International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 8, pp 416-419, August-2021

https://doi.org/10.47001/IRJIET/2021.508093

Projecting Future Total Fertility Rates in Solomon Islands Using Artificial Neural Networks

[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* - This study was conducted to project future total fertility rates (TFRs) from 2019 to 2030 in Solomon Islands using Artificial Neural Networks using data on past TFRs from 1960 to 2018. Results obtained reveal that TFRs for Solomon Islands are expected to remain constant at around 4.4 throughout the out of sample period.**

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

I. INTRODUCTION

Solomon Islands is located in the Guadalcanal Islands and has been experiencing rapid population growth since the 1970s (Chand, 2003). It is made up of 92 Islands. The average population growth rate for the period 1970 to 1976 was 3.4% per year with a total fertility rate (TFR) of 7.3 children per woman and if it continues to grow like this pressure will be put on resources (Solomon Islands, Ministry of Finance, 1981). The TFR for Solomon Islands has been constant at 6.4 from 1960 to 1965, has been around 7 from 1966 to 1978 and slowly fell from there reaching 4.4 in 2018 (World Bank Indicators) This study intends to predict future TFR for Solomon Islands up to the year 2030.

II. LITERATURE REVIEW

There is little or no literature on the prediction of fertility.

Table 1: Literature review

Author/s (Year)	Study period	Method	Topic	Key results
McMurray (1988)	1970 to 1986	-quantitative analysis	Population growth in Solomon Islands: signs of slowing	-Fertility slowing was due to the deferment of marriage -family planning also caused stalling of fertility
Gani (1999)	1982 to 1993	-panel data regression analysis	An economic analysis of factors influencing fertility in the Pacific Island countries	-high infant mortality rates are associated with high fertility rates -family planning, urbanisation, female education and high incomes are negatively correlated with fertility
Sorchik et al (2019)	1999, 2007 and 2009	-quantitative and trend analysis	Fertility trends in Pacific Island countries and territories	-TFR for Solomon Islands declined over a 10-year period from 6 in 1989 to 4.7 in 1999 -fertility was highest in Solomon Islands among women aged 25 to 29
Hortacsu et al (2001)	2000	-ANOVA -Instrumental Variable approach	Desire for children in Turkmenistan and Azerbaijan: son preference and perceived instrumentality for value satisfaction	-Turkmens desire to have more children and ascribe greater importance to having children than Azeris. -Turkmen and Azeri men desire more sons than daughters whilst Azeri women prefer sons only
Tucker (1996)	1990	Narrative analysis	Haiti: unions, fertility and the quest for survival	-most popular unions are legal marriage and setting up of a

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 8, pp 416-419, August-2021

https://doi.org/10.47001/IRJIET/2021.508093

				household in Haiti -more urban women use contraceptives than rural women
Sutherland, Carr & Curtis (2004)	1998-1999	-Ordinary Least Squares	Fertility and the environment in a natural resource dependent economy: Evidence from Peten, Guatemala	-increasing maternal age and rural residence are positively related to fertility -improvement in living standards and maternal education is negatively related to fertility
Kazenin &Kozlov (2020)	Multiple Indicators Clusters Survey of 2012 and 2014	Cumulative Probabilities -Regression Analysis	What factors support the early age patterns of fertility in a developing country: Kyrgyzstan	-women education, labour market relations and family gender relations influence her likelihood of becoming a mother
Cetorelli and Leone (2012)	1990, 1997, 2002, 2007 and 2009	-Linear regression model	Is fertility stalling in Jordan?	-fertility is really stalling in Jordan and not due to data errors -for more than ten years fertility in Jordan has remained constant at a rate more than 3.5 children
Yurtseven (2015)	2000-2013	-dynamic panel data estimation model	The socio-economic determinants of fertility rates in Muslim countries: a Dynamic Panel Data Analysis	-income, past realizations of fertility, college enrolment rate, contraceptive usage and time trends are significant as determinants of fertility in Muslim nations.

III. 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 Solomon Islands.

Data Issues

This study is based on annual total fertility rate (births per woman) in Solomon Islands 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.

