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Utilisation of Holt-Winters Forecasting Model in Lembaga Zakat Selangor (LZS) For Zakat Collection

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Abstract— Predicting the collection of zakat in Malaysian zakat institutions is crucial for effective zakat distribution. The surplus problems in zakat funds motivated this study to use more precise statistical methods to predict the future trend of zakat collection. The main objective of this paper is to forecast monthly zakat collection for 12 months ahead of the Lembaga Zakat Selangor (LZS). This research used the Seasonal Exponential Smoothing (Holt-Winters) model to predict zakat collection in LZS. The study utilised monthly zakat collection time series data from 2010 to 2018. The analysis was carried out using Excel Solver. The findings show that the Holt-Winters model is suitable to forecast the monthly zakat collection of LZS as it accounts for seasonal variation. The finding of this study indicates that the Holt-Winters Multiplicative (HWM) model best fits the monthly zakat collection time series data. The multiplicative form of Holt-Winters model yields 24.51% lower error compared to the additive one using the Mean Absolute Percentage Error (MAPE). The findings of this study will help zakat institutions to accurately predict future zakat collection which may consequently improve the management of zakat distribution without leaving a significant amount of zakat surplus. The forecast results can also be used to create a strategy to handle zakat funds based on the amount of registered asnaf. In addition, the study can serve as a basis for the development of a framework to forecast future zakat collections.

Keywords— Holt-Winters Multiplicative exponential smoothing; Holt-Winters Additive exponential smoothing; Forecasting; Zakat Collection Trend; Zakat.

I. BACKGROUND OF STUDY

A. Overview

The purpose of this section is to introduce the research topic and key fundamental frameworks that lay the foundation of the study. This section also covers the problem statement, research questions, research objectives, the scope of the research as well as the structure of the study.

B. Introduction

Islamic teachings encourage Muslims to perform *shalat* and give zakat to the needy. Zakat is third pillar of Islam after the obligatory prayer and is always mentioned in the Holy Qur'an after the word *shalat*, which highlights its importance. The Shariah obliged Muslims to perform zakat as an economic support system for the society through wealth transfer from the wealthy to the needy. Islam conveys the message that the income received by oneself is not totally for his personal use. One must set aside a small percentage of the income as charity for the poor and needy.

The word zakat is literally defined as "what cleanses" or "alms" and it is an act of sharing. In the Islamic philosophy, Zakat is the most appropriate technique to solve social issues such as poverty. Zakat is used as a proportion of the resources shared with eligible beneficiaries. According to the rules and directives of the Shariah, zakat is the responsibility of any Muslim who can afford to pay. Forecasting will allow zakat centres to reliably approximate the upcoming collection of zakat and disperse the collections correctly. An advanced study of the anticipated importance of zakat will also help the management prepare a plan to accomplish their goal.

In Malaysia, zakat institutions at the state and national levels have shown significant improvement in managing zakat collections and distributions. Among the major achievements is the increasing amount of zakat collection from year to year for all zakat institutions in Malaysia. For example, in 2017, the Majlis Agama Islam Wilayah Persekutuan (Islamic Religious Council of Federal Territory) declared that the zakat collection of all states in Malaysia showed a substantial increase. The aggregate zakat collection amounted to RM1.702 billion for 2013. This number rose to RM2.047 billion in 2014 and increased again in 2015 to RM2.33 billion. The zakat collection for 2017 was RM2.92 billion [1].

The imposition of zakat is to purify one's own property and oneself. Allah says, "Take of their wealth alms to purify and cleanse them thereby" (Qur'an 9:103). If a wealthy person is used to paying zakat, Islam assumes that his infatuation with money will be reduced and that it will ultimately benefit him and society. Avarice is the worst ethical trait that can contribute too many social issues [7].

