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

ISSN (online): 2581-3048
Volume 6, Issue 12, pp 270-275, December-2022
https://doi.org/10.47001/IRJIET/2022.612051

Relying on Empirical Evidence to Draft and Implement Effective Adolescent Health Policies in Gabon

[1]Smartson. P. NYONI, [2]Thabani NYONI

[1]ZICHIRe Project, University of Zimbabwe, Harare, Zimbabwe
[2]Independent Researcher & Health Economist, Harare, Zimbabwe

***Abstract* - This research article employs annual time series data of adolescent fertility rate for Gabon from 1960 to 2020 to predict future trends of adolescent fertility rate over the period 2021 to 2030. The study utilizes Holt's linear exponential smoothing model. The optimal values of smoothing constants α and β are 0.9 and 0.1 respectively based on minimum MSE. The results of the study indicate that annual adolescent fertility rate will continue to decline throughout the out of sample period. Therefore, we encourage authorities in Gabon to scale up educational campaigns among communities, allocate funds for youth empowerment programs and set up youth friendly clinics that offer accessible and affordable sexual and reproductive health services.**

Keywords: Exponential smoothing, Forecasting, adolescent fertility rate.

I. INTRODUCTION

Sub-Saharan Africa is currently battling numerous challenges such as poverty, hunger, political conflicts, infectious diseases, and maternal and child problems. The region is well known for high fertility, maternal and child mortality rates (UNICEF, 2019; WHO, 2011). Adolescent pregnancy has emerged as an important cause of mortality and morbidity among pregnant teenagers due to its association with adverse pregnancy outcomes (Berthelon & Kruger, 2017; Fall *et al.* 2015; Gibbs *et al.* 2012). Several researchers highlighted that poverty, lack of education, social norms, child marriages, lack of adequate knowledge of SRH services, peer influence, alcohol and drug abuse remain among the top drivers of teenage conception in Sub-Saharan Africa and beyond (Mekonnen*et al.* 2019; Wado *et al.* 2019; Odimegwu & Mkwananzi , 2016;Ahorlu*et al.* 2015;UNFP, 2013; Gibbs *et al.* 2012). Although maternal deaths have declined significantly in Africa, mortality rates continue to worry governments in this region. A maternal death is a huge loss to the family and society as the woman is a pillar of social and economic development. Reduction of teenage pregnancy is anticipated to bring about substantial reduction of adverse maternal and child health outcomes as highlighted in the Agenda 2030 for sustainable development (UN, 2020; WHO, 2019; UNICEF, 2018; UN, 2016; UN, 2015). In addition, addressing the problem of child marriages will have a positive impact on family planning programs across the entire African continent. A collaborative approach is very essential in the fight against gender based violence and sexual abuse of women especially in low and middle income countries like Gabon. All relevant stakeholders must be involved during policy making, planning, budgeting and implementation of action plans in order to achieve set targets. As reported by the World Bank, Gabon has made significant progress towards achieving the 3rd SDG targets as the country has reported a decline in adolescent fertility over the years from 180 births per 1000 females aged 15-19 years in 1960 to around 90 births per 1000 females aged 15-19 in 2020. This drop is attributed to increase in contraceptive prevalence, improvements in education and increased SRH knowledge among adolescents which is similar to other countries in the region (Birhanu *et al.* 2019; Sedgh *et al.* 2016).

This paper applies the double exponential smoothing technique to forecast future trends of adolescent fertility in Gabon. The findings are expected to highlight the future burden of adolescent fertility in the out of sample period. This will trigger an appropriate national response to the problem of teenage pregnancy and child marriage in the country through timeous allocation of resources to teenage pregnancy prevention programs.

II. METHODOLOGY

This study utilizes an exponential smoothing technique to model and forecast future trends of adolescent fertility rate in Gabon. In exponential smoothing forecasts are generated from the smoothed original series with the most recent historical values having more influence than those in the more distant past as more recent values are allocated more weights than those in the

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

ISSN (online): 2581-3048

Volume 6, Issue 12, pp 270-275, December-2022

https://doi.org/10.47001/IRJIET/2022.612051

distant past. This study uses the Holt's linear method (Double exponential smoothing) because it is an appropriate technique for modeling linear data.

