

# Relying on Empirical Evidence to Address the Challenge of Adolescent Fertility in Cote D'Ivoire

<sup>1</sup>Smartson. P. NYONI, <sup>2</sup>Thabani NYONI

<sup>1</sup>ZICHIRE Project, University of Zimbabwe, Harare, Zimbabwe

<sup>2</sup>Independent Researcher & Health Economist, Harare, Zimbabwe

**Abstract** - This research article uses annual time series data of adolescent fertility rate for Cote d'Ivoire 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  $\alpha$  and  $\beta$  are 0.9 and 0.2 respectively based on minimum MSE. The results of the study indicate that annual adolescent fertility will continue to drop but remain very high throughout the forecast period. Therefore, we encourage authorities in Cote d'Ivoire to implement intervention activities such as awareness campaigns, promoting girl child education, strictly enforce laws that protect women's rights, ensuring availability of appropriate and client specific birth control methods at all levels of healthcare and setting up of more adolescent friendly health facilities.

**Keywords:** Exponential smoothing, Forecasting, adolescent fertility rate.

## I. INTRODUCTION

Low and middle income countries continue to report worrying trends of teenage pregnancies and births (Fall *et al.* 2015). Poverty, lack of adequate SRH information, inaccessible reproductive services and social norms have been found to be among the factors that contribute to adolescent pregnancy (Ochako *et al.* 2015; Chandra-Mouli *et al.* 2014; UNICEF, 2014; Wong, 2012; UNICEF, 2011). Sub-Saharan Africa has the highest teenage pregnancy rates in the world followed by Latin America and the Caribbean (PAHO, 2010). Globally, the leading causes of death among adolescent girls between 15 and 19 years old are related to pregnancy and child bearing (Kaphagawani & Kalipeni, 2017; Sedgh *et al.* 2016; PAHO, 2015; Larsson *et al.* 2002). Previous studies highlight high school dropouts, social rejection and psychological disorders among pregnant teenage girls (Croft *et al.* 2018; Berthelon & Kruger, 2017; Okigbo & Speizer, 2015; Duflo *et al.* 2014). In addition, complications during the antenatal period, at birth and post natal periods were also highlighted (Odimegwu & Mkwanaenzi, 2016; WHO, 2016; Neal *et al.* 2012). Undesirable consequences of teenage pregnancy also include repeat pregnancy, obstetric fistula, lower educational level leading to getting lower paying jobs and repeating cycle of poverty (Sychareunet *et al.* 2018; Gibbs *et al.* 2012). World Bank data shows that adolescent fertility rate in Cote d'Ivoire dropped from 232 births per 1000 women aged 15-9 years in 1960 to 113 births per 1000 women aged 15-19 years in 2020. This shows that adolescent fertility is still very high in the country and this calls for more resources in order to substantially reduce teenage pregnancy in the country. This paper aims to forecast future trends of adolescent fertility in Cote d'Ivoire using the double exponential smoothing technique. The findings are expected to highlight future trends of adolescent fertility in the out of sample period. This will facilitate planning and allocation of resources to teenage pregnancy prevention programs in the country.

## II. METHODOLOGY

This study utilizes an exponential smoothing technique to model and forecast future trends of adolescent fertility rate in Cote d'Ivoire. 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 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 exponential smoothing model is specified as follows:

Model equation

$$A_t = \mu_t + \rho_t t + \varepsilon_t$$

Smoothing equation

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

$$0 < \alpha < 1$$

Trend estimation equation

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

$$0 < \beta < 1$$

Forecasting equation

$$f_{t+h} = L_t + hb_t$$

$A_t$  is the actual value of adolescent fertility rate at time t

$\varepsilon_t$  is the time varying **error term**

$\mu_t$  is the time varying mean (**level**) term

$\rho_t$  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

$\alpha$  is the exponential smoothing constant for the data

$\beta$  is the smoothing constant for trend

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

$b_t$  is the trend estimate at time t

$b_{t-1}$  is the trend estimate at time period t-1

**Data Issues**

This study is based on annual adolescent fertility rate in Cote d'Ivoire 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