However, zakat management, especially zakat distribution in Malaysia, is generally still inefficient. A proper mechanism is needed to efficiently allocate the zakat funds to the beneficiaries. Hence, a good model of forecasting is necessary. Forecasting can help the zakat institution to accurately forecast the collection of zakat and then allocate it better. Furthermore, understanding the estimated importance of collecting zakat in advance will help the management prepare a better strategy to distribute the zakat funds effectively according to the collection [23].

In most states in Malaysia, the zakat administration is under the state jurisdiction through the State Islamic Religious Counters (SIRCs). Some religious councils have formed an agency responsible for collecting and distributing zakat in all states because of the need to collect and administer zakat funds more efficiently and effectively in Malaysia. The effort began in 1991 with the establishment of Pusat Pungutan Zakat (PPZ) for Wilayah Persekutuan, followed by Pusat Zakat Selangor, Pahang and Pulau Pinang in 1995 and later Tabung Baitulmal Sarawak in 2001. Finally, Sabah formed Pusat Zakat Sabah in 2007.

This research is organised as follows: Chapter 2 will discuss the literature reviews on forecasting models in zakat collection future value. Chapter 3 will discuss the methodology and Chapter 4 will highlight the expected results for this study. Lastly, Chapter 5 will outline the plan of the research.

C. Problem Statement

Zakat institutions need to be efficient in distributing zakat according to the amount of zakat collection in the current year. Zakat institutions are responsible to distribute the collected zakat in the same year and cannot hold or invest the zakat. Zakat surplus should be decreased to represent zakat institutions' productivity in performing their duties. However, the amounts of zakat surplus fluctuate with some years being overspent and other years being underspent. For example, in 2011, the collection of zakat was RM394.1 million in Lembaga Zakat Selangor (LZS) but the amount distributed was only RM324.2 million, leaving RM69.9 million as zakat surplus. The value of the zakat fund surplus rose to RM106 million, RM118.5 million, RM59.3 million and RM29.6 million for 2012, 2013, 2014 and 2015, respectively. Meanwhile, the value of the undistributed zakat fund was negative in 2016, suggesting that the distribution exceeded the allocation. The figure increased in 2017 to RM140.6 million. In 2018 and 2019, the zakat surplus was negative RM36.2 million and RM13.2 million respectively.

The accuracy in yearly zakat distribution can be increased if the zakat institution is able to accurately forecast the amount of zakat collection. Therefore, there is a need for this research to be carried out to produce a better forecasting method like Holt exponential smoothing.

According to [17], Prophet Muhammad (PBUH) practiced the idea of *al-Fauran* (prompt) whereby the zakat funds raised

were promptly distributed. This means that the collected zakat funds were distributed in the interests of the Muslims who were in need at that time as soon as possible. The zakat fund was distributed during the PBUH period in the same area where it was collected. Amil, who was named as a zakat collector, promptly dispersed all the zakat funds after they were collected, leaving no surplus or reserve. It seems that the zakat funds gathered at that time were distributed to the recipients quickly and efficiently.

[3] observed that there are few studies that predict the collection of zakat. Nevertheless, forecasting work will help policymakers determine the extent to which zakat potential can be reached in the long run as an indicator of what should be done in order to achieve the maximum zakat potential.

D. Research Objectives

The objectives of the study are to:

1. To investigate the trends of zakat collection in LZS.
2. To model the zakat collection in LZS using Holt's exponential smoothing methods.
3. To identify the best fit model for zakat collection of zakat institutions in LZS.
4. To forecast the future zakat collection using Holt's exponential smoothing methods.

E. Importance of the Study

In general, this study will allow zakat institutions in LZS to improve the efficiency of zakat distribution more accurately. This would also benefit and enhance the standard of living of the zakat recipients (*asnaf*) and improve their quality of life. This study aims to model the zakat collection in LZS using Holt's exponential smoothing models. This study also has potential significance as follows:

1. The findings of this study would help zakat institutions to improve the process of zakat distribution.
2. Accuracy of the zakat collection forecast will indirectly help policy makers in managing zakat funds efficiently, considering that there are fluctuations in zakat surplus or zakat deficit.

