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MEASURING MARKET EFFICIENCY IN CAPITAL MARKET OF PAKISTAN

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Abstract
This research investigates day-of-the-week (DOW) and month-of-the-year (MOY) anomalies in Pakistan during the Gregorian and Islamic calendars. Applying GARCH models on KSE100 index data from November 1991 to May 2021, the paper investigates calendar anomalies over periods of overall, non-crises, crises, before and after capital market reform. Results identify a DOW anomaly in which strongly positive Wednesday returns and strongly negative Monday returns exist across all periods. MOY anomalies also present, as January and Ramzan effects confirmed international equity markets. Results were confirmed in robustness checks with dollar-adjusted returns and the KSE All Shares Index. It can be concluded from the study that Pakistani equity market returns are unpredictable, signifying inefficient markets. These findings will help investors to improve the accuracy of decisions based on using calendar-based anomalies.

INTRODUCTION

Broadly, the stock market alluded as a security exchange and captured the great attention of people from different walks of life such as investors, firms, bankers, government and other stakeholders (Roche et al., 2020). Fama(1970) brought out the efficient market theory that embraced three sorts of the market: weak, semi-strong and strong (Malini, 2019) and each form of the market has its features. Khanh & Dat (2020) has explained these features as a weak form of market ascertain that future returns are not associated with current market returns. Semi-strong market presumes that prevailing market prices are the reflection of past returns and the strong form of market posits that all public and private information are readily available to stakeholders and none of them can make access gain to stocks.

Market anomalies are an irregular fashion of stock returns. A plethora of researchers have studied market anomalies for several decades. Rana Shahid Imdad Akash et al.(2020) studied abnormal and elusive behavior of monthly stock return in the KSE100 index and found greater returns harvest in September. The January effect was found by Rashid & Kausar (2019) in the Pakistan Stock Exchange when they segregated a complete sample in low, medium and high beta firms to examine monthly abnormal stock returns with distinguishing levels of risk. Presence of weekly and monthly stock return variance in the Pakistan stock exchange. After

analyzing 143 non-financial firms enlisted with the Pakistan Stock exchange from 2012-2018 (Bakhsh & Akhtar, 2020) narrated that accrual and cash-flow anomalies associated with future gain in the ambience of EMH and positively & significantly exist in the Pakistan stock exchange.

Jebran et al.(2017) studied different anomalies such as the day-of-the-week effect, turn-of-the-month effect, time-of-the-month effect and half-of-the-month effect from September 2008 to June 2015 in the Islamic equity index. They did not find the presence of Ramzan and January effect. On the flipside, the day of the week, time of the month, half of the month and turn of the month effect are significantly present in the Karachi Meezan index and KSE 100 index. On the other hand, it was postulated by Nasir (2017) that Muslims spend a lot of their time on religious activities during Ramzan, and this holy month can affect the abnormal return in the Karachi stock exchange 100-index. He collected data for ten years from January 2001 to December 2010. He revealed that Ramzan had a minor and significant effect on stock return and the stock market's volatility was minimal during Ramzan. Working of Ali et al.(2017) is worthful as they studied the effect of Muslim holy days on stock market returns. Gathering data from Pakistan, Bahrain, Turkey and Saudi Arabia from 2001 to 2014, outcomes revealed that only Muslim's event "Eid-ul-fitr" and Friday have significant stock returns. Some other anomalies, such as the January effect, weekend effect, reversal, ex-dividend effect, momentum, and ex-rights day effect anomalies studied by Gao (2019) and embraced data from 1912 to 1978 from Sweden's Stock market.

Aslam et al. (2022) examined the calendar anomalies of frontier market of eight Islamic countries. Both the Islamic and calendar period data of daily and monthly closing prices was taken and controlled the risk through MSCI index. The study revealed that, limited evidence is to suggest that extra ordinary gain achieved in Islamic months except the month of Rajab shows small decrease in Kuwait while in Pakistan and Bangladesh, Monday return were slightly decline and stock returns of Morocco stock market seem increasing in January.

Stosic et al. (2022) pens that calendar anomalies can turn stock market into inefficient market. By using the multi-fractal de-trended fluctuation analysis technique to test the temporal dynamics of stock return in 19 stock markets daily data. The investigation consequent that Monday return are persistent especially in financial crises period. On the other hand, Elangovan et al. (2022) studies NIFTY 500 and S&P BSE 500 index from 2011 to March 2021. The study conclude that Stock returns of March are negatively significant.

Zhang (2023) investigated the calendar anomalies in Shangai composite index and the data was taken from December 1999 to May, 2022. The examination of day of the week effect anomaly was intended to test in this study. The examination conclude that the stock returns of Tuesday were negatively insignificant and the stock market of chine proved inefficient. However Aggarwal & Jha (2023) investigated six Asian stock market by taking month stock return data from 1991 to 20202. Unique results of this study highlighted that, except japan, all other market proved the presence of MOY effect. In Malaysia, Indonesia and South Korea, the months of February, April and July were found positively significant.

Earlier studies, only employed consecutive time periods data to investigate the presence of calendar effect anomaly instead by focusing any specific economic regime. This study examined several clusters such as crises and non-crises time periods, and before and after capital market reform time periods using Gregorian and Hijri calendar data. In the crises period, only specific events included that had significantly dent the market returns such as 1997-98 Asian Currency crisis, Dot-com crisis, 9/11 attacks, 2005 earthquake, 2008-09 Great recession in world economy, 2016-17 Panama Papers Leaks and 2019-20 Covid-19 periods. This study employed KSE100 index daily market returns data from 1991 to 2021 to examine the market efficiency. Basic diagnostic measures, GARCH estimates and KSE-All Shares Index & Dollar adjusted returns were used to estimate the reliability of data, conditional volatility of different returns series and robustness of main findings respectