Stock Market Seasonality in the Face of a Pandemic: Turn of the Month Effect Across Emerging and Developed Markets

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ABSTRACT

This research analyses the calendar anomalies and the adaptive market hypothesis (AMH) concept to identify the turn of the month (TOM) effect in the stock markets. This study applies the effect of the COVID pandemic by using the data of approximately 10 years, i.e., January 2011 to March 2021, for the five countries, which are Pakistan, the United States of America, the United Kingdom, Brazil, and India. This study further evaluated the results, divided as complete data, before COVID, and during COVID, from the models OLS regression, GARCH, TGARCH, and EGARCH. The results indicate the existence of a calendar anomaly with reference to the turn-of-the-month effect, which depicts the significance in each market. The adaptability of the markets is because of the emotional sentiment of the investor, and this is the reason why, during the COVID-19 pandemic, it is evident that the stock markets under study turned out to be adaptive.

Keywords: *Turn of the Month (TOM) Effect, COVID-19, Emotional Sentiment, Stock Markets, Calendar Anomalies, Adaptive Market Hypothesis.*

INTRODUCTION

We have seen that the market efficiency is impacted by the existence of the anomalies, which is supported by the literature; however, in comparison to the research of Malkiel and Fama (1970), the author Lo (2004) gave the investors a new insight to look at the market trends from a different perspective. He argues that the Efficient Market Hypothesis is not wrong, but it is at fault since it does not incorporate the investor's sentiments. The efficient market hypothesis lacks the behavioral aspect of the investor. A market is driven by investors, or the markets drive the investors; in both concepts of the studies, behavioral finance plays a vital role in explaining the prevailing market conditions (Anjum 2020). The author states that markets are neither efficient nor inefficient at a particular instance; however, the market adapts to the persisting trends. Therefore, he brought to this emerging phenomenon the Adaptive Market Hypothesis (Holopainen 2021). It states that the investors are keener towards acting in their own self-interest, while doing that, they learn and adapt to the prevailing market conditions. Individuals are evolutionarily trained to make judgments (Plastun et al. 2020).

In response to the COVID pandemic, multiple countries and their economies have been drastically impacted due to the high death rate and the lockdown imposed by their respective government. the economy of these countries has been drastically impacted (Liu et al. 2020). Since investor behavior plays a vital role in the market trends, i.e., bearish and bullish, the impact of COVID on investors has impacted their investment decisions. In addition to this, not just the investment decisions have been impacted, but the price depreciation in the share price has also impacted the overall returns of the index. Till the present date, the United States of America, the United Kingdom, India, and Brazil are the four countries that have been drastically impacted by the coronavirus (Takyi and Bentum-Ennin 2021).

Moreover, the impact of the coronavirus in these countries is still increasing, and the death rate is increasing exponentially (Holopainen 2021). Considering these factors, there is a scope to study the existence of the adaptive market hypothesis in these countries, along with Pakistan, where the comparison will be made between the period before COVID and during the COVID period, because it is evident that COVID has not come with a return ticket. Furthermore, the authors have already begun to analyze the effects in the market. (Okorie and Lin 2021). Besides this, the authors, Adekoya and Kofi Nti (2020), also signified the effects of COVID-19 on the stock market indices, where the economic losses are verified in the fluctuations of the stock prices.

There have been multiple studies conducted in the past by researchers from Pakistan on either the Pakistan stock exchange or the international exchanges. Among these researchers, the most prominent work was that of Shahid and Sattar (2017). In his research, the author studies the impact of calendar anomalies on the returns of the KSE 100 index to validate the existence of AMH. In addition to this, the authors Shahid, Latif, Chaudhary, and Adil (2020) and Shahid et al. (2019) have conducted their studies on the commodity market returns, inclusive of gold, silver, metal, and oil, through which they have justified the presence of the adaptive market hypothesis. Moreover, the authors Shahid, Latif, Chaudhary, and Kouser (2020), studied the TOM calendar anomaly on the returns of 107 companies listed on the Pakistan stock exchange to signify the adaptive market hypothesis.

In this research, the TOM has been studied using the models of OLS regression, GARCH, TGARCH, and EGARCH for the period of approximately 10 years, i.e., 31st January 2011 to 31st March 2021. This research not only analyzed the Pakistan stock market calendar anomalies impact but also considered the 4 international markets that are the United States of America (USA), the United Kingdom (UK), Brazil, and India. This helps in the evaluation of calendar anomalies under the concept of the adaptive market hypothesis.

