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

ISSN (online): 2581-3048

Volume 6, Issue 7, pp 492-496, July-2022

https://doi.org/10.47001/IRJIET/2022.607109

Forecasting Future Trends of Under Five Mortality Rate for Sudan Using Double Exponential Smoothing Technique

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

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

***Abstract* - This study uses annual time series data on under five mortality rate (U5MR) for Sudan from 1960 to 2020 to predict future trends of U5MR over the period 2021 to 2030. Residuals and model evaluation criteria indicate that the applied Holt's linear method model is stable in forecasting under five mortality rate. Optimal values of smoothing constants α and β are 0.9 and 0.1 respectively based on minimum MSE. The double exponential smoothing model projections suggest that annual U5MR will decline over the out of sample period. Therefore, the Sudanese government must allocate more funds to child health programs to ensure availability of medical supplies, equipment and health work force.**

Keywords: Exponential smoothing, Forecasting, U5MR.

I. INTRODUCTION

Our world today is facing a lot of challenges that will hinder sustainable development goal (SDG) progress. The persistence and emergence of wars, extreme weather conditions due to climate change, natural disasters and emergence of new infectious diseases continue to reduce the prospects of achieving all the 169 targets of sustainable development goals. The agenda 2030 recognizes the importance of unity of purpose of all UN member countries in the fight against poverty, hunger, injustices, inequalities and other deprivations (UN, 2016; UN, 2015). By the end of 2030, all countries are expected to have covered significant ground in all the 17 thematic areas outlined in the global action plan. Addressing issues related to maternal and child health should be a global health priority. All the countries should strive to achieve a reduction of newborn and under five mortality to levels as low as 12 neonatal deaths per 1000 live births and 25 under five deaths per 1000 live births by 2030 (UN, 2020; UNICEF, 2019; WHO., 2019; UNICEF, 2018). The objective of this study is to project future trends of under-five mortality rate for Sudan using double exponential smoothing. The results are expected to inform child health policies, planning and allocation of resourcesso as to end all preventable under five deaths in the country.

II. LITERATURE REVIEW

Survival modelling was utilized by Tiruneh *et al.* (2021) to assess the pooled estimate of infant mortality rate (IMR), time to death, and its associated factors in SSA using the recent demographic and health survey dataset between 2010 and 2018. The study concluded that the most common cause of infant death is a preventable bio-demographic factor.Juarez *et al.* (2020) conducted a quality improvement study to increase the detection of neonatal complications by lay midwives in rural Guatemala, thereby increasing referrals to a higher level of care. A quality improvement team in Guatemala reviewed drivers of neonatal health services provided by lay midwives. Improvement interventions included training on neonatal warning signs, optimized mobile health technology to standardize assessments and financial incentives for providers. The primary quality outcome was the rate of neonatal referral to a higher level of care. It was found that structured improvement interventions, including mobile health decision support and financial incentives, significantly increased the detection of neonatal complications and referral of neonates to higher levels of care by lay midwives operating in rural home-based settings in Guatemala. Rhoda *et al.* (2018) reviewed efforts made by the South African government to reduce neonatal mortality. The study findings showed that high-impact interventions, providing an adequate number of appropriately trained healthcare providers and a more active role played by ward-based community health workers and district clinical specialist teams was pivotal to achieve substantial reduction in neonatal deaths. Kayode *et al.* (2017) conducted an ecological study which revealed that there is a wide variation in neonatal mortality in SSA. A substantial part of this variation can be explained by differences in the quality of healthcare governance, prevalence of HIV and socioeconomic deprivation.

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

ISSN (online): 2581-3048

Volume 6, Issue 7, pp 492-496, July-2022

https://doi.org/10.47001/IRJIET/2022.607109

III. METHODOLOGY

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

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

Smoothing equation

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

Trend estimation equation

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

Forecasting equation

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

K_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 rate in Sudan 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	K
Included Observations	61 (After Adjusting Endpoints)
Smoothing constants	
Alpha (α) for data	0.900
Beta (β) for trend	0.100
Forecast performance measures	
Mean Absolute Error (MAE)	2.345378
Sum Square Error (SSE)	4273.253888
Mean Square Error (MSE)	70.053342
Mean Percentage Error (MPE)	-0.058493
Mean Absolute Percentage Error (MAPE)	1.609406

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 6, Issue 7, pp 492-496, July-2022
https://doi.org/10.47001/IRJIET/2022.607109

