

Calendar effects: Empirical evidence from the Vietnam stock markets



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ABSTRACT

The Efficient Market Hypothesis (EMH) deals with informational efficiency and strongly based on the idea that the stock market prices or returns are unpredictable and do not follow any regular pattern, so it is impossible to "beat the market." According to the EMH theory, security prices immediately and fully reflect all available relevant information. EMH also establishes a foundation of modern investment theory that essentially advocates the futility of information in the generation of abnormal returns in capital markets over a period. However, the existence of anomalies challenges the notion of efficiency in stock markets. Calendar effects break the weak form of efficiency, highlighting the role of past patterns and seasonality in estimating future prices. The present research aims to study the efficiency in Vietnam stock markets. Using daily and monthly returns of VnIndex data from its inception in March 2002 to December 2018, we employ dummy variable multiple linear regression techniques to assess the existence of calendar effects in Vietnam stock markets. To correct for volatility clustering and ARCH effect present in the daily returns, the results are modeled using the EGARCH estimation methodology. The study reveals the existence of calendar effects in Vietnam in the form of a significant Friday Effect as well as a significant "January effect," thereby suggesting that the Vietnam stock markets do not show informational efficiency even in the weak form, a trait observable in emerging markets.

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1. Introduction

Market efficiency is put into words that since all relevant information is reflected in the stock prices, it is impossible to outperform the market consistently. It subscribes to the view that the price changes are unpredictable and dependent on information, which arrives randomly. [Bachelier \(1900\)](#) first introduced the idea of random and unpredictable price changes, which [Fama \(1965\)](#) later evolved into the concept of market efficiency. The market efficiency hypothesis has emerged in recent decades due to works of [Malkiel \(1973\)](#), [Beja \(1977\)](#), [Grossman and Stiglitz \(1980\)](#), [Lehmann \(1990\)](#), and due to its theoretical underpinnings, is still of immense interest in research. In the words of [Malkiel and Fama \(1970\)](#), "A market in which prices

always fully reflect available information is called efficient." He further stated the sufficient conditions for market efficiency as (i) No transaction costs in trading securities; (ii) Costless and accessible information to all market participants; (iii) Complete consensus between the market participants on the implications of available information on the stock prices and the future distribution of stock prices.

In an informationally efficient market fulfilling the sufficient conditions, prices fully reflect all the available information. However, in the actual observed world, it is difficult to find a market exhibiting all the above-mentioned conditions simultaneously. However, [Malkiel and Fama \(1970\)](#) maintained that while these conditions are sufficient, they are not necessary. The violation of one or more of these conditions does not necessarily lead to market inefficiency. The effect of the distortions created when these sufficient conditions are violated is of substantial interest to researchers of market efficiency. As elaborated by [Roberts \(1967\)](#) and further, [Malkiel and Fama \(1970\)](#), market efficiency is categorized into three forms based on the type and absorption of the information reflected in the stock prices. These can be classified into weak, semi-

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strong, and strong forms of market efficiency. Weak form of efficiency implies all past information in the markets is completely reflected in the stock prices, and analysis of past information is irrelevant in the prediction of future price movements. A semi-strong form of market efficiency states that stock prices reflect all information available publicly. It enlarges the scope of prices to include both past information and currently prevalent information, i.e., it relates to the idea that the stock prices instantaneously adjust to the news arriving in the market in addition to the past information. A strong form of market efficiency is the broadest form comprising of both the weak and semi-strong forms. It implies that all information, whether public or private information, is reflected in the stock prices.