LITERATURE REVIEW

TOM Anomaly

Bank The authors, Chen et al. (2019), investigated the TOM anomaly being persistent in the stock market of New Zealand. The data collected for his study approximates to be of 17 years, analyzing over 4,166 trading days in total. The findings turned out to be that the returns on the ending 3 days of every calendar month are significantly positive and higher, on average, in contrast to the remaining days of the month. The authors further analyzed the justifications of the TOM anomaly by looking into the window dressing dividend payouts and the price pressures; however, these did not validate the existence of the TOM anomaly. Therefore, according to the research, the presence of TOM anomaly in the New Zealand stock market was a dilemma that could be misused in planning the planning of the investor's investment decisions.

Arendas and Kotlebova (2019), examined the TOM anomaly in Central and Eastern European Countries. The anomaly in stock returns, along with the anomaly in volatility of stock prices, was also investigated. To do so, a total of eleven countries were selected, including Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Turkey, Romania, Lithuania, Slovakia, Poland, and Russia. The major repetitive stocks of each country were selected. Data on daily stock prices were collected over a time period of approximately twenty years, spanning from the year 1999 to 2018. Two methods were used to divide the total trading days of each of the indices, i.e., the TOM window and the remaining month. The TOM window was classified into three categories, i.e., (-1, +1), (-2, +2), and (-3, +3). The results of the study signified the existence of the TOM anomaly in seven of the eleven countries that were chosen for this research. In

addition to this, the calendar anomaly did not have an important impact on the volatility in stock prices; however, it showed a momentous effect on the return of stocks.

Mutuku (2019), conducted his research to study the existence and impact TOM anomaly in the Nairobi Securities Exchange. The Nairobi Securities Exchange All Share Index was taken into account to conduct this study. The daily stock price data was collected over a period of four years, spanning from October 2015 to October 2019. The researcher employed three types of tests to evaluate the significance of turn of the turn-of-the-month calendar anomaly, which included Ordinary Least Squares (OLS) Regression model, parametric, and non-parametric tests. The results of the study turned to proved the existence of a calendar anomaly in the Nairobi Securities Exchange, as the (-4, +4) turn of the month rolling window signified abnormal profits and losses, which signified the presence of the calendar anomaly.

Aziz and Ansari (2018), investigated the significance of the TOM anomaly in the Asian Pacific stock markets. The authors took twelve of the major countries of the Asian Pacific to study the persistence of calendar anomaly in the stock returns. Daily stock price data was collected over a period of approximately five years, spanning from January 1st, 2000, to April 30th, 2015. Two tests are used to conduct this research, including, GARCH (1, 1) model Wilcoxon Signed Rank test. A foreseeable pattern in equity returns based on the calendar time is synchronized as a calendar anomaly. The researchers used a (-7, +7) TOM rolling window to signify the existence of the calendar anomaly. The results of the research turned out to be in alignment with the significance of the TOM anomaly in the Asian Pacific stock markets. Out of the twelve major stock markets selected, eleven of them proved to have a significant impact of turn–of–the–month anomaly on the return prices; however, only Malaysia did not show a significant impact. In addition to this, these eleven countries did not have a significant impact on the turn-of-the-year effect.

Vasileiou (2018), coherently examined the presence of the TOM anomaly by investigating eleven countries that happen to fall under the European Monetary Union. The data was collected from 4th January 1999 till 2nd September 2016, accounting for approximately seventeen years' period. Data was collected from 1999 onwards, as all the selected countries adopted the same currency. The principal focus of the research is to find the relationship between the stock returns and the trading volume of stocks. The findings of the study were indicative of showing no apparent direct relationship between the trading volume and the trading value of the stocks. They were independent of each other, except in a few cases. The author further supported it with the critical evaluation of this result by suggesting that the payment hypothesis is not indicative of the TOM anomaly. In addition to this, the results further supported the optimal TOM anomaly definition where the rolling window is considered (-4, +1), as six out of eleven countries showed the TOM anomaly in this rolling window, in contrast to (-3, +1) and (-1, +3).

