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EFFECTS OF CALENDAR VARIATIONS ON THE INDONESIA STOCK EXCHANGE: AN EMPIRICAL STUDY OF POTENTIAL STOCKS

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ABSTRACT

This study examines the effect of calendar variations on potential stocks on the Indonesia Stock Exchange. Calendar variations are observed in telecommunications, retail, food and cigarettes sub-sectors. The observed calendar variations are divided into two: the holiday effect, namely the effect of the month of Ramadan, the effect of the Eid al-Fitr holiday, and the effect of changes in the month of the Eid holidays; and the trading day effect, namely the effect of the day of the week and month of the year effects. ARIMA and ARIMAX model is used to see the effect of previous return data and the calendar variations on predicting stock returns. Descriptively, there is the effect of calendar variations due to Ramadan and Eid holidays and the influence of Monday and January effect. The existence of calendar variations does not apply equally to all types of stocks and to all observation time periods. The calendar variation tends to vary, does not form a clear pattern, does not consistently affect stock returns on the Indonesia Stock Exchange and is not statistically significant. Based on the analysis, it was found that the Monday effect and January effect are the most common phenomena in the Indonesian stock exchange.

Keywords: *calendar variations, ARIMAX, stock returns*

1. INTRODUCTION

Numerous time-series data related to the business and economy are influenced by many interventions such as government political policies, disaster events, holidays in the long term, and so on. These data, usually non-stationary and contain trends or seasonality. A recurring pattern that can be considered a seasonal pattern that occurs due to changes in the length of the month that is not the same every month, weekly periodicity, or holiday effect is known

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as the calendar variation effect. There are two types of calendar variation, namely, the trading days and the holiday's effect. In Indonesia, a Muslim-majority country, the calendar effect appears during religious holidays such as Eid al-Fitr. In general, the economic activity on Eid al-Fitr holidays has a significant increase. The Islamic calendar (Hijri) uses the lunar circulation as a reference, where one year in the Hijri Calendar is about eleven days shorter than a year in the Gregorian calendar. It is necessary to make calendar adjustments by detecting and eliminating calendar variations to obtain better modelling and prediction results.

The months of Ramadan and Eid al-Fitr are usually special moments for most people in Muslim countries like Indonesia. From an economic perspective, in the years before the Coronavirus pandemic, the period of Ramadan and Eid al-Fitr became the peak momentum of national economic growth. People's shopping activities increase drastically during the fasting month of Ramadan until Eid al-Fitr arrives. Purchases of primary and processed foodstuffs during this period increased. Apart from main foodstuffs, other goods in demand include the textile/clothing industry, telecommunications, vehicle rental services, and public transportation tickets, both land, sea, and air. Holiday event also affects the movement of shares in the stock market. Issuers engaged in the food and beverage and retail sectors are prima donna during the month of Ramadan and have the potential to increase stock prices. The performance of stocks in the consumption sector, such as consumer goods, retail, telecommunications, automotive and transportation, will increase, while stocks of cigarettes and airlines tend to decline (Tempo.co). The existence of this interference needs to be considered by shareholders to control the movement of their share prices because calendar variations can affect the level of stock returns of a commodity.

In real cases, several products and consumer behaviour patterns are related to the occurrence of holiday events, resulting in changes in the number of product sales. Research on the effect of calendar variations was first investigated by Hillmer (1982) and Bell and Hillmer (1983). Ariel (1990) examines the calendar effect of financial data on the stock market. The results show that the observed returns on the days before the national holidays are, on average, many times greater than the returns on other trading days. Ariel's research on the trading day effect is also supported by several other researchers such as Mills and Coutts (1995), Brockman and Michayluk (1998), Balaban (1995), Brooks and Persand (2001), Sullivan, Timmermann, and White (2001), Holden, Thompson, & Ruangrit (2005),

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Kling and Gao (2005), Seyyed, Abraham, & Al-Hajji (2005), Alagidede (2008), Al-Khazali, Koumanakos, & Pyun (2008), and Evans and Speight (2010). Based on the evidence, calendar anomaly, when broadly defined to include day, month, day of the month, holiday and crisis effects, may be important in explaining some of the changing variance phenomena found in financial markets.

The ARIMA model has been recognised for its success in time series forecasting and is widely used to provide an accurate prediction. ARIMA is easily identified, estimated, and used for forecasting by forming a simple representative model. ARIMA(*p*,*d*,*q*) is a combination of the AR(*p*) model and the moving average MA(*q*), as shown in the equation (see Box et al. (1994), Makridakis, Wheelwright, & McGee (1999), and Wei (2006))

$$(1-B)^d \emptyset_p(B) Z_t = \mu + \theta_q(B) a_t \quad (1)$$

with Z_t the response variable, $\emptyset_p$ the *p*-th autoregressive parameter, θ_q the *q*-th moving average parameter, where $\emptyset_p(B) = (1 - \emptyset_1 B - \cdots - \emptyset_p B^p)$ and $\theta_q(B) = \left(1 - \theta_1 B - \cdots - \theta_q B^q\right)$ are AR and MA processes, respectively, with $BZ_t = Z_{t-1}$. a_t is a white noise process if $a_t, a_2, \cdots, a_n$ *i.i.d* with $E(a_t) = 0$, $Var(a_t) = \sigma_a^2$ constant and $a_t \sim WN(0, \sigma_a^2)$. Equation (1) can also be expressed in the form

$$Z_t = \mu + \emptyset_1 Z_{t-1} + \cdots + \emptyset_p Z_{t-p} + \theta_1 a_{t-1} + a_t \quad (2)$$

In determining the model, the problem that may arise is that the model contains too many parameters. This problem can happen because the model often uses a large order to obtain a good approximation. Generally, a large number of parameters can reduce the efficiency of the model formed. The ARIMA model can be used by only including the significant past data (lags) so that there are not too many parameters that must be estimated. This model is called a subset of additive model. The ARIMA subset model is part of the generalized ARIMA model and is a subset of the ARIMA model. The ARIMA subset model only includes significant autoregressive and moving average lags, with several other parameters in equation (2) being zero.

With the influence of calendar variations, time-series data is not only influenced by past data. Time series modelling can be done using historical data and adding other variables that are considered to have a significant influence on the data to improve forecasting accuracy. So, the ARIMA model is no longer suitable to describe the data information adequately. Furthermore, ARIMA developed into the ARIMAX model by adding a calendar effect

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variable as an exogenous variable. In this study, the ARIMAX model is used to explain the effect of calendar variation on time series data. In this model, the factors that affect the response variable Z at time t are a function of variable Z in time and other independent variables at time t. In general, the form of the ARIMAX(p,d,q) model is given by the equation

$$(1-B)^d \emptyset_p(B) Z_t = \mu + \theta_q(B) a_t + \alpha_1 X_{1t} + \cdots + \alpha_k X_{kt,} \qquad (3)$$

Equation (3) is an expansion of equation (2) by adding the variable X_{it} as an exogenous variable (predictor) and α_i, $i = 1,\ldots, k$, is the coefficients of the exogenous variable. ARIMAX modelling steps are generally the same as ARIMA modelling, but components of other independent variables are added to the model (Rosadi, 2011). Equation (3) can also be expressed in the form

$$Z_t = \mu + \emptyset_1 Z_{t-1} + \cdots + \emptyset_p Z_{t-p} + \theta_1 a_{t-1} + a_t + \cdots + \theta_q a_{t-q} + \alpha_1 X_{1t} + \cdots + \alpha_k X_{kt}$$

We can identify the determination of ARIMA by plotting the lag partial autocorrelation function (PACF). ARIMA subset model can be formed based on significant lag. Furthermore, the ARIMA subset developed into ARIMAX by adding a calendar effect variable, namely a calendar effect dummy as an exogenous variable. The estimation of ARIMA and ARIMAX models is carried out using the Maximum Likelihood method.