Holt's double exponential smoothing method is expressed as follows:

Model equation

$G_t = \mu_t + \rho_t \mathbf{t} + \varepsilon_t$

Smoothing equation

$L_t = \alpha G_t + (1-\alpha)(L_{t-1} + b_{t-1})$

$0<\alpha<1$

Trend estimation equation

$b_t = \beta (L_t - L_{t-1}) + (1-\beta) b_{t-1}$

$0<\beta<1$

Forecasting equation

$f_{t+h} = L_t + \mathrm{h} b_t$

G_t is the actual value of adolescent fertility rate at time t

ε_t is the time varying **error term**

μ_t is the time varying mean (**level**) term

ρ_t is the time varying **slope term**

t is the trend component of the time series

L_t is the exponentially smoothed value of adolescent fertility rate at time t

α is the exponential smoothing constant for the data

β is the smoothing constant for trend

f_{t+h} is the h step ahead forecast

b_t is the slope of the trend at time t

b_{t-1} is the slope of the trend at time period t-1

Data Issues

This study is based on annual adolescent fertility rate in Gabon 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

Exponential smoothing Model Summary

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 6, Issue 12, pp 270-275, December-2022
https://doi.org/10.47001/IRJIET/2022.612051

Table 1: ES model summary

Variable	G
Included Observations	61
Smoothing constants	
Alpha (α) for data	0.900
Beta (β) for trend	0.100
Forecast performance measures	
Mean Absolute Error (MAE)	2.827987
Sum Square Error (SSE)	2372.200587
Mean Square Error (MSE)	38.888534
Mean Percentage Error (MPE)	-0.027137
Mean Absolute Percentage Error (MAPE)	1.623931

Residual Analysis for the Applied Model

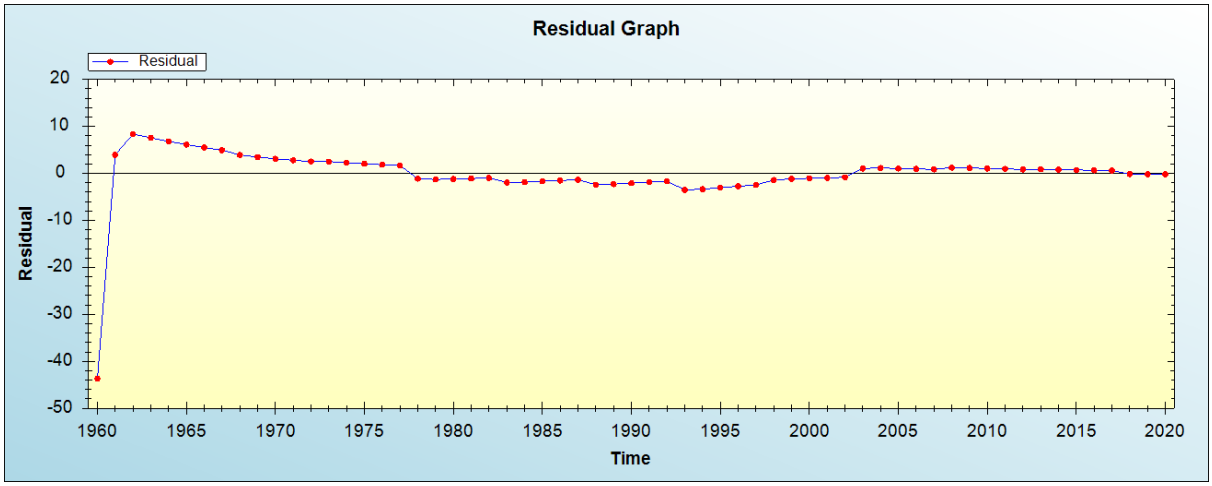

Figure 1: Residual analysis

In-sample Forecast for G

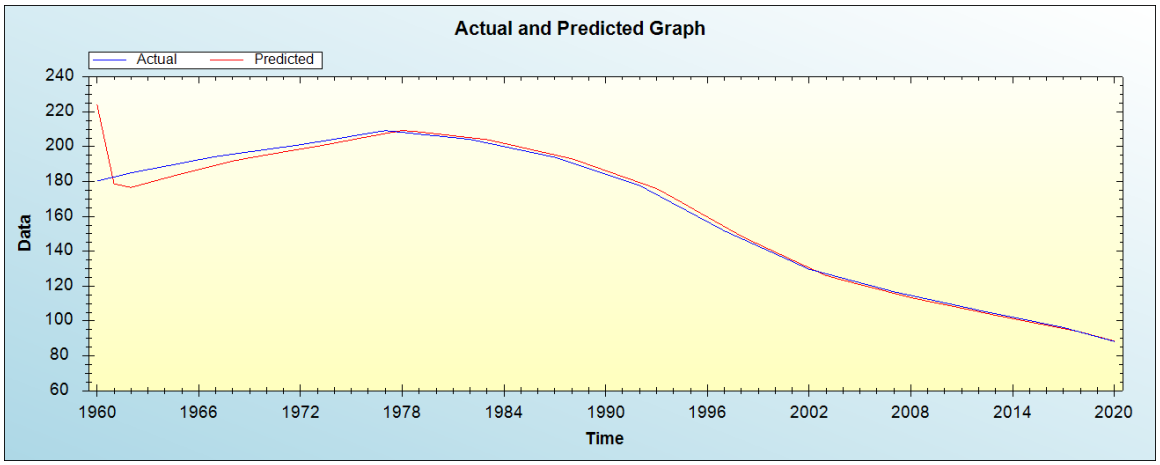

Figure 2: In-sample forecast for the G series

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 6, Issue 12, pp 270-275, December-2022
https://doi.org/10.47001/IRJIET/2022.612051