Sudarvel and Velmurugan (2016) coherently studied the presence of two calendar anomalies, namely, the TOM anomaly and the semi-month effect in the stock market of India. For the research, the data of daily stock prices were collected over a period of approximately eleven years, spanning from April 2055 to March 2016. The parametric paired sample t-test was employed to signify the existence of the two calendar anomalies mentioned above in the Indian stock market. The National Stock Exchange Nifty index was taken into consideration was this study. The findings of the research signified the existence of the TOM anomaly (in the first half of the month) while ruling out the presence of the semi-month effect in the stock market of India. In alignment with the findings of the research, the author suggested that investors invest in securities after the first half of the month and sell them in the first half of the month, as the returns recorded are highest in the first half of the month. Conclusively, due to the presence of the TOM anomaly, the Indian Stock Market is said to be inefficient.

Kayaçetin and Lekpek (2016), studied the effect of TOM anomaly in the Turkish equity returns. The data was collected from the BIST100 index over the period of 27 years. To research the existence of this calendar anomaly, the author includes trading days with respect to (-1, +2). The results of the study explained that this effect is powerfully present, with a mean daily index return of 0.46%, comprising the three days. Moreover, the 27-year sample period was divided into subgroups, comprising early, interim, and late subperiods, to evaluate the existence of this phenomenon over the passage of time. Furthermore, in Turkey, the official financial statements of the film industry are released in April; thus, the turn-of-the-month anomaly turned out to be strongest in April, which was found by evaluating the monthly decomposition of returns. In addition to this, an exponential generalized autoregressive heteroscedasticity model was run to examine the volatility of the BIST100 index over a daily time series. The results showed that at the end of the month, the volatility of the index decreased, and this decrease in conditional volatility was observed in January and April. Along with these findings, the TOM anomaly at the end of the month passed to the start of the current turn of the month, and the conditional volatility depicts the returns in the current turn of the month.

Marchewka (2014), critically analyzed the evolution of the TOM anomaly. The author tested the persistent anomaly with a different rolling window, i.e., (-4, +1), in addition to the already existing rolling window, i.e., (-1, 3). The data was collected over a time period of nine years, spanning from 2005 to 2014. The daily return prices of the Standard and Poor's 500 index. A t-test for unequal variances was employed to validate the significance of the TOM anomaly. The results of the research turned out to point towards the persistent turn of the month anomaly with the changed month period, i.e., (-4, +1). In addition to this, there was a pattern of increased returns in the first half of the month; thus, investors are advised to adopt an investment strategy to sell their securities in the first half of the month, while buying or holding on to them in the second half of the month.

Adaptive Market Hypothesis

Mushinada (2020) signified the existence of behavioral biases within investors' decisions, which validates the existence of AMH in the Indian stock market. The researcher takes into consideration two biases, i.e., self-attribution bias and overconfidence bias, by evaluating over 384 Indian investors spanning over five different cities. Primary data is collected by using questionnaires. The criterion for an investor to be considered as "an active investor" is that they shall have five years of trading experience. Structural Equation Model (SEM) is used to signify the relationship between the behavioral biases and the rationality/irrationality of investors in decision making, which frames the phenomenon of AMH. The findings of the study reflect that due to the presence of cognitive biases, there is a likelihood that the investor moves away from rationality since an investor is more concerned about maximizing their overall returns or profits. Conclusively, this study is evidence that an investor can be both rational and irrational simultaneously, depending upon his behavior, thus adapting to the changing environment, which supports the existence of AMH. In addition to this, if investors experience behavioral biases, there exists a direct impact on the Indian stock market.

Lekhal and El Oubani (2020) critically analyzed the existence of the Adaptive Market Hypothesis as being the major reason behind the evolutionary changes in the Moroccan stock market. To do so, the authors collected the daily returns data of the Moroccan All Share Index, covering a time period of approximately twenty-seven years, spanning from 2nd January 1992 till 10th September 2019. There were three tests taken into consideration to study the efficiency of the Moroccan stock market, which fall under the categories of linear and nonlinear tests. In addition to this, the rolling window technique was also employed. Due to the evident presence of heteroscedasticity, which is often found in the stock returns, the

authors used the linear models, including, WBAVR test, the Non-Bayesian Time-Varying model approach, and the Automatic Portmanteau test. In addition to this, the nonlinear model, McLeod–Li test was used. These tests were employed to mitigate the existence of heteroscedasticity in the datasets. The findings of the study turned out to be in alignment with the adaptive market hypothesis, proving it to be a better explanation of the investor behavior in the Moroccan stock market. In addition to this, it was observed that abnormal returns were incurred when the market was inefficient, in contrast to when the market was efficient. Furthermore, the abnormality in returns proved to be impacted by multiple factors persisting in the market, for instance, the liquidity of the market and the financial crisis. The results were indicative that when the stock market was going through a financial crisis, it was observed that the momentum profit was barely evident, and the stock market was indicative of inefficiency. However, when the stock market experienced high liquidity, the market was less efficient and more inefficient, and the stock returns were indicative of momentum profits.