This study aims to determine whether there is an effect of calendar variations on stock prices on the Indonesian stock exchange. The observed calendar variations are related to the holiday effect and the trading day effect. There are three observed holiday effects, namely the month of Ramadan, the Eid holiday and the effect of changing the month of the Eid holiday. As for the trading day effect, the day of the week and month of the year are investigated. This research is expected to provide information and recommendations in analysing the value of stock returns influenced by calendar variations in Indonesia.

2. METHODOLOGY

2.1. Data Collection

The data used in this study was the daily closing price of shares on the Indonesia Stock Exchange from 18 June 2012 to 13 November 2020 accessed from finance.yahoo.com. We selected five issuers, each containing 2045 observation data. The issuers selected are in sectors that are predicted to be affected by Ramadan and Eid. The issuers are Indofood Sukses Makmur Tbk (INDF), Unilever Indonesia Tbk (UNVR), and Hanjaya Mandala Sampoerna Tbk (HMSP) from the consumer goods industry sector; Ramayana Lestari

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Sentosa Tbk (RALS) from the trade, services, and investment in the retail sub-sector; and Telekomunikasi Indonesia Tbk (TLKM) from the infrastructure, utilities, and transportation sectors of the telecommunications sub-sector. The five issuers also have good sales records and are listed in the LQ45 index. In addition, the IDX Composite is also used to observe the effect of calendar variations. This study obtained the total return value by comparing the current period's stock price with the previous period's stock price. Stock return calculated using the equation (Jogiyanto, 2014)

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \quad (4)$$

where R_{it} is the realised return of stock i at time t, P_{it} is the stock price at time t, and P_{it-1} the stock price at time t-1. The return has a profit (positive value) if the stock's closing price at time t is higher than at time t-1. Conversely, there is a loss (negative value) if the opposite occurs. The next step is to estimate the ARIMA model to determine the significant lag of the observational data that affects stock returns. Furthermore, the ARIMAX model is estimated by adding a calendar variation variable to the best ARIMA model.

2.2. Time Series with Calendar Variation Effects

A calendar variation can be seen as a seasonal pattern; the difference is a recurring pattern with varying lengths due to events that occur on different dates each year. Calendar variations can occur due to changes in the size of the month that are not the same every month. There are two variations of the calendar, namely the trading day effect and the holiday effect (Liu (1986); Hillmer (1982); Bell and Hillmer (1983)). The effect of the trading day can occur where the economic or business activity level may change depending on the composition of trading days (or working days) in each week/month. Meanwhile, the holiday effect occurs because the culture of a place or major religious celebrations such as Eid al-Fitr, Easter, and Chinese New Year can affect business activities and consumer behaviour patterns.

To accommodate the calendar effect in the data, we formed five dummy variables. This dummy variable will be an exogenous variable from the selected ARIMA model and develop the ARIMAX model. The ARIMAX model to be estimated refers to equation (2), where the X_{it} is a calendar effect dummy variable. Furthermore, the ARIMAX model will be estimated using the following five calendar variations dummy to determine whether the calendar variation affects the stock returns.

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a. Ramadan effect

Two dummy variables are used to show the calendar effect of the event of Ramadan and not the month of Ramadan. So that the estimated equation is of the form

$$Z_t = \emptyset_p(B)Z_t + \theta_q(B)a_t + \alpha_1 DRam_{1t} + \alpha_2 DRam_{2t} \quad (6)$$

where Z_t is the stock return value observed at time *t*, $DRam_{1t}$ is a dummy variable of the effect calendar on the occurrence of Ramadan, and $DRam_{2t}$ is a dummy variable of the month other than Ramadan. Each dummy variable is one if the time corresponds to a calendar variation and is zero for any other time.

b. Eid Holiday Effects

Two dummy variables are used to show the effect of the Eid holiday effect.

$$Z_t = \emptyset_p(B)Z_t + \theta_q(B)a_t + \beta_1 Dpre_t + \beta_2 Dpost_t \quad (7)$$

where Z_t is the stock return value observed at time *t*, $Dpre_t$ is a dummy variable of the securities calendar five days before the Eid holiday, and $Dpost_t$ is the dummy of five days after the Eid holiday. Use of this dummy variable is based on the trading day in one week on the stock market, which consists of five days, and generally one week before and after the Eid holiday; stock exchange activities are still influenced by the Eid holiday. Each dummy variable is one of the times corresponds to a calendar variation and is zero for any other time.

c. The effect of the turn of the month of the Eid holiday

Three dummy variables are used to show the effect of calendar changes in the month of the Eid al-Fitr holiday.

$$Z_t = \emptyset_p(B)Z_t + \theta_q(B)a_t + \beta_1 Dbef_t + \beta_2 Deid_t + \beta_3 Daft_t \quad (8)$$

where Z_t is the stock return value observed at time *t*, $Dbef_t$ is the dummy variable of the securities calendar one month before the month of Eid al-Fitr, $Deid_t$ is the dummy of the effect calendar of the month of Eid al-Fitr and $Daft_t$ is the dummy of one month after the month of Eid al-Fitr. The determination of this dummy variable is based on people's consumption patterns that change one month before and during the month of Eid, which is mainly spent on consumption, and one month after that, when normal economic activities begin to return after the holiday. Each dummy variable is one of the time corresponds to a calendar variation and is zero for any other time.

d. The day of the week effect

Five dummy variables are used to show the calendar effect of the trading day of the

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week

$$Z_t = \emptyset_p(B)Z_t + \theta_q(B)a_t + \beta_1 D_{d1t} + \beta_2 D_{d2t} + \beta_3 D_{d3t} + \beta_4 D_{d4t} + \beta_5 D_{d5t} \quad (9)$$

where Z_t is the stock return value observed at time *t*, $D_{d1t}, D_{d2t}, D_{d3t}, D_{d4t}, D_{d5t}$ are the dummy variable of the trading days, namely Monday, Tuesday, Wednesday, Thursday, and Friday. The dummy variable assumes that there are differences in stock returns at the beginning, middle, and end of the week. Each dummy variable is one of the time corresponds to a calendar variation and is zero for any other time.

e. The month of the year effect

Twelve dummy variables are used to show the effect of the calendar month of the year

$$Z_t = \emptyset_p(B)Z_t + \theta_q(B)a_t + \beta_1 D_{m_1 t} + \beta_2 D_{m2t} + \beta_3 D_{m_3 t} + \cdots + \beta_{12} D_{m_{12} t} \quad (10)$$

where Z_t is the value of stock returns observed at time t, $D_{m_1 t}, D_{m_2 t}, D_{m_3 t}, \cdots, D_{m_{12} t}$ are the dummy variable for calendar effects for trading months, namely January to December. The dummy variable use is based on the assumption that there are differences in stock returns at the end of the year and January. Each dummy variable is one of the times that correspond to a calendar variation and is zero for any other time.

