

Original Article

The Analyst Impacts of Covid-19 on Zakat Revenue in Indonesia using an Exponential Smoothing Model

Ria Indah Sari¹, Tomi Z.², Era Napra Tilopa Sihombing³, Mahiroh⁴, Rado Yendra⁵, Arisman Adnan⁶

¹Department of Communication, Informatics, and Statistics of Riau Province, Pekanbaru, Indonesia

²Information Technology and Database Center, UIN Sultan Syarif Kasim Riau, Pekanbaru, Indonesia

^{3,4,6}Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Riau, Pekanbaru, Indonesia

⁵Department of Mathematics, Faculty of Sciences and Technology, UIN Sultan Syarif Kasim Riau, Pekanbaru, Indonesia

Received: 12 March 2022

Revised: 05 May 2022

Accepted: 19 May 2022

Published: 27 May 2022

Abstract - The Covid-19 pandemic initially occurred in Indonesia in early March 2020 and has destroyed almost all development sectors, including economic sectors. The Central Statistics Agency reports that Indonesia's economic growth figure for the first quarter of 2020 was minus 2.41% or lower than that of the fourth quarter of 2019 (before the pandemic). However, this study aims to prove that zakat revenue in Indonesia is not affected by the Covid-19 pandemic because it has increased. This analysis employed an exponential smoothing model. Holt's exponential smoothing (HES) model could reveal more actual data with smaller mean square errors (MSE) and mean absolute percentage errors (MAPE) than the simple exponential smoothing (SES) model. This study reveals that the zakat revenue has elevated during the Covid-19 pandemic.

Keywords - Zakat, Holt's winter, Exponential smoothing, Forecasting, Trend, Covid-19.

1. Introduction

At the end of 2019, Wuhan, a city in China, suddenly became famous globally. On December 31, 2019, Xinhua News Agency reported a mysterious outbreak of pneumonia that affects most seafood market traders in Wuhan. The disease is caused by a virus called SARS-CoV-2, and its symptoms are fever, cough, and shortness of breath[1]. Afterward, the World Health Organization (WHO) officially declared the disease the Covid-19 pandemic in March 2020.

The disease is considered a pandemic because its transmission is very fast and occurs simultaneously almost all over the world. Several studies summarized by WHO show that the Covid-19 is transmitted through respiratory droplets from infected patients, for example, when talking or touching objects affected by droplets. Ironically, the speed of the disease transmission is not directly proportional to the knowledge of its treatment. Therefore, the governments of many countries immediately take measures to prevent the Covid-19 transmission, these include lockdown or social restrictions.

This policy has impacted many development sectors, such as the economy, social, and education. In the economic sector, this crisis affected Indonesia's economic growth, which fell to 2.41% in the first quarter of 2020[2]. One of the reasons for this decline was that many business units were forced to reduce their working hours and employees[3]. Consequently, the number of unemployment escalated by 1.84% in August 2020[4] while the number of the poor increased by 2.76 million people in September 2020[5].

However, the good news is that Indonesia is a Muslim-majority country that applies zakat. In Islam, zakat is one of its pillars. Islamic history records various roles of zakat in alleviating poverty. For example, it is said that poverty did not exist during the leadership of Umar Bin Abdul Aziz because of the people's high awareness of zakat and alms. The collected zakat and alms were managed well for the benefit of the people and helped the poor[6]. These poor people eventually became independent and also paid zakat. Finally, no people needed economic assistance.

The significant roles of zakat in the economy have triggered many studies to investigate them, especially its roles in poverty alleviation. For example, a study by Choiriyah et al. has employed the welfare Index of BAZNAS to measure the impacts of



zakat on decreasing the number of poor people[7]. Meanwhile, Nadzri [8] has conducted a conceptual study to prove the role of zakat in alleviating poverty.

Kasri[9] has conducted a study on a wider topic than zakat, namely donations, and discovered strong indications that donations have increased during the crisis, and the donation sources are more than the middle-income population. The World Giving Index, which has been released by the Charities Aid Foundation (CAF) since 2018, confirms Indonesia as the most generous country[10]. According to the aforementioned issues, this study would examine whether the Covid-19 pandemic affects the zakat revenue in Indonesia. This study initially hypothesizes that zakat is not affected by the Covid-19 pandemic.

