

Case Study

Calendar Anomalies: A Case Study of the Vietnam's Stock Market

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Abstract

This study empirically investigated the existence of Calendar effects by using closing daily data for the Vietnam index (VN-index) before and during the Covid-19 pandemic. Daily returns of the VN-Index from 2 January 2018 to 12 August 2022 are used in this study to ascertain calendar anomalies in Ho Chi Minh Stock Exchange (HOSE). To test these effects, the entire study period is divided into two sub-periods: during and before the Covid-19 crisis. Then, the ordinary least square (OLS) method and the Generalized Autoregressive Conditional Heteroskedasticity [GARCH (1,1)] regression model were employed. The empirical results from the OLS model support the occurrence of calendar anomalies for the HOSE both before and during the Covid-19 pandemic while the results of GARCH (1,1) only confirmed the positively significant effect on Friday during the Covid-19 periods. Regarding stock returns, positive returns were found only on Friday, during the Covid-19 pandemic. It implies that Covid-19 has changed the nature of the stock market from efficient to inefficient. The study's findings suggest that the Covid-19 crisis significantly impacted the daily returns anomaly in Vietnam's HOSE.

Keywords: Calendar anomalies, Covid-19, GARCH, Ho Chi Minh Stock Exchange, The day-of-the-week effect, VN-Index.

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Introduction

Recent studies have provided empirical evidence on stock market responses to major systemic events. The impact of major events on the capital market is inevitable. Many studies focused on the effect of major events on the stock market, such as the severe acute respiratory syndrome (SARS) pandemic was considered by Chen et al. (2007) and Chen et al. (2018). The effect of the recent Covid-19 outbreak is also detected. In the initial phase, extensive studies proposed significant evidence of the negative impact of widespread Covid-19 on stock markets (Al-Awadhi et al.,2020; Liu et al.,2020; Ahmar & Val, 2020; & Zhang et al., 2020). In the Vietnam context, some studies have examined this issue and found that the Covid-19 pandemic has a negative effect on stock returns (Anh & Gan, 2020; Hung et al., 2021; Nguyen et al., 2021).

The presence of anomalies has been investigated extensively in the capital markets. Calendar effects (market anomalies) have been well studied in different financial markets, including the day-of-the-week effect, January effect, Monthly effect and Turn-of-the-month effect. The day-of-the-week effect seem to be more ubiquitous. Some anomalies appear once and then disappear, while other anomalies are frequently observed. The study by Paital & Panda (2018) indicated that the efficiency of the stock market is held when all private and public information reflects in the stock price itself. Gormsen & Koijen (2020) also showed that in the short run, it is usual to find the adverse reaction in stock markets to this outbreak, but they will correct themselves and go up again in the long run. The day-of-the-week effect patterns have been widely observed in many markets. Some studies indicated that there is the existence of the day-of-the-week effect (Cabello & Ortiz, 2003; Seif et al., 2017). Other studies did not find any proof of these calendar effects (Sharma, 2011; Kristjanpoller, 2012a). In Vietnam, there seems to be a limitation of studies in this research area. Only some focused on the day-of-the-week term (Loc, 2006; Le Hau, 2010; Luu et al., 2016; Truong & Friday, 2021).

The impact of the Covid-19 crisis is not examined yet in the above-mentioned studies when they focused on the day-of-the-week effect on stock returns or volatility. This limitation leads to the motivation of the present study.

This paper intends to investigate whether the presence of calendar anomalies, specified, the day-of-the-week effect, on stock returns for the HOSE before and during the Covid-19 crisis; then, it is possible to know the impact of Covid-19 outbreaks on stock returns. The case of the HOSE provides an excellent natural experiment for some reasons: first, the HOSE is the first and official largest stock exchange of Vietnam; second, it was almost operated ten years earlier than the Ha Noi Stock Exchange (HNX); in addition, there are 601, updated in 2022, listed stocks on HOSE in compared with 330 listed ones on the HNX; moreover, the Vietnam government has planned to finish transferring all of the HNX's stocks into the HOSE in 2025 (GOV, 2020). The research utilizes the two subsamples of the daily index to determine the calendar anomalies specified as the day-of-the-week effect. The findings contributed to the literature on frontier markets, the Vietnam stock market.