Because all the dummy calendars defined are made into dummy variables, in other words, the dummy variables formed are equal to the number of dummy variables defined, so to avoid the dummy variable trap, the intercept is omitted from the model.

2.3. Research Procedure

At the initial stage, a description of the return value of the six-stock data is carried out. The description of the data presented here is the average value as well as the maximum and minimum values of the return data. Then the ARIMA procedure is carried out followed by ARIMAX. The ARIMA and ARIMAX methods have the same stages of analysis consisting of (1) model identification, (2) parameter estimation, and (3) diagnostic checking. Yet, in ARIMAX modeling, model identification starts by using the best ARIMA model. Before the data is modeled with ARIMA, the stationarity of the data is tested using the Augmented Dicky Fuller test (ADF). The ARIMA and ARIMAX procedures are shown in Figures 1 and 2.

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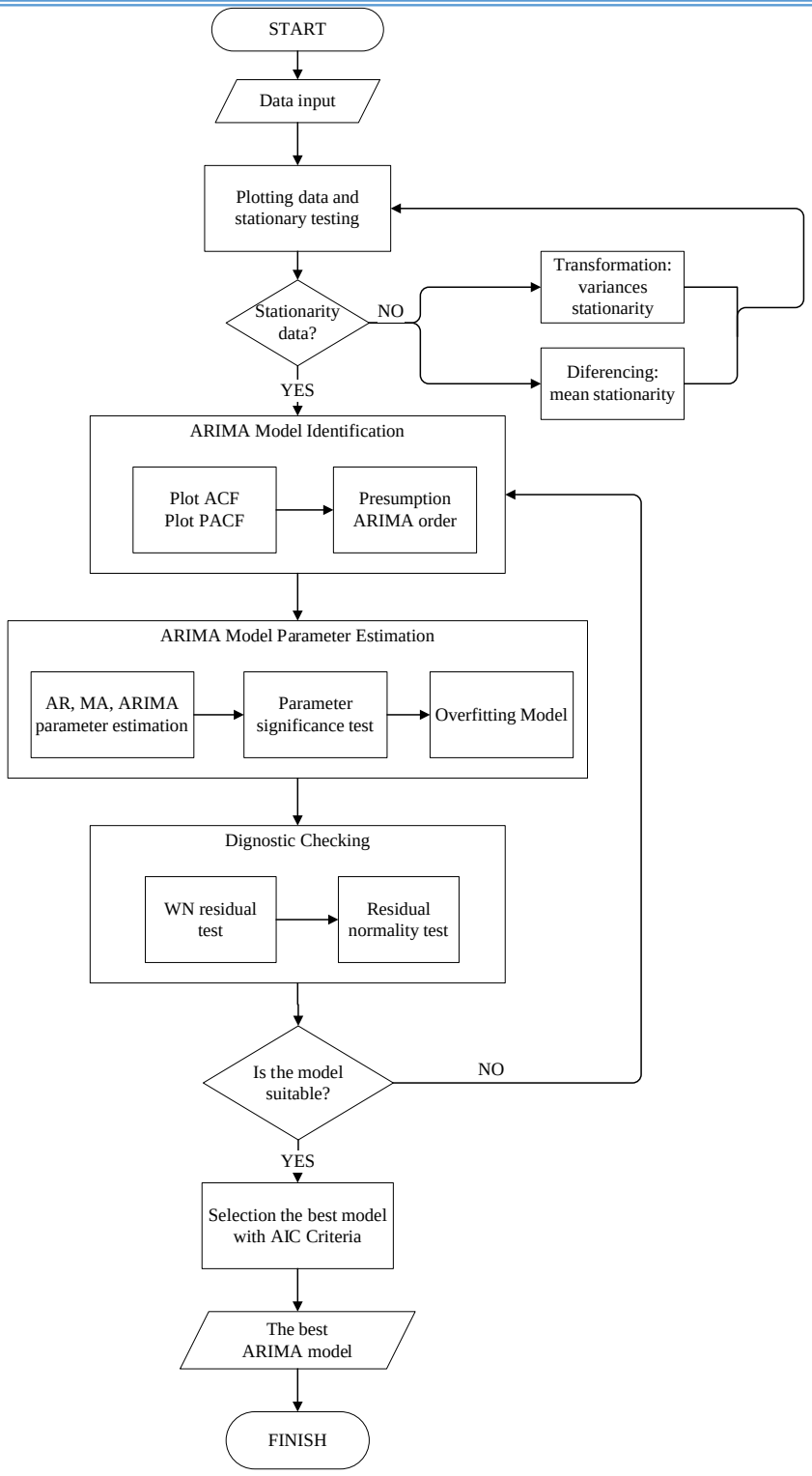

Figure 2. ARIMA Procedure

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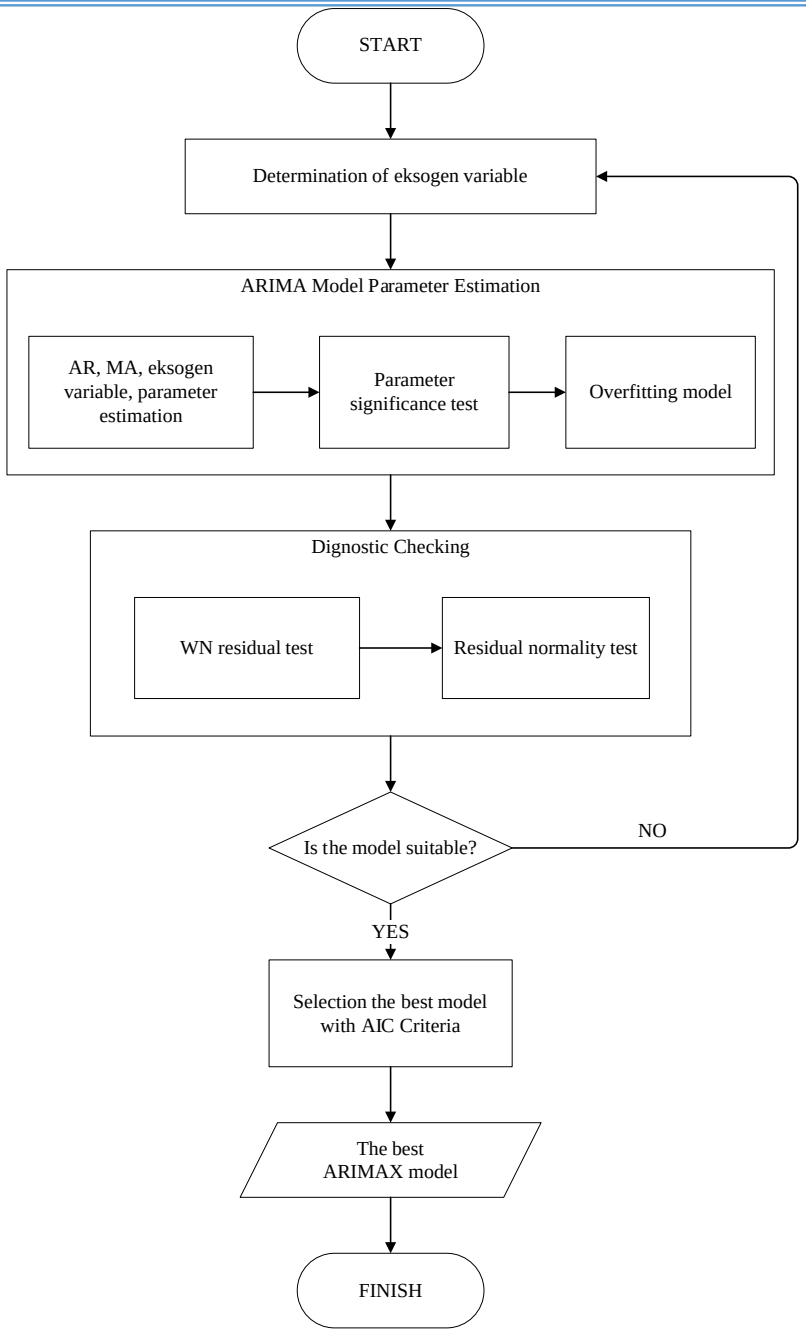