The analysis was conducted by forecasting the number of zakat revenue in the period after Covid-19 and comparing this revenue with the field facts using exponential smoothing model. This model is a procedure that shown an exponential weighting of the decrease in the previous observation[11]. A previous study that has forecasted zakat is conducted by Husti et al. who have discovered that zakat data in Indonesia is more appropriately forecasted using Holt's Exponential Smoothing (HES) model[12]. This finding is supported by Akbarizan [13] et al. Meanwhile, research by Asogwa et al.compared three exponential smoothing models: single, double, and triple (Holt-Winter) exponential smoothing models to forecast traffic accident data. The study shows that the Holt-Winter model provides the most optimal results among the other models[14].

Research on zakat using other mathematical models has been conducted by Namdar [15] et al. who employ the accuracy and repetition feature of the Fourier series in the Matlab application to predict zakat potentials in Iran. Meanwhile, Parisi has employed the multiplicative decomposition forecasting method to determine the zakat potentials in the future and discovered that voluntary zakat in Indonesia affects the total zakat collection[16]. Belgacem conduct a more complex study using a stochastic model to examine the dynamics of the wealth distribution of individuals in a population that obeys zakat systems [17].

2. Research Methodology

This study employed ZIS data (zakat, infaq, alms, and other religious social funds) from the 2022 Zakat Outlook publication by BAZNAS[10]. The 2019 National Zakat Statistics defines zakat as a property that must be disbursed by a Muslim or business entity and given to those who are entitled to receive the zakat based on Islamic law. Meanwhile, infaq is a property disbursed by a person or business entity outside zakat for public benefits. Finally, alms is property or non-property disbursed by a person or business entity outside of zakat for public benefits[18]. In this paper, the term ZIS would be referred to as zakat.

This research analyzed data on national ZIS growth in billion rupiahs from 2002 to 2019. The data were analyzed using the R application to produce graphs of exponential smoothing models: Simple Exponential Smoothing (SES) and Holt's Exponential Smoothing (HES) models. Afterward, these models were compared to discover the actual data. Furthermore, these models were used to examine if the forecasting data for the following years, in 2020 and 2021, would increase or not.

2.1. Simple Exponential Smoothing (SES)

This model is commonly used in data without a trend or seasonality. For example, an observed time series is denoted by $X_1, X_2, X_3, \dots, X_n$. In general, the SES formula is as follows.

$$\hat{X}_{i+1} = \beta X_i + (1 - \beta)\hat{X}_i$$

With

- \hat{X}_{i+1} = Forecasting values for a period of time $i + 1$
- β = Smoothing constants with values between 0 and 1
- X_i = The actual series values known in a period of time i
- \hat{X}_i = Approximate values of variables Y in a period of time i

2.2. Holt's Exponential Smoothing (HES)

This model is used in data that show a trend without a seasonal pattern. For example, $X_1, X_2, X_3, \dots, X_n$ is a set of observations in a time series. The HES formula could be obtained by using two smoothing constants, as follows.

$$B_t = \beta X_t + (1 - \beta)(B_{t-1} + T_{t-1}) \quad (0 < \beta < 1; t = 1, 2, \dots, n)$$

$$T_t = \gamma(B_t - B_{t-1}) + (1 - \gamma)T_{t-1} \quad (0 < \gamma < 1; t = 1, 2, \dots, n)$$

Thus, the HES formulation is as follows.

$$\hat{X}_{t+p} = B_t + pT_t \hat{X}_{i+p} = B_t + pT_t \quad (p = 1, 2, 3, \dots, k)$$

With

- \hat{X}_{t+p} = Forecasting results to p
- p = Total of future periods to predict
- B_t = Forecasting in a period t
- T_t = The trend in a period t

The best model selection could be estimated using error sizes, such as mean absolute percentage errors (*MAPE*) and mean square errors (*MSE*).

$$MSE = \frac{1}{n} \sum_{t=0}^n (X_t - \hat{X}_t)^2$$

$$MAPE = \frac{100}{n} \sum_{t=0}^n \frac{|X_t - \hat{X}_t|}{X_t}$$

3. Results and Discussion

This study applied two exponential smoothing models to illustrate the zakat collection in Indonesia from 2002 to 2019. These models are the simple exponential smoothing (SES) and Holt's exponential smoothing (HES) as presented in Figures 1 and 2.