Literature Review

Attracted to market anomalies, following up on the studies carried out by French (1980) and Gibbons & Hess (1981), many studies have detected the existence of the dayof-the-week effect which shows abnormally higher returns on some days of the week than on other days. In other words, there is a difference in average stock returns throughout the different days of the week. It is often to see the negative effect on Monday and the positive effect on Friday on average returns.

By utilizing a GARCH in mean (GARCH-M) model to examine the day-of-the-week effect on the Greek stock market for the period from January 1985 to February 1994, Alexakis & Xanthakis (1995) found significant positive returns on Mondays for both the total period and first subperiod. Moreover, significant negative returns on Tuesdays were also indicated in this study. Zhang et al. (2017) employed GARCH (1,1) to consider the day-of-the-week patterns in 28 stock markets, including developed and emerging countries. The author concluded that the anomaly effects were confirmed in all markets examined. An Autoregressive Integrated Moving Average (ARIMAX) model was applied by Tadepalli & Jain (2018), who also evaluated the day-of-the-week anomaly in several indices of the Indian equity market and found a widespread existence of this anomaly on stock returns. Some extensive studies concentrated on this research area in the Mexican stock market. The studies of Cabello & Ortiz (2003) and Winkelried & Iberico (2018) had the same conclusion that average returns on Mondays were statistically the lowest of the week or significantly negative. The evidence of the anomaly effect of other days of the week was also determined in many studies. Zhang et al. (2017) found a significant positive impact on stock returns on Wednesdays in the MSE between 1994 and 2016. Seif et al. (2017) recognized the highest average returns on Fridays.

Contrastly, some studies confirmed the absence of the day-of-the-week effect on stock returns. The results of the study by Kristjanpoller (2012a) showed no proof of the day-of-the-week effect in the returns of the MSE from 1993 to 2007. Sharma (2011) and Plastun et al. (2019) had similar findings when their studies demonstrated that the day-of-the-week effects do not exist in the Indian stock market, which can be considered informationally efficient.

Mixed results were also found in this area of research. The study of Gbeda & Peprah (2018) is a typical example. By employing the OLS method, GARCH (1,1), threshold GARCH (TGARCH) and Exponential GARCH (EGARCH) model for GSE and NSE index, the study obtained the findings that there is no evidence of day-of-the-week effect in GSE, whereas this effect was found on Friday in NSE.

Regarding measuring the Covid-19 impact, Sahoo (2021) investigated the existence of the day-of-the-week effect by using closing daily data for some subindices (Nifty 50, Nifty 100...) before and during the Covid-19 health crisis. The output of GARCH (1,1) indicated a difference in the day-of-the-week effect between pre and post Covid-19 appearance. Negative returns were found on Mondays during the Covid-19 pandemic. Conversely, positive returns were represented on Mondays before the Covid-19 period. In addition, significant positive effects on index returns were reported for all indices during the Covid-19 outbreak.



In the Vietnam context, Loc (2006) used OLS regression and GARCH model to consider the VN-index from 2002 to 2004. The OLS model exhibited positive returns on Fridays, while the GARCH models confirmed a negative return on Tuesdays. Continuously, Le Hau (2010) also did a study on VN-index. The author found the day-of-the-week effect only for volatility. Recently, Truong & Friday (2021) examined the impact of the introduction of the VN30-Index futures contract on the stock returns anomaly for the HOSE. The methodology of OLS, GARCH (1,1), and EGARCH (1,1) were applied to ascertain the day-of-the-week anomaly on stock returns. The study found the presence of the day-of-the-week effect on stock returns; specifically, a negative effect was only observed for Monday in stock returns for the pre-index futures period.

In general, numerous studies evaluated the day-of-the-week effect on stock returns, however, the findings were still various. Especially in the Vietnam stock market, there are limited studies in the documented literature. Thus, the day-of-the-week effect is considered as a dummy variable in the present paper, and the two first hypotheses are proposed as follows:

Hypothesis 1. There are differences in the stock returns across the days of the week during the Covid-19 crisis.

Hypothesis 2. There are differences in the stock returns across the days of the week before the Covid-19 crisis.