Actual and Smoothed graph for G series

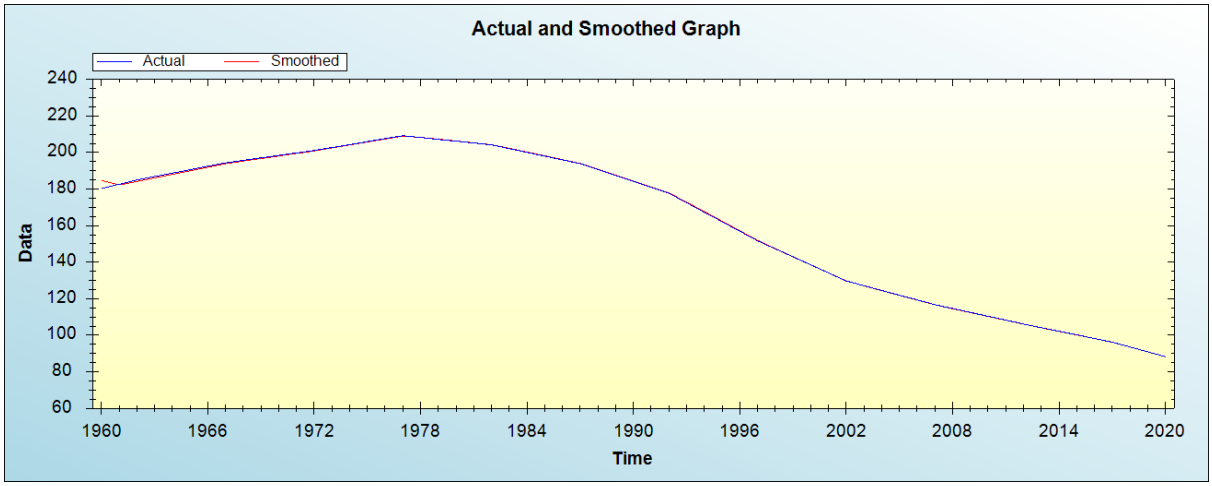

Figure 3: Actual and smoothed graph for G series

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

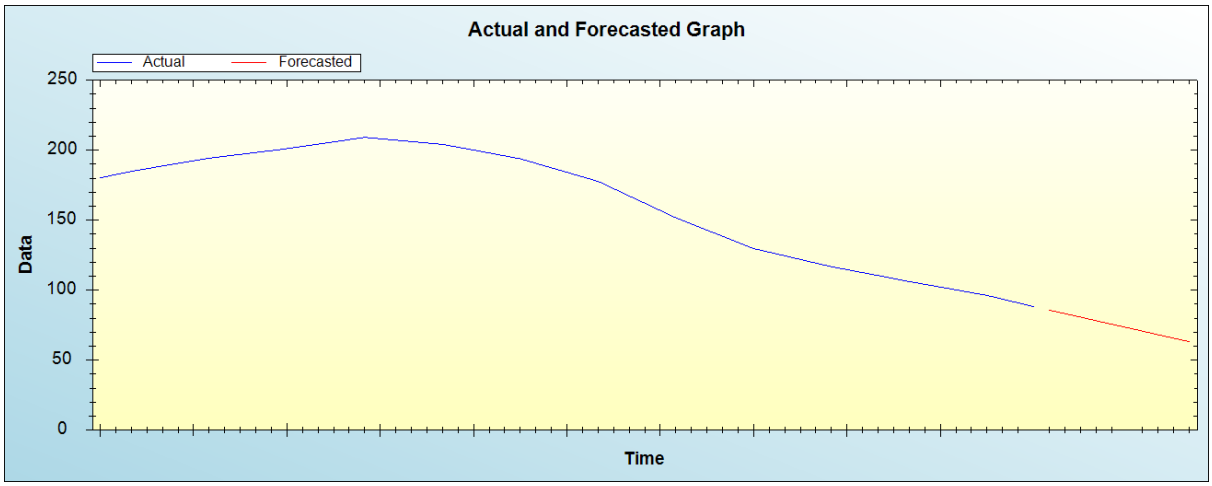

Figure 4: Out-of-sample forecast for G: actual and forecasted graph

Out-of-Sample Forecast for G: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Predicted adolescent fertility rate
2021	85.7449
2022	83.2319
2023	80.7190
2024	78.2061
2025	75.6931
2026	73.1802
2027	70.6673
2028	68.1543
2029	65.6414
2030	63.1284

ISSN (online): 2581-3048
Volume 6, Issue 12, pp 270-275, December-2022
https://doi.org/10.47001/IRJIET/2022.612051

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 continue to decline throughout the out of sample period.