Loredana (2019), critically investigated the presence of the efficient market hypothesis. The existence of the three forms of market efficiencies, i.e., weak form, semi–strong form, and strong form, is precluded in multiple studies. The author further supported it with the help of multiple empirical evidences, where she signified the nonexistence of EMH due to the behavioral aspect of investors. The random walk hypothesis, in alignment with the investor's behavior and its rationality, rejects the EMH is rejected. After the critical analysis of the EMH and its rejection, we conclude that the presence of the Adaptive Market Hypothesis is validated, since the behavioral aspect in accordance with the emotional sentiment of the investor is aligned to study the market dynamics.

Boya (2019), studied the existence of EMH along with the AMH in the French stock market. The author used a rolling window model to evaluate the efficiency behavior for 20 years by using weekly data from 1988 to 2018. The result of the study validates that the AMH is a better explanation of the behavior of the stock returns. The disruption in the trend of the stock market can be explained through the macroeconomic global events, which provided the reasoning for the time variation in the patterns of future returns. The study concluded the existence of the adaptive market hypothesis, where the market witnessed both efficiency and inefficiency, of which inefficiency is explained via major events of history.

Numapau Gyamfi (2018), examined the presence of AMH in the stock market of Ghana by considering the two market indices, namely, the Ghana Stock Exchange (GSE) Composite index and the Ghana Stock Exchange (GSE) Financial Stock index. The data was collected, based on its availability, over the time span of approximately 4 years, dating from January 4th, 2011, till August 28th, 2015. Three autocorrelation tests were used to signify the return predictability, which included, GS Test, AQ Test, and WBAVR Test. In addition to this, rolling window estimation was also used to further signify the presence of the AMH. The results of the research validated that the stock returns of the two indices are not predictable. In accordance with the rolling window estimation, the Ghana Stock Exchange Composite index, in comparison to the Ghana Stock Exchange Financial Stock Index, had more predictability, which means that there were certain periods in which the return of stocks was predictable, while in some periods it was not. Thus, the results supported the presence Adaptive Market Hypothesis in the Ghana stock exchange based on the two indices.

METHODOLOGY

This research evaluated the calendar anomalies in the stock market under the adaptive market hypothesis concept, where the data of approximately 10 years have been taken, i.e., 1st January 2011 to 31st March 2021, which results in 2,542 observations of trading days. The study was conducted on the five

main international indices of Pakistan –KSE-100 Index, USA –S&P 500 Index, UK –FTSE 100 Index, Brazil –BOVESPA (BVSP) Index, and India –NIFTY 500 Index. The data collected for the returns of the stock market from the website of the PSX website and investing.com.

For the detailed analysis and results evaluation of turn of the turn-of-the-month effect anomaly, four different models have been used which including the Ordinary Least Squares (OLS) regression, Generalized Autoregressive Conditional Heteroskedastic (GARCH), Exponential GARCH (EGARCH), and Threshold GARCH (TGARCH). These models have been taken into consideration to align our study with the previous research of Gbeda and Peprah (2018), Mutuku (2019), Zhang, Lai, and Lin (2017). Table 1 provides the interpretation of all 4 methodologies.

