The Day of The Week Effect and Volatility: Evidence from Indonesia

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Abstract

This study examines the pattern of stock returns in relation to trading days by using Modified-GARCH which was previously initiated by Berument and Kiymaz (2001). By observing the movement of the return from 1990 to 2019, we found that the existence of the day-of-the-week effect both on return and volatility equation. The highest return occurred on Wednesdays, while the lowest return occurred on Mondays. Meanwhile, the highest volatility occurred on Mondays and the lowest on Fridays.

JEL classification: G10, G12, C22.

Keywords: Day-of-the-week effect, Market anomaly.

Introduction

The early work of day of the week effect dated back on Cross (1973) and French (1980)'s papers. They prove that the return pattern of S&P 500 Index on Monday is negative and Friday is positive. This finding is crucial in determining buy-sell strategy and market timing on that period.

For the past decades, the day of the week effect topic is hectic

Several studies have investigated the day of the week effect in Indonesia Stock Market (IDX) which have a mixed result. Cahyaningdyah (2005) report that there are negative return on Monday and positive on Friday. The Monday negative return inline with Sumiyana (2008)'s finding by using intra-day data on the the several most liquid stocks . In contrast, Tandelilin and Algifari (1999) report that not only Friday, but also Tuesday and Wednesday have positive abnormal returns.

The previous studies of the day-of-the-week effect are still focus on investigating the mean return using Ordinary Least Square (OLS) method. However, many new evidence show that the characteristics of return (financial asset data) which are time-varying and conditional volatility (Campbell, 1999; Brooks, 2012). It means that the standard deviation estimate may too low or too high, which lead to misleading statistical evidence of a linear relationship between independent non-stationary variables. This shortfall does not satisfy the classic Gauss-Markov assumption in OLS regression. To address this shortfall, Berument and Kiymaz (2001); Berument and Dogan (2012) propose a modified-GARCH model to account for time varying volatility. They found that the mean return and volatility relationship is no different in most of US Equity market, and Turkish Stock Exchange after taking into account the day-of-the-week difference.

In this paper we revisit the day-of-the-week effect in Indonesia Stock Market (IDX) by taking into account the mean and volatility by apply Berument and Dogan (2012)'s model. We offer a more appropriate method compared to other research that use the same sample. Previous studies in Indonesia still not apply GARCH and has a relatively short estimation period.

This project provided an important opportunity to advance the understanding of. The major objective of this study was to investigate. The practical contribution of this paper will be still informative and useful for investors in making buy-sell decision.

The outline of the paper as follows: Section (2) discuss the summary of literature review on day of the week effect and its model development. Section (3) shows the data and methodology that is employed. Section (4) presents empirical result and its discussions. Section (5) shows conclusion and suggestion for further research.

Prior Work on The Day of The Week Effect

Asset return pattern has profound implication for trading strategies and investor behaviour. Many evidence show that in the US market Monday's return is negative or lower than the other days, and Friday's return is positive (Cross, 1973; French, 1980; Lakonishok and Smidt, 1988; Stambaugh and Keim, 1984). The implication of this findings can put into investors' trading strategies by buying on Monday and sell on Friday (buy low, sell high).

Numerous studies have been attempted to explain asset return pattern in trading days. The earliest work is from Cross (1973) who show that the S&P500 composite is perform better on Friday than Monday. French (1980) also found that on average there is a negative return on Monday on the same sample. Generally, the argue that the negative return on Monday occurs because of the anticipation the arrival of unfavourable information during the weekend, by discounting the price on Monday.

Lakonisho and Maberly (1990) investigatethe daily trading pattern of Individual and Institutional investors in New York Stock Exchange during 1962-1986. They found that the propensity of individual investor to buy on Monday is lower than the propensity to sell. n Monday. Furthermore, the desire of investors to conduct a transaction Monday is higher than other days so that transaction volume on Monday is higher than other days. They also argue that the investors have tendencies selling at a higher-level price than buying price, which make the equilibrium price shift toward a lower level.