Figure 2. ARIMAX Procedure

3. RESULT AND DISCUSSION

Trading days on the Indonesia Stock Exchange are Monday to Friday, with the market closed on Saturdays, Sundays and public holidays. In a country with strong cultural characteristics, such as Indonesia, the holiday effect is related to religious holidays, and the most essential is Eid al-Fitr. Three models of holiday effect are used, namely the effect of the month of Ramadan, the effect of the Eid al-Fitr holiday, and the effect of changing the

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month of the Eid holiday, as well as two models of variations of the trading day effect, namely the day of the week, and the month of the year. This empirical study uses stock returns from five issuers, namely INDF, UNVR, HMSP, RALS, TLKM and as a comparison, the IDX Composite.

3.1. Description of Stock Return Data

Tables 1 to 5 contain descriptive information of the six stock returns in each calendar variation model. Table 1 shows that the six stocks' average daily return (average return) includes the IDX in Ramadan and the other month, is positive. Only RALS shows a negative average return in Ramadan, and HMSP shows a negative average return outside the month of Ramadan. TLKM showed the most prominent positive average return in the month of Ramadan. Meanwhile, outside the month of Ramadan, the average stock return value tends to be the same value and not much different from the IDX average return rate. The lowest and highest average return values for all stocks were recorded outside the month of Ramadan. It can be seen that stock prices tend to rise outside the month of Ramadan.

Table 1. Descriptive Statistics of Stock Returns on the Effects of the Month of Ramadan

	Average						Minimum Maximum					
	IDX	TLKM	HMSP	INDF	RALS	UNVR	IDX	TLKM	HMSP	INDF	RALS	UNVR
$DRam_{1t}$	0,0009	0,0021	0,0017	-2.3E-05	0,0013	0,0019	-0,0235 0,0326	-0,0514 0,0601	-0,0567 0,0897	-0,0661 0,0458	-0,0763 0,1062	-0,0462 0,0765
$DRam_{2t}$	0,0002	0,0003	-7.9E-05	0,0004	0,0002	0,0003	-0,0658 0,1019	-0,0869 0,1374	-0,1821 0,1645	-0,0972 0,1832	-0,1733 0,2157	-0,1210 0,1938

Table 2. Descriptive Statistics of Stock Returns on Eid Holiday Effects

	Average						Minimum Maximum					
	IDX	TLKM	HMSP	INDF	RALS	UNVR	IDX	TLKM	HMSP	INDF	RALS	UNVR
$Dpre_t$	0,0023	0,0054	0,0048	-0,0003	0,0024	0,0010	-0,0185 0,0201	-0,0424 0,0595	-0,0354 0,0897	-0,0662 0,0455	-0,0653 0,0645	-0,0461 0,0331
$Dpost_t$	-0,0014	0,0017	-0,0029	-0,0024	-0,0068	-0,0011	-0,0558 0,0198	-0,0502 0,0597	-0,0489 0,0976	-0,0667 0,0478	-0,0794 0,0702	-0,0489 0,0452

Table 2 shows that the average daily return of TLKM, HMSP, RALS, and UNVR stocks five days before the Eid holiday is positive, as well as the IDX, only INDF shows a negative value. Meanwhile, in the five days since the end of the Eid al-Fitr holiday, only TLKM

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showed a positive average return, and the other five stock returns were negative. TLKM shares always show a positive average return both before and after the end of the Eid al-Fitr holiday and recorded the highest positive value. The determination of five days is based on the trading period on the IDX, which is five days a week. Meanwhile, five days after the end of the Eid al-Fitr holiday, the average stock return value tends to be negative. This negative value may be because the five-day period since the end of Eid al-Fitr has not returned to normal. The level of spending ability is still low, affecting activities in the capital market more or less. This thing can also be seen from the negative average return on the IDX.

Positive average returns in one month before Eid is shown in the five stocks, but on the contrary, IDX shows negative numbers, shown in Table 3. Meanwhile, INDF shows positive average returns equal to IDX in one month after Eid, in contrast to TLKM, HMSP, RALS, and UNVR, which show negative values. This result shows a good response in the stock market with a positive IDX average return and an improvement in the consumer goods subsector, namely INDF. However, unlike TLKM, HMSP, RALS, and UNVR tend to experience a decline compared to during the month of Eid. During the month of Eid, INDF and RALS showed negative average returns in contrast to TLKM, HMSP, UNVR and IDX, which obtained positive average returns during this period. The most significant average positive return of TLKM, INDF, and RALS was achieved one month before Eid, in the holy month of Ramadan, where consumption of food, telecommunications and textiles increased.

Table 3. Descriptive Statistics of Stock Returns on the Effects of the Turn of the Eid Al-Fitr Holiday

	Average						Minimum Maximum					
	IDX	TLKM	HMSP	INDF	RALS	UNVR	IDX	TLKM	HMSP	INDF	RALS	UNVR
$Dbef_t$	-0,0003	0,0016	0,0002	0,0006	0,0030	0,0009	-0,0368 0,0408	-0,0480 0,0767	-0,0587 0,1090	-0,0638 0,0709	-0,0763 0,2157	-0,0551 0,0765
$Deid_t$	0,0004	0,0011	0,0013	-0,0005	-0,0028	0,0020	-0,0558 0,0233	-0,0661 0,0644	-0,0970 0,0976	-0,0923 0,0783	-0,0882 0,1062	-0,0575 0,1005
$Daft_t$	0,0005	-0,0001	-0,0014	0,0004	-0,0015	-0,0005	-0,0397 0,0465	-0,0869 0,0757	-0,0449 0,0548	-0,0866 0,0951	-0,1417 0,1359	-0,0652 0,0912

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Table 4. Descriptive Statistics of Stock Return on Day of Week Effects