At some point in time, markets can exhibit some degree of inefficiency. Such inefficiencies are majorly caused by anomalies, which induce a predictable pattern of price and volume movements in the market. Such anomalies affecting market inefficiency have been classified in research as fundamental, technical, and calendar anomalies. Fundamental anomalies pertain to the semi-strong form of market efficiency. The objective of fundamental analysis is to search and evaluate stocks that systematically outperform other category stocks in the market. Basically, fundamental anomalies relate to anomalies in the valuation of stock prices. One example of the fundamental anomalies can be seen in valuations based on the book-to-market ratio. [Banz \(1981\)](#) indicated that within a certain period, companies with low ratios outperform the companies with high book to market ratios. This pertains to the fact that the stock prices of well-known companies are overestimated, whereas stock prices of lesser-known companies are underestimated. On the other hand, technical and calendar anomalies relate to the weak form of market efficiency. Technical anomalies create predictability in movements of the stock price, which can be exploited through technical analysis of historical information of price and volume to earn abnormal returns on stocks. These anomalies make it possible to predict future price changes by analyzing past information. A common example is a technical analysis technique using a moving average or momentum strategy with the latter suggesting application of a contrarian strategy to earn above-normal returns. When such an anomaly exists in the market, technical analysis helps in the generation of a trading rule to outperform the market. Calendar anomalies arise due to seasonality in the stock, i.e., the stock price is systematically lower or higher in a calendar period. These anomalies can be seen as the distribution of stock returns being unequal for certain periods of time. For example, the Weekend effect is a calendar anomaly such that the returns on an index are systematically higher on Friday and lower on Monday. Many studies on the day of the week effect in the developed stock market before the 1990s, after that, [Doyle and Chen \(2009\)](#) found that this effect has disappeared in the developed stock markets. They pointed out the existence of the effect

in the US, Japan, UK, France, Germany, Canada, Italy, Netherlands, and Australia in the period 1980-1990 but, on the contrary, did not exist in the period of 1993-2007 except for the Japanese stock market. It can be realized that long-term perfection in the effectiveness of the market has erased the effect of the day of the week. Calendar effects also imply that at a particular day, month, or period of the year, stock returns behave contrary to the market efficiency hypothesis. This anomaly is reflected in the varying distribution of stock returns within the period of study, with such variation presenting a systematic pattern. Hence, the existence of calendar effects can entail the emergence of predictable patterns in returns exploitable by investors to earn above-normal returns. Some calendar effects can be described as:

1. Day-of-the-week effect: The day-of-the-week effect relates to the significant inequality in the mean of returns for different days of the week.
2. Month-of-the-year effect: This calendar effect relates to the significant inequalities in the mean of returns for different months of the year, i.e., a particular month generates a significantly different (higher or lower) return than the other remaining months in the year.
3. Weekend effect: The observation that means returns on Monday are the smallest and sometimes even negative, while mean returns on Friday are positive and highest compared to returns on other days of the week is known as the weekend effect.
4. Turn-of-the-month and intra-month effects: A turn-of-the-month effect is found where the stock prices rise on the last trading day in the month and the first few trading days of the following month. The intra-month effect is seen in patterns of returns where there is a significantly unequal distribution of returns within a month, i.e., high positive returns in the first half of the month as compared to the succeeding second half.
5. Turn-of-the-year effect/January effect: The turn-of-the-year effect pertains to the seasonal pattern in the stock markets associated with increasing trading volumes and comparatively higher stock prices in the last week of December and the first two weeks of January.
6. Super Bowl effect: The Super Bowl effect is an indicator wherein investors can predict the stock market's year-end closing price based on which conference wins the Super Bowl. The theory claims that if the NFC team wins, the stock market will finish the year higher, and if the AFC team wins, the market will finish lower.
7. Halloween effect: It is an effect based on the observation that stock returns tend to perform much better over the winter half of the year (November–April) than over the summer half of the year (May–October).

The Efficient Market Hypothesis has important implications for investors and firms alike. In an

efficient market, information is instantly reflected in the stock prices, so obtaining released and available information will not help an investor to outperform the market. Furthermore, since reflected information makes the price of the stock to be fair and representative, firms cannot profit from deluding investors in the market. However, anomalies are related to a kind of distortion that contradicts the efficient market hypothesis. Specifically, the presence of calendar anomalies in stock returns violates the weak form of market efficiency as equity prices do not remain random, and their future values can be predicted on observed past patterns. Market participants such as day traders can devise trading strategies that could fetch abnormal profits based on the deduced past pattern. For example, if the past stock returns show evidence of “weekend effect,” investors could execute a trading strategy of selling securities on Fridays and buying on Mondays to make excess profits. Thereby, the presence of market anomalies, such as calendar effects, provides results deviating from the EMH and creates an opportunity to earn abnormal returns through the existing information.