IV. POLICY IMPLICATION & CONCLUSION

Adolescent pregnancy has emerged as an important cause of morbidity and mortality among pregnant teenagers due to its association with adverse pregnancy outcomes. Poverty, lack of education, social norms, child marriages, lack of adequate knowledge of SRH services, peer influence, alcohol and drug abuse remain among the top drivers of teenage conception in Sub-Saharan Africa and beyond. Addressing the problem of child marriages will have a positive impact on family planning programs across the entire African continent. A collaborative approach is key in the fight against gender based violence and sexual abuse of women especially in low and middle income countries like Gabon. This study applied Holt's double exponential smoothing technique to forecast future trends of adolescent fertility for Gabon. We established that adolescent fertility will continue to decline throughout the out of sample period. Therefore, we encourage the government to scale up educational campaigns among communities, allocate funds for youth empowerment programs and set up youth friendly clinics that offer accessible and affordable sexual and reproductive health services.

REFERENCES

[1] UNICEF (2019). Levels and trends in child mortality: report 2019. Estimates developed by the UN Inter-agency Group for child mortality estimation. New York: UNICEF.
[2] United Nations (2015). transforming our world: The 2030 agenda for sustainable development, A/RES/70/1. New York: UN General Assembly.
[3] UN (2020) sustainable development goals. https://www.un.org/sustainabl development/development-agenda
[4] UNICEF (2018). Every Child alive. New York: UNICEF
[5] World Health Organization (WHO) (2019). SDG 3: Ensure healthy lives and promote wellbeing for all at all ages.
[6] United Nations (2016). Transforming our world: The 2030 agenda for sustainable development.
[7] World Health Organization (2011).WHO Guidelines on Preventing Early Pregnancy and Poor Reproductive Outcomes among Adolescents in Developing Countries. Geneva.
[8] World Bank (2020). Adolescent fertility rate for females aged 15-19.
[9] Berthelon M., and Kruger D.I (2017). Does adolescent motherhood affect education and labor market outcomes of mothers? A study on young adult women in Chile during 1990- 2013. Int J Public Health 2017; 62:293–303.
[10] Fall C.H.D., Sachdev H.S., and Osmond C (2015). Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low- income and middle- income countries (cohorts collaboration). Lancet Glob Health 2015;3:e366–77
[11] UNFPA(2013). State of World Population 2013 Motherhood in Childhood: Facing the challenge of adolescent pregnancy. New York.
[12] Gibbs C.M., Wendt A., Peters S., and Hogue C.J (2012). The impact of early age at first childbirth on maternal and infant health. Paediatr Perinat Epidemiol. 26(Suppl 1):259–84.
[13] Sedgh G., Ashford L.S., and Hussain R (2016). Unmet need for contraception in developing countries: examining women's reasons for not using a method. New York: Guttmacher Institute. 2016; 2:2015-6.
[14] Birhanu B.E., Kebede D.L., Kahsay A.B., and Belachew A.B (2019). Predictors of teenage pregnancy in Ethiopia: a multilevel analysis. BMC Public Health. 19(1): 601. https://doi.org/10.1186/s12889-019-6845-7.
[15] Odimegwu C., and Mkwananzi S (2016). Factors associated with teen pregnancy in sub-Saharan Africa: a multi-country cross-sectional study. Afr J Reprod Health. 20(3):94–107. https://doi.org/10.29063/ajrh2016/v20i3.14
[16] Wado Y.D., Sully E.A., and Mumah J.N (2019). Pregnancy and early motherhood among adolescents in five east African countries: a multi-level analysis of risk and protective factors. BMC Pregnancy Childbirth. 2019; 19(1):59. https://doi.org/10.1186/s12884-019-2204-z.
[17] Ahorlu C.K., Pfeiffer C., and Obrist B (2015). Socio-cultural and economic factors influencing adolescents' resilience against the threat of teenage pregnancy: a cross-sectional survey in Accra, Ghana. Reprod Health. 2015;12:117
[18] Mekonnen T., Dune T., and Perz J (2019). Maternal health service utilization of adolescent women in sub- Saharan Africa: a systematic scoping review. BMC Pregnancy Childbirth 2019; 19:366.

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

ISSN (online): 2581-3048

Volume 6, Issue 12, pp 270-275, December-2022

https://doi.org/10.47001/IRJIET/2022.612051

Citation of this Article:

Smartson. P. NYONI, Thabani NYONI, "Relying on Empirical Evidence to Draft and Implement Effective Adolescent Health Policies in Gabon" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 6, Issue 12, pp 270-275, December 2022. Article DOI https://doi.org/10.47001/IRJIET/2022.612051

****

