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

ISSN (online): 2581-3048

Volume 7, Issue 2, pp 461-466, February-2023

https://doi.org/10.47001/IRJIET/2023.702077

Using Empirical Evidence to Address the Burden of Teenage Pregnancy and Child Births in the United States of America

[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 paper uses annual time series data of adolescent fertility rate for the United States of America 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 continue to drop to levels below 10 births per 1000 women aged 15-19 years by the end of 2030.Therefore, we encourage authorities in the US to address local factors which significantly contributes to adolescent pregnancy.**

Keywords: Exponential smoothing, Forecasting, adolescent fertility rate.

I. INTRODUCTION

The United States government has made tremendous progress in the reduction of teenage pregnancy. Over the years, the country has recorded a steady decline of teen pregnancy (Martin*et al.*2017). Adolescent pregnancy declined from 89.1 births per 1,000 females in 1960 to 26.5 births per 1,000 females in 2013, a historic low for the United States and a drop of 10% from 2012. In addition, birth rates for teenagers aged 15–19 years declined for all groups from 2012to 2013, with rates down 9% for non-Hispanic white, 10% for Hispanic and Asian/Pacific Islander, and 11% for non-Hispanic black and American Indian/Alaska Native teenagers (Martin*et al.*2015). Research evidence indicates that this remarkable decline was attributed to the declining share of teens, particularly younger teens, ever having sexual intercourse (Santelli *et al.* 2007; Santelli *et al.* 2004;Jacqueline*et al.*1999). In addition, risk of pregnancy declined because teens with sexual experience reported improved use of contraceptives. Teens were more likely to use condoms and long-acting hormonal methods and less likely to use withdrawal or no method of contraceptives (Fernandes-Alcantara, 2018).This change in behavior may be attributed to the national AIDS epidemic (Sarah Kliff, 2015). Despite this huge improvement, teen pregnancy and births remain among the highest of all developed countries (United Nations Population Division, 2017; Sedgh*et al.*2015). The reported estimate of teenage pregnancies in 2010 was 57 pregnancies per 1,000 women aged 15–19, which amounted to more than 625,000 teen pregnancies country wide (Kost and Henshaw, 2014). Studies conducted in the United States have showed that there is a notable variation of teenage pregnancies based on geographic, socio-economic and racial groups (Martinez *et al.*2011.). Higher adolescent pregnancy rates are seen among the Latino group when compared with their white counterparts (Martin*et al.*2017). Several issues have been identified as risk factors for teenage pregnancy and they include lack or poor parental guidance, in adequate sexual and reproductive health knowledge, and peer pressure (Kalmuss & Austrian, 2010; Lowery*et al.* 2005; Fortenberry *et al.* 2002). To address the problem of teenage pregnancy, the United States government has implemented teen pregnancy prevention programs (TPP) designed to improve sexual and reproductive health of adolescents (Goesling *et al.* 2015).The development of TPP programs specifically for adolescent males has been identified by the U.S. Department of Health and Human Services of Adolescent Health as a priority area warranting further research and programmatic development (Marsiglio, 2017).

This research is conducted in line with the government's Teen Pregnancy Prevention (TPP) programs and employs Holt's double exponential smoothing technique to forecast future trends of adolescent fertility in the country for the out of sample period. The findings of this paper are expected to provide evidence of the likely future burden of adolescent births in the US. This will facilitate planning and allocation of resources to Teen Pregnancy Prevention programs in order to curb adverse SRH outcomes related to teen pregnancy.

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

ISSN (online): 2581-3048

Volume 7, Issue 2, pp 461-466, February-2023

https://doi.org/10.47001/IRJIET/2023.702077

II. METHODOLOGY

This study utilizes an exponential smoothing technique to model and forecast future trends of adolescent fertility rate in the United States of America. 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 model is specified as follows:

Model equation

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

Smoothing equation

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

$0<\alpha<1$

Trend estimation equation

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

$0<\beta<1$

Forecasting equation

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

Y_t Represents adolescent fertility rate at timeperiod 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 time period 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 the United States of America 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.