In addition, Viet Nam’s securities market has continued its positive growth over the course of 20 years of development. In September 2018, FTSE Russell added Viet Nam to its watch list for possible reclassification as a “Secondary Emerging market” instead of a “Frontier market.” In this study, our aim is to explore the anomalies such as days of the week effect and month of the year effect in the Vietnam stock market, and the Vietnam stock market is ineffective weak form.

2. Review of literature

Many scholars reveal a distinctive regionality in the level of efficiency in the stock markets around the world. In practice, the efficiency of markets varies through different markets and countries. Studies on American, European, and Asian markets reveal the differences in the calendar effects observed in these markets. Calendar effects themselves were first reported as a form of seasonality by [Wachtel \(1942\)](#) for the first time. [Rozeff and Kinney \(1976\)](#) found the January effect in New York Exchange stocks for the period 1904 to 1974 as the mean return for the month of January was higher than the mean returns of other months. A similar conclusion was drawn by [Reinganum \(1983\)](#), who opined that the entire seasonality in stock returns could not be explained by the tax-loss-selling hypothesis alone. [Gultekin and Gultekin \(1983\)](#) studied the stock markets of sixteen industrial countries and provided evidence to support calendar effects in the stock market in the form of January returns, which was found to be exceptionally large in fifteen of sixteen countries under study. Similarly, [Brown et al. \(1983\)](#) studied the monthly returns of the Australian stock market and found the prevalence in December-January and July effects. They attribute this to the financial year in Australia

being from June to July. [Mills et al. \(2000\)](#) reported similar calendar effects in FTSE 100, Mid 250, and 350 indices for the period 1986 and 1992. A January effect was reported by [Choudhry \(2001\)](#) in the UK and US returns, but similar evidence could not be found in the case of German returns. However, [Borges \(2009\)](#) critiqued the earlier methodologies of analyzing and modeling stock returns and proposed a new methodology of single variable dummy regression analysis to examine a day of the week and month of the year effects in seventeen European stock market indices in the period 1994-2007. They use GARCH and bootstrapping techniques in addition to standard OLS procedures to find significant calendar effects in the form of August and September effects in country-specific returns. However, recent studies by [Yavrumyan \(2015\)](#) suggested that there are no calendar anomalies in returns of the Oslo stock indices in the post-global financial crisis period, thereby providing support towards market efficiency. [Zhang et al. \(2017\)](#) studied the effect of the presence of the day of the week in 28 markets from 25 countries using the rolling sample test and the GARCH (1, 1) model and find the day of the week effect differs according to country.

In the Vietnam context, early studies could not provide any substantial proof of calendar effects or informational inefficiency. It was [Nghiem et al. \(2012\)](#) who first presented strong evidence of the existence of day of the week effect by studying that the VnIndex daily returns to conclude that Tuesday had the lowest mean returns. Further, using the VnIndex and HnIndex daily returns data from 2000 to 2013, [Tram et al. \(2014\)](#) confirmed the existence of anomalies in stock markets in Vietnam during the financial crisis and attributed it to the “tax-loss selling” hypothesis. Using a non-parametric Kruskal-Wallis Test ([Kruskal and Wallis, 1952](#)), [Friday and Hoang \(2011\)](#) tested daily returns of VnIndex for the period July 2000 to December 2010 for the presence of seasonality and found that the January and April set for the indices had the highest positive deviation, thereby indicating the opportunity to make abnormal returns through a strategy of selling on January as famous quote “Go away in May come back Halloween Day.”

The literature review reveals certain aspects of the existing body of research on the existence of calendar effects in Vietnam. First, the existing body of literature has used either a limited time window for the selection of their data picked randomly between selective dates without prior justification. Second, most research suffers from model misspecification in terms of the effects of volatility clustering. As such, it is pertinent to update the existing body of research while employing the necessary time series analysis techniques to get the most representative results.

