The Best Model for Predicting Tourists to Visit Kalibiru Tourism Object

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ABSTRACT
Tourism sector is the most effective sector in encouraging an increase in Indonesia's foreign exchange, although there is no forecasting model that can be used to predict the number of tourist visits. This study attempted to fill the void of the model to predict the number of tourist visits to Kalibiru in particular and to Indonesia in general. Based on the value of Root Mean Squared Error (RMSE) and forecasting ability measured by the value of Mean Absolute Percentage Error (MAPE), from the 4 proposed models, which were ARIMA, GARCH (0.2), GARCH (2.1) and GARCH (2.2), the GARCH model (2.1) was concluded as the best model to predict the number of tourist visits to Kalibiru tourism object.
Keywords: *ARIMA, GARCH, visitors, tourists, travelers*.

1. INTRODUCTION

In the last few decades, one of the most important sectors in driving the global economy is the tourism sector that shows sustainable and exponentially-moving growth [1], which exceeds the growth of oil exports, food and automotive production [2].
The conditions above are not much different from the Indonesian economy. According to Bank of Indonesia, tourism sector is the most effective in boosting Indonesia's foreign exchange [3]. The contribution of tourism sector to foreign exchange in Indonesia was targeted to be around US $20 billion in 2019, which was equivalent to Rp2.8 trillion. This number relatively increased 17.65% from that of the previous year.
To achieve this target, the government is targeting the number of foreign tourist arrivals
to reach 20 million people in 2019, which was about 25% higher than the previous year's target. The optimistic target could be achieved because Indonesia's achievements in driving the tourism sector had been appreciated by The World Travel & Tourism Council (WTTC) as the 9th country in the world with the highest growth of tourist visits [3].
The increase in tourist visits will have implications to increasing demand for various needs from the tourists, which in turn will have a multiplier effect on other economic activities, so that it can be expected to partially increase regional and national income aggregately.
Kalibiru tourism object as one among various tourist attractions in Kulon Progo Regency located in Yogyakarta Special Region in Indonesia, in recent years had shown significant development. The Kalibiru concept is a community forest conservation to increase community income through natural tourism [4]. This condition was evidenced by the number of tourist visits that tend to increase every year until 2016, but during 2016-2018 it decreased about 59% from 443.070 people (2016) to 183.498 people (2018), of which in more detail can be seen in Figure 1.

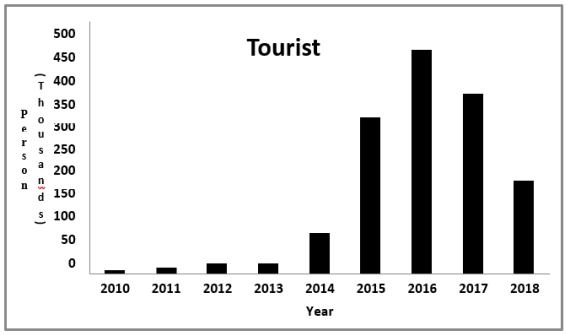

Figure 1. Number of Tourist Visits during 2010-2018
Source: Processed from several sources

Related to the fluctuation of the visits, a model of tourist visit forecasting was developed for Kalibiru tourism object, so that it can be used for planning and providing accommodation for the tourists.
According to the research by [5], the development of tourism will be able to drive economic improvement and also have a long-term social impact. Meanwhile, the result of the research by [6] in Austria mentioned that the contribution of tourism sector to Gross Domestic Product (GDP) reached 5%. The findings from [6] and [7] revealed that New Zealand tourism will contribute around $41 billions annually to the New Zealand economy by 2025, which increases by 71% compared to the value in 2015.
The research conducted by [8] explained that an increase in tourist visits is triggered by Olympic activities. The Olympics will increase infrastructure development, as well as increasing tourist arrivals. The findings by [9] from Central Finland, explained that tourist visits can increase production activities from consumption activities carried

out by the tourists both directly and indirectly. Besides, consumption by tourists will increase employment in the tourism sector and related sectors, as well as community income.