F. Scope and Limitation of the Study

The scope of the study focuses on the prediction of zakat collection for the next 12 months based on the dataset spanning from 2010 to 2018. Holt's exponential smoothing model will be used to forecast zakat collection in LZS. Furthermore, Excel Solver is the software used to implement Holt's exponential smoothing model.

II. LITERATURE REVIEW

G. Introduction

As explained in the previous section, forecasting, especially in economics and business organisations where decision-making is particularly important, is an extremely important instrument for effective planning. By using forecasting techniques such as Auto-Regressive Integrated Moving Average (ARIMA) and Holt-Winters Exponential Smoothing (HWES), the zakat institutions responsible for gathering zakat will suggest a fair goal for future zakat collection. Based on their goals, they can also plan to distribute zakat. In addition, the information supplied implicitly improves the efficiency of managing zakat collection.

The various forms of the forecast model implemented will be explained in this chapter. Other than that, the literature review from previous studies on zakat collection forecast and various applications of forecasting models are discussed in the following section.

H. Application of forecasting method in zakat collection from previous studies

Various studies have shown that ARIMA and Holt Exponential Smoothing (HES) are better predictive models than econometric or other time-series models. [2] used HES and ARIMA models to forecast annual zakat collection in Indonesia from 2009 to 2014. [2] illustrated that HES method fits the time series data of zakat collection in Indonesia very well, thus is suitable to predict future zakat collection. In this study, HES method has smaller error than ARIMA method based on mean absolute percentage error (MAPE) and mean square error (MSE). Moreover, HES is less complicated than ARIMA and does not require sophisticated software. The study suggests that both the HES and ARIMA models can be used by zakat institutions in Indonesia to target future zakat collection and consequently distribute zakat to the zakat beneficiaries (*muzzaki*) based on the targeted zakat collection. The study also suggests that the practice of forecasting future zakat collection can improve the efficiency of the zakat collection and distribution process. Furthermore, these forecasting models can help in the development of a charity management system based on the number of registered *mustahiq* (zakat payers).

To help zakat institutions devise a strategy for future planning, an accurate forecast model is important to effectively predict the future trends of zakat collection. [15] utilised the polynomial model, the exponential model, and the discrete Malthusian growth model to forecast the trend of zakat collection for Pusat Zakat Melaka (PZM) for year 2000-2009. The study found that the polynomial model was the best model compared to exponential and Malthusian models based on the smallest value of sum square error (SSE) for in-sample forecast. Therefore, the polynomial model was used to predict the zakat collection for five years ahead (2010-2014) for PZM.

[22] applied Artificial Neural Network (ANN) to forecast the amount of property zakat (*zakat al-mals*) collection for Pusat Zakat Pahang (PZP). Two ANN models were developed

using two learning algorithms which were Back Propagation (BP) and Levenberg-Marquardt (LM). The precision of the model was validated using MSE and correlation values. The BP-ANN model outperformed the LM-ANN model as it has the highest correlation value and the lowest MSE. Therefore, the BP-ANN model is suitable to forecast property zakat collection for PZP. Research on hybrid ANN model should be continuously done to derive a more accurate forecast model for zakat institutions such the combination with ARIMA models, regression, and other time series models. An accurate forecast model would certainly help zakat institutions to enhance their management, especially in terms of more efficient distribution of zakat.

[8] compared yearly zakat collection of Indonesia, Malaysia, and Brunei in 2014. The study used Holt's exponential smoothing and single exponential smoothing (SES) model to forecast the national zakat collection for Indonesia, Malaysia, and Brunei. The study found that Holt's model performed better than SES model because the data observed trend but no seasonality. However, SES model is the best model for data with constant level and no seasonality like zakat collection in Brunei. Therefore, zakat organisations can set a reasonable goal for the collection of zakat to be achieved in the future. In addition, based on the number of targets suggested for the distribution of zakat, they can make plans to distribute zakat.