3. Research methodology

The Vietnam Stock Index or VN-Index is a capitalization-weighted index of all the companies

listed on the Ho Chi Minh City Stock Exchange. The index was created with a base index value of 100 as of July 28, 2000. The study focuses on the broad daily and monthly return patterns in the Vietnam stock markets. To derive significant results, the VnIndex has been taken as the benchmark index representing the Vietnam stock markets. The VnIndex is a diversified stock index covering prestigious companies accounting for more than 25 sectors of the economy and is managed by the State Security Commission of Vietnam (SSC). It follows a free-float market capitalization-weighted method, where the level of the index shows the total market value of all the stocks in the index relative to a particular base period, in this case, the base value of 100 as of July 28, 2000. For studying the day-of-the-week effect, the daily data of the closing index values ranging from March 1st, 2000 to December 31, 2018. However, data was collected since March 4th, 2002, due to the last period, just three transactions per week, and not fit with time-series data. For the study, the returns are computed as:

$$R_t = \ln(P_t/P_{t-1})$$

where, R_t is the log return of the stock market index, and P_t is the stock index at date t .

The log-returns are continuous rates of returns, computed as the log of the ratio of the current time period's price (daily or monthly) to the previous period. The log-returns are preferred over linear returns primarily due to ease of calculation since they are given by the first-order difference of the logarithmic prices.

Since the study employs time series data analysis technique, the regression results may be spurious if the data series is non-stationary. The stationarity of the data can be checked using the Unit-root test. The existence of a unit root indicates that the data is non-stationary. Further, as documented by [Connolly \(1989\)](#), several specific problems arise when using the approach, the standard OLS estimation procedures in time series analysis that do not account for the time-dependent changes in volatility in financial market returns. These include (i) autocorrelation of the stock market index returns (ii) non-normality of the residuals (iii), and the variance of the residuals may not be constant. As such, it is important to check for heteroskedasticity in the residuals to account for time-varying volatility normally seen in the stock return series. Accordingly, the ARCH LM test is employed, and the results are interpreted at a 5% level of significance with the null hypothesis that no ARCH effect exists in the log return series.

The study of seasonality with respect to daily and monthly patterns in the stock returns of VnIndex employs a Dummy Variable Regression model. The technique quantifies qualitative aspects, such as months, as explanatory variables in the regression model. A dummy variable (are also called a categorical, indicator, or binary variable) is a variable that takes only two values of 1 or 0. While 1

indicates the presence of an attribute, 0 indicates the absence of the attribute. In general, for categorical variables with q categories, $(q-1)$ dummies are needed, with one category being omitted. The estimated intercept for the equation will represent the intercept for the omitted category, and the coefficients will represent the intercepts for other categories.

To examine the days of the week effect, the following dummy variable regression model is specified as follows:

$$R_t = \beta_0 + \beta_1 \text{Tuesday} + \beta_2 \text{Wednesday} + \beta_3 \text{Thursday} + \beta_4 \text{Friday} + \mu \tag{1}$$

For studying the month-of-the-year effect in the series, the model is specified as:

$$R_t = \beta_0 + \beta_1 \text{Feb} + \beta_2 \text{Mar} + \beta_3 \text{Apr} + \beta_4 \text{May} + \beta_5 \text{Jun} + \beta_6 \text{July} + \beta_7 \text{Aug} + \beta_8 \text{Sept} + \beta_9 \text{Oct} + \beta_{10} \text{Nov} + \beta_{11} \text{Dec} + \mu \tag{2}$$

4. Hypothesis

For testing the days of the week effect, our hypothesis is that returns across all days are equal, i.e.,

$$H_0: \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4$$

H_1 : At least one β is different

Similarly, for testing the month of the year effect, the hypothesis is framed as:

$$H_0: \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11}$$

H_1 : At least one β is different

If the dummy variable for any particular day/month is significant, we know that a particular day/month to have a significant return effect. If no seasonal pattern exists, the hypothesis that the coefficients are all zero should not be rejected. However, in the presence of ARCH effect, the dummies found significant in the results obtained from the standard OLS estimation are used as explanatory variables for the ARCH family models. These "significant dummies" from the OLS regression will be truly anomalous only if they remain significant in the mean equation of the ARCH family regression models. Else, it can be concluded that the excess return is due to varying market volatility.

