualitative exploratory study in Rangpur District, Bangladesh. *PLoS One*, 11(6):e0157664

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