According to [3], there are various forms of zakat schemes used in Muslim countries. Indonesia uses a voluntary zakat scheme that could affect the amount of zakat received. The results of this study are intended to educate policy makers on the management of the collection of zakat.

The issue of surplus of zakat funds (*tawaqquf*) that are not allocated to eligible recipients has been debated among the public, academics, and zakat institutions, but few studies have been carried out to examine the issue empirically. Therefore, [17] identified factors that lead to zakat surplus and examined the current practice of Malaysian zakat institutions in managing the zakat surplus fund. The study found that there are three main factors that lead to zakat surplus which are unmatched amount of zakat collection and zakat distribution, late zakat payment, and difficulty in identifying the eligible zakat recipients. [10] referred to Amil, who was hired and had dispersed all the zakat funds immediately after they were raised, leaving no surplus or balance. It seems that the received zakat funds were easily and efficiently allocated to the beneficiaries at that time. [24] reported that if the surplus no longer exists in society, the poverty rate will generally decrease and, at the same time, represent a decrease in the crime rate in Malaysia.

I. Application of exponential smoothing forecasting method from previous studies

The exponential smoothing is used in many applications. [9] used Holt-Winters Exponential Smoothing (HWES) model with seasonal trend to predict the annual international tourist arrivals in Zambia using time series data from 1995 to 2014. The results show that HWES is more appropriate than the ARIMA model based on various accuracy measures such as MAPE, RMSE and MAE. By 2024, the HWES forecasted

annual tourist arrivals in Zambia to be increased to around 42 percent. [18] predicted the future foreign tourist arrivals to Bali. The exponential Holt-Winters smoothing is the best method for forecasting because it produces a smaller MAPE value.

[5] used the combination of Holt Winters and Bootstrap aggregation (Bagging) to forecast the demand for air transportation industry for 14 countries. The result found that Bagging Holt Winters methods provided a more accurate forecast compared to the other five time series methods including the original Holt Winters, SARIMA and Seasonal Naïve.

Meanwhile, [13] used the SES approach to estimate the groundwater tax revenue in Indonesia using tax revenue data from 2013 to 2017. The study used alpha constant value between 0.1 to 0.5 and indicated that the alpha value of 0.1 is the best based on the lowest MAPE. The groundwater tax revenue for year 2018 is estimated to be Rp 443.904.600,7192.

[12] developed a framework for selection of the optimum smoothing constant parameter for the SES method. The study compared a trial-and-error method with Excel Solver to find the smoothing constant value that minimises the MSE and MAD. The study concludes that the use of Excel Solver had derived the optimum constant parameter in lesser time and is considered as less complicated.

[4] used three forecasting methods namely SES, Double Exponential Smoothing (DES) and Triple Exponential Smoothing (TES) to predict future lime price in Thailand. SES and DES methods with designed input data showed a smaller MAPE.

[16] used exponential smoothing methods to obtain the best fit exponential smoothing method to forecast. Double Exponential Smoothing Technique (DEST) was the most suitable technique for handling the temperature level data where it produces the lowest value of MSE and Root Mean Square Error (RMSE) compared to compared to Single Exponential Smoothing Technique (SEST) and Holt's method. [6] mentioned about the exponential smoothing method being suitable for the forecast of time-series data with trends and seasonality. In the time series study of human brucellosis in China, the exponential smoothing based on the additive model approach could be effectively used.

[20] concluded that the method of DES to predict future production of palm oil is not suitable because the observation data has a seasonal component. By using the TES method, forecasts for data containing seasonal components should be solved.

[19] using the DES method predicted the number of new student admissions into a university study programme. Using parameters $\alpha = 0.8$ and $\beta = 1$, with a Mean Percentage Error (MPE) value of 0.1172, the best forecast value was obtained.