The argument of Monday effect is supported by Gibbson and Hess (1981) which report that the negative return on Monday is caused by a measurement error. They examined S&P 500, CRSP

Value Index, NYSE capitalization-weighted index and AMEX (America Stock Exchange) from 1962 to 1978. The Monday negative return was calculated based on close-to-close price on Friday. Jaffe dan Westerfield (1985a dan 1985b) confirm this anomaly which was also occurred in Canada, the U.K., Japan, and Australia's stock market. Their finding shows that on average the negative returns is on Monday in Canada, The U.K., and the U.S. while in Japan and Australia are happened on Tuesday.

An investigation of the day of the week effect in emerging countries by Aggarwal and Rivoli (1989) report the presence of Monday effect. Their study showed that a negative return on Monday in Hong Kong, Singapore, Malaysia, and Philippines. What is interesting in their finding is that they also find Tuesday effect. It is suspected that the negative return on Tuesday reflects relationship between the emerging markets and New York market situation on Monday which is 13 hours difference.

Preliminary work on the day-of-the-week-effect on Indonesia was undertaken by Tandelilin and Algifari (1999). They examined 40 of the most active traded stocks based on trading volume from January to December 1996. They claim that there are negative returns on Tuesday, Wednesday, and Friday but not on Monday. They also point out that on Monday and Thursday, there is a tendency of Investors to hold their transaction for reformulating their trading strategies for the next day. This argument is supported by their findings on trading volume on Monday and Tuesday which are relatively lower than any other days.

In contras to Tandelilin and Algifari (1999), Cahyaningdyah (2005) argues that the lowest return is on Monday and the highest one is on Friday. She points out that it is still unclear why there are significant return both on Monday and Friday. Similarly, the negative Monday return in Indonesia is supported by Sumiyana (2007, 2008) who report that the negative return on Monday happened partially and incidental. Based on his intraday analysis of LQ45 Index member, he claims that the negative return is only happened on specific time on trading sessions.

The day-of-the-week effect is not only on mean of return but also on volatility of return. While previous studies have based their analysis on Ordinary Least Square (OLS) estimation, Berument

and Kiymaz (2001); Berument and Dogan (2012) introduced a new approach by using modified GARCH (Generalized Autoregressive Conditional Heteroscedasticity) estimation. Their finding points out that the volatility of return is much higher on Monday in German and Japan while on Wednesday in The U.K. The lowest volatility is on Monday in Canada, German, The U.K., and United States.

Until recently, there has been no published research that introduce GARCH method to investigate the-day-of-the-week effect in Indonesia, even though the nature characteristic of stock return's data has a tendency of time-varying and conditional heteroscedasticity. Moreover, the data characteristic of financial asset return also has a tendency of cluster volatility or pooling volatility. Cluster volatility means that a big change of an asset's price is followed by a big change and a little change of an asset's price is also followed by a little change (Brooks, 2014).

A major problem with the OLS is that if the variance is inconstant, then the standard errors are invalid because of the violation of heteroscedasticity. When this assumption does not hold, then the estimated statistical inferences are also invalid for hypothesis testing. To address this violation, our research offers another approach to adopt the modified GARCH model to re-examine the presence of the day of the week effect in Indonesia Stock Exchange.

Data and Methodology

The daily index price of Indonesia Composite Index is gathered from Thomson Reuters. The observation start from 1 January 2000 to 31 December 2019. The Indonesia Composite Index (IDX) was issued by Indonesia Stock Exchange in 1983. The index is value-weighted and contained all listed company (equity) in Indonesia. The return used is calculated as (close-to-close):

$$R_t = ln\left(\frac{P_t}{P_{t-1}}\right) * 100 \tag{1}$$

where P_t and R_t are index price and index return at time t, respectively. The index return is our independent variable.

In the 20 years of observation, we arrange each day to determine between trading days and non-trading days. If there is one or more holiday in five trading days (a week), we drop the observation from the sample. Each observation can only contain one day trading information. An exception for Monday return which contain information from close-price on Friday until close-price on Monday (three calender days). Each return which contain zero value also exclude from observation which is happened if the close-price of time t is equal to close-price of time t-1 (one period before).

The dependent variables are dummy variables which represent each trading day from Monday to Friday. There are four dummy variables from five trading days. Dummy variable Monday (M_t) is coded 1 if the return is Monday and 0 (zero) otherwise. Then, the same rule is also applied to Tuesday (T_t), Thursday (H_t), and Friday (F_t). The base category is Wednesday.