Table 1: ES model summary

Variable	A
Included Observations	61
Smoothing constants	
Alpha ( $\alpha$ ) for data	0.900
Beta ( $\beta$ ) for trend	0.900
Forecast performance measures	

Mean Absolute Error (MAE)	0.385090
Sum Square Error (SSE)	41.034377
Mean Square Error (MSE)	0.672695
Mean Percentage Error (MPE)	0.019412
Mean Absolute Percentage Error (MAPE)	0.212704

Residual Analysis for the Applied Model

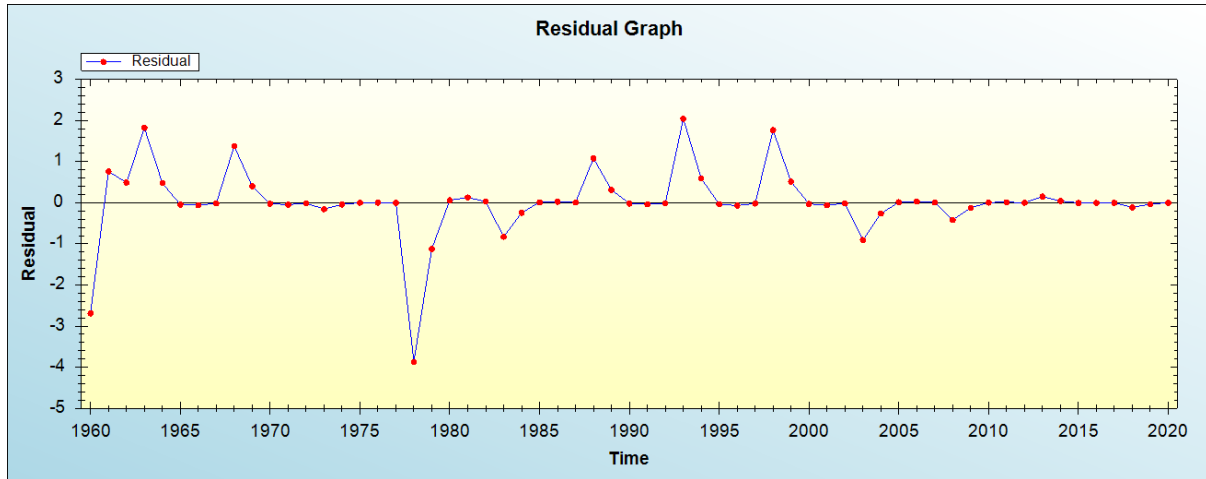


Figure 1: Residual analysis

In-sample Forecast for A

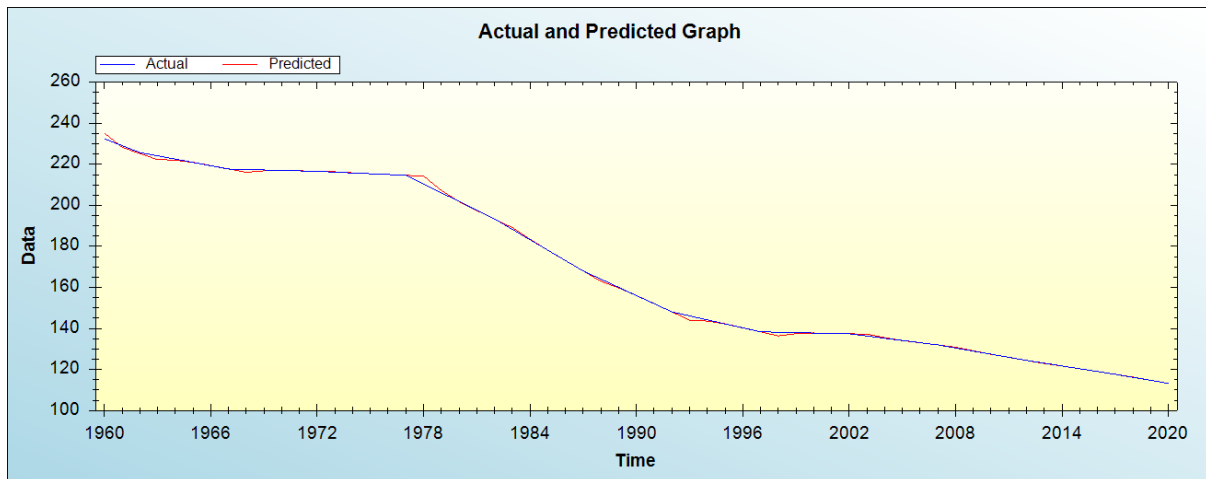


Figure 2: In-sample forecast for the A series

Actual and Smoothed graph for A series

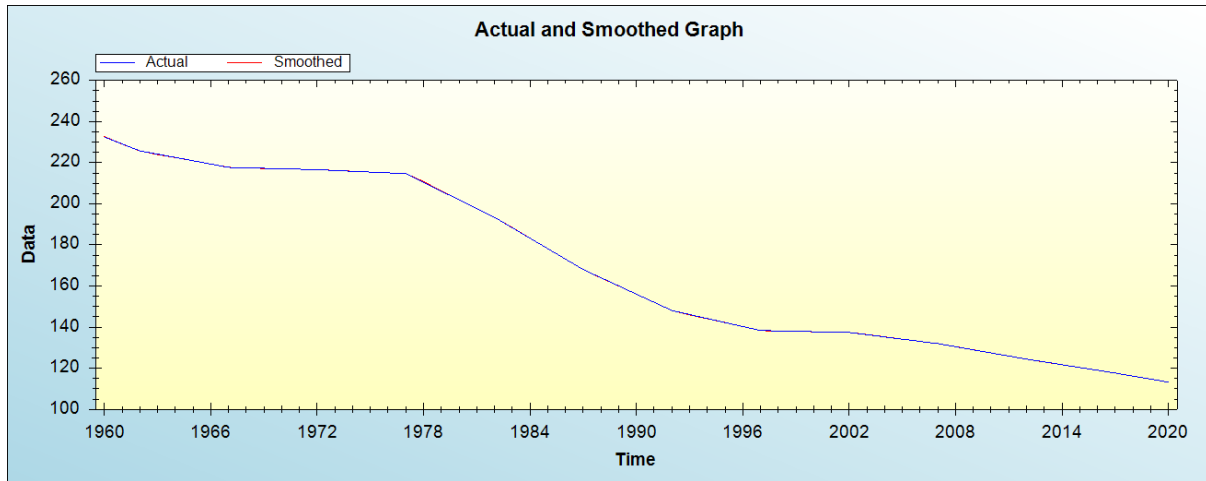


Figure 3: Actual and smoothed graph for A series

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

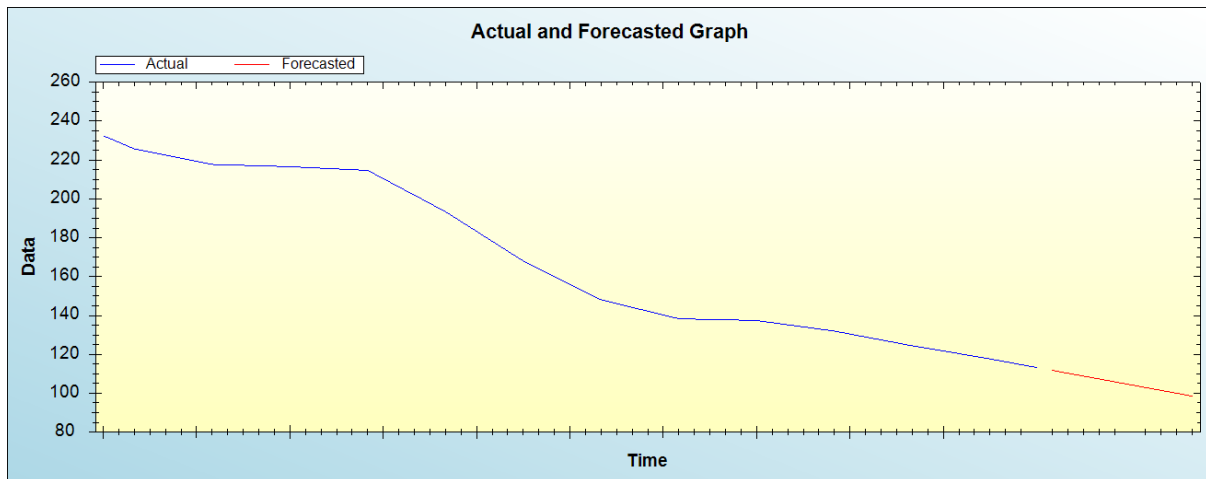


Figure 4: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Forecasted adolescent fertility rate
2021	111.7489
2022	110.2767
2023	108.8045
2024	107.3324
2025	105.8602
2026	104.3881
2027	102.9159
2028	101.4438
2029	99.9716
2030	98.4995

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 drop but remain very high throughout the forecast period.

#### IV. POLICY IMPLICATION & CONCLUSION

Low and middle income countries continue to report worrying trends of teenage pregnancies and births. Undesirable consequences of teenage pregnancy such as repeat pregnancy, obstetric fistula, lower educational level leading to getting lower paying jobs and repeating cycle of poverty