[21] studied extensively several exponential smoothing methods for forecasting crude palm oil productions in Thailand. The study also indicates that both the Additive Holt-Winters (AHW) and the Extended Additive Holt-Winters (EAHW) methods significantly show accurate forecast results when a 12-year input data is applied. [11] discussed forecasting annual production of some oil seed crops (sesame, sunflower and soybean) in Turkey. They used Holt exponential smoothing method with two parameters, which yielded the best result among the exponential smoothing methods.

However, the literature shows that there is no single model which is consistently used as the best model for forecasting. Therefore, this paper seeks to use the Holt-Winters exponential smoothing to arrive at the best method that can be used for forecasting the collection of zakat in LZS.

III. METHODOLOGY

J. Introduction

In this study, both HWES models are used to forecast zakat collection in the LZS future value using past data. The accuracy of both HWES models is measured using RMSE and MAPE. The model is chosen based on the smallest MAPE and RMSE.

K. Data Collection

The study used data sets from the official website of the zakat institution (<https://www.zakatselangor.com.my>). This paper uses monthly data of zakat collection from January 2010 to December 2018.

L. Holt-Winters method

Winters (1960) generalised Holt's approach to capture direct seasonality. The Holt-Winters approach is based on three smoothing equations: one for degree, one for pattern, and one for seasonality. This is analogous to Holt's strategy, with some seasonality to deal with one more calculation. There are currently two distinct forms of Holt-Winters, depending on whether the seasonality is expressed in an additive or multiplicative method [14].

1) Holt-Winters Additive Method

The strategies of Holt-Winters provide measures of the seasonal influences for periods (denoted by S). The number of seasonal seasons per year is given by the p parameters. For instance, $p = 12$ correspond to monthly seasonal changes and $p = 4$ correspond to quarterly seasonal adjustments. In the additive form, the projection for the $t+n$ duration (n periods after the present period) is given by

$$\text{Level: } L_t = \alpha(Y_t - S_{t-s}) + (1 - \alpha)(L_{t-1} + b_{t-1}) \quad (1)$$

$$\text{Trend: } b_t = \beta(L_t - L_{t-1}) + (1 - \beta)b_{t-1} \quad (2)$$

$$\text{Seasonal: } S_t = \gamma(Y_t - L_t) + (1 - \gamma)S_{t-s} \quad (3)$$

$$\text{Forecast: } F_{t+m} = L_t + b_t m + S_{t-s+m} \quad (4)$$

While the $\gamma(0 < \gamma < 1)$ parameter is used to smooth the trend, α and β smooth the base and trend.

2) Holt-Winters Multiplicative method

The multiplicative version of the Holt-Winters method uses seasonal factors as multipliers rather than additive constants. The forecast for period $t+n$ is given by

$$\text{Level: } L_t = \alpha \frac{Y_t}{S_{t-s}} + (1 - \alpha)(L_{t-1} + b_{t-1}) \quad (5)$$

$$\text{Trend: } b_t = \beta(L_t - L_{t-1}) + (1 - \beta)b_{t-1} \quad (6)$$

$$\text{Seasonal: } S_t = \gamma \frac{Y_t}{L_t} + (1 - \gamma)S_{t-s} \quad (7)$$

$$\text{Forecast: } F_{t+m} = (L_t + b_t m)S_{t-s+m} \quad (8)$$

Where s is the seasonality length (e.g. number of months or quarters in a year), L_t represents the series level, b_t denotes the trend, S_t is the seasonal component, and the forecast for m periods ahead is F_{t+m} .

Equation (7) is comparable to the seasonal index found as a ratio of the series' current values, Y_t , split by the series' current single smooth value, L_t . The ratio will be greater than 1 if Y_t is greater than L_t , whereas if it is smaller than L_t , the ratio will be less than 1. L_t is a smoothed (average) value of the series that does not include seasonality and the data values Y_t , on the other hand, do contain seasonality. In order to smooth this randomness, equation (7) weights the newly computed seasonal factor with γ and the most recent seasonal number corresponds to the same season with $(1 - \gamma)$.