	Average						Minimum Maximum					
	IDX	TLKM	HMSP	INDF	RALS	UNVR	IDX	TLKM	HMSP	INDF	RALS	UNVR
D_{d1t}	-0,0010	-0,0006	-0,0020	-0,0018	-0,0004	-0,0027	-0,0658 0,0407	-0,0694 0,0757	-0,1821 0,1090	-0,0972 0,0672	-0,1417 0,2157	-0,0683 0,0562
D_{d2t}	0,0008	1,1E-05	0,0009	0,0004	-0,0014	0,0020	-0,0499 0,0398	-0,0870 0,0602	-0,0676 0,1218	-0,0662 0,0817	-0,0882 0,1359	-0,0681 0,1413
D_{d3t}	0,0003	0,0013	6.5E-05	0,0005	0,0015	0,0012	-0,0401 0,0382	-0,0486 0,0769	-0,0587 0,0919	-0,0879 0,0866	-0,0867 0,1161	-0,1079 0,0948
D_{d4t}	0,0001	0,0007	0,0003	0,0019	0,0019	0,0003	-0,0520 0,1019	-0,0676 0,1374	-0,0685 0,0976	-0,0699 0,1832	-0,0970 0,2146	-0,1209 0,1938
D_{d5t}	0,0009	0,0011	0,0010	0,0010	-0,0003	0,0012	-0,0281 0,0476	-0,0675 0,0992	-0,1029 0,1645	-0,0753 0,1381	-0,1733 0,1500	-0,0677 0,1101

Table 5. Descriptive Statistics of Stock Return on Monthly Effects

	Average						Minimum Maximum					
	IDX	TLKM	HMSP	INDF	RALS	UNVR	IDX	TLKM	HMSP	INDF	RALS	UNVR
D_{m_1t}	0,0009	0,0004	0,0017	0,0027	0,0023	0,0020	-0,0658 0,0408	-0,0408 0,0453	-0,0634 0,0679	-0,0447 0,1037	-0,1733 0,2146	-0,0381 0,0512
D_{m_2t}	0,0008	0,0003	0,0001	0,0005	0,0029	0,0005	-0,0499 0,0398	-0,0423 0,0591	-0,0403 0,0549	-0,0879 0,0500	-0,0654 0,1500	-0,0455 0,0397
D_{m_3t}	-0,0008	-0,0005	-0,0010	-0,0003	-0,0046	0,0009	-0,0401 0,0382	-0,0696 0,1374	-0,0936 0,1645	-0,0827 0,1832	-0,1329 0,0869	-0,0692 0,1938
D_{m_4t}	-2,5E-05	0,0016	-0,0003	-9,6E-05	0,0029	0,0016	-0,0349 0,0408	-0,0466 0,0767	-0,1061 0,1090	-0,0597 0,0817	-0,0971 0,2157	-0,0551 0,1413
D_{m_5t}	8,6E-05	0,0004	0,0016	-0,0005	8,4E-06	0,0009	-0,0255 0,0267	-0,0675 0,0574	-0,0548 0,0823	-0,0667 0,0469	-0,0662 0,1062	-0,0572 0,1101
D_{m_6t}	-0,0002	0,0020	-0,0022	0,0005	0,0005	0,0004	-0,0368 0,0382	-0,0524 0,0537	-0,0567 0,0500	-0,0538 0,0866	-0,0606 0,0778	-0,0677 0,0948
D_{m_7t}	0,0012	0,0019	0,0009	0,0003	7,2E-05	0,0008	-0,0368 0,0280	-0,0870 0,0597	-0,0970 0,0976	-0,0680 0,0565	-0,0763 0,1009	-0,0575 0,0765
D_{m_8t}	-0,0006	-0,0005	-0,0017	0,0006	-0,0031	0,0015	-0,0558 0,0455	-0,0661 0,0757	-0,0601 0,0854	-0,0866 0,0951	-0,1417 0,1359	-0,0489 0,1005
D_{m_9t}	-0,0004	-0,0004	-0,0011	0,0008	-0,0022	-0,0006	-0,0501 0,0465	-0,0476 0,0674	-0,1821 0,0493	-0,0923 0,0672	-0,0650 0,0857	-0,0652 0,0570
$D_{m_{10}t}$	0,0009	-0,0001	0,0014	-0,0005	0,0021	-0,0012	-0,0319 0,0323	-0,0486 0,0742	-0,0958 0,1218	-0,0699 0,0727	-0,0757 0,0889	-0,0407 0,0459
$D_{m_{11}t}$	-0,0003	-0,0003	0,0003	-0,0009	0,0008	-0,0013	-0,0401 0,0304	-0,0581 0,0769	-0,1029 0,0556	-0,0972 0,0579	-0,0625 0,0866	-0,0648 0,0491
$D_{m_{12}t}$	0,0012	0,0015	0,0010	0,0019	0,0019	-0,0003	-0,0192 0,0250	-0,0328 0,0370	-0,0484 0,0537	-0,0331 0,0718	-0,0694 0,1111	-0,1209 0,0909

Table 4 shows the same average return on all trading days, except for RALS which shows negative values on Tuesdays and Fridays, different from other stocks. On Monday, all average returns were negative, including the IDX. It is in accordance with the theory of the Monday effect, where Mondays tend to produce negative returns. Monday effect is part of the day of the week because patterns of irrational investor behavior influence trading on Mondays. This result is in line with previous research on the negative Monday effect on the IDX conducted by Azlina (2009), Cahyaningtyas (2010), and Wulandari (2018). The Monday effect is often called the weekend effect, which describes the tendency of negative stock prices and decreases on Monday, meaning that the closing price on Monday is lower

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than the closing price on the previous Friday (Gharaibeh and Jaradat, 2018). Returns on Mondays are consistently lower than any other day of the week (Damodaran, 1989). Monday is the only business day with a negative average return for the IDX.

Table 5 shows that January, February, and July produced positive average returns. In particular, the average return generated in January is the largest compared to other months of the year. This result is consistent with the January effect concept, which states that stock prices tend to rise in the first month of each current year. This concept was first observed by investment banker from Washington, United States, Sidney Wachtel, in 1942. Several previous researchers have also examined the January effect on stock returns, also known as the year-end effect. These findings confirm the results of research by Alrabadi & AL-Qudah (2012), Gharaibeh (2017), and Gharaibeh & Jaradat (2018), which state that there is a positive and significant influence in January on various stocks in the capital market. This January effect also happened in the Indonesian stock market and also affected the IDX value.

3.2. Data Stationarity

The data stationarity is first evaluated using the Augmented Dicky-Fuller (ADF) test for the six stock returns, specifically the test with an intercept without a trend and the test with an intercept and a trend, to guarantee that the selected data may be used. The hypothesis that the data is not stationary can be rejected if the p-value is less than the significance level of 5%. Table 6 shows the statistical value of the ADF test and the p-value, which shows that the hypothesis of a unit root can be rejected at a significance level of 1% for all stock return values. In other words, all return data in this study are stationary. So, the transformation and differencing of the data are not required. Data estimation with the ARIMA model can be done directly.