IV. FINDINGS OF THE STUDY

ANN Model Summary

Table 2: ANN model summary

Variable	TFR
Included Observation	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	0.064312
MSE	0.017476
MAE	0.106523

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 5, Issue 8, pp 416-419, August-2021
https://doi.org/10.47001/IRJIET/2021.508093

Residual Analysis for the Applied Model

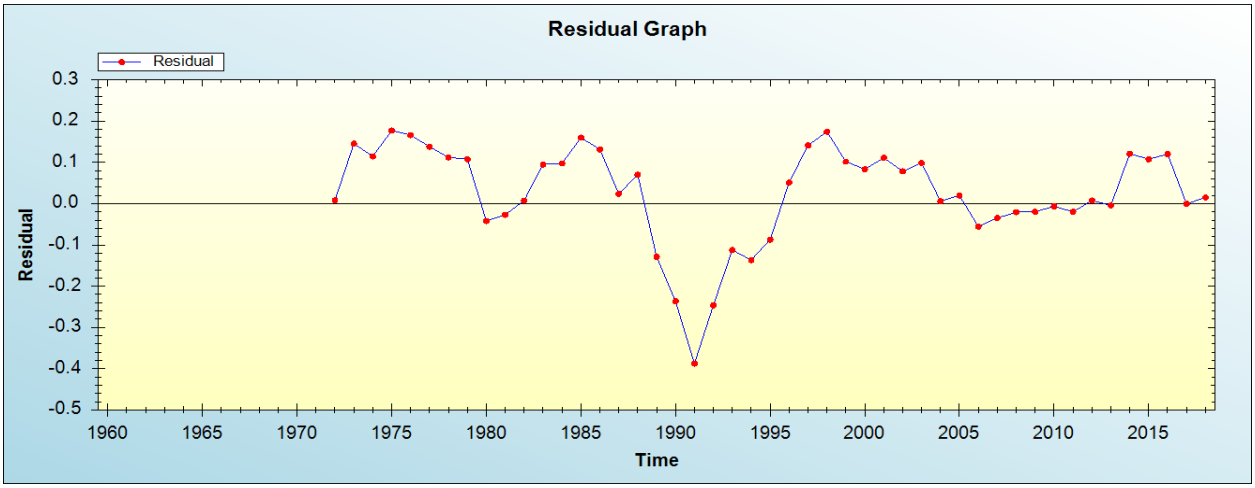

Figure 1: Residual analysis

In-sample Forecast for TFR

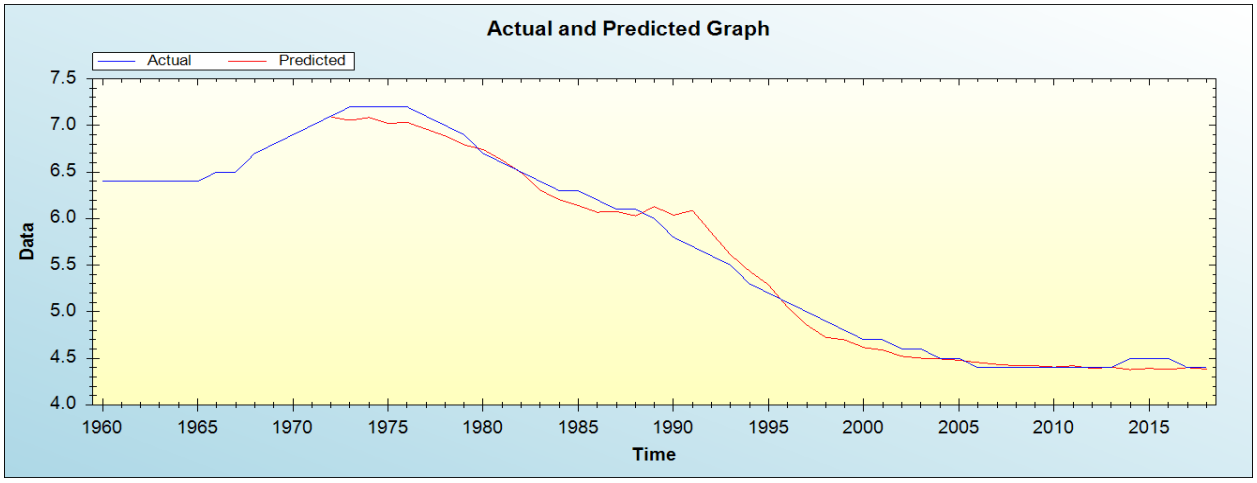

Figure 2: In-sample forecast for the TFR series

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

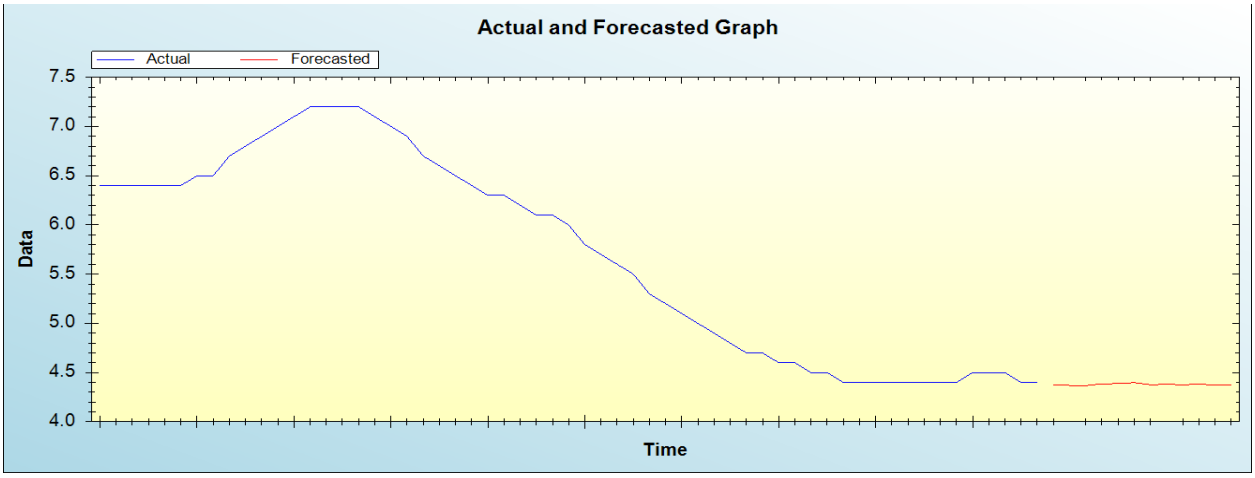

Figure 3: Out-of-sample forecast for TFR: actual and forecasted graph

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 8, pp 416-419, August-2021

https://doi.org/10.47001/IRJIET/2021.508093

Out-of-Sample Forecast for TFR: Forecasts only

Table 3: Tabulated out-of-sample forecasts

Year	Forecasted
2019	4.3780
2020	4.3693
2021	4.3676
2022	4.3856
2023	4.3884
2024	4.3981
2025	4.3763
2026	4.3817
2027	4.3762
2028	4.3820
2029	4.3742
2030	4.3789

The main results of the study are shown in table 2. 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 Solomon Islands are likely to be almost constant over the out-of-sample period.

V. CONCLUSIONS AND RECOMMENDATIONS

Results obtained pointed to a constant TFR of about 4.4 throughout 2019 to 2030. This rate is more than the fertility replacement level of 2.1 increasing the possibility of Solomon Islands to continue growing throughout this period ceteris paribus. The continued growth of population entails the need for Solomon Islands authorities to implement population control policies aimed at curtailing further growth of population. The authorities may also implement policies that foster technological innovation to ensure increased productivity so as to avoid shortage of resources in the face of future continuous population growth.