5. Results and discussion

Before analyzing descriptive statistics for the log returns on the VnIndex, it is relevant to observe time series plots for the closing index values, and log returns series.

[Fig. 1](#) presents a series on the closing values of the VnIndex. It is visible that at certain points in time, prices on the index move slowly, whereas, at other time points, the movement is faster. This is because of the news and information announced

within that period with positive news conducting prices to grow and negative information, causing them to decline. From this graph, the price growth before the global financial crisis in 2008 and the drop in the closing prices during the crisis (2008-2009) is eminently visible.



Fig. 1: VnIndex closing values

Fig. 2 and Fig. 3 presents time series for logarithmic returns on the VnIndex that emphasize a period of high volatility during 2008 in both daily and monthly series, attributable to the global financial crises during the said period. From these graphs, it seems that the disturbances follow a mean-reverting process and are heteroskedastic with non-constant variance. Further, periods of high and low volatility, when returns are dispersed respectively, could indicate the presence of volatility clustering in series. As such, these are tested through formal statistical procedures.

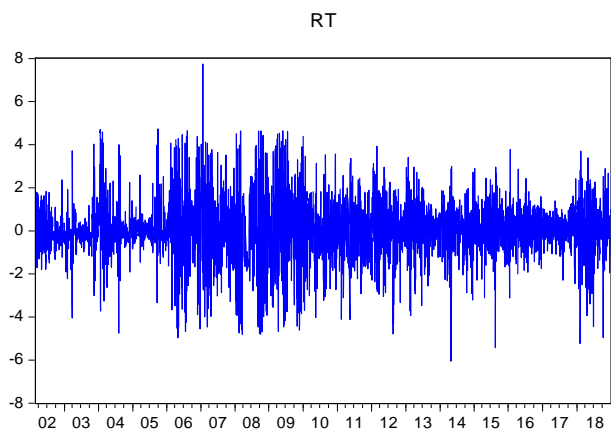


Fig. 2: VnIndex daily returns for period 2002-2018

As seen, the index shows a positive mean return over the study period. The skewness and kurtosis of the empirical distribution for the VnIndex deviate from the theoretical normal distribution parameters where skewness equals 0 and kurtosis equals to 3. Skewness indicates the asymmetry of the return's distribution around its mean. Kurtosis is a measure of the peakedness of the distribution. Here, the negative skewness indicates that the distribution is skewed to the left, i.e., it is more overspread towards negative values. In terms of data pertaining to financial returns, it highlights the significant probability of small gains and a small probability of

large losses in terms of obtaining large negative returns. A kurtosis greater than 3 shows positive excess kurtosis signifying that the distribution is peaked and is fat-tailed relative to the normal distribution, i.e., leptokurtic in nature. The non-normality of the data is confirmed in the results of the Jarque-Bera normality test, which are significant at 5% level and allows us to reject the null hypothesis of normality of returns.

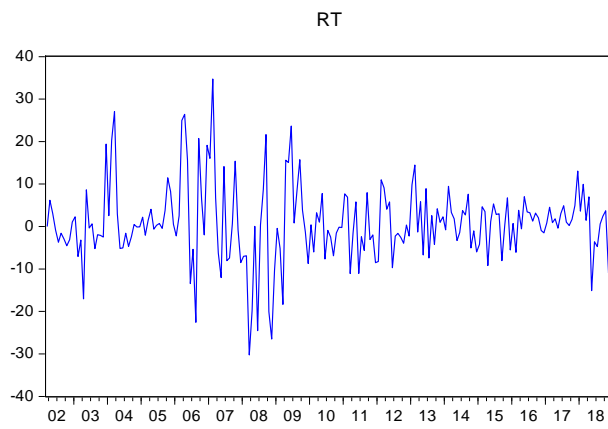


Fig. 3: Monthly returns of VnIndex for 2002-2018

Next, the descriptive statistics of returns of VnIndex are computed, as shown in Fig. 4.