Table 6. Stationarity Test: Unit Root Test

Stocks	ADF T-stat (*with intercept*)	ADF T-stat (*with intercept & trend*)
IHSG	-42,07963***	-42,08423***
	(0,0000)	(0,0000)
TLKM	-26,67291***	-26,76395***
	(0,0000)	(0,0000)
HMSP	-33,90770***	-34,00297***
	(0,0000)	(0,0000)
INDF	-29,95665***	-29,96117***
	(0,0000)	(0,0000)
RALS	-44,55031***	-44,54994***
	(0,0000)	(0,0000)
UNVR	-36,63013***	-36,64884***

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	(0,0000)	(0,0000)

*** Rejection of H_0 at the 1% significance level

3.3. ARIMA Model Estimation of Stock Return

Estimated the best ARIMA model, the coefficients (along with p-values) and diagnostic checking with statistical values (SSR, AIC, SBC/BIC) information for each stock return were displayed in Table 7. The best ARIMA model for stock returns of IDX, TLKM, HMSP, INDF, RALS, and, UNVR consecutive are given by ARIMA([1,2,4],0,0), ARIMA([2],0,[1,2]), ARIMA([2,4],0,[3]), ARIMA([3],0,0), and ARIMA([2],0,[1]). The ARIMA model is estimated using the Maximum Likelihood method and is used to predict the value of stock returns by looking at the previous data (lag) of each significant stock return. Table 7 shows. ARIMA that met the assumption of white noise error and residual normality was chosen as the best model. For all stocks, previous returns affect the value of future returns. In the IDX, the one, two, and four previous day data significantly affect future returns' value. The best ARIMA is then used as the basic model to determine the ARIMAX model by adding a calendar effect dummy variable as an exogenous variable to assess the effect of the calendar on stock returns.

Table 7. The Best ARIMA Model Estimation from Six Stock Returns

Coefficient	Stock Return					
	IHSG	TLKM	HMSP	INDF	RALS	UNVR
$\emptyset_1$	0,0754*** (0,0000)					
$\emptyset_2$	-0,0612*** (0,0000)	0,4236*** (0,0000)	-0,0689*** (0,0000)	-0,0931*** (0,0000)		-0,0787*** (0,0000)
$\emptyset_3$					-0,0477*** (0,0000)	
$\emptyset_4$	-0,0368*** (0,0058)		-0,0732*** (0,0000)	-0,0494*** (0,0024)		
θ_1		-0,0429*** (0,0010)				-0,1086*** (0,0000)
θ_2		-0,5652*** (0,0000)				
θ_3				-0,0913*** (0,0000)		
num of parameter	3	3	2	3	1	2
SSR	0,2227	0,6911	0,8113	0,8327	1,6597	0,7653
AIC	-6,2826	-5,1502	-4,9919	-4,9639	-4,2962	-5,0499
BIC	-6,2716	-5,1392	-4,9865	-4,9529	-4,2707	-5,0410

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Note: This table shows the estimation of the ARIMA model expressed in the equation
$$Z_t = \emptyset_p(B)Z_t + \theta_q(B)a_t$$
The null hypothesis states that the coefficients of significant constants are zero.
*** represents the rejection of H_0 at the 1% significance level.

3.4. Effect of Calendar Variation on Stock Return

Table 8 shows the ARIMAX model obtained by observing the dummy variable of calendar variations. ARIMAX is estimated using significant lags of the best ARIMA model in Table 7 by adding a calendar dummy variable. The Ramadan month effect calendar significant at the 5% level on the Ramadan month dummy variable ($DRam_{1t}$) on TLKM stocks with a coefficient value of 0.0026. This positive coefficient indicates the positive effect of the month of Ramadan on TLKM returns.

The variation of the Eid holiday effect calendar also shows statistically significant results for TLKM on the dummy variable five days before the Eid holiday ($Dpre_t$) with a coefficient of 0.0054 with a significance level of 1%. This positive coefficient indicates a positive effect on five days before the Eid al-Fitr holiday on TLKM returns. Different things can be seen in the return of RALS which is statistically significant at the 5% level for the dummy variable five days after the Eid holiday ($Dpost_t$). However, five days after the Eid al-Fitr holiday has a negative effect on RALS returns. This effect is realistic, considering that RALS is engaged in retail, and five days after the Eid holiday ends, public consumption for clothing, accessories, and cosmetics tends to decline. Meanwhile, five days before the Eid al-Fitr holiday, which is the fasting period of Ramadan, the use of telecommunications services, including internet access, tends to be high.

The variation of the calendar effect of changing the month of the Eid al-Fitr holiday also shows statistically significant results for TLKM on the dummy variable one month before the Eid al-Fitr holiday ($Dbef_t$) and in the month during the Eid al-Fitr holiday ($Deid_t$) with a significance level of 1%. The dummy variable one month before the Eid holiday ($Dbef_t$) is also statistically significant at the 5% level in the RALS. All the coefficients of these variables are positive, which means that one month before the Eid al-Fitr holiday and during the month of the Eid al-Fitr holiday positively influences the stock return value of both TLKM and RALS. Meanwhile, one month after the Eid holiday does not significantly affect stock returns.