Data and Methodology

Data Description

To test for the day-of-the-week and January effect, and the impact of the Covid-19 crisis on the daily returns anomaly in the HOSE, the data are obtained from January 2, 2018, to August 12, 2022, from the website of Vietstock company (<u>www.vietstock.vn</u>). According to Brooks (2019), one way to obtain a time series of daily continuously compounded returns, which are computed as follows:

$$ret_t = ln\left(\frac{pr_t}{pr_{t-1}}\right) = ln\left(pr_t\right) - ln\left(pr_{t-1}\right) \tag{1}$$

Where: ret_t stands for index return at time t,

In is the natural logarithm,

Prt-1 and prt are two consecutive daily closing market indexes.

Table 1 reports the basic statistics of daily stock return over the observed sample period. The mean of stock returns is positive and very small both before and during the Covid-19 crisis. The maximum stock returns during the Covid-19 health pandemic were a bit higher than before the Covid-19 crisis. While the minimum stock returns during the Covid-19 period were smaller than before the Covid-19 crisis. It means that investors got a big loser during the Covid-19 pandemic. The normality test was also employed to avoid misleading inferences and due to the error term assumed to follow non-central t



distribution. The skewness of stock returns both before and during the Covid-19 pandemic are all significant at the 1% level and not equal to zero. Likewise, the kurtosis terms are all significant for both before and during the Covid-19 crisis at the 1% level, and they are very different from the three. Additionally, the two Jarque-Bera test statistics, which are also significant at the 1% level, rejected the null hypothesis that stock returns are normally distributed.

Before Covid-19 Crisis				
Mean	9.31e-07	Std. Dev.	0.012735	
Median	0.000428	Skewness	-0.78267*	
Maximum	0.040365	Kurtorsis	5.7539*	
Minimum	-0.060083	Jarque-Bera	214.0679*	
Sample size	512	Probability	0.00000	
During Covid-19 Crisis				
Mean	0.00043	Std. Dev.	0.0142	
Median	0.0018	Skewness	-1.191*	
Maximum	0.0486	Kurtorsis	7.249*	
Minimum	-0.0691	Jarque-Bera	629.72*	
Sample size	637	Probability	0.00000	

Table 1. Basic Descriptive statistics

Notes:1. * (**) (***) *denote* 1% (5%) *and* (10%) *level of significance.*

Methodology

Tests for the day-of-the-week anomaly in the HOSE were first performed using an OLS regression. A dummy variable regression model is fitted to detect the day-of-the-week effect as follows:

$$ret_t = \alpha_0 + \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \varepsilon_t$$
(2)

Here, D_{1t} , D_{2t} , D_{3t} , D_{4t} are dummy variables for Monday, Tuesday, Wednesday and Thursday at time t, respectively (D_{1t} , D_{2t} , D_{3t} , D_{4t} are equal 1 if the t observations fall on Monday, Tuesday, Wednesday, and Thursday, respectively or 0 for the remainder).

The error term \mathcal{E}_t is assumed to be independent and identically distributed. The homoscedasticity assumption for a financial time series is often violated, therefore, the OLS model may contain auto-correlated error terms that give misleading inferences. Then, it is necessary to perform Durbin Watson and ARCH-LM tests to detect autocorrelation and heteroscedasticity, respectively. The ARCH model proposed by Engle (1982) allows a model where the variance of errors varies through time as a function of past errors. Later, Bollerslev (1986) developed GARCH from ARCH (Autoregressive Conditional Heteroscedasticity) to allow conditional variance to depend on prior lags. When the autocorrelation and heteroscedasticity from the simple regression model are detected, the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model should be fitted to resolve these problems. Particularly, the GARCH model takes the form as follows:



$$ret_{t} = a_{0} + a_{1}D_{1t} + a_{2}D_{2t} + a_{3}D_{3t} + a_{4}D_{4t} + \sum_{i=1}^{n} b_{i}ret_{t-i} + \varepsilon_{t}$$
(3)

$$\varepsilon_t \sim T(0, \sigma_t^2) \tag{4}$$

$$\sigma_t^2 = \omega + \sum_{i=1}^m \lambda_i \varepsilon_{t-1}^2 + \sum_{j=1}^n \phi_j \sigma_{t-j}^2 + \varepsilon_t$$
(5)

