

How to Use Empirical Evidence to Address Teenage Pregnancy and Child Births in the Islamic Republic of Iran

¹Smartson. P. NYONI, ²Thabani NYONI

¹ZICHIRE Project, University of Zimbabwe, Harare, Zimbabwe

²Independent Researcher & Health Economist, Harare, Zimbabwe

Abstract - This research article employs annual time series data of adolescent fertility rate for the Islamic Republic of Iran 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 0.5 respectively based on minimum MSE. The results of the study indicate that annual adolescent fertility will hover around 40 births per 1000 women aged 15-19 years throughout the out of sample period. Therefore, we encourage authorities in Iran to promote girl child education, protect the rights of women and girls, and set up adolescent friendly health facilities that are well resourced to address adolescent health problems.

Keywords: Exponential smoothing, Forecasting, adolescent fertility rate.

I. INTRODUCTION

Teenage pregnancy is a worldwide problem which continues to affect both developing and developed countries (Vogel *et al.* 2015; Sedgh *et al.* 2015; Ajala, 2014). Preventing pregnancy among adolescents is very important as it helps to reduce adverse maternal and child health outcomes such as maternal and neonatal deaths, preterm delivery, hypertensive disorders, anemia, obstructed labour and low birth weight (Karataşlı *et al.* 2019; Ogawa *et al.* 2019;). Several previous studies in developing regions revealed that teenage girls from poor families, living in the rural areas, with low education level, having little knowledge on family planning services and who lack parental guidance are at increased risk of experiencing unintended pregnancies (Geda, 2019; Wado *et al.* 2019; Caffé *et al.* 2017). Young girls who live close to mining areas, border towns and growth points through peer pressure and poverty are pushed into commercial sex work which exposes them to unsafe abortions, sexually transmitted infections and HIV. They end up being involved in alcohol and substance abuse among other criminal activities. Some of them end up dropping out of school and thus spoiling their future. Child marriage in some settings is a common finding due to religious or cultural norms which force young girls into early marriage. The 3rd sustainable development goal (SDG-3) emphasizes prioritization of adolescent sexual and reproductive health as a way to end all preventable maternal and perinatal deaths. It highlights the importance of identifying SRH needs of adolescents in every country and addressing them taking into consideration individual needs (UN, 2020; WHO, 2019; UNICEF, 2018; UN, 2016; UN, 2015). In addition, it is crucial to educate adolescents on comprehensive sexuality education as a way of empowering them. Regular public awareness and incorporation of comprehensive sexuality education into the education curriculum is expected to improve knowledge on family planning services. HIV prevention and treatment is included in adolescent sexual and reproductive health. Encouraging adolescents to know their status with the help of their parents and guardians is crucial in the control of the HIV epidemic. Early detection and treatment will improve treatment outcomes and ultimately improve the quality of life among adolescents and this helps them to realize their lifetime goals. In the case of Iran teenage pregnancy is still a problem. Early marriage is still prevalent. In 2018, child marriage stood at 3% for girls under the age of 15 and 17% for those under the age of 18 (Kohan *et al.* 2021; UNICEF, 2018). Iran's adolescent fertility steadily declined from around 150 births per 1000 women aged 15-19 in 1960 to around 40 births per 1000 women aged 15-19 in 2020 (World Bank, 2020). This shows that the Iranian government has made significant progress in improving educational levels among adolescents, contraceptive prevalence increased and family planning knowledge has also improved.

The purpose of this paper is to model and forecast future trends of adolescent fertility in Iran using double exponential smoothing technique. The findings of this paper will highlight the future burden of adolescent fertility in Iran. This will inform family planning policy, planning and allocation of resources to the family planning program in the country.