Table 8. ARIMAX Model Estimation for Six Stock Returns

	IDX	TLKM	HMSP	INDF	RALS	UNVR

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The month of Ramadan	$\emptyset_1$	0,0745***	$\emptyset_2$	0,4507***	$\emptyset_2$	-0,0694***	$\emptyset_2$	-0,0938***	$\emptyset_3$	-0,0480***	$\emptyset_2$	-0,0799***
		(0,0000)		(0,0000)		(0,0000)		(0,0000)		(0,0077)		(0,0000)
	$\emptyset_2$	-0,0619***	θ_1	-0,0488***	$\emptyset_4$	-0,0736***	$\emptyset_4$	-0,0501***			θ_1	-0,1103***
		(0,0000)		(0,0002)		(0,0000)		(0,0021)				(0,0000)
	$\emptyset_4$	-0,0375***	θ_2	-0,5944***			θ_3	-0,0921***				
		(0,0055)		(0,0000)				(0,0000)				
	β_1	0,0009	β_1	0,0026**	β_1	0,0010	β_1	-0,0002	β_1	0,0018	β_1	0,0019
		(0,3294)		(0,0067)		(0,5509)		(0,8854)		(0,4201)		(0,1128)
	β_2	0,0002	β_2	0,0003	β_2	1,16E-05	β_2	0,0005	β_2	0,0001	β_2	0,0003
		(0,5079)		(0,3099)		(0,9768)		(0,2327)		(0,8642)		(0,4693)
Eid al-Fitr holiday	$\emptyset_1$	0,0739***	$\emptyset_2$	0,4381***	$\emptyset_2$	-0,0693***	$\emptyset_2$	-0,0933***	$\emptyset_3$	-0,0489***	$\emptyset_2$	-0,0787***
		(0,0000)		(0,0000)		(0,0000)		(0,0000)		(0,0055)		(0,0000)
	$\emptyset_2$	-0,0617***	θ_1	-0,0483***	$\emptyset_4$	-0,0735***	$\emptyset_4$	-0,0496***			θ_1	-0,1084***
		(0,0000)		(0,0002)		(0,0000)		(0,0023)				(0,0000)
	$\emptyset_4$	-0,0368***	θ_2	-0,5811***			θ_3	-0,0914***				
		(0,0059)		(0,0000)				(0,0000)				
	β_1	0,0023	β_1	0,0054***	β_1	0,0018	β_1	-0,0009	β_1	0,0027	β_1	0,0007
		(0,2737)		(0,0054)		(0,6020)		(0,6777)		(0,5541)		(0,7921)
	β_2	-0,0011	β_2	0,0021	β_2	0,0008	β_2	0,0002	β_2	-0,0076**	β_2	-0,0007
		(0,3710)		(0,3063)		(0,7089)		(0,9586)		(0,0333)		(0,78788)
Turn of the Eid al-Fitr holiday	$\emptyset_1$	0,0750***	$\emptyset_2$	0,4609***	$\emptyset_2$	-0,0694***	$\emptyset_2$	-0,0936***	$\emptyset_3$	-0,0504***	$\emptyset_2$	-0,0794***
		(0,0000)		(0,0000)		(0,0000)		(0,0000)		(0,0052)		(0,0000)
	$\emptyset_2$	-0,0617***	θ_1	-0,0496***	$\emptyset_4$	-0,0735***	$\emptyset_4$	-0,0501***			θ_1	-0,1096***
		(0,0000)		(0,0001)		(0,0000)		(0,0025)				(0,0000)
	$\emptyset_4$	-0,0371**	θ_2	-0,6042***			θ_3	-0,0919***				
		(0,0056)		(0,0000)				(0,0000)				
	β_1	-0,0002***	β_1	0,0018***	β_1	0,0008	β_1	0,0004	β_1	0,0036**	β_1	0,0010
		(0,7382)		(0,0290)		(0,5285)		(0,7358)		(0,0470)		(0,3430)
	β_2	0,0003***	β_2	0,0016*	β_2	0,0003	β_2	-0,0004	β_2	-0,0031	β_2	0,0017
		(0,6766)		(0,0990)		(0,8417)		(0,7424)		(0,1350)		(0,1918)
	β_3	0,0005	β_3	7,48E-05	β_3	-0,0009	β_3	0,0002	β_3	-0,0013	β_3	-0,0005
		(0,4236)		(0,9313)		(0,5108)		(0,8312)		(0,4965)		(0,6840)
Day of the week	$\emptyset_1$	0,0768***	$\emptyset_2$	0,4309***	$\emptyset_2$	-0,0683***	$\emptyset_2$	-0,0913***	$\emptyset_3$	-0,0468**	$\emptyset_2$	-0,0784***
		(0,000)		(0,0000)		(0,0000)		(0,0000)		(0,0101)		(0,0000)
	$\emptyset_2$	-0,0619***	θ_1	-0,0454***	$\emptyset_4$	-0,0724***	$\emptyset_4$	-0,0488***			θ_1	-0,1066***
		(0,0000)		(0,0006)		(0,0000)		(0,0030)				(0,0000)
	$\emptyset_4$	-0,0365***	θ_2	-0,5723***			θ_3	-0,0914***				
		(0,0076)		(0,0000)				(0,0000)				
	β_1	0,0008	β_1	-0,0006	β_1	0,0021**	β_1	-0,0018*	β_1	-0,0005	β_1	0,0019**
		(0,1512)		(0,4951)		(0,0183)		(0,0719)		(0,7192)		(0,0451)
	β_2	0,0004	β_2	1,34E-06	β_2	0,0010	β_2	0,0004	β_2	-0,0015	β_2	0,0016*
		(0,4922)		(0,9989)		(0,3167)		(0,6884)		(0,3408)		(0,0930)
	β_3	-4,37E-05	β_3	0,0011	β_3	4,70E-05	β_3	0,0002	β_3	0,0012	β_3	-0,0007
		(0,9318)		(0,2260)		(0,9639)		(0,8516)		(0,4135)		(0,4826)
	β_4	0,0008	β_4	0,0009	β_4	0,0002	β_4	0,0022**	β_4	0,0022	β_4	0,0015
		(0,1633)		(0,3070)		(0,8710)		(0,0232)		(0,1365)		(0,1426)
	β_5	-0,0008*	β_5	0,0011	β_5	0,0012	β_5	0,0011	β_5	-0,0003	β_5	-0,0022**
		(0,0935)		(0,2498)		(0,2097)		(0,3267)		(0,8461)		(0,0384)

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The month of the year	$\emptyset_1$	0,0713***	$\emptyset_2$	0,4686***	$\emptyset_2$	-0,0739***	$\emptyset_2$	-0,0974***	$\emptyset_3$	-0,0539***	$\emptyset_2$	-0,0822***
		(0,0000)		(0,0000)		(0,000)		(0,0000)		(0,0048)		(0,0000)
	$\emptyset_2$	-0,0654***	θ_1	-0,0547***	$\emptyset_4$	-0,0782***	$\emptyset_4$	-0,0546***			θ_1	-0,1133***
		(0,0000)		(0,0000)		(0,0000)		(0,0011)				(0,0000)
	$\emptyset_4$	-0,0417***	θ_2	-0,6154***			θ_3	-0,0968***				
		(0,0030)		(0,0000)				(0,0000)				
	β_1	0,0007	β_1	0,0005	β_1	0,0017	β_1	0,0027*	β_1	0,0025	β_1	0,0015
		(0,4915)		(0,6684)		(0,2384)		(0,0776)		(0,1801)		(0,3018)
	β_2	0,0006	β_2	0,0006	β_2	0,0002	β_2	0,0007	β_2	0,0029	β_2	0,0008
		(0,5735)		(0,6698)		(0,9309)		(0,6042)		(0,1787)		(0,6395)
	β_3	-0,0006	β_3	-0,0009	β_3	-0,0011	β_3	-0,0007	β_3	0,0046**	β_3	0,0006
		(0,2829)		(0,3125)		(0,3222)		(0,5120)		(0,0194)		(0,5130)
	β_4	-5,50E-05	β_4	0,0020**	β_4	-0,0004	β_4	-0,0002	β_4	0,0029	β_4	0,0015
		(0,9438)		(0,0228)		(0,7707)		(0,9063)		(0,1582)		(0,2019)
	β_5	0,0002	β_5	0,0005	β_5	0,0016	β_5	-0,0002	β_5	0,0001	β_5	0,0015
		(0,8422)		(0,6202)		(0,2681)		(0,8926)		(0,9657)		(0,1956)
	β_6	-0,0001	β_6	0,0018*	β_6	-0,0022	β_6	0,0003	β_6	0,0001	β_6	0,0001
		(0,8700)		(0,0621)		(0,2283)		(0,8062)		(0,9564)		(0,9084)
	β_7	0,0008	β_7	0,0021**	β_7	0,0011	β_7	0,0004	β_7	0,0005	β_7	0,0011
		(0,3295)		(0,0419)		(0,3521)		(0,7324)		(0,8200)		(0,3580)
	β_8	-0,0006	β_8	0,0008	β_8	-0,0018	β_8	0,0003	β_8	-0,0031*	β_8	0,0013
		(0,3948)		(0,3735)		(0,1589)		(0,7708)		(0,0968)		(0,2859)
	β_9	-0,0001	β_9	0,0001	β_9	-0,0009	β_9	0,0009	β_9	-0,0022	β_9	0,0004
		(0,8789)		(0,8966)		(0,4729)		(0,4324)		(0,3337)		(0,7446)
	β_{10}	0,0007	β_{10}	-8.35E-05	β_{10}	0,0014	β_{10}	-0,0001	β_{10}	0,0021	β_{10}	0,0014
		(0,4569)		(0,9355)		(0,2433)		(0,9041)		(0,3273)		(0,3808)
	β_{11}	1,79E-05	β_{11}	-0,0003	β_{11}	0,0003	β_{11}	-0,0012	β_{11}	0,0009	β_{11}	-0,0006
		(0,9835)		(0,7140)		(0,8330)		(0,3437)		(0,6921)		(0,6827)
	β_{12}	0,0012	β_{12}	0,0010	β_{12}	0,0011	β_{12}	0,0019	β_{12}	0,0016	β_{12}	-0,0003
		(0,3266		(0,4502)		(0,5680)		(0,2450)		(0,4566)		(0,8148)