In equation (3), the term of ret_{t-i} was added to consider the effect of return on stock returns at time t-i. n is the lag order of stock returns and determined based on AIC or SBC. Equation (4) contains the error term ε_t assumed to follow the non-central t distribution. In equation (5), λ_i is the ARCH coefficient which measures the influence of past squared residuals (ε_{t-1}^2) on recent volatility. The coefficient, ϕ_j is the GARCH term which measures the influence of the recent past period's volatility (σ_{t-1}^2) on current volatility at time t.

Empirical Results

Table 2 provides the results of AIC and SBC in three main unit root hypotheses (time trend, constant term and neither constant term nor time trend). Unit root test helps to avoid spurious estimation and nonsense results. Dickey-Fuller (DF) approach of Dickey-Fuller (ADF) test was used to follow the process of the unit root test. The ADF test statistics in table 2 instructed that the stock returns of all three cases are stationary at level both before and during the Covid-19 crisis. Order 1 was selected based on the minimum AIC and SBC results for both subsamples.

Before Covid-19 Crisis						
Int		rcept	Trend and Intercept		None	
Lag	AIC	SBC	AIC	SBC	AIC	SBC
1	-5.91*	-5.89*	-5.91*	-5.88*	-5.92*	-5.90*
2	-5.91	-5.87	-5.91	-5.87	-5.92	-5.89
3	-5.91	-5.87	-5.91	-5.86	-5.92	-5.88
	During Covid-19 Crisis					
Lag	Inter	rcept	Trend and Intercept		None	
Lag	AIC	SBC	AIC	SBC	AIC	SBC
1	-5.68*	-5.66*	-5.68	-5.65*	-5.68*	-5.67*
2	-5.68	-5.65	-5.67	-5.64	-5.68	-5.66
3	-5.67	-5.64	-5.67	-5.63	-5.67	-5.65

Table 2. The results of unit root test

Notes: * 1. denotes minimum value.

Table 3 provides the test statistics of diagnostic and ARCH effects. For model diagnosing, the Ljung-Box Q test results show that Q (6), Q (12) are significant at the 5% level; Q^2 at lag 6 and lag 12 are significant at the 1% level before the Covid-19 crisis.



Additionally, Q (6), Q (12) are significant at the 5% level during the Covid-19 crisis. Q^2 at lag 6 and lag 12 are significant at the 1% level during the Covid-19 crisis. These results indicate a serial correlation in the standardized residuals of the two simple regression models for two subsamples.

For the ARCH effect, the ARCH (with 1 lag) statistics for both subsamples are greater than the critical Chi-square value ($\chi_{(1)} = 6.635$) at 1% level of significance. Thus, the null hypothesis that all q lags of squared residuals of each regression have coefficients that are not significantly different from zero, is rejected. It mentions that the market returns have ARCH effect or the two models of market returns have heteroscedasticity.

Before Covid-19 Crisis				
Q(6)	12.349**	Q(12)	22.198**	
$Q^{2}(6)$	104.21*	$Q^{2}(12)$	164.68*	
ARC	CH(1)	30.16*		
During Covid-19 Crisis				
Q(6)	13.551**	Q(12)	24.161**	
$Q^{2}(6)$	91.659*	$Q^{2}(12)$	164.18*	
ARCH(1)		24.7	57*	

Table 3	Ling-Box	O and	ARCH	statistics
Table 5.	Ljung-DUA	Q and	AICH	statistics

Notes:1. * (**) (***) *denote* 1% (5%) *and* (10%) *level of significance.*

GARCH (1,1) can capture boh symmetry and asymmetry volatility of stock returns. Accordingly, the GARCH (1,1) model is fitted on market returns for both before and during the Covid-19 pandemic. The GARCH (1,1) is given as follows:

$$ret_{t} = a_{0} + a_{1}D_{1t} + a_{2}D_{2t} + a_{3}D_{3t} + a_{4}D_{4t} + b_{1}ret_{t-1} + \varepsilon_{t}$$
(6)

$$\varepsilon_{t} \sim T(0,) \tag{7}$$

$$\sigma_t^2 = \omega + \lambda_1 \varepsilon_{t-1}^2 + \phi_1 \sigma_{t-1}^2 + \varepsilon_t$$
(8)