Table 1: Description of Methodologies

OLS Regression	**GARCH**	**TGARCH**	**EGARCH**
This model helps in analyzing the relationship between the dependent and independent variables of the research. The following is the general form of the model: $\boldsymbol{Y_i = \sigma_0 + \sigma_1 X_i + \varepsilon_i}$ Where, $\boldsymbol{Y_i}$ is the dependent variable, $\boldsymbol{\sigma_0}$ is the intercept, $\boldsymbol{X_i}$ is the independent variables list and $\boldsymbol{\varepsilon_i}$ is the error term.	This model is the advanced form of ARCH model introduced by Bollerslev (1986) to analyze the volatility and evaluation of stock returns volatility indices. The general equation of this model is: $\boldsymbol{\sigma_t^2 = \omega + \gamma_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2}$ where $\boldsymbol{\omega}$ need to be 0 or lesser, $\boldsymbol{\gamma_1 and\ \beta_1}$can be equal to 0 or greater and $\boldsymbol{\gamma_1 + \beta_1}$ must be less than 1.	This model is a step forward of GARCH model helps in evaluation of negative and positive news volatility of the stock market proposed by Glosten, Jagannathan, and Runkle (1993). The general form for this is: $\boldsymbol{\sigma_t = \omega + \alpha_1 \varepsilon_{t-1}^2 + \gamma d_{t-1} \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}}$ Where, d_{t-1}=1, if ε_t less than 0 then there is negative news, on the contrary, d_{t-1}=0, if ε_t is greater than 0, then this depicts the positive news.	This model provides the analysis based on natural log of the GARCH model results which omits the restrictions of non-negative returns. The general form of equation is: $\boldsymbol{\ln(\sigma_t^2) = \omega + \alpha_1 \frac{\lvert\varepsilon_{t-1}\rvert + \gamma_1 \varepsilon_{t-1}}{\sigma_{t-1}} + \beta_1 \ln(\sigma_{t-1}^2)}$ Where, $\boldsymbol{\gamma_1}$predicts the leveraged parameter.

The OLS regression equation for turn–of–the–month - anomaly is as follows:

$$Return\ of\ Index = \beta_0 + \beta_1 April + \beta_2 August + \beta_3 December + \beta_4 February + \beta_5 January + \beta_6 July + \beta_7 June + \beta_8 March + \beta_9 May + \beta_{10} November + \beta_{11} October + \varepsilon_i$$

For the first 4 days of the month, the dummy variable when equal to 1 is turn of the month, otherwise 0. M1 = April, M2 = August, M3 = December, M4 = February, M5 = January, M6= July, M7 = June, M8 = March, M9 = May, M10 = November, M11 = October, M12 = September.

For the last 5 days of the month, dummy variable when equal to 1 is turn of the month, otherwise 0. M1 = April, M2 = August, M3 = December, M4 = February, M5 = January, M6= July, M7 = June, M8 = March, M9 = May, M10 = November, M11 = October, M12 = September.

ANALYSIS AND RESULTS

TOM Anomaly

In the stock market indices of Pakistan, the returns KSE 100 Index, the results are insignificant. In the international stock market indices, which are highly impacted due to coronavirus, the FTSE Index in the first four days of the month turned out to be significant in May, August, September, and December, with negative returns, except in September, which reflects positive returns. In addition to this, in the returns of the Nifty 500 Index in the first four days of the month, March is significant with positive returns. However, both the BVSP Index and S&P 500 Index turned out to be insignificant for both the first four days of the month and the last five days of the month. The results, which are significant for the turn-of-the-month anomaly with respect to complete data, are as follows.

Table 2 OLS Regression – Complete Data - Turn-of-the-Month-Anomaly

OLS Regression - Complete Data: Turn-of-the-Month-Anomaly					
Indices	**Days**	**Month**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	**Day>1&Day<4**		No Impact		
	Day>25&Day<31	**June**	0.0045098	1.95	0.052
BVSP Index	**Day>1&Day<4**		No Impact		
	Day>25&Day<31	**April**	0.0072126	1.98	0.048
		August	0.0065298	1.82	0.07
		July	0.0066746	1.8	0.072
		June	0.0067139	1.83	0.068
		March	0.0076264	2.18	0.03
FTSE 100 Index	**Day>1&Day<4**	**August**	-0.008262	-2.1	0.037
		December	-0.007652	-1.98	0.049
		March	-0.006756	-1.78	0.077
		May	-0.007383	-1.94	0.054
		October	-0.007367	-1.97	0.051
		September	0.0065231	2.35	0.02
	Day>25&Day<31		No Impact		
S&P 500 Index	**Day>1&Day<4**		No Impact		
	Day>25&Day<31	**March**	0.0043111	1.82	0.07
Nifty 500 Index	**Day>1&Day<4**	**March**	0.0077579	1.96	0.051
	Day>25&Day<31		No Impact		

