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Tracking Future Trends of Under Five Mortality in Afghanistan Using Double Exponential Smoothing Model

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***Abstract* - This study uses annual time series data on under five mortality rate (U5MR) for Afghanistan from 1960 to 2020 to predict future trends of U5MR 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 and0.3 respectively based on minimum MSE. The results of the study indicate that annual U5MR will continue to decline over the out of sample period. Therefore, we encourage authorities in Afghanistan to prioritize the welfare of women and children through formulation of appropriate maternal and child health policies that will help in the achievement of SDG3 by 2030.**

Keywords: Exponential smoothing, Forecasting, U5MR.

I. INTRODUCTION

The 1994 International conference on Population and development recognized sexual and reproductive health rights of women and girls. In September 2015, the agenda 2030 for sustainable development also included sexual and reproductive health and rights as part of the 3rd sustainable development goal. SDG3 also incorporates the welfare of children whose rights and welfare must be considered. Women and girls must have access to education, quality healthcare including sexual & reproductive health, equal employment opportunities, and the freedom of expression. Sexual and reproductive health problems are among the leading causes of mortality and morbidity among adolescent girls and women (November & Sandall, 2018; Black *et al.* 2016; Nove *et al.* 2014). Many developing countries are facing challenges such as conflicts, poverty, hunger, and poor health infrastructure which negatively impact on sexual and reproductive health and rights for women (Eze *et al.* 2020; UN, 2020;UN, 2016; UN, 2015). Civil conflicts have displaced thousands of people in war zones putting adolescent girls and women at risk of physical and sexual abuse which result in unwanted pregnancies, STIs and mental trauma (OCHA, 2019; Al-Mekhlafi, 2018; Burki, 2015).

Pregnancy and child birth among adolescents are associated with a higher risk of adverse maternal and neonatal health outcomes compared to women aged 20-24 (Chandra-Mouli *et al.* 2015). High adolescent birth rates lead to rapid growth of the young population in Sub-Saharan Africa and this results in persistent economic burden and perpetuates poverty (Shahabuddin *et al.* 2016).Mortality among under five children remains a global concern and calls for quick and appropriate strategies to attend to the various issues that lead to morbidity and mortality among this age group (WHO, 2019; UNICEF, 2019; UNICEF, 2018). This study proposes Holt's linear exponential smoothing model to forecast future trends of under-five mortality for Afghanistan and the results are expected to help in policy making, planning and resource allocation in order to end all preventable under five deaths in the country.

II. LITERATURE REVIEW

A cross-sectional study in Ethiopia was carried out by Bariki *et al.*(2020) to examine factors affecting infant mortality among the general population of Ethiopia in 2016. A total of 10,641 live births were included in the analysis. The study findings indicated that sex of the child, multiple births, prematurity, and residence were notably associated with infant mortality. The risk of infant mortality has also shown differences across different regions. A retrospective study in Yemen was conducted byEze *et al.* (2020) to examine morbidities & outcomes of a neonatal intensive care unit in a complex humanitarian conflict setting, Hajjah for the period 2017-2018. The study findings revealed that preterm newborns bear disproportionate burden of neonatal morbidity and mortality in this setting which is aggravated by difficulties in accessing early neonatal care. Usman *et al.* (2019) analyzed the incidence of the rate of neonatal mortality in Nigeria using ARIMA models. Their trend plot of the incidence indicated that there was a steady decrease in the incidence rate over the years. The ARIMA (1, 1, 1) model was found to be the optimal model. The time series analysis also revealed that neonatal mortality rate has reduced by 17.8% from 51.7% in the year 1990 to 33.9% in the year 2017.Dejong*et al.* (2017) utilized Countdown to 2015 (Millennium Development Goals) health indicators to provide an up-to-date review and analysis of the best available data on Syrian refugees in Jordan, Lebanon and Turkey and internally displaced within Syria and explored data challenges in this conflict setting. The study obtained data from electronic databases and relevant stakeholders. The study revealed that in Syria, the infant mortality rate and under-five mortality rate increased, and coverage of antenatal care (one visit with a skilled attendant), skilled birth attendance and vaccination (except for DTP3 vaccine) declined. The number of Syrian refugee women attending more than four antenatal care visits was low in Lebanon and in non-camp settings in Jordan.