The equation (5) divides the first term by the seasonal number S_{t-s} . To deseasonalise (eliminate seasonal fluctuations from) Y_t this is done. This modification can be seen by considering the case when S_{t-s} is greater than 1, which happens when the magnitude of the period $t - s$ is greater than the average in its seasonality. Dividing Y_t by this number larger than 1 gives a value less than the original value by a percentage just equal to the quantity higher than the average seasonality of period $t - s$. When the seasonality number is less than 1, the opposite modification occurs. In these calculations, the value S_{t-s} is used because S_t cannot be calculated until (5) is known from L_t .

M. Comparative Analysis between Holt-Winters Additive (HWA) and Holt-Winters Multiplicative (HWM) methods.

When comparing Seasonal HWA with Seasonal HWM approaches, forecasting was conducted over a 12-month period (January 2019 – December 2019) using SSE, MSE, Mean Absolute Deviation (MAD), RMSE and MAPE to find the most efficient model for forecasting the collection of zakat. While MAPE is useful for purposes of reporting, it expresses accuracy as a percentage of the error. RMSE's value is minimised during the parameter estimation process and it is the statistic that determines the width of the confidence interval for prediction. The following measures of accuracy to identify the best model of forecast are as the below formulas:

$$\text{Sum of Squared Error: } \sum_{t=1}^n (e_t)^2 \quad (9)$$

$$\text{Mean Squared Error: } \frac{1}{n} \sum_{t=1}^n (e_t)^2 \quad (10)$$

$$\text{Mean Absolute Deviation: } \frac{1}{n} \sum_{t=1}^n |y_t - F_t| \quad (11)$$

$$\text{Root Mean Squared Error: } \sqrt{\frac{1}{n} \sum_{t=1}^n (e_t)^2} \quad (12)$$

$$\text{Mean Absolute Percentage Error: } \frac{1}{n} \sum_{t=1}^n \left| \frac{e_t}{y_t} \right| * 100 \quad (13)$$

where,

The forecast error is e_t , and it is calculated by subtracting the forecast value from the series' actual value. y_t and F_t represent actual and forecast values respectively. Here n is the number of effective observations used to match the model, p is the number of parameters in the model, and $\hat{\sigma}_e^2$ is the sum of sample squared residuals. Other similar criteria have also been proposed in literature for optimal model identification. Minimum values of these accuracy measures provide the best fitting models.

N. Data Analysis and Results Presentation

The time series of the zakat collection in Lembaga Zakat Selangor (LZS) from January 2010 to December 2018 is presented in Figure 1 below.

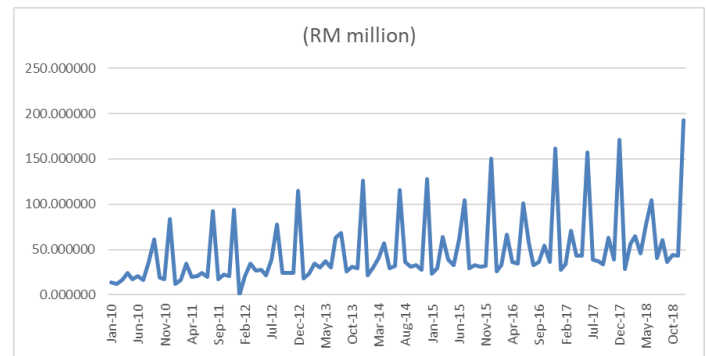


Figure 1 Plot of Monthly Time series Data from January, 2010 to December, 2018

According to time series plot in Figure 1 and seasonal factors result in Table 1, there are seasonal effects in the zakat collection data. Seasonal factors are expressed in percentage. It is clear that June, July, August and December recorded relatively higher factors (128.9%, 115.6%, 109.9% and 285.9%), while January, February and November recorded relatively lower factors (43.5%, 59.2%, and 62.7%). This suggests that June, July, August, and December are months of high zakat collection which peaked in December due to tax effect and during Ramadhan in June where the people are encouraged to pay zakat Fitrh. Meanwhile, January, February and November recorded relatively lower collection from payers.