**The results displayed for the significant days for each index at 1%, 5% and 10% level of significance*

Andar Volatility

During TOM, with respect to volatility in returns, during the first four days of the month, in the KSE 100 Index, GARCH (1,1) and EGARCH (1,1) turned out to be significant, while during the last five days of the month, GARCH (1,1), EGARCH (1,1), and TGARCH (1,1) turned out to be significant. In the FTSE 100 Index, during the first four days of the month, the results are insignificant, while during the last five days of the month, GARCH (1,1) and EGARCH (1,1) turned out to be significant. In addition to this,

in S&P 500 Index returns, during the first four days of the month, EGARCH (1,1) turned out to be significant, while during the last five days of the month, GARCH (1,1) and EGARCH (1,1) turned out to be significant at 5% level of significance. Moreover, in Nifty 500 Index returns, during the first four days of the month, EGARCH (1,1) turns out to be significant, while during the last five days of the month, GARCH (1,1), EGARCH (1,1), and TGARCH (1,1) turned out to be significant. Lastly, in BSP Index returns, during the first four days of the month, EGARCH (1,1) turned out to be significant, while during the last five days of the month, EGARCH (1,1) and TGARCH (1,1) turned out to be significant. The first five days of all indices are not significant; therefore, the table is not displayed.

With respect to the above results found, in the stock indices of Pakistan, the existence of the TOM anomaly is significant during the last four trading days of the month. This result is in alignment with the results of Yardımcı and Erdem (2020), where in Pakistan the last trading days depict the highest returns. This is further explained via the pay-day-hypothesis, which elaborates that during the last few days of the month, employees get their salaries and they use these funds to invest in the stock market. In addition to this, the presence of TOM in S&P 500 Index returns is in alignment with the study of Plastun et al. (2019).

As the turn of the month reflects that the stock price appreciates in the last few days of the month, following the first few days of the next month, this is because of the investor behavior, i.e., when he receives his income, he tends to invest, which increases the bullish trend in the market. This anomaly should pertain in most of the indices; however, in Pakistan, it does not exist in the KSE30 and KSE 100 index, which is reflectively of the fact that market capitalization plays a vital role, i.e., since KSE 100 is the benchmark index of Pakistan, it requires heavy bullish or bearish trends to shake the volatility and returns of this index. The results are displayed in Table 3, Table 4, Table 5, Table 6, and Table 7

Table 3: **GARCH – Complete Data - TOM Anomaly**

GARCH: TOM Day>1&Day<4									
Indices	**Complete Data Set**			**Before COVID**			**During COVID**		
	Coefficient	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	-2.510324	-3	0.003			No Impact			
S&P 500 Index					No Impact				
FTSE 100 Index					No Impact				
BVSP Index					No Impact				
NIFTY 500 Index					No Impact				

Table 4: **GARCH – Complete Data - TOM Anomaly**

GARCH: TOM Day>25&Day<31									
Indices	**Complete Data Set**			**Before COVID**			**During COVID**		
	Coefficient	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	0.921139	4.14	0.000	0.744114	2.9	0.004			
BVSP Index					No Impact				
FTSE 100 Index	0.493945	3.16	0.002	0.793686	3.9	0.00	-0.53558	-3.2	0.001
S&P 500 Index	1.054452	6.69	0.000	0.724377	3.33	0.001		No Impact	
Nifty 500 Index	0.908676	8.42	0.000		No Impact			No Impact	

Table 5: **EGARCH – Complete Data - TOM Anomaly**

EGARCH: TOM Day>1&Day<4									
Indices	**Complete Data Set**			**Before COVID**			**During COVID**		
	Coefficient	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	14.74024	603.58	0.000	-4.088374	-2.23	0.026		No Impact	
FTSE 100 Index					No Impact				
BVSP Index	2.895843	507.67	0.000	9.62083	481.23	0.00	-1.446548	-15.16	0.000
S&P 500 Index	-9.459246	-640.92	0.000	4.643914	1241.26	0.00		No Impact	
Nifty 500 Index		No Impact		8.431158	453.25	0.00		No Impact	

Table 6: **EGARCH – Complete Data - TOM Anomaly**

EGARCH: TOM Day251&Day<31									
Indices	**Complete Data Set**			**Before COVID**			**During COVID**		
	Coefficient	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	1.166918	5.67	0.00	0.999449	4.25	0.00	-0.73946	-1.67	0.094
BVSP Index	0.485569	1.65	0.099	0.86725	1.71	0.087	-1.0647	-2.31	0.021
FTSE 100 Index	0.966716	5.05	0.00	1.130889	4.06	0.00	-1.34472	-2.45	0.014
S&P 500 Index	-1.03355	-1.91	0.057	1.309895	5.33	0.00	No Impact		
Nifty 500 Index	0.470171	3.66	0.00	0.493699	3.77	0.00	1.197613	1.64	0.1