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III. METHODOLOGY

This study utilizes an exponential smoothing technique to model and forecast future trends of under-five mortality rate in Afghanistan. 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.

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

Smoothing equation

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

Trend estimation equation

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

Forecasting equation

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

A_t is the actual value of time series at time t

L_t is the exponentially smoothed value of time series 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

T_t is the trend estimate

Data Issues

This study is based on annual under five mortality ratein Afghanistan 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.

IV. FINDINGS OF THE STUDY

Exponential smoothing Model Summary

Table 1: ES model summary

Variable	A
Included Observations	61 (After Adjusting Endpoints)
Smoothing constants	
Alpha (α) for data	0.900
Beta (β) for trend	0.300
Forecast performance measures	
Mean Absolute Error (MAE)	0.631010
Sum Square Error (SSE)	115.208284
Mean Square Error (MSE)	1.888660
Mean Percentage Error (MPE)	0.214289
Mean Absolute Percentage Error (MAPE)	0.370623

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Residual Analysis for the Applied Model

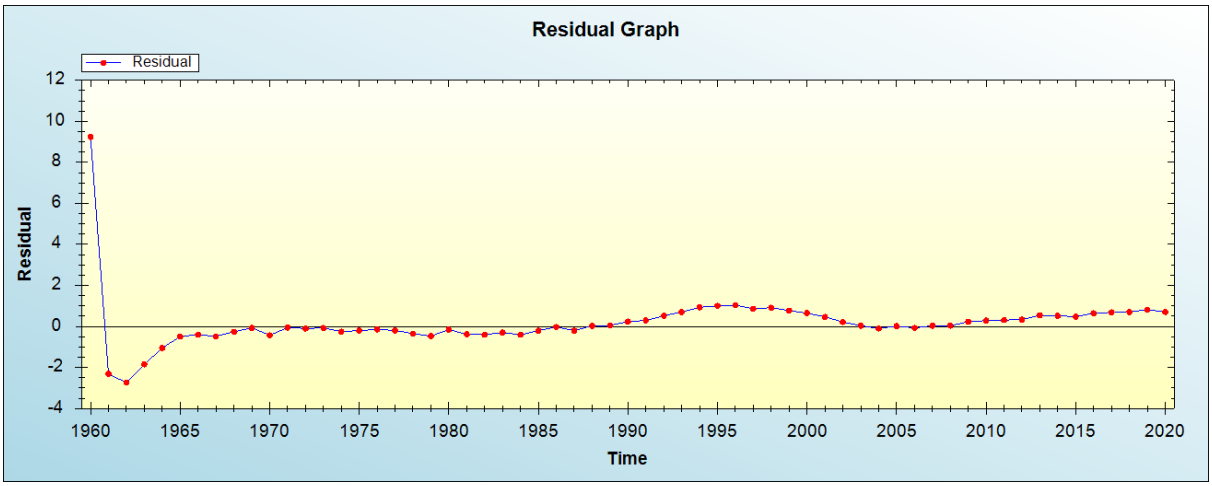

Figure 1: Residual analysis

In-sample Forecast for A

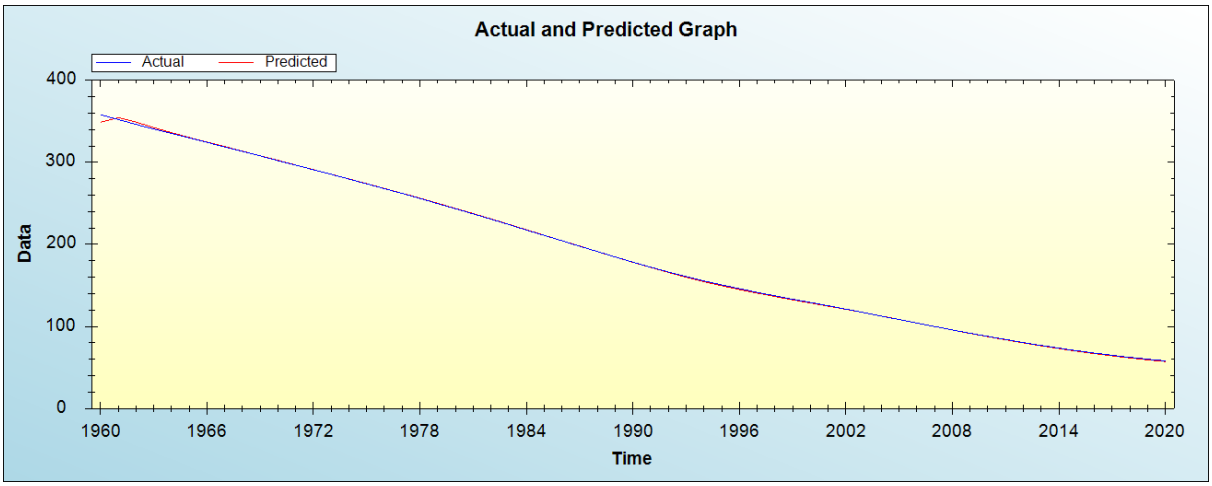

Figure 2: In-sample forecast for the A series

Actual and Smoothed graph for A series

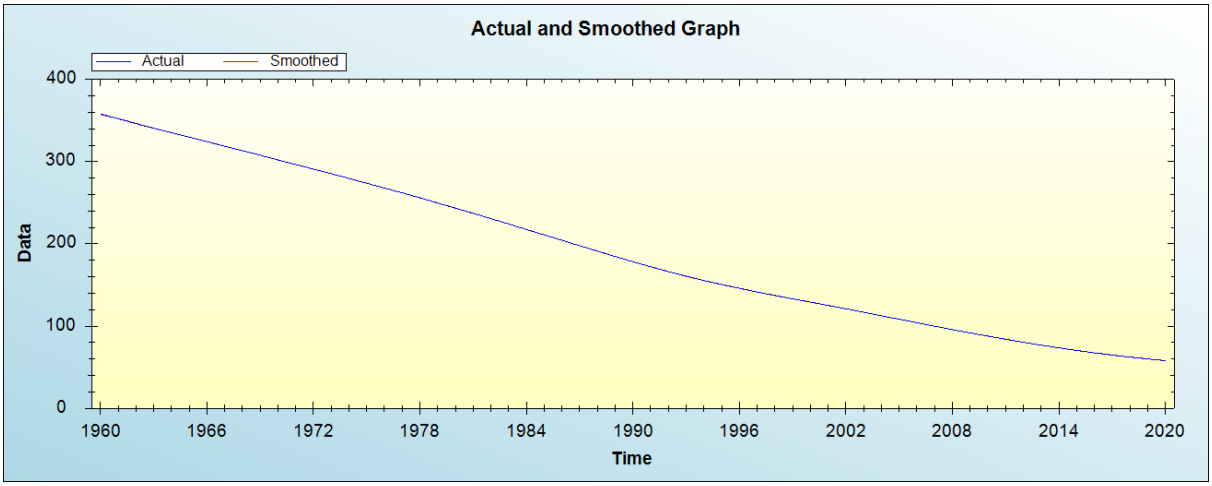

Figure 3: Actual and smoothed graph for A series