Table I Seasonal Index

Month	Total Zakat Collection from 2010-2018	Monthly Average	Seasonal Index (%)
January	186,058,343	23,257,293	43.5
February	253,268,687	31,658,586	59.2
March	425,296,060	53,162,008	99.4
April	320,998,160	40,124,770	75.0
May	320,901,553	40,112,694	75.0
June	551,602,883	68,950,360	128.9
July	494,501,415	61,812,677	115.6
August	470,193,117	58,774,140	109.9
September	298,485,025	37,310,628	69.8
October	320,881,762	40,110,220	75.0
November	268,097,751	33,512,219	62.7
December	1,223,129,400	152,891,175	285.9
Total	5,133,414,156	641,676,770	1200.0
Average	427,784,513	53,473,064	100.0

IV. RESULTS AND DISCUSSIONS

This section shows the result obtained using Holt-Winter’s exponential smoothing technique for predicting zakat collection of LZS.

O. Data Analysis and Results Presentation

In examining exponential smoothing models, we use the SSE and the MSE. To determine the best combination of α , β and γ that minimises SSE and MSE, the Solver in Excel was used. The minimum SSE and MSE values are the Alpha (α), Gamma (β) and Delta (γ) parameters that have been identified through the iteration process to minimise the SSE and MSE values.

Table II HWES Parameters

Model	α	β	γ	SSE	MSE
Holt-Winter’s Multiplicative model	0.09	0.18	1	35163.56	370.143
Holt-Winter’s Additive model	0.1	0.183	0.75	41437.20	436.181

Table II above shows that Holt-Winter’s Multiplicative exponential smoothing recorded relatively lower SSE and RMSE values, which suggests that Holt-Winter’s Multiplicative exponential smoothing is more appropriate for forecasting zakat collection compared to the additive model. However, before making the final conclusion on which model fit better, we use accuracy error measures as a diagnostic check.

P. Diagnostic Model

To test for the model accuracy error measures, we use MAD, RMSE and MAPE for both models with actual data. Table III depicts the result for these accuracy error measures which show that Holt-Winter’s Multiplicative model has smaller MAD, RMSE and MAPE. So, the Holt-Winter’s Multiplicative model is more suitable to forecast zakat collection in LZS.

Table III Error measurement for MAD, RMSE and MAPE

Model	MAD	RMSE	MAPE
Holt-Winter’s Multiplicative model (HWM)	11.89	19.24	24.51
Holt-Winter’s Additive model (HWA)	12.66	20.88	24.74

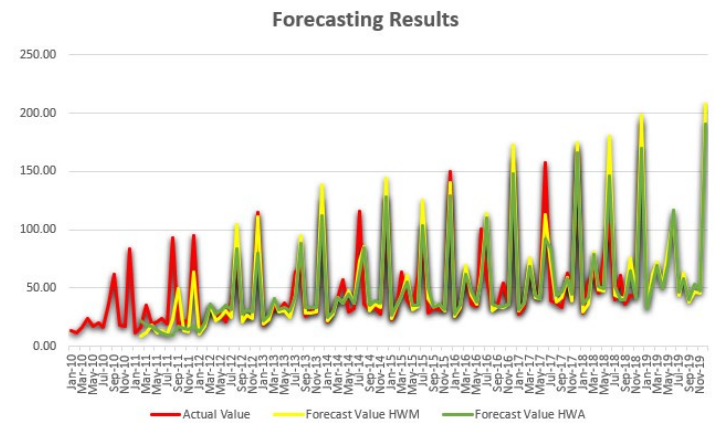


Figure II Forecasting result using HWM and HWA

A sketch of the real zakat collections from January 2010 to December 2018 and estimated zakat collections from January 2019 to December 2019 is shown in Figure II. With a monthly upward trend, the graph displays a predictive value. The graph shows that both HWM and HWA models fit the actual data very well. However, based on the accuracy error measurement earlier, we conclude that HWM is more suitable for forecasting zakat collection of LZS.