The findings by [10] in ASEAN-5 countries (Singapore, Indonesia, Thailand, Malaysia,
and the Philippines) explained that the visits to a tourist attraction are determined by the occurrence of disasters. The effects of disasters in a tourist region are distinctly different and depend on the characteristics and policies of each government. Besides affecting tourist visits, the occurrence of disasters in an area will also affect GDP and unemployment.

According to [11], tourist visits can increase economic growth, in which the number of
tourist visits has a statistically significant relationship with climate change both in short-term and long-term.

The research conducted by [12] found that foreign and local tourist visits are determined by the existence of world-class monuments, natural landscape, cultural heritage , and economic development. Conversely, security / criminality conditions will negatively affect tourist visits. For this reason, regulations on tourism must be able to safeguard the possibility of tourist risks caused by natural factors and disasters or otherwise anticipate the risk of natural damage that is triggered by the presence of the tourists.

Based on the above studies, tourist visits to an area is one of the reasons for economic improvement, expansion of employment, increased production and infrastructure development.

Related to the magnitude of the contribution of tourism sector to the economy, this study attempted to show the model on the number of tourist visits, especially to Kalibiru tourist attraction. The result of the model is a novelty of this study, because so far there has not been a model developed to estimate the number of tourists visits to a tourist destination. Besides, this model can be used later as a guide to model the tourist visits in other areas.

2. LITERATURE REVIEW

Tourism is a movement of people who can create opportunities and develop various activities related to the tourism industry [13]. The existence of the tourism industry will encourage various activities related to the tourism itself such as restaurants, hotels and lodging, transportation facilities, infrastructure, and so on.

The development of tourism sector cannot be separated from the psychological, sociological, economic, and geographic aspects. So , the tourism sector is often known as "an umbrella concept" [14], which means that if the tourism industry grows and develops, it will protect many other industries in an economy. With the involvement of these various aspects, caution is needed in defining tourism, because the meaning of tourism will differ depending on the field of the study [15].

Based on the above concept, the most important element of tourism is the tourists, which consequently defines tourists as a keyword in studying the tourism industry [16] - [23].

The research by [22] revealed that the term "tourist" was firstly used by Stendhal in 1838 in "Memoires and tourists". Tourists can be interpreted as people who travel while leaving the area of origin and also spend their money [24]. Furthermore, thoughts related to the definition of "tourist" have been put forward in research and books such as [2], [19], [24] - [27].

Among the various notions of "tourist" put forward in the study above, it has not been able to produce a single understanding of "tourist". According to [14], [28], [29], it could be explained that this is because tourism is a multidisciplinary activity covering many fields of science (demography, sociology, economics, etc.) as well as many perspectives (tourist perspective, destination perspective, business perspective, population perspective, etc.).

Since a comprehensive and unified definition of tourists has not yet been found, the definition of tourists used in this study refers to the definition of the World Tourism Organization, which is more aimed at statistical and technical interests and is most widely used by experts in conducting research related to tourism [24], [25], [30].

According to the UNWTO, there are differences among "visitors, tourists and travelers". A person who travels including a one-day stay is classified as a tourist, while a resident traveling outside his home area is said to be a visitor, and someone who travels to an area with a purpose (business, vacation, personal, etc.) with the duration less than 1 year is considered as a traveler [2], [27]. Those three types are divided into three main components, namely, the movement (Movement), the duration of the visit (Duration) and the purpose (Purpose).

Forecasting can be stated as an activity to estimate future conditions by utilizing various data and information of the past and present. According to [31], [32], forecasting is an activity to compile information and data of past demand to estimate future demand by considering various variables that influence it.

The result of forecasting will be determined by the method chosen to produce the smallest residual value. The smaller the residuals generated from a forecasting method, the more accurate the forecasting results will be.

3. METHODS

To estimate the number of tourists coming to Kalibiru, the GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model was used based on the data of tourists coming to Kalibiru that had unstable fluctuations, so the data used was not stationary either on average (mean) or on variant.