II. METHODOLOGY

This study utilizes an exponential smoothing technique to model and forecast future trends of adolescent fertility rate in Iran. 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 double exponential smoothing method is specified as follows:

Model equation

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

Smoothing equation

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

$$0 < \alpha < 1$$

Trend estimation equation

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

$$0 < \beta < 1$$

Forecasting equation

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

R_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 trend estimate at time t

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

Data Issues

This study is based on annual adolescent fertility rate in Iran 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	R
Included Observations	61
Smoothing constants	
Alpha (α) for data	0.900
Beta (β) for trend	0.500
Forecast performance measures	
Mean Absolute Error (MAE)	1.392172
Sum Square Error (SSE)	480.191276
Mean Square Error (MSE)	7.871988
Mean Percentage Error (MPE)	0.553303
Mean Absolute Percentage Error (MAPE)	1.668914

Residual Analysis for the Applied Model

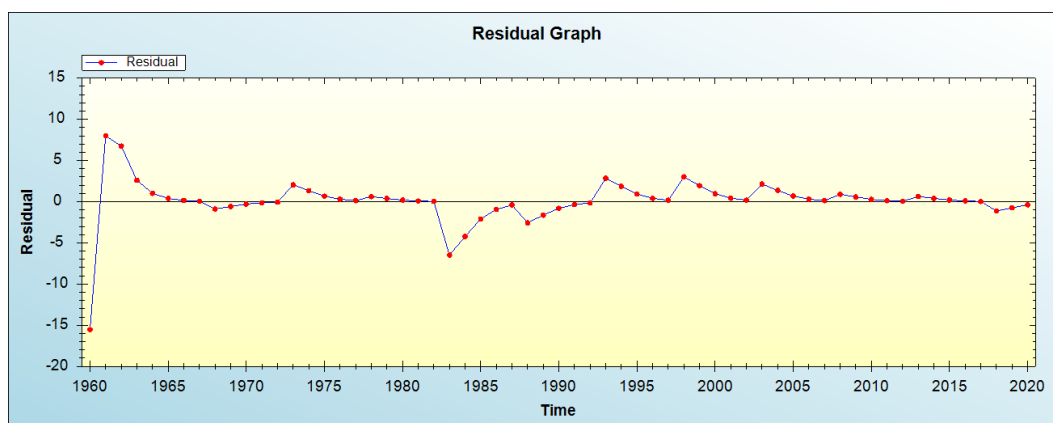


Figure 1: Residual analysis

In-sample Forecast for R

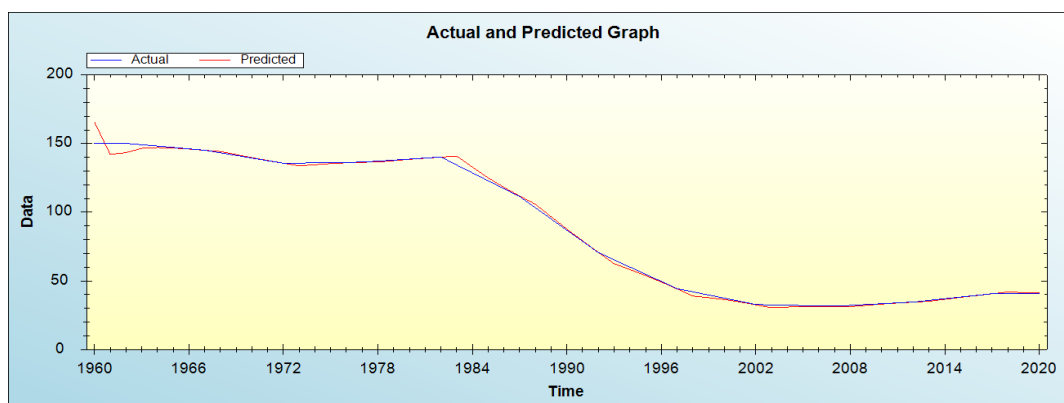


Figure 2: In-sample forecast for the R series

Actual and Smoothed graph for R series

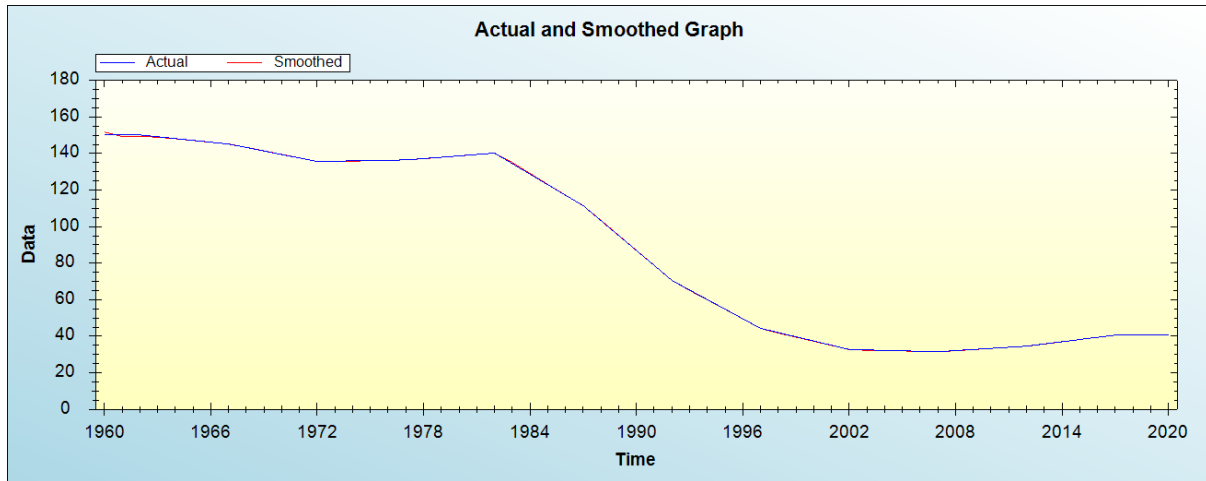


Figure 3: Actual and smoothed graph for R series