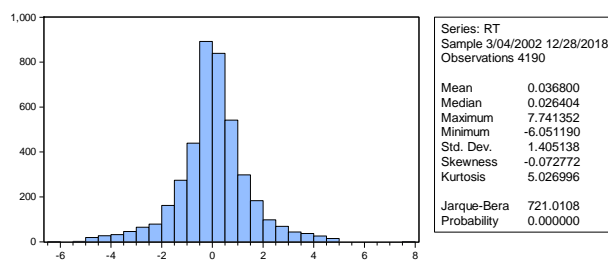


Fig. 4: Descriptive Statistics of the VnIndex

To test for stationarity of the underlying data, the Augmented Dickey-Fuller Test and PhillipPerron Test are employed with the null hypothesis that the underlying data is not stationary, i.e., there is an existence of unit root. The results of the ADF and PP test at the level are examined in Table 1.

The t-statistics and the respective p-values of both the test in Table 1; allow the rejection of the null hypothesis, indicating the stationarity in the returns.

Now, the model 1 is estimated to study days of the week effect in VnIndex return. The results are reported in Table 2. The benchmark day is Monday shown by the intercept, which provided a return of -0.03 on an average during the sample period.

An examination of the p-values of the respective days highlights that for the stock returns, it shows that the p-value is significant for Friday, i.e., Friday effect exists in the stock returns. However, R² is 0.005, which is very low, and the F-statistic indicates that the overall fit of the model is poor. The return series exhibits autoregressive conditional heteroskedasticity (ARCH) effects and is autocorrelated at level 1, as evidenced by Table 3 and Table 4.

The statistical significance of the p-values for the ARCH LM test indicates the presence of Autoregressive Conditional Heteroskedasticity in the residuals. This confirms the clustering effects in

returns, i.e., large shocks to the error process are succeeded by large ones, and small shocks are followed by small ones of either sign.

Table 1: Results of the unit root test

| Test | Intercept t-Statistic (p-Value) | Trend and Intercept t-Statistic (p-Value) | None t-Statistic (p-Value) |
|--|------------------------------------|--|----------------------------------|
| Augmented Dickey-Fuller test statistic | -27.86627 (0.0000) | -27.86522 (0.0000) | -27.83457 (0.0000) |
| Test critical values: | 1% level 5% level 10% level | -3.43172 -2.86203 -2.56707 | -2.56551 -1.94090 -1.61664 |
| Phillips-Perron test statistic | -53.01421 (0.0001) | -53.00803 (0.0001) | -53.04074 (0.0001) |
| Test critical values: | 1% level 5% level 10% level | -3.43172 -2.86203 -2.56707 | -2.56551 -1.94090 -1.61664 |

Table 2: Results of OLS estimation procedures for VnIndex daily returns

| Variable | Coefficients | Standard Error | t Stat | P-value |
|-------------------|--------------|----------------|-----------|---------|
| Monday | -0.034445 | 0.048977 | -0.703289 | 0.4819 |
| Tuesday | -0.094647 | 0.048419 | -1.954743 | 0.0507 |
| Wednesday | 0.070999 | 0.048275 | 1.470715 | 0.1414 |
| Thursday | 0.051509 | 0.048218 | 1.068243 | 0.2855 |
| Friday | 0.188280 | 0.048361 | 3.893194 | 0.0001 |
| R-squared | | 0.004731 | | |
| F-statistic | | 5.487687 | | |
| Prob(F-statistic) | | 0.0002 | | |

Table 3: Results of the ARCH LM test

| | | | |
|---------------|----------|---------------------|--------|
| F-statistic | 820.5493 | Prob. F(1,4187) | 0.0000 |
| Obs*R-squared | 686.4198 | Prob. Chi-Square(1) | 0.0000 |