The GARCH model was firstly introduced by [33]. Based on the GARCH model, this research used the formula as follow;

Conditional Mean Equation,

$TOU_t = \alpha + \beta_1 AR(p) + \delta_1 MA(q)$ **1**

Conditional Variance Equation,

$\sigma_t^2 = c + \rho_1 e_{t-1}^2 + \gamma_1 \sigma_{t-1}^2$..... **2**

Explanation,

TOU is the number of tourists; t is the time period (month); α dan C are constants; β, δ, ρ and γ are the coefficients of the average and variance equations; AR (Autoregressive); MA (Moving Average; σ_t^2 is a variant; e_{t-1}^2 is the previous period residual (ARCH Component) and σ_{t-1}^2 is the variant of the previous period (GARCH Component).

The development of forecasting models for tourist visits to Kalibiru used several assumptions, which were (1). Tourist visits were only determined by the pattern of visits during the previous period, (2). Tourist visits were determined by the pattern of change in visits from one period to the next, (3). There were no significant changes in natural conditions in Kalibiru tourist attraction in particular and in Indonesia in general, (4). Economic and political conditions were considered not changed much during the forecast period.

The estimation period in this study started from January 2010 to December 2017 (in sample), and then the estimated result was tested using the data from January 2018 to December 2018 (out of sample) to find out the forecasting ability of the model.

The best model used to estimate the number of tourist visits from January 2019 to December 2019 was based on the value of the smallest Root Mean Square Error (RMSE) as well as the value of Mean Absolute Percentage Error (MAPE). Referred to [34], with the criteria of a small MAPE value of 10%, the forecasting ability is categorized as precisely good. If the MAPE value is between 10% and 20%, then the model has good forecasting ability. If the MAPE value is between 20% and 50%, the model is classified as having sufficient ability. And if the MAPE value is above 50%, the model has poor forecasting ability.

4. RESULT AND DISCUSSION

From the results of data analysis, the number of tourist visits to Kalibiru had obtained several models as shown in Table 1 below.

Table 1. Estimated Model on Tourist Visits to Kalibiru, Yogyakarta

	ARIMA		**GARCH (0.2)**		**GARCH (2.1)**		**GARCH (2.2)**	
	Coeff	**P_{value}**	**Coeff**	**P_{value}**	**Coeff**	**P_{value}**	**Coeff**	**P_{value}**
C	10,842.300	0.494						
AR(1)	0.749	0.000*			0.579	0.000*	0.805	0.000*
AR(5)	0.249	0.000*	0.261	0.000*	0.299	0.003*	0.252	0.001*
AR(12)	0.395	0.001*	0.881	0.000*	0.893	0.000*	0.809	0.000*
AR(13)	-0.472	0.000*			-0.718	0.000*	-0.873	0.000*
MA(1)	-0.411	0.002*			-0.307	0.117	-0.482	0.003*
MA(4)	0.284	0.001*	0.408	0.000*	0.318	0.013*		
C			5,196.034	0.929	1,607.246	0.352	859.221	0.290
e^2_{t-1}			1.291	0.000*	0.841	0.020*	0.527	0.029*
e^2_{t-2}			0.889	0.001*	-0.948	0.019*	-0.607	0.027*
σ^2_{t-1}					1.128	0.000*	1.537	0.000*
σ^2_{t-2}							-0.447	0.155
Adjusted R^2	0.840		0.623		0.757		0.767	
AIC	20.493		18.827		18.509		18.578	
Autocorrelation	Yes		No		No		No	
Normality	0.000		0.645		0.622		0.354	
ARCH Effect	0.002		0.920		0.902		0.900	
RMSE	5,662.538		12,586.270		6,953.276		8,674.197	
MAPE	37.158		90.636		39.951		59.733	