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

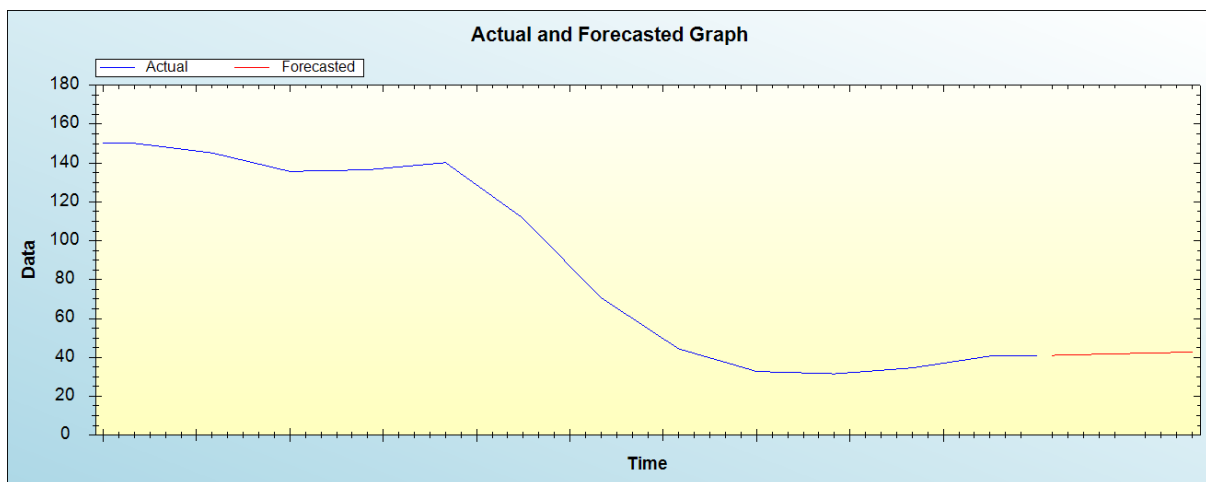


Figure 4: Out-of-sample forecast for R: actual and forecasted graph

Out-of-Sample Forecast for R: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Predicted adolescent fertility rate
2021	41.0337
2022	41.2209
2023	41.4080
2024	41.5952
2025	41.7823
2026	41.9695
2027	42.1566
2028	42.3438
2029	42.5309
2030	42.7181

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 hover around 40 births per 1000 women aged 15-19 throughout the out of sample period.

IV. POLICY IMPLICATION & CONCLUSION

Iran's adolescent fertility gradually declined from around 150 births per 1000 women aged 15-19 in 1960 to around 40 births per 1000 women aged 15-19 in 2020. This indicates that the Iranian government has made significant progress in improving educational levels among adolescents, contraceptive prevalence increased and family planning knowledge has also improved. This study applied Holt's double exponential smoothing technique to forecast future trends of adolescent fertility for Iran. Our study findings indicated that adolescent fertility will hover around 40 births per 1000 women aged 15-19 throughout the out of sample period. Therefore, the Iranian government is encouraged to promote girl child education, protect the rights of women and girls, and set up adolescent friendly health facilities that are well resourced to address adolescent health problems.

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