Note: This table shows the estimation of the ARIMAX model expressed in equation

$$Z_t = \emptyset_p(B)Z_t + \theta_q(B)a_t + \beta_1 D_{it} + \cdots + \beta_k D_{kt}$$

The null hypothesis that the exogenous variable (calendar dummy variable) is not significant tested against the alternative hypothesis where the exogenous variable is significant to stock returns. Suppose the coefficient value of the dummy variable is significantly different from zero, H_0 rejected, and it can be concluded that the calendar dummy variable is significant on stock returns. * represents the rejection of H_0 at the 10% significance level, ** represents H_0 at the 5% significance level, and *** represents the rejection of H_0 at the 1% significance level.

The holiday effect is usually marked by a fall in stock prices ahead of a long holiday. Because what will happen on long holidays is unpredictable, so holidays are assumed to have considerable risk. This assumption has resulted in many stockholders releasing shares to the market before the holidays to reduce risk. However, for certain commodity stocks, the opposite is true. Several stocks have potential to increase before the holidays due to the increase in public demand for commodities from stocks during the holiday period. Several sectors affected by the holiday effect tended to generally increase stocks in the telecommunications, transportation, retail, and foodstuff sub-sectors. Based on three models of variations of the holiday effect, in this case, Ramadan and Eid holidays, only TLKM and RALS returns are statistically significantly affected. In contrast, other stocks are not affected by this holiday effect.

The day of the week calendar effect shows a positive and statistically significant Monday

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effect (D_{1t}) on HMSP and UNVR returns at the 5% significance level and a negative Monday effect at the 10% significance level for INDF returns. In addition, the UNVR also shows that Tuesday (D_{2t}) has a positive and significant effect at the 10% level, and there is a significant negative effect at the 5% level on Friday (D_{5t}). On the return of the IDX, no significant effect was found from the Monday effect, but there was a significant negative effect with a significance level of 10% on Friday. These results show that the Monday effect phenomenon is not statistically significant for all stock returns. Descriptively, it can be seen that there is a Monday effect on stocks, but this is not proven on statistical tests. Further research related to this can refer to Brusa, Liu and Schulman (2000).

The variation of the month of the year effect shows a positive and statistically significant January effect (D_{m1t}) on INDF returns at a significance level of 10%, while other stocks, including the IDX, do not show a significant effect from the January effect. April, June, and July had a positive and significant effect on TLKM returns. In contrast to RALS which has a positive influence in May and a negative influence in August. Other months do not show a significant effect on stock returns. Based on the effect of variations in the trading day calendar, it can be seen that the effects of trading day and month were different to each stock return.

3.5. Discussion

The effect of the trading day can be seen at certain times which is fixed and recurring, so that if the stock prices on the Indonesian stock exchange is indeed influenced by the trading day effect, the pattern will be clearly visible. However, for some of the stocks analysed here, this pattern does not appear. The results of observations on the day of the week and month of the year do not show a similar pattern for all stocks and all periods of observation. Meanwhile, holiday effects can be seen as a seasonal pattern, the difference is a recurring pattern with varying lengths due to events that occur on different dates each year. The analysis of the month of Ramadan, the Eid holiday and the effect of changing the month of the Eid holiday does not show the same results for all stocks. This is greatly influenced by the type of stock subsector. Some stocks experienced gains ahead of Eid, while others did the opposite. This is what underlies the conclusion that calendar variations, both holiday and trading day effects, form unclear and inconsistent patterns in stock prices data.

Several cases of data influenced by calendar variations that show a clear, fixed, and

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consistent pattern are generally influenced by holiday effect, especially Ramadan and Eid. Several previous studies regarding the effect of calendar variations on data other than stock prices can be seen in Lee, et al (2010), and Hendikawati, et all (2021). In Lee (2010), we see a recurring pattern in clothing sales data that is influenced by Ramadan. Meanwhile, Hendikawati (2021) shows a similar pattern in the food stuff index data, which is influenced by the Eid holiday. The existence of calendar variations that can be detected clearly affects changes in data can facilitate analysis, because it can be assumed that it will be repeated in the next time period so that it will be able to predict more accurately.

In this study, the existence of calendar variations does not apply equally to all types of stocks and to all observation time periods. The effect of calendar variations cannot be generalized to all stock data on the Indonesian stock exchange. However, there are several things that need to be underlined, namely the influence of the trading day effect is greater than the holiday effect on stock price data. Based on the analysis, it was found that the Monday effect and January effect are the most common phenomena in the Indonesian stock exchange. Meanwhile, the holiday effect is not significantly affected the stock price returns. The occurrence of the Monday effect was also found by Azlina (2009), Cahyaningtyas (2010), and Wulandari (2018). Damodaran (1989) evaluated previous research that gave the same results, that returns on Mondays are consistently lower than any other day of the week. The positive and significant influence in January on various stocks in the capital market was also found by Alrabadi & AL-Qudah (2012) and Gharaibeh (2017). Gharaibeh & Jaradat (2018) also found a January effect on the Amman stock exchange. Meanwhile, not many references have been found regarding the holiday effect on stock price returns. However, because these calendar variations always occur in trading days on the stock exchange, it is still important to pay attention to.

4. CONCLUSION

The results of this study indicate that the holiday's effects, specifically Ramadan and Eid and the trading days effect, impact stock returns included in the potential sub-sector. The holiday's effect related to Ramadan and Eid al-Fitr is quite influential for TLKM engaged in the technology sub-sector. However, the effects that occur tend to vary and do not form a clear pattern. Although holiday effects and trading day effects occur in some stocks, they do not apply to all shares in the Indonesian stock market. The existence of calendar variations

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does not apply equally to all types of stocks and to all observation time periods. The effect of calendar variations cannot be generalized to all stock data on the Indonesian stock exchange. But it was found that the Monday effect and January effect are the most common phenomena in the Indonesian stock exchange. Due to the limited number of shares that are the object of this research, further research needs to be done on calendar variations by adding the number of issuers in various sub-sectors and observing other calendar variations to obtain more accurate results. This finding is expected to provide information and recommendation for practitioners such as companies, shareholders, or people who are interested in investing in stocks, as well as academics who are interested in studying stocks and stock exchange activities.

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