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

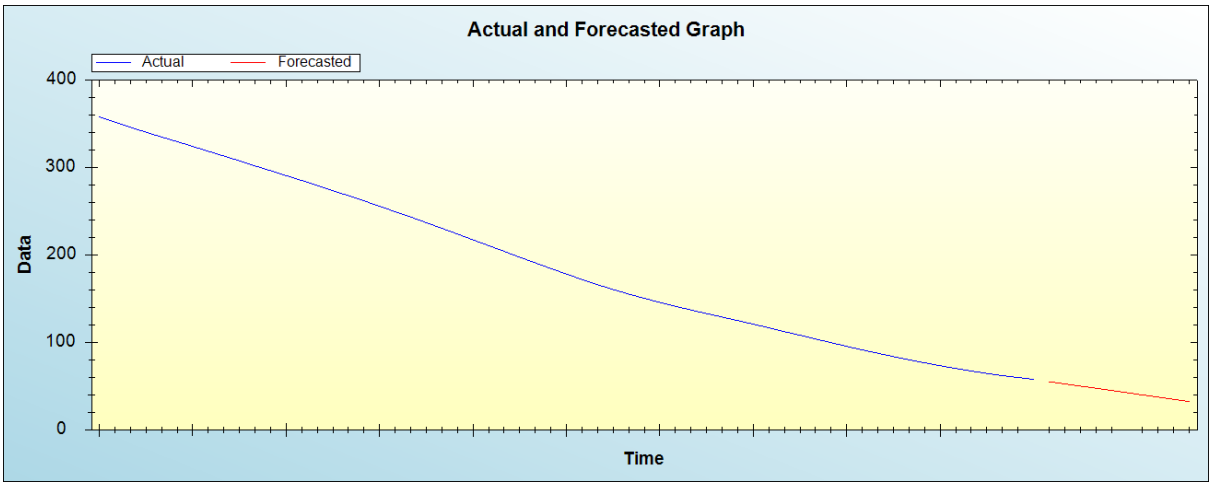

Figure 4: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

2021	55.3946
2022	52.8599
2023	50.3252
2024	47.7904
2025	45.2557
2026	42.7210
2027	40.1863
2028	37.6516
2029	35.1169
2030	32.5822

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 U5MR will continue to decline over the out of sample period.

V. POLICY IMPLICATION & CONCLUSION

Afghanistan continues to experience political conflicts that are characterized by the persistent emergence of armed groups which are battling for control of state power. In the midst of chaos, women and children bear most of the pain. The quick implementation of sustainable development goals (SDGs) is expected to significantly improve the quality of life for women and children. In addition, under five mortality is expected to decline substantially if the government incorporates SDGs in national plans and budgets. The results of this study indicate that annual U5MR will continue to decline over the out of sample period. Therefore we encourage the authorities to channel more resources to maternal and child health programs to ensure availability of medical supplies, pay medical staff and improve health infrastructure.

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] Eze P., Al-Maktari F., Alshehari A.H and Lawani L. O (2020). Morbidities & outcomes of a neonatal intensive care unit in a complex humanitarian conflict setting, Hajjah Yemen: 2017-2018, Conflict and Health, 2020, 14, 53.
[7] Office for the Coordination of Humanitarian Affairs (OCHA) (2019). Yemen: 2019 Humanitarian Needs Overview, 2019

ISSN (online): 2581-3048
Volume 6, Issue 7, pp 81-85, July-2022