Table IV Comparison of HWM and HWA forecasting for zakat collection data

Month	Forecast of Zakat Holt-Winters Multiplicative	Forecast of Zakat Holt-Winters Additive	Deviations in forecast of zakat
Jan-19	33,207,552	32,543,329	664,222
Feb-19	61,719,400	53,466,611	8,252,789
Mar-19	72,024,065	69,579,874	2,444,191
Apr-19	51,358,984	49,267,525	2,091,459
May-19	81,839,362	70,651,726	11,187,637
Jun-19	112,617,629	116,618,224	-4,000,596
Jul-19	43,477,791	46,734,457	-3,256,666
Aug-19	62,655,745	58,217,900	4,437,845
Sep-19	37,666,273	40,101,244	-2,434,970
Oct-19	46,994,617	53,553,983	-6,559,365
Nov-19	45,833,691	47,577,126	-1,743,436
Dec-19	207,358,677	191,001,801	16,356,876

Table IV shows a summary of the forecasting future value zakat collection from January 2019 to December 2019. Based on the fitted model, the range of forecasted value for LZS monthly zakat collection based on HWM model is between 33.2 million to 207.4 million whereas based on HWA model, it is between 32.5 million to 191 million. The deviation of forecasted value for each model is considered small, between 1.7 million to 16.3 million.

Q. DISCUSSION AND CONCLUSION

Monthly zakat collections in LZS of up to 12 months were predicted using zakat collection data from January 2010 to December 2018. To forecast zakat, the Holt-Winters Multiplicative Method (HWM) and Holt-Winters Additive Model (HWA) were used. The predicted results summarised in Table IV show that the HWM method fits best with data from the zakat time series. Thus, to predict zakat collection, this technique is appropriate. The aim of this paper was to compare the suitability of two models in the short-term forecast of the zakat collection in LZS. In order to capture the seasonality pattern of the data, the performance of HWM and HWA exponential smoothing were examined. The findings show that HWM model with alpha (0.09), Delta (0.18) and Gamma (1) is a more accurate model for forecasting zakat collection in the short run through comparative analysis between models using measures of accuracy such as MAD, RMSE and MAPE.

[2] mentioned that the two prediction methods, namely Auto-Regressive Integrated Moving Average (ARIMA) and Holt's exponential smoothing, were used to predict the collection of zakat in Indonesia using annual data from 2009 to 2014 from the zakat collection. Because of its accuracy, the study also found that the best fit model is HWM.

R. RECOMMENDATIONS

A better distribution of zakat could be achieved through forecasting techniques to accurately forecast the zakat collection and thus improve the performance of zakat management especially in LZS. This study can help institutions in the management of zakat more quickly and efficiently by using future values of zakat collection as a reference for the purpose of zakat distribution. Besides, it may assist institutions to reduce the gap between the collection and distribution of zakat. This is a way to ensure that a more precise zakat collection forecast can be obtained to optimise the distribution of zakat in order to achieve zero surplus. Therefore, the poor can receive financial assistance from zakat institutions more fairly and no one is left behind. This method may be able to avoid negative perceptions from zakat payers because when there is a surplus of zakat that is not distributed to the poor.

The researcher recommends that more zakat organisations could participate in the forecasting process for zakat collection. Further studies should also be carried out to increase the effectiveness of forecasting model by using newer and emerging forecasting techniques.

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