Table 4: Breusch-Godfrey serial correlation LM test

| | | | |
|---------------|----------|---------------------|--------|
| F-statistic | 117.2851 | Prob. F(2,4183) | 0.0000 |
| Obs*R-squared | 222.4864 | Prob. Chi-Square(2) | 0.0000 |

The presence of the ARCH effects implies that ARCH-type models accounting for such heteroskedasticity component in the series are the most appropriate for modeling returns on the VnIndex. Introduced by Engle (1982), the ARCH-LM test is the standard test to detect autoregressive conditional heteroscedasticity. The first ARCH model was extended to account for multiple types of volatility clustering over time beginning with the Generalized ARCH (GARCH) model by Bollerslev et al. (2000), Exponential GARCH (EGARCH) model by Nelson (1991), Asymmetric Power ARCH (APARCH), and model by Ding et al. (1993). The selection of the ARCH family model most relevant for the series can be made through the choice of the model with the AIC, BIC (Schwarz) information criteria. Based on the results provided by these criteria as per Table 5, the EGARCH model has been selected. The EGARCH model, as specified by Nelson (1991), accounts for the leverage effect and the asymmetric information property found in financial returns. An EGARCH (p, q) can be stated as having a mean equation of:

$$R_t = \mu + \varepsilon_t$$

such that $\varepsilon_t = \sigma_t z_t$,

where, z_t is standard Gaussian constant, and the conditional variance equation is given as:

$$\ln(\sigma_t^2) = \omega + \alpha(|z_{t-1}| - E[|z_{t-1}|]) + \gamma z_t - 1 + \beta \ln(\sigma_{t-1}^2)$$

where, ω is constant; $\ln(\sigma_{t-1}^2)$ is a lag of the conditional variance; α is magnitude effect; γ is asymmetric or leverage effect.

Further to correct the autocorrelation of the order one, an AR (1) term is added to the right side of the dummy regression model. The improved model selection and the detailed results are seen in Table 6. Table 6 shows the results of the mean returns and variance equation of the EGARCH model for the day-of-the-week effect. Here, we include the Monday dummy as an explanatory variable. As seen in Table 6, the EGARCH (1, 1) model clearly shows that the Monday dummy is still significant in the mean equation of the GARCH model. Thus, we know that the Friday effect cannot be explained by time-varying volatility and reflects truly anomalous returns.

To test for the seasonality in VnIndex stock return using monthly data, the Eq. 2 was estimated using standard OLS estimation procedure. The results for monthly returns for VnIndex are reported in Table 7. January has been taken as the benchmark month in the model represented by the intercept, which provided a positive return of 5.646 percent on an average over the study period. An examination of the corresponding p-values shows that some of the coefficients are significant such as January, May, July, which indicate the presence of January, May, July effect in VnIndex monthly returns.

As evidence, both the R² and F-statistic are quite low, which indicates that the overall fit of the model is poor. Also, unlike daily returns, monthly stock returns do not exhibit autoregressive conditional heteroskedasticity (ARCH) effects, as confirmed by results of ARCH-LM test shown in Table 8. Further, the monthly returns do not exhibit autocorrelation, as seen in Table 9.

Table 5: Selection of appropriate ARCH model for the data set

| | ARCH | GARCH | TARCH | EGARCH | APGARCH |
|-----------------------|----------|----------|----------|-----------|----------|
| Akaike info criterion | 3.071817 | 3.080061 | 3.078940 | 3.070347* | 3.075252 |
| Schwarz criterion | 3.086950 | 3.092167 | 3.092560 | 3.083966* | 3.090385 |

Table 6: Results of EGARCH model for day-of-the-week returns

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|-------------------|-------------|------------|-------------|--------|
| Monday | -0.034973 | 0.025075 | -1.394763 | 0.1631 |
| Tuesday | -0.032034 | 0.026017 | -1.231264 | 0.2182 |
| Wednesday | 0.029396 | 0.029060 | 1.011572 | 0.3117 |
| Thursday | 0.026088 | 0.026161 | 0.997214 | 0.3187 |
| Friday | 0.076160 | 0.025790 | 2.953103 | 0.0031 |
| AR(1) | 0.196568 | 0.015257 | 12.88364 | 0.0000 |
| Variance Equation | | | | |
| C(7) | -0.289189 | 0.012230 | -23.64585 | 0.0000 |
| C(8) | 0.387759 | 0.017261 | 22.46411 | 0.0000 |
| C(9) | -0.018092 | 0.009598 | -1.885027 | 0.0594 |
| C(10) | 0.954941 | 0.004154 | 229.9088 | 0.0000 |
| R-squared | | 0.054192 | | |