are being reported. Adolescent fertility rate in Cote d'Ivoire steadily declined from 232 births per 1000 women aged 15-9 years in 1960 to 113 births per 1000 women aged 15-19 years in 2020. This indicates that adolescent fertility is still very high in this country and this calls for more resources in order to substantially reduce teenage pregnancy and its adverse pregnancy outcomes. This study applied Holt's double exponential smoothing technique to forecast adolescent fertility for Cote d'Ivoire. Our study findings revealed that adolescent fertility will continue to drop but remain very high throughout the out of sample period. Therefore, we encourage the government to implement intervention activities such as awareness campaigns, promoting girl child education, strictly enforce laws that protect women's rights, ensuring availability of appropriate and client specific birth control methods at all levels of healthcare and setting up of more adolescent friendly health facilities.

#### REFERENCES

- [1] Pan American Health Organization(PAHO) (2010).Adolescent and Youth Regional Strategy and Plan of Action 2010–2018. Washington, DC.
- [2] Pan American Health Organization (PAHO) (2015). Violence against Women. Strategy and Plan of Action on Strengthening the Health System to Address Violence against Women. Washington, DC. [http://iris.paho.org/xmlui/bitstream/handle/123456789/18386/CD549Rev2\\_eng.pdf?sequence=47&isAllowed=4y](http://iris.paho.org/xmlui/bitstream/handle/123456789/18386/CD549Rev2_eng.pdf?sequence=47&isAllowed=4y).