REFERENCES

[1] Cetorelli, V., & Leone, T. (2012). Is fertility stalling in Jordan? Demographic Research, 26(13), 293-318.

[2] Gani, A. (1999). An economic analysis of factors influencing fertility in the Pacific Island countries, International Journal of Social Economics, 26(1/2/3), 345-353.

[3] Hortascu, N., Bastug, S. S., & Muhammetberdiev, O. B. (2001). Desire for Children in Turkmenistan and Azerbaijan, Journal of Cross-Cultural Psychology, 32(3), 309-321.

[4] Kazenin, K., & Kozlov, V. (2020). What factors support the early age patterns of fertility in a developing country: the case of Kyrgyzstan, Vienna Yearbook of Population Research, (vol 18), 185-213.

[5] McMurray, C. (1988). Population growth in Solomon Islands: signs of slowing, Pacific Economic Bulletin, 4(2).

[6] Sorchik, R. et al. (2019). Fertility trends in Pacific Island countries and territories, Statistics for Development Division, Pacific Community.

[7] Sutherland, E. G., Carr, D., & Curtis, S. L. (2004). Fertility and the environment in a natural resource dependent economy: Evidence from Peten, Guatemala, Network Scientific Journals, 2(1).

[8] Turker, G. (1996). Haiti: Unions, Fertility and the quest for survival, Social Science and Medicine, 43(9), 1379-1387.

[9] Yurtseven, C. (2015). The socioeconomic determinants of fertility rates in Muslim countries: A dynamic panel data analysis, Economics and Sociology, 8(4), 165-178.

Citation of this Article:

Dr. Smartson. P. NYONI, Tatenda. A. CHIHOHO, Thabani NYONI, "Projecting Future Total Fertility Rates in Solomon Islands Using Artificial Neural Networks" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 8, pp 416-419, August 2021. Article DOI https://doi.org/10.47001/IRJIET/2021.508093

****