Method	ARCH(1)	SBT	NSBT	PSBT	JT
	0.0227	0.338	5.395	-19.892	(5.162)
		(1.191)	(0.298)	(-0.820)	
Before Covid-19 Crisis	Q(6)	4.291		Q(12)	10.677
	Q ² (6)	1.275		Q ² (12)	2.447
	0.1953	0.341	4.149	-20.284	$(c, 0, c, \tau)$
		(1.189)	(0.365)	(-1.037)	(0.007)
During Covid-19 Crisis	Q(6)	3.963		Q(12)	8.959
	$Q^2(6)$	0.171		Q ² (12)	13.226

Table 4. Sign-bias Test and Model Diagnostic

Notes: 1. * (**) (***) *denote* 1% (5%) *and* (10%) *level of significance*



Table 4 demonstrates the results of the sign-bias test and model diagnostic. The signbias test statistics show that the statistics of SBT, NSBT, PSBT and joint test are all insignificant. The joint test statistics (JT) are smaller than the critical Chi-squared value of 7.82 with 3 degrees of freedom at the 5% level of significance for both before and during the Covid-19 pandemic. Consequently, the null hypothesis of no asymmetric effect is accepted; the market returns are not asymmetric both before and during the Covid-19 pandemic. It means that other GARCH models, such as EGACH and TGARCH, should not be additionally tried to apply. Moreover, the model diagnostic tests indicate that GARCH (1,1) is adequate due to no more serial correlation or conditional heteroscedasticity in the standardized residuals of the fitted model based on the insignificance of ARCH (1), Q and Q² statistics.

The empirical findings derived from OLS before and during the Covid-19 crisis show that the day-of-the-week effect is present in market returns for the HOSE. The results also indicate a difference in the day-of-the-week effect on market returns before and during the Covid-19 pandemic. Particularly, there was a negative Thursday effect (-0.8245) on stock returns before the Covid-19 crisis, while it exhibited a negative Monday effect (-0.00404) on stock returns during the Covid-19 pandemic. However, It is noted here that the OLS method ignores the time-varying volatility detected in the observed series. Thus, the results of GARCH (1,1) are more appropriate.

In terms of the conditional mean equation, the results of GARCH (1,1) report that the day-of-the-week effect did not exist on market returns before the Covid-19 crisis when the statistics of coefficients were all insignificant. This finding is supported by many studies which do not confirm the day-of-the-week effect on stock returns, such as Le Hau (2010), Kristjanpoller (2012a), Sharma (2011) and Plastun et al. (2019). Conversely, the weekend effect was present on market returns for the HOSE during the Covid-19 outbreaks, specifically, positive Friday effect was detected based on its significant statistic at the 5% level. It means that the impact of Covid-19 changes the the weekend effect on market returns for the HOSE. This result is consistent with some findings, for instance, French (1980), Seif et al. (2017). The findings are also suitable with the theory of behavioral finance, weekend effect which supposes investors usually being optimistic at the weekend after the stock prices going down on Monday. Therefore, the findings seem to be supported for the conclusion of Truong & Friday (2021), who indicated a negative effect of Mondays on stock returns for the pre-index futures period. Overally, the results of present study support the evidence that the Vietnam stock market is impacted by calendar effects such as the day-of-the-week effect during the Covid-19 pandemic, however, this anomaly was not found before the period of Covid-19 outbreaks. This finding is a meaningful proof for the big impact of the Covid-19 crisis when it makes an efficient market becoming inefficient. In other words, this study once again confirms that the Vietnam stock market is not totally follow the efficient market hypothesis theory or it facilitates the efficient market hypothesis in the period of Covid-19 appearance.