Residual Analysis for the Applied Model

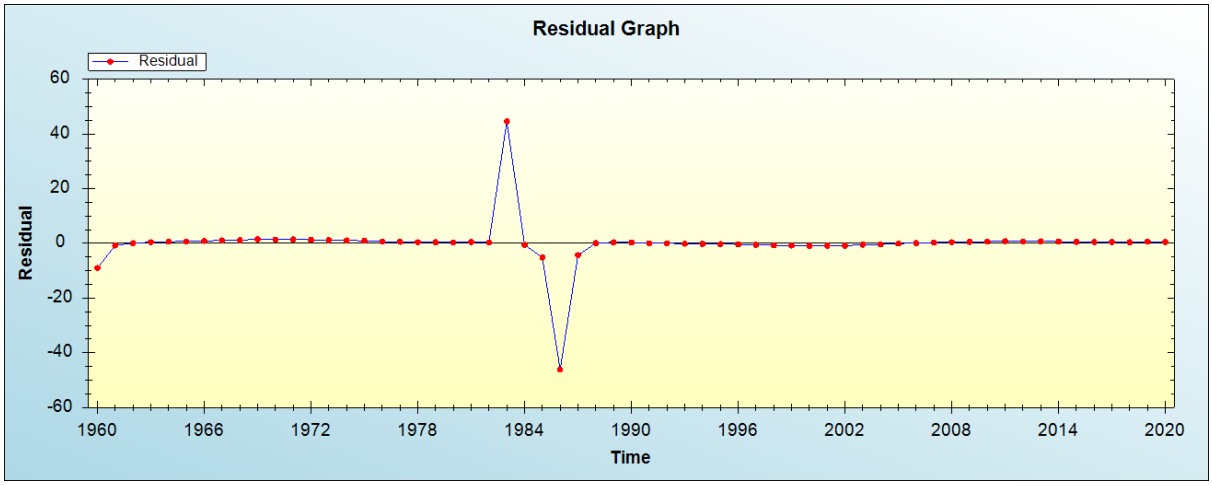

Figure 1: Residual analysis

In-sample Forecast for K

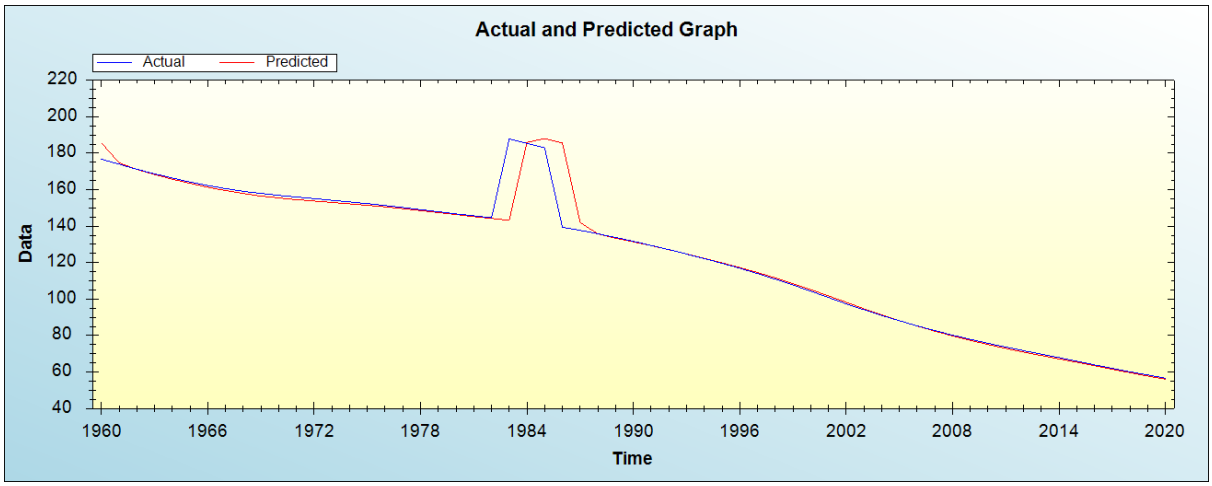

Figure 2: In-sample forecast for the K series

Actual and smoothed graph for K

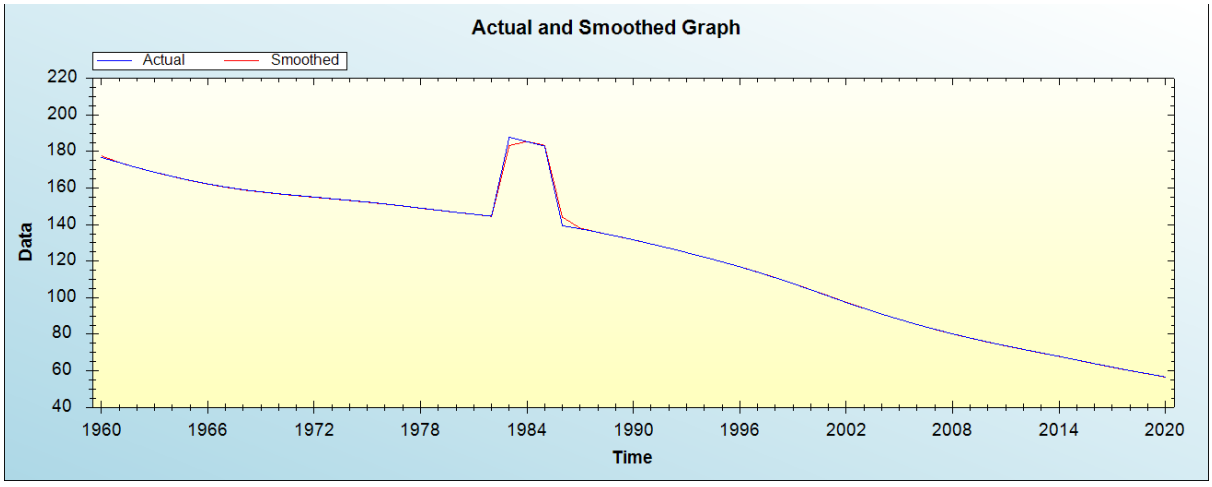

Figure 3. Actual and smoothed graph for K

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 6, Issue 7, pp 492-496, July-2022
https://doi.org/10.47001/IRJIET/2022.607109

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

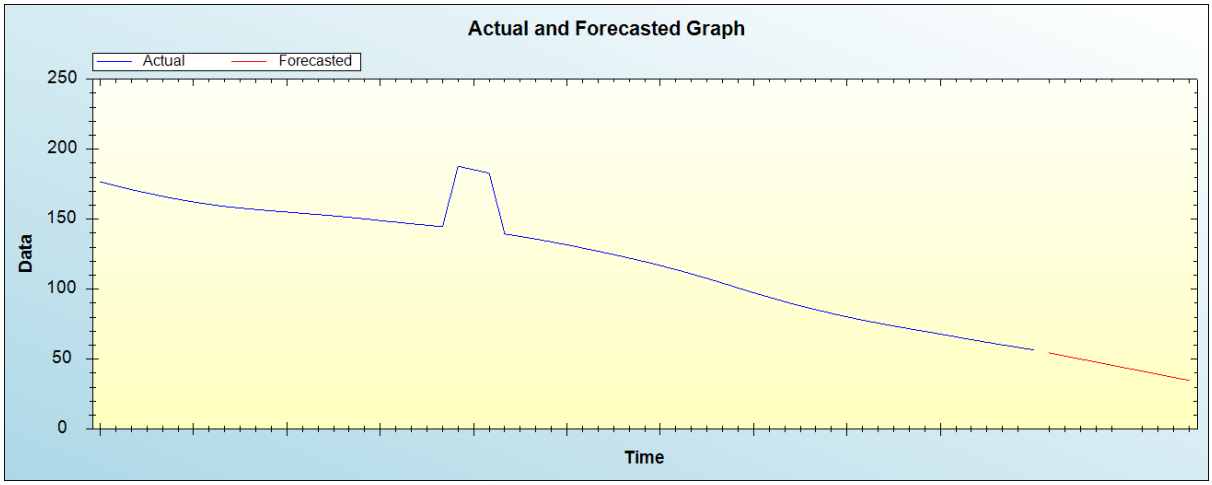

Figure 4: Out-of-sample forecast for K: actual and forecasted graph

Out-of-Sample Forecast for K: Forecasts only

Table 2: Tabulated out-of-sample forecasts

2021	54.3749
2022	52.1980
2023	50.0211
2024	47.8442
2025	45.6673
2026	43.4904
2027	41.3136
2028	39.1367
2029	36.9598
2030	34.7829

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 decline over the out of sample period.

V. POLICY IMPLICATION & CONCLUSION

Sudan witnessed a downward trend of under-five and neonatal mortality rates over the past decades. This is clear evidence that the government is committed to the substantial reduction of under-five mortality. The several challenges faced by the country call for a unified effort so as to achieve the set SDG targets by 2030. This study applies Holt's linear method to forecast future trends of under-five mortality rate and the results indicate that annual U5MR will decline over the out of sample period. Therefore, we encourage the Sudanese government to channel more resources to child health programs to ensure availability of medical supplies, medical staff and equipment at all levels of healthcare.

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 Nation. Transforming our world: The 2030 agenda for sustainable development 2016.

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

ISSN (online): 2581-3048

Volume 6, Issue 7, pp 492-496, July-2022

https://doi.org/10.47001/IRJIET/2022.607109

Citation of this Article:

Dr. Smartson. P. NYONI, Thabani NYONI, "Forecasting Future Trends of Under Five Mortality Rate for Sudan Using Double Exponential Smoothing Technique" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 6, Issue 7, pp 492-496, July 2022. Article DOI https://doi.org/10.47001/IRJIET/2022.607109

****