Table 7: TGARCH – Complete Data - TOM Anomaly

TGARCH: TOM Day>25&Day<31									
Indices	**Complete Data Set**			**Before COVID**			**During COVID**		
	Coefficient	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	-0.26658	-2.02	0.044	-0.28916	-2.03	0.042	No Impact		
FTSE 100 Index	No Impact								
BVSP Index	0.228419	1.69	0.092	No Impact			1.019338	4.78	0.00
S&P 500 Index	No Impact			0.253711	1.93	0.053	No Impact		
Nifty 500 Index	1.005258	27.62	0.00	No Impact					

Before COVID

In the KSE 100 Index, the results are insignificant for both the first four days and the last 5 days of the month. In the FTSE 100 Index, during the first four days of the month, May, June, August, September, October, and December turned out to be significant with negative returns, while February turned out to be significant with negative returns as well. In addition to this, in S&P 500 Index returns, during the last five days of the month, the month of August turned out to be significant with positive returns, while November turned out to be significant with positive returns. Moreover, in the Nifty 500 Index returns, during the first four days of the month, March turned out to be significant with positive returns. Furthermore, in the BVSP Index returns, during the first four days of the week, the month of November turned out to be significant with negative returns. The results, which are significant for the turn-of-the-month anomaly before COVID in Table 8.

Table 8: OLS Regression – Before COVID - Turn-of-the-Month-Anomaly

OLS Regression - Before COVID: Turn-of-the-Month-Anomaly					
Indices	**Days**	**Month**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	**Day>1&Day<4**		No Impact		
	Day>25&Day<31		No Impact		
BVSP Index	**Day>1&Day<4**	**May**	-0.0124055	-1.76	0.08
	Day>25&Day<31	**August**	0.0063462	1.84	0.067
		June	0.0068983	1.95	0.052
		March	0.0071721	2.09	0.037
FTSE 100 Index	**Day>1&Day<4**	**August**	-0.0116553	-2.96	0.004
		December	-0.0105553	-2.68	0.008
		February	-0.0076553	-1.94	0.054
		June	-0.0093364	-2.32	0.022
		March	-0.0112636	-2.8	0.006
		May	-0.0087236	-2.33	0.021
		October	-0.0090236	-2.41	0.017
		September	0.0078636	2.76	0.007
	Day>25&Day<31		No Impact		
S&P 500 Index	**Day>1&Day<4**		No Impact		
	Day>25&Day<31	**August**	0.0036443	1.65	0.1
		November	0.0045184	2.06	0.04
Nifty 500 Index	**Day>1&Day<4**	**March**	0.0076091	1.79	0.075
	Day>25&Day<31		No Impact		

**The results displayed for the significant days for each index at 1%, 5% and 10% level of significance*

Volatility

With respect to volatility, in the KSE 100 Index, during the first four days of the month, EGARCH (1,1) turned out to be significant, while during the last five days of the month, GARCH (1,1), EGARCH (1,1), and TGARCH (1,1) turned out to be significant. In FTSE 100 Index returns, during the first four days of the month, the results are insignificant for all the volatility models, while during the last five days of the month, GARCH (1,1) and EGARCH (1,1) turned out to be significant. In addition to this, in S&P 500 Index returns, during the first four days of the month, EGARCH (1,1) turned out to be significant, while during

the last five days of the month, GARCH (1,1), TGARCH (1,1), and EGARCH (1,1) turned out to be significant. Moreover, in Nifty 500 Index returns, during the first four days of the month, EGARCH (1,1) turned out to be significant, while during the last five days of the month, TGARCH (1,1) and EGARCH (1,1) turned out to be significant. Furthermore, in BVSP Index returns, during the first four days of the month, EGARCH (1,1) turned out to be significant, while during the last five days of the month, the results are significant for all the volatility models.

During COVID

In the KSE 100 Index returns, during the last five days of the month, April turned out to be significant with positive returns. In FTSE 100 Index returns, during the last 5 days of April, June, and November turned out to be significant, where April depicts negative returns, while June and November show positive returns. In addition to this, in the Nifty 500 Index returns, during the first four days of the month, April turned out to be significant with negative returns. Whereas, in the last five days of the month, January and February turned out to be significant with negative returns. Moreover, in the BVSP Index returns, the month of June turned out to be significant, with positive returns during the first four days of the month. However, in the returns of the S&P 500 Index, the results are insignificant during the first four days and the last five days of the month. The results, which are significant for the turn-of-the-month anomaly before COVID in Table 9.