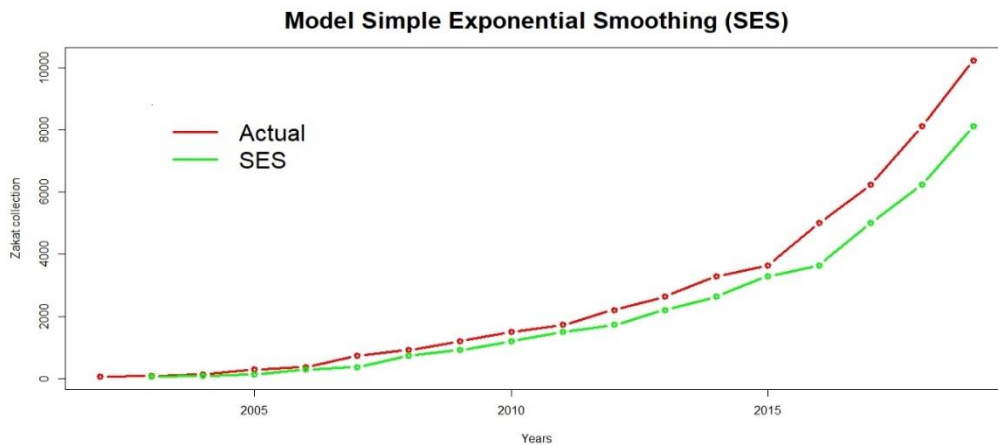


Fig. 1 Graph of SES zakat in Indonesia in 2002–2019

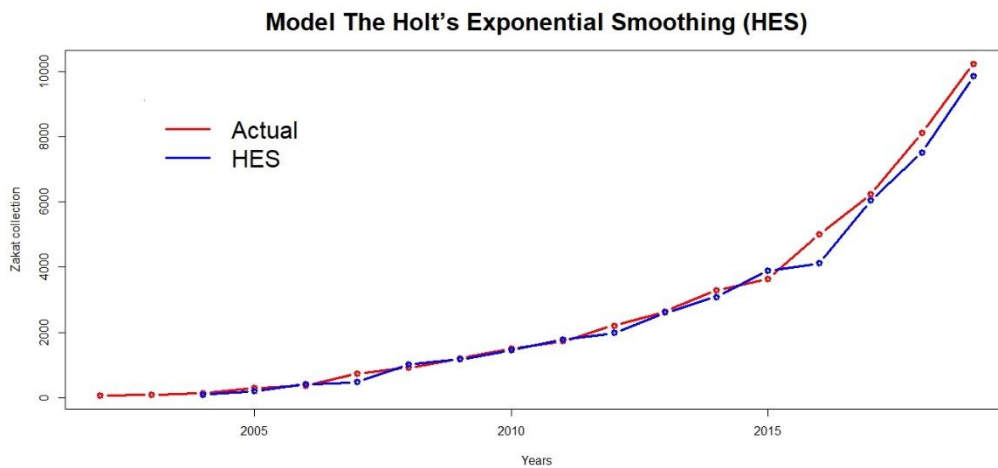


Fig. 2 Graph of HES zakat in Indonesia in 2002–2019

Figures 1 and 2 show that the curve of the SES model is green while that of HES is blue. It is clear that the HES model is closer to the actual data curve.

Moreover, Figures 3 and 4 present that the HES model has lower error levels of MAPE and MSE than the SES model.

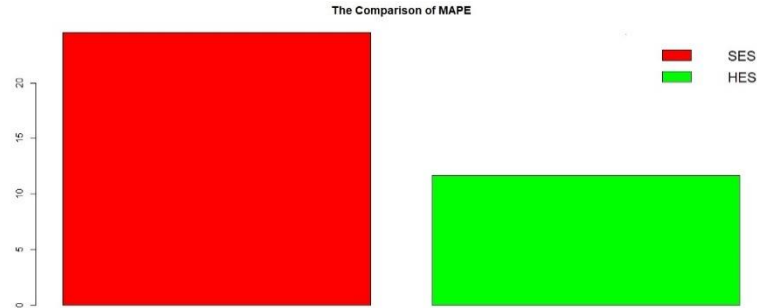


Fig. 3 MAPE zakat comparison

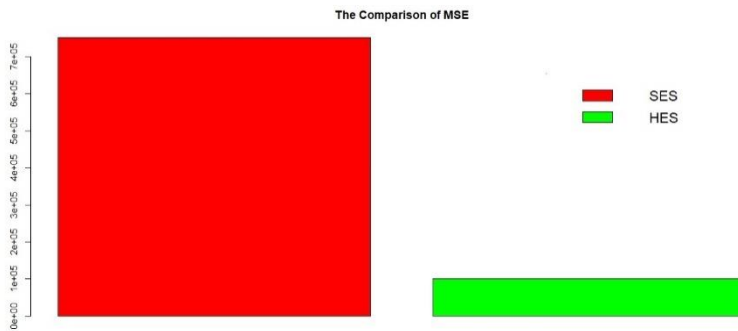


Fig. 4 MSE zakat comparison

The values of MAPE and MSE are also presented in Table 1.