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

ISSN (online): 2581-3048

Volume 7, Issue 2, pp 461-466, February-2023

https://doi.org/10.47001/IRJIET/2023.702077

III. FINDINGS OF THE STUDY

Exponential smoothing Model Summary

Table 1: ES model summary

Variable	Y
Included Observations	61
Smoothing constants	
Alpha (α) for data	0.900
Beta (β) for trend	0.500
Forecast performance measures	
Mean Absolute Error (MAE)	0.659999
Sum Square Error (SSE)	99.475623
Mean Square Error (MSE)	1.630748
Mean Percentage Error (MPE)	0.038773
Mean Absolute Percentage Error (MAPE)	1.232246

Residual Analysis for the Applied Model

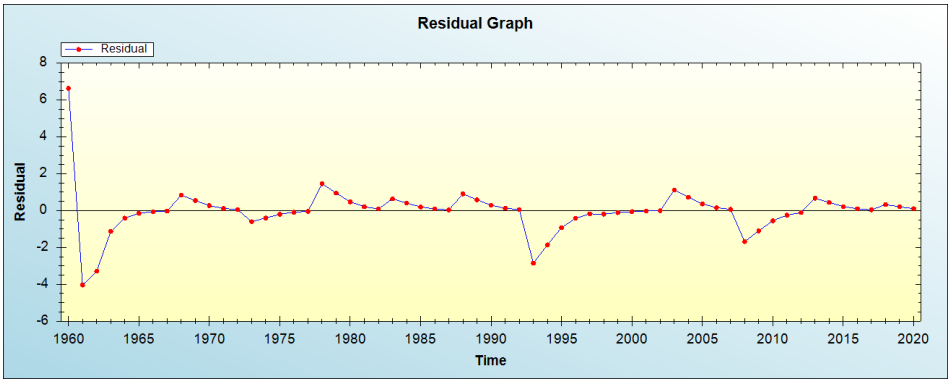

Figure 1: Residual analysis

In-sample Forecast for Y

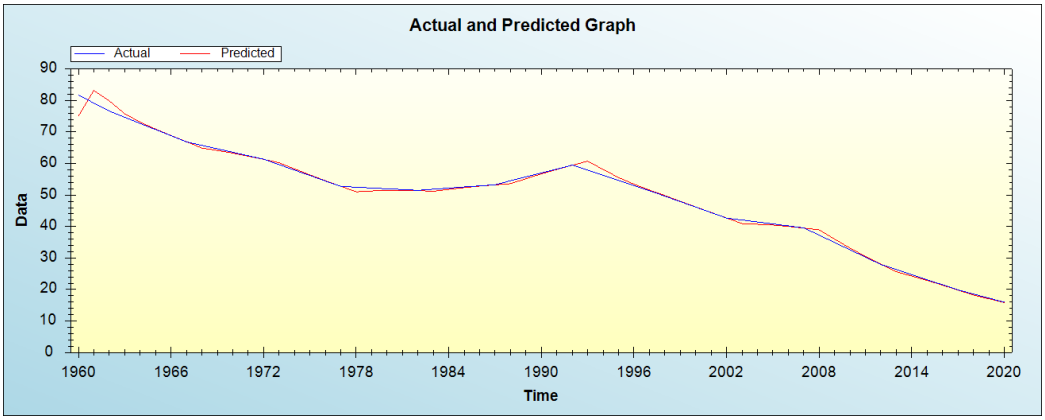

Figure 2: In-sample forecast for the Y series

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

ISSN (online): 2581-3048

Volume 7, Issue 2, pp 461-466, February-2023

https://doi.org/10.47001/IRJIET/2023.702077

Actual and Smoothed graph for Y series

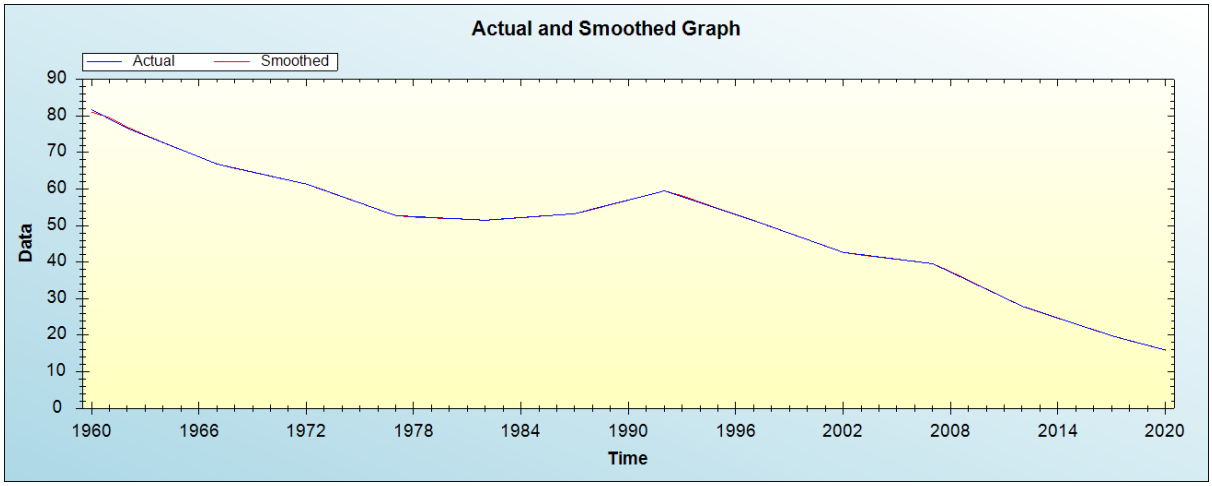

Figure 3: Actual and smoothed graph for Y series

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

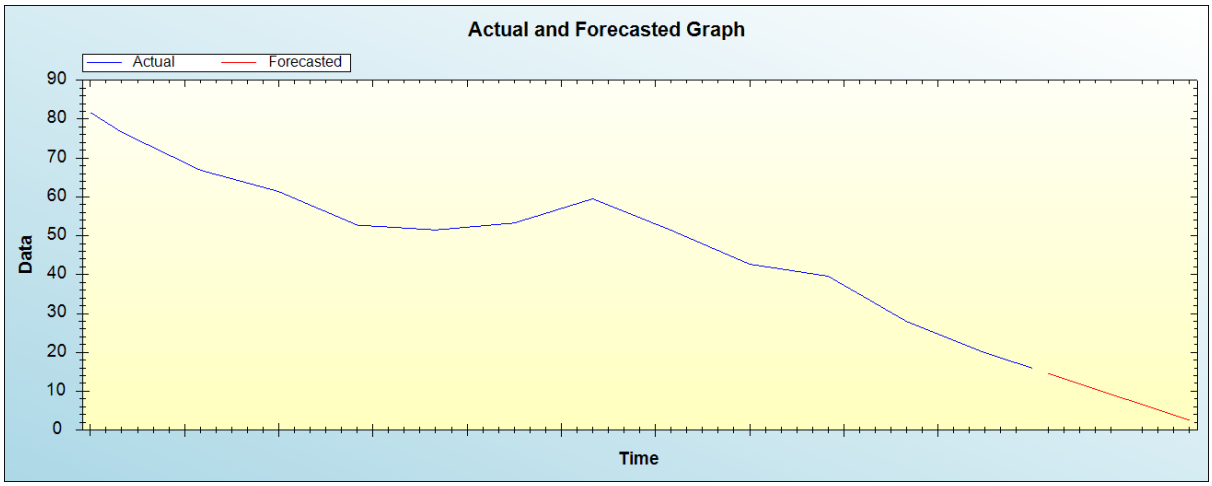

Figure 4: Out-of-sample forecast for Y: actual and forecasted graph

Out-of-Sample Forecast for Y: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Predicted adolescent fertility rate
2021	14.5985
2022	13.2588
2023	11.9191
2024	10.5794
2025	9.2397
2026	7.8999
2027	6.5602
2028	5.2205
2029	3.8808
2030	2.5411

ISSN (online): 2581-3048
Volume 7, Issue 2, pp 461-466, February-2023
https://doi.org/10.47001/IRJIET/2023.702077

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 is also a public health problem of importance in the developed world due to the associated adverse sexual and reproductive health outcomes. The United States has made significant progress towards the reduction of adolescent fertility over the past decades reflecting substantial improvements in girl child education and women empowerment. It also indicates the high quality of family planning programs in the country. This paper applied Holt's double exponential smoothing technique to forecast future trends of adolescent fertility for the US. The study findings indicate that adolescent fertility will continue to drop to levels below 10 births per 1000 women aged 15-19 years by the end of 2030. In order to continue on this desirable path, the US government is encouraged to address local factors which drive teenage pregnancy.