Table 9: OLS Regression – During COVID - TOM Anomaly

OLS Regression - During COVID: Turn-of-the-Month-Anomaly					
Indices	**Days**	**Month**	**Coefficient**	**Statistic**	**P-value**
KSE 100 Index	**Day>1&Day<4**		No Impact		
	Day>25&Day<31	**April**	0.018925	2.01	0.052
		July	0.0198	2.11	0.042
S&P 500 Index	**Day>1&Day<4**		No Impact		
	Day>25&Day<31		No Impact		
BVSP Index	**Day>1&Day<4**	**June**	0.03155	2.03	0.065
	Day>25&Day<31		No Impact		
FTSE 100 Index	**Day>1&Day<4**	**August**	0.02375	1.92	0.079
		June	0.01825	1.8	0.096
		November	0.01945	1.92	0.078
	Day>25&Day<31	**February**	-0.023525	-1.83	0.076
Nifty 500 Index	**Day>1&Day<4**	**April**	-0.03085	-3.57	0.004
	Day>25&Day<31	**February**	-0.0271417	-2.85	0.007
		January	-0.0147167	-1.74	0.09

**The results displayed for the significant days for each index at 1%, 5% and 10% level of significance*

Volatility

With respect to volatility, in the returns KSE 100 Index, during the first four days of the month, the results are insignificant for all the volatility models, while during the last five days of the month, EGARCH (1,1) turned out to be significant. In FTSE 100 Index returns, during the first four days of the month, the results are insignificant, while during the last five days of the month, GARCH (1,1) and EGARCH (1,1) turned out to be significant. In addition to this, in S&P 500 Index returns, during the first four days of the

month and the last five days of the month, the results are insignificant for all the volatility models. Moreover, in Nifty 500 Index returns, during the first four days of the month, the results are insignificant for all the volatility models, while during the last five days of the month, EGARCH (1,1) turned out to be significant. Furthermore, in BVSP Index returns, during the first four days of the month, EGARCH (1,1) turned out to be significant, while during the last five days of the month, TGARCH (1,1) and EGARCH (1,1) turned out to be significant.

CONCLUSION

The findings of this research conclude that in the TOM anomaly, the returns are recorded higher in the last four days of the month in the Pakistan stock market; however, in the BVSP Index and S&P 500 Index returns, the results were insignificant, but in the FTSE 100 and Nifty 500, the results were significant. This means there exists a calendar anomaly under the adaptive market hypothesis which are being analyzed for the period of 10 years with the help of four models of OLS regression, GARCH, TGARCH, and EGARCH. After analyzing the pre-COVID time period and during COVID time period, we can see that the stock markets turned out to be adaptive in nature; however, the S&P 500 Index is not adaptive in nature. As comprehended by Lo (2004), investor sentiments play a vital role in driving market efficiency. He argued that the EMH lacks the behavioral aspect of the investor. A market is driven by investors or the markets drive the investors; in both concepts of the studies, behavioral finance plays a vital role in explaining the prevailing market conditions. The author states that markets are neither efficient nor inefficient at a particular instance; however, the market adapts to the persisting trends.

In correspondence to this phenomenon, we can see that the Pakistan Stock market is adaptive in nature. The authors, Shahid, Latif, Chaudhary, and Kouser (2020)Validated the corresponding results in 107 companies in Pakistan. In addition to this, the stock markets of the USA, UK, Brazil, and India also turned out to be adaptive in nature. The author, Okorie and Lin (2021), further signifies this impact in the USA, UK, Brazil, and Russia. The results of the adaptive market hypothesis are also signified by, Sinha, Jalan, and Singh (2020), where they studied a sudden decrease in the stock market returns as well. The investors can get information about calendar anomalies which may affect investment decisions due to the presence of calendar anomalies. Thus, the investors can get the proper information to make proper returns on their investments. Governments can make stock markets more efficient with the analysis of how calendar anomalies may affect the markets. The major limitation of this research is that to validate the adaptive market hypothesis, most of the authors have employed rolling window regression. However, the current study is derived from the existence of calendar anomalies and volatility in returns. The future studies can incorporate the COVID impact should be separately studied for the Indian stock market, since the COVID pandemic is brutally impacting the economy of India at its peak.

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