Table 7: Results of OLS estimation procedure for VnIndex monthly returns

| Variable | Coefficients | Standard Error | t Stat | P-value |
|--------------------|--------------|----------------|-----------|---------|
| January | 5.646214 | 2.221212 | 2.541953 | 0.0118* |
| February | -4.648216 | 3.141268 | -1.479726 | 0.1406 |
| March | -4.802904 | 3.094728 | -1.551963 | 0.1223 |
| April | -3.825673 | 3.094728 | -1.236191 | 0.2179 |
| May | -7.017319 | 3.094728 | -2.267508 | 0.0245* |
| June | -5.683282 | 3.094728 | -1.836440 | 0.0679 |
| July | -7.094988 | 3.094728 | -2.292605 | 0.0230* |
| August | -3.538918 | 3.094728 | -1.143531 | 0.2543 |
| September | -4.426718 | 3.094728 | -1.430406 | 0.1542 |
| October | -7.337274 | 3.094728 | -2.370895 | 0.0187 |
| November | -5.912734 | 3.094728 | -1.910583 | 0.0576 |
| December | -4.281567 | 3.094728 | -1.383504 | 0.1681 |
| R-squared | | 0.046637 | | |
| F-statistic | | 0.844962 | | |
| Prob (F-statistic) | | 0.595395 | | |

Table 8: Results of the ARCH-LM test

| | | | |
|---------------|----------|---------------------|--------|
| F-statistic | 0.011786 | Prob. F(1,199) | 0.9137 |
| Obs*R-squared | 0.011904 | Prob. Chi-Square(1) | 0.9131 |

Table 9: Breusch-Godfrey serial correlation LM test

| | | | |
|---------------|----------|---------------------|--------|
| F-statistic | 10.41042 | Prob. F(1,188) | 0.8391 |
| Obs*R-squared | 20.14075 | Prob. Chi-Square(2) | 0.8387 |

6. Conclusion

The Efficient Market Hypothesis is essentially a no-arbitrage condition, so to test the hypothesis, one needs to look for arbitrage opportunities. It seems fairly unlikely that the patterns in stock market return found would allow an investor to create arbitrage portfolios such as the day of the week effect that can exist in the mean equation for stock market returns but disappears when returns are adjusted with transaction costs. In practice, the efficiency of markets varies through different markets and different countries. While a strong form of market efficiency is practically not observed, it has been seen that markets around the world fail to exhibit even a weak form of efficiency due to the existence of anomalies. Various reasons have been given for these anomalies, such as high competition and free entry conditions. These reasons imply that while markets can be efficient to different extents, the presence of anomalies distort efficiency and create profitable ventures for participants.

Based on the empirical evidence presented here, the weak-form market efficiency hypothesis can be

rejected in Vietnam. The results were seen in the EGARCH, and OLS model estimates for daily and monthly returns clearly indicate the existence of calendar anomalies in the VnIndex return series in the context of Vietnam, the existence of anomalies could be attributable to a number of causes. While the study does not delve into finding these causes, the existence of exploitable patterns in the stock market returns helps active investment strategy to be an important exercise in generating excess returns. As such, investors can improve their returns by timing their investment in the Vietnam stock markets. The other limitation is the study only examines the effects of the day of the week, the month of the year with the market index such as VnIndex, but has not gone into depth to test this effect in detail in individual stocks that investors are interested in and need information. From the above limitations, for further studies, the study needs to be studied with more models to be able to draw accurate conclusions, need to find out the cause of the effect, and verify the effect with individual securities.

Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

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