GARCH Models

Our model was inspired by French (1980)'s work by starting from a static OLS (Ordinary Least Square) regression model:

$$R_t = \beta_0 + \beta_M M_t + \beta_T T_t + \beta_H H_t + \beta_F F_t + \sum_{n}^{i=1} \beta_i R_{t-i} + \varepsilon_t \tag{2}$$

assumed that all of the Gauss-Markov assumption hold, so the parameters are BLUE (Best Linear Unbiased Estimator). It implies that $var(\varepsilon_t | M_t, T_t, H_t, F_t)$ is constant. Even when this unconditional variance is constant, we may have time-variation in the conditional variance of ε_t:

$$E(\varepsilon_t^2 | \varepsilon_{t-1}, \varepsilon_{t-2}, ...) = E(\varepsilon_t^2 | \varepsilon_{t-1}) = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 \tag{3}$$

Based on equation (3), the conditional variance of ε_t is a linear function of the square value of its lag $(t-1)$. If the ε_t is not serially correlated, then we can rewrite equation (3) as follow:

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 \tag{4}$$

where $\varepsilon_t = \sqrt{h_t} v_t, v_t \sim (0,1)$. Equation (4) demonstrates the ARCH(1) model, where the lag value of ε^2 is taken into account. We can include a higher-order of ARCH by adding additional lag of ε^2. α_0 and α_1 must be positive to guarantee positive variance.

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \gamma_1 h_{t-1} \tag{5}$$

is called as GARCH (1,1) model. The model (5) includes a single lag of both ARCH term (ε_{t-1}^2) and the conditional variance (GARCH) term (h_{t-1}). It also require $\gamma_1 > 0$ to ensure positive variance. If p is number of ARCH term and q is number of GARCH term, then:

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \gamma_j h_{t-j}^2 \tag{6}$$

where $\alpha_0 > 0$, $\alpha_i > 0$, $\gamma_j > 0$, and ε_t is independent and identically distributed with $E[\varepsilon_0] = 0$ and $E(\varepsilon_0^2 = 1)$.

Moving from equation (6), we adopt a GARCH modified model which was proposed by Berument and Kiymaz (2001). In this modified-model, we include day-of-the-week dummy variables and modify standard GARCH model (Eq. 6). The base category is Wednesday. We then specify the volatility model as:

$$h_t = \alpha_0 + \alpha_M M_t + \alpha_t T_t + \alpha_H H_t + \alpha_F F_t + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \gamma_j h_{t-j} \tag{7}$$

The GARCH-modified model is inherently non-linear. We jointly estimate the mean equation (2) and the volatility equation (7) by using maximum likelihood method.

Result and Discussion

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Table 1. Indonesia Composite Index Return Descriptive Statistics

Period	All Days	Monday	Tuesday	Wednesday	Thursday	Friday
2000-2019						
Mean	0.0458	-0.1603	0.0476	0.1564	0.0532	0.1280
Standard Deviation	1.3134	1.5183	1.2229	1.3175	1.2818	1.1801
N	4759	939	961	978	952	929
2000-2004						
Mean	0.0455	-0.2597	0.0331	0.1328	0.0611	0.2442
Standard Deviation	1.3881	1.6838	1.2391	1.3761	1.3347	1.2366
N	1161	220	232	245	238	226
2005-2009						
Mean	0.0657	-0.1373	0.0556	0.0798	0.1199	0.2134
Standard Deviation	1.6771	1.9855	1.5675	1.7116	1.5892	1.4788
N	1192	234	245	248	238	227
2010-2014						
Mean	0.0580	-0.1384	0.0782	0.3269	-0.0168	0.0384
Standard Deviation	1.1882	1.2691	1.1401	1.152	1.2156	1.1141
N	1224	250	243	249	242	240
2015-2019						
Mean	0.0133	-0.1134	0.0225	0.0816	0.0497	0.0258
Standard Deviation	0.8698	0.9671	0.8329	0.8533	0.8871	0.7946
N	1182	235	241	236	234	236

We calculate the Indonesia Composite Index return using geometric return formula, where $return_t = log(price_t/price_{t-1}) * 100$.The mean is stated as % return. The data is collected from Thomson Reuters. Each observation contain one day close-to-close return, except for Monday which contain information from Friday's close to Monday's Close. The observation is ranging from 4th January 2000 to 30th December 2019.

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