- [3] Berthelon M., and Kruger DI (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.
- [4] Fall C.H.D., Sachdev H.S., Osmond C., Restrepo-Mendez M.C., Victora C., Martorell R (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.
- [5] 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.
- [6] Sychareun V., Vongxay V., Houaboun S., Thammavongsa V., Phummavongsa P., Chaleunvong (2018). Determinants of adolescent pregnancy and access to reproductive and sexual health services for married and unmarried adolescents in rural Lao PDR: a qualitative study. *BMC Pregnancy Childbirth*. 18(1):219.
- [7] Neal S., Matthews Z., Frost M., Fogstad H., Camacho AV., and Laski L (2012). Childbearing in adolescents aged 12–15 years in low resource countries: a neglected issue. New estimates from demographic and household surveys in 42 countries. *Acta Obstet Gynecol Scand*. 91(9):1114–8. <https://doi.org/10.1111/j.1600-0412.2012.01467.x>.
- [8] WHO (2016). Global health estimates 2015: deaths by cause, age, sex, by country and by region, 2000-2015. Geneva.
- [9] World Bank (2020). Adolescent fertility rate women aged 15-19.

#### Citation of this Article:

Smartson. P. NYONI, Thabani NYONI, “Relying on Empirical Evidence to Address the Challenge of Adolescent Fertility in Cote D'Ivoire” Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 6, Issue 12, pp 197-201, December 2022. Article DOI <https://doi.org/10.47001/IRJIET/2022.612037>

\*\*\*\*\*