Source: Processed by the Author

* Significant at 1% Degree of Freedom

In Table 1, it is shown that the modeling used ARIMA (Autoregressive Integrated Moving Average), because the Unit Root test results from data on the number of tourist visits to Kalibiru was not stationary at the level evidenced by the Augmented Dicky Fuller p-value (ADF Test), that was greater than 5% (0.524).
ARIMA modeling proved that all independent variables of the AR and MA elements of
the average equation were statistically significant at 1% degree of freedom, but the good model requirements were violated, which are: (1) residual white noise could not be fulfilled, as evidenced by the result of Correlogram-Q-Statistics until lag 36, there was still a probability that the Partial Auto Correlation Function (PACF) and Auto Correlation Function (ACF) was smaller than 5%; (2) residuals normally distributed were also not met, as evidenced by the Jarque-Bera p-value smaller than 5% (0.000); and (3) residuals had homogeneous variants that were not fulfilled, so it was suspected that there was an ARCH Effect, as evidenced by the Q-Square probability value of the ARCH Effect test up to a lag of 28, which was less than 5% (0.002).
Because the ARIMA model was not the best model that could be used to estimate the number of tourist visits to Kalibiru, the presence of the ARCH Effect as an alternative modeling was done using GARCH (0.2); GARCH (2.1) and GARCH (2.2), whereas these three alternative models met the requirements of a good model and white noise, but they had different forecasting capabilities as evidenced by different Root Mean Squared Error (RMSE) values.
Among the three GARCH models, the GARCH model (2.1) was the best model for estimating the number of tourist visits to Kalibiru, because this model satisfied the residual model of the white noise with no correlation between the time of residuals. Normal residual distribution patterns were evidenced by the probability Jarque-Bera, which was greater than 5% (0.622) and the residual variant was homogeneous, so that the GARCH model (2.1) no longer had the ARCH Effect. Besides, this model had the smallest forecasting bias (RMSE) compared to other GARCH models (6.953.276) and had a fairly good forecasting ability with a MAPE value of 39.95i, so that the expected forecasting result was close to the actual result.

The GARCH model (2.1) was used to estimate the number of tourist visits to Kalibiru from
January 2019 to December 2019, of which the result is shown in Table 2 as follow.

Table 2. Forecasting Result of Tourist Visits to Kalibiru Tourits Attraction January - December 2019.

Month	Tourist
January	11,782
February	9,798
March	11,105
April	27,928
May	14,660
June	11,465
July	10,464
August	9,586
September	16,389
October	26,537
November	14,846
December	10,793

Source: Processed by Author

The number of tourist arrivals decreased sharply in February and August 2019, because in those months educational activities were started in the schools and tertiary institutions in Indonesia, so the number of domestic tourist arrivals in particular decreased. Meanwhile, a significant increase in the number of visits was expected to occur in April and October 2019. This was driven by the inclusion of educational holidays at the elementary, secondary and tertiary levels.
The development of tourist visits to Kalibiru from January 2010 to December 2019 is
shown in Figure 2, whereas the TOURIST line showed the historical development of tourist visits to Kalibiru. Meanwhile, the TOURISTF line showed the development of the number of tourist visits to Kalibiru based on the result of the forecast by using the GARCH model (2.1) which showed that the movement was almost the same as the development of visits between 2017 and 2018.

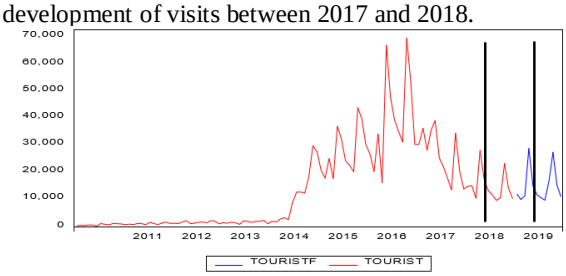

Figure 2. Development of Tourist Visits to Kalibiru, January 2010 - December 2019.
Source: Processed by Author

5. CONCLUSION

From the explanation and research result, it can be concluded that the best model for predicting the number of tourist visits to Kalibiru tourist attraction is the GARCH model (2.1), which gives the smallest error-rate compared to those of other models and has a fairly good forecasting ability.

6. LIMITATION

The forecasting model proposed in this study was limited to predicting the number of tourist visits based on fluctuations from tourist visits in the previous period, but the result model was good enough to know how many tourists visits approximately are.
However, it must be realized that the visits to a tourist attraction is not only determined by fluctuations in the visit during the previous period, but also by many other factors such as infrastructure, economic conditions, socio-cultural conditions, etc., that can directly determine the number of visits.

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