Table 1. Comparison of MAPE and MSE between SES and HES

Models	The measurement of model errors	
	MAPE	MSE
SES	24.52759	750573
HES	11.64209	99965.9

Based on the MAPE and MSE comparison, the zakat revenue is more suitably forecasted by the HES model. The forecasting results of the HES model are presented in Table 2.

Table 2. The prediction data of the fit model for zakat collection for the next two years

Years	Actual	HES ($\beta = 0.8326689; \gamma=1$)	Description
2002	68.39	-	
2003	85.28	-	
2004	150.09	102.17	
2005	295.52	198.86	
2006	373.17	416.62	
2007	740.00	481.54	

2008	920.00	1013.06	
2009	1200.00	1174.39	
2010	1500.00	1455.86	
2011	1729.00	1789.51	
2012	2212.00	1985.64	
2013	2639.00	2609.12	
2014	3300.00	3093.88	
2015	3650.00	3897.02	
2016	5017.29	4117.16	
2017	6224.37	6042.01	
2018	8117.60	7521.04	
2019	10227.94	9841.70	
2020	12429.25	12308.84	Covid-19
2021	14118.19	14454.38	Covid-19

The forecasting curve of the HES model is presented in Figure 5.

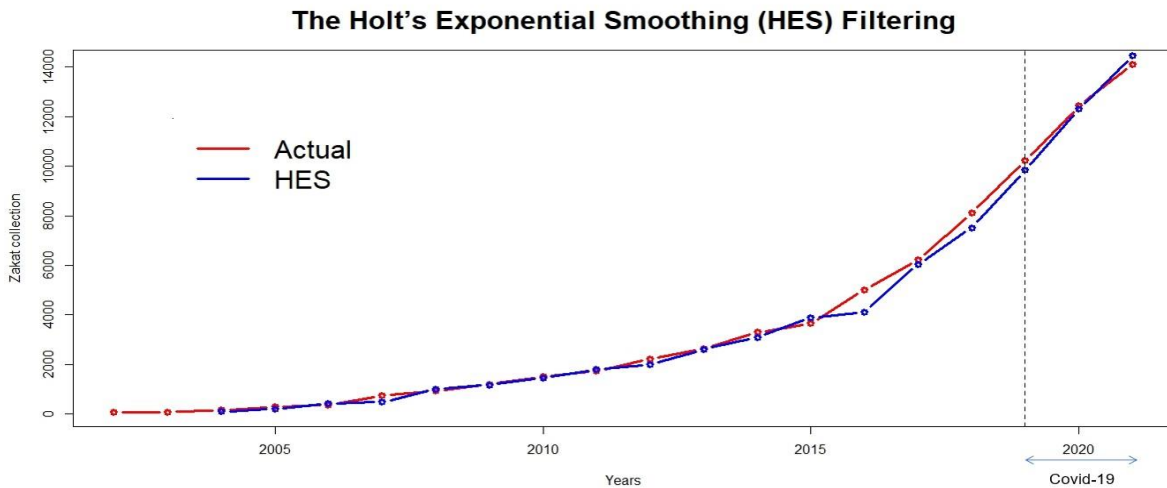


Fig. 5 Graph of the fit models and prediction for zakat collection in Indonesia

Table 2 and Figure 5 show the prediction of zakat revenue in the following two years (2020-2021), and the graph tends to rise although the Covid-19 pandemic hit Indonesia. Compared to factual figures in the field (Table 2), the zakat revenue during the 2020 pandemic is 12429.25 with a previously predicted value of 12308.84. Meanwhile, the zakat revenue in 2021 is 14118.19 with a previously predicted value of 14454.38. In general, the results of this forecasting, which indicates that the total zakat revenue has increased during the Covid-19 pandemic, are correct.

4. Conclusion

This study concludes that the future zakat revenue rate is more suitably predicted by Holt's Exponential Smoothing (HES) model because its data show a linear trend without a seasonal pattern. Moreover, the HES model has lower error levels of MAPE and MSE. Finally, the HES curve is also closer to the actual data.

Compared to the actual data, the forecasting results show numbers with an upward trend during the pandemic. Thus the hypothesis that the Covid-19 pandemic situation does not affect the total zakat revenue is accepted.