REFERENCES

[1] Martin J., Hamilton B., OsteranM (2017).Final data for 2015. National vital statistics reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 66(1):1–70. Available at: https://www.cdc.gov/nchs/data/nvsr/ nvsr66/nvsr66_01.pdf.

[2] United Nations Population Division (2017). Adolescent fertility rate (births per 1, 000 women ages 15–19). The World Bank website. Available at: http:// data.worldbank.org/indicator/SP.ADO.TFRT.

[3] SedghG., FinerLB., and Bankole A (2015). Adolescent pregnancy, birth, and abortion rates across countries: Levels and recent trends. J Adolesc Health. 56:223–30. doi:10.1016/j.jadohealth.2014.09.007.

[4] Kost K., and Henshaw S (2014). Us teenage pregnancies, births and abortions, 2010 National and state trends by age, race, and ethnicity. New York (NY): Guttmacher Institute; 2014.

[5] Kalmuss D., and Austrian K (2010). Real men do. Real men don't: Young Latino and African American men's discourses regarding sexual health careutilization. Am J Mens Health. 4:218–30. doi: 10.1177/1557988309331797.

[6] Fortenberry JD., McFarlane M., Bleakley A (2002). Relationships of stigma and shame to go norrhea and HIV screening. Am J Public Health. 92:378–81. doi:10.2105/AJPH.92.3.378.

[7] Lowery L., Chung S., and Ellen J (2005). Social support and sexually transmitted disease related healthcare utilization in sexually experienced African-American adolescents. Sex Transm Infect. 81:63–6.doi:10.1136/sti.2003.008920.

[8] Martin J.A., Hamilton B.E., Osterman M. J. K., Curtin SC., and Mathews TJ (2015). Births: final data for 2013. Natl Vital Stat Rep. 64:1-68.

[9] Martinez G., Copen C. E., and Abma J.C (2011). Teenagers in the United States: sexual activity, contraceptive use, and childbearing, 2006–2010 National Survey of Family Growth. Vital Health Stat 23 2011(31). 15

[10] John S. Santelli et al (2004)."Can Changes in Sexual Behaviors Among High School Students Explain the Decline in Teen Pregnancy Rates in the 1990s?" Society for Adolescent Medicine, vol. 35, no. 2 (August 2004);

[11] Jacqueline E.,Darroch and Susheela Singh (1999). Why Is Teenage Pregnancy Declining? The Roles of Abstinence, Sexual Activity and Contraceptive Use, The Alan Guttmacher Institute, Occasional Report, 1999;

[12] John S. Santelli et al (2007). "Explaining Recent Declines in Adolescent Pregnancy in the United States: the Contribution of Abstinence and Improve Contraceptive Use," American Journal of Public Health, vol., 97, no. 5, 2007.

[13] Adrienne L. Fernandes-Alcantara (2018).Teen Birth Trends: In Brief, Congressional Research Service, pp. 1-12.

[14] Sarah Kliff (2015), "The Mystery of the Falling Teen Birth Rate," Vox. (Hereinafter, Sarah Kliff, "The Mystery of the Falling Teen Birth Rate.")

[15] MarsiglioW (2017). Young men and teen pregnancy: Are view of sex, contraception, and fertility-related issues. Washington (DC): National Campaign to Prevent Teen Pregnancy; 2006. Available at: https://thenationalcampaign.org/sites/ default/files/resource-primary-download/guy_thing.pdf.

[16] Goesling B., Lugo-Gil J., Lee J., and Novak T (2015). Updated findings from the HHS Teen Pregnancy Prevention evidence review: April 2013 through July 2014. https://tppevidencereview.aspe.hhs.gov/pdfs/ Summary_of_findings_2014.pdf.

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

ISSN (online): 2581-3048

Volume 7, Issue 2, pp 461-466, February-2023

https://doi.org/10.47001/IRJIET/2023.702077

Citation of this Article:

Smartson. P. NYONI, Thabani NYONI, "Using Empirical Evidence to Address the Burden of Teenage Pregnancy and Child Births in the United States of America" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 7, Issue 2, pp 461-466, February 2023. Article DOI https://doi.org/10.47001/IRJIET/2022.702077

****