https://doi.org/10.47001/IRJIET/2022.607015

[8] Al-Mekhlafi H. M (2018). Perspective piece: Yemen in a time of cholera: current situation and challenges. Am J Trop Med Hyg, 98, 6, 1558–62
[9] Burki T (2015). Yemen health situation "moving from a crisis to a disaster". Lancet, 385, 9978, 1609.
[10] Black RE., Levin C., Walker N., Chou D., Liu L., Temmerman M., DCP3 RMNCH Authors Group (2016). Reproductive, maternal, newborn, and child health: key messages from disease control priorities 3rd edition. Lancet. 2016; 3(388): 2811–24. https://doi.org/10.1016/S0140-6736 (16)00738-8. PubMed PMID: 27072119
[11] November L., & Sandall J (2018). „Just because she‟s young, it doesn‟t mean she has to die‟: exploring the contributing factors to high maternal mortality in adolescents in eastern Freetown; a qualitative study. Reprod Health, 15(1):31
[12] Nove A., Matthews Z., Neal S., Camacho AV (2014). Maternal mortality in adolescents compared with women of other ages: evidence from 144 countries. Lancet Glob Health, 2(3):e155–64
[13] Chandra-Mouli V., Svanemyr J., Amin A., Fogstad H., Say L., Girard F., & Temmerman M (2015). Twenty years after international conference on population and development: where are we with adolescent sexual and reproductive health and rights? J Adolesc Health, 56:1–6.
[14] Shahabuddin A., Nöstlinger C., Delvaux T., Sarker M., Bardají A., De Brouwere V., &Broerse JE (2016). What influences adolescent girls‟ decision-making regarding contraceptive methods use and childbearing? A qualitative exploratory study in Rangpur District, Bangladesh. PLoS One, 11(6):e0157664
[15] United Nation. Transforming our world: The 2030 agenda for sustainable development 2016.

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