References

- [1] W. H. Organization, Transmission of SARS-CoV-2: implications for infection prevention precautions: scientific brief, 09 July 2020, World Health Organization, (2020). [Online]. Available: (No. WHO/2019-nCoV/Sci_Brief/Transmission_modes/2020.3).
- [2] B. P. Statistik, Official Statistics News : Indonesia's Economic Growth Quarter I-2020, www.riau.bps.go.id, (2020). [Online]. Available: <https://www.bps.go.id/pressrelease/2020/05/05/1736/ekonomi-indonesia-triwulan-i-2020-tumbuh-2-97-persen.html>.
- [3] I. Dictionary, Covid-19 Pandemic : Its Effect on Retail Business, *Int. J. Econ. Bus. Account. Res.*, 6(1) (2022) 515–520, 2022.
- [4] B. P. Statistik, Official Statistics News : State of Indonesia's Employment August , www.riau.bps.go.id, (2020). [Online]. Available: <https://www.bps.go.id/pressrelease/2020/11/05/1673/-revisi-per-18-02-2021--agustus-2020--tingkat-pengangguran-terbuka--tpt--sebesar-7-07-persen.html>.
- [5] B. P. Statistik, Official News Statistics : Poverty Profile in Indonesia September, www.riau.bps.go.id, (2020). [Online]. Available: <https://www.bps.go.id/pressrelease/2021/02/15/1851/persentase-penduduk-miskin-september-2020-naik-menjadi-10-19-persen.html>.
- [6] N. A. S. Irhamdi, Muhamad; Yusuf, Dimas Ramadhani Adi; Aisyah, Refleksi Kepemimpinan Uma bin Abdul Aziz dalam Mensejahterakan Rakyat Melalui Perantara Zakat, *Mudabbir*, 1(2) (2020) 82–98.
- [7] Choiriyah, E., Kafi, A., Hikmah, I., & Indrawan, I., Zakat And Poverty Alleviation In Indonesia: A Panel Analysis At Provincial Level, *Journal of Islamic Monetary Economics and Finance*, 6(4) (2020) 811 - 832. <https://doi.org/10.21098/jimf.v6i4.1122>.
- [8] Nadzri, F.A.; A. Rahman, R. & Omar, N., Zakat and Poverty Alleviation: Roles of Zakat Institutions in Malaysia, *International Journal of Arts and Commerce*, 1(7) (2012) 61 –72.
- [9] Rahmatina Awaliah Kasri , Giving behaviors in Indonesia: motives and marketing implications for Islamic charities, *Journal of Islamic Marketing*, 4(3) (2013) 306 – 324, 2013.
- [10] Baznas, Outlook Zakat Indonesia www.puskasbaznas.com, (2022). [Online]. Available: <https://www.puskasbaznas.com/publications/outlook/indonesia-zakat-outlook-2022>.
- [11] S. Makridakis, S. Wheelwright, and R. Hyndman, *Forecasting: Methods and Applications* Third Edition. John Wiley & Sons Inc., (1997).
- [12] A. Husti, Ilyas; Akbarizan; Marizal, Muhammad; Yendra, Rado; Fudholi, Forecasting Model Holt's for the Zakat Collection in Indonesia, Malaysia and Brunai, *Soc. Sci.*, 12(12) (2017)2370–2374.
- [13] Akbarizan et al., Utilization of Holt's forecasting model for zakat collection in Indonesia, *Am. J. Appl. Sci.*, 13(12) (2016) 1342–1346.[doi: 10.3844/ajassp.2016.1342.1346](https://doi.org/10.3844/ajassp.2016.1342.1346).
- [14] O. C. Asogwa, C. . Eze, and C. R. O. nkwo, Modeling the Cases of Road Traffic Crashes: A Case of Exponential Smoothing Approach, *Int. J. Math. Trends Technol.*,65(1) (2019) 46–52.[doi: 10.14445/22315373/ijmtt-v65i1p508](https://doi.org/10.14445/22315373/ijmtt-v65i1p508)
- [15] N. Namdar and R. Hassanzadeh, Developing A Mathematical Equation to Predict Khums and Zakat in the Iranian Economy, *Int. J. Zakat*, 6(2) (2021) 43-62.
- [16] S. Al Parisi, Overview of Forecasting Zakat Collection in Indonesia Using Multiplicative Decomposition, *Int. J. Zakat*, 2(1) (2017) 45–59, 2017.
- [17] F. Bin, M. Belgacem, H. R. H. Prince, and T. Bin, Modeling the stochastic dynamics of Zakaat, *Math. Eng. Sci. Aerosp.*, 1(1) (2010) 91–103.