Before Covid-19 Pandemic				
GARCH (1,1) OLS				
С	onditional mean equ	ation		
a contraction of the second se	0.00107	0.00164		
Constant	(1.4192)	(1.5349)		
	-0.00786	-0.00146		
Monday	(-0.7592)	(-0.9551)		
	-0.00090	-0.00223		
Tuesday	(-0.8313)	(-1.4646)		
	-0.00077	-0.00125		
Wednesday	(-0.6903)	(-0.8245)		
	-0.00051	-0.00329		
Thursday	(-0.4913)	(-2.1762**)		
	0.0269			
Ret(-1)	(0.6219)			
Cor	nditional Variance e	quation		
G	2.00E-06			
C	(1.6841***)			
	0.1009			
$\text{RESID}(-1)^{n/2}$	(2.9871*)			
	0.8834			
GARCH(-1)	(27.9869*)			
D	uring Covid-19 Pan	demic		
	GARCH(1,1)	OLS		
C	onditional mean equ	ation		
Constant	0.001775	-0.00044		
Constant	(2.122**)	(0.3560)		
Monday	0.00037	-0.00404		
Monday	(0.3386)	(-2.3064**)		
Tuandary	-0.000106	0.00180		
Tuesday	(-0.0881)	(1.0345)		
Wadnasday	0.000447	0.00186		
wednesday	(0.3711)	(1.0649)		
Thursday	0.000446	0.00028		
Thursday	(0.3949)	(0.1616)		
$\mathbf{D}_{ot}(1)$	0.02107			
Ket(-1)	(0.5179)			
Conditional Variance equation				
C	2.77E-05			
	(2.7239*)			
	0.2999			
KESID(-1)^2	(2.8810*)			
CARCII(1)	0.6359			
GARCH(-1)	(8,0003*)			

Table 5. The Estimation Results of GARCH (1,1) Model

Notes: 1. * (**) (***) denote 1% (5%) and (10%) level of significance.



In terms of the conditional variance equation, the statistics of constant are all significant at the 10% and 1% level for both periods, before and the Covid-19 pandemic, respectively. Additionally, the coefficients, λ , and ϕ are all positive and significant at the 1% level for both subsamples. It concludes that the past squares residuals lead to bigger recent volatility and the past volatility positively affects current volatility as well. The findings also imply that the impact of the Covid-19 health crisis seems to increase the volatility of market returns.

Conclusion

Considering the calendar anomalies combined with the impact of Covid-19 will help investors and policymakers react rightly when making their financial decisions. This present study aims to investigate the effect of calendar anomaly, specified by the day-ofthe-week, on market returns pre and during the Covid-19 period. Closing daily data in two sub-periods for the Vietnam stock market (VN- index), the OLS method and GARCH (1,1) model were employed. The findings additionally contributed evident proof for the Vietnam stock market – a frontier market. Regarding stock returns, positive returns were found only on Friday, during the Covid-19 pandemic. It implies that Covid-19 has changed the nature of the stock market from efficient to inefficient. However, the positive effect on Friday during the Covid-19 crisis is also a signal that facilitates or makes efficiency back in the short run. This finding again supports previous studies that mentioned the day of the week affected on stock returns in the Vietnam stock market (Loc, 2006; Truong & Friday, 2021). In addition, this finding may partially support the conclusion that weak-form efficiency does not hold in the Vietnam stock market (Dong Loc et al., 2010; Phan & Zhou, 2014; Shaik & Maheswaran, 2017; Vo & Truong, 2018; Le & Duong, 2022) and the Vietnam stock market is efficient in the periods before and during Covid-19 pandemic (Kok & Geetha, 2023).

This explanation based on the argument of Gormsen & Koijen (2020) that stock markets adversely react to this outbreak in the short run but they will correct themselves and go up again in the long run. The present finding is also supported by the study of Phan Tran Trung & Pham Quang (2019), which mentioned that the efficiency of the Vietnam stock market varies over time and is influenced by market conditions.

The present research only uses a market index (VN-Index) to evaluate the day-of-theweek effect before and during the Covid-19 pandemic. Therefore, the day-of-the-week impact on specific sectors before and during the Covid-19 pandemic has not yet been detected. This may lead to a limitation of conclusion. Hence, to get a precise view in this context, future research needs to consider more sector indices and may apply more GARCH family models. On the other hand, the day of the week is not the only factor which affects stock returns; thus, future research can add more variables such as the January effect, monthly effect, etc. These variables will help to explain more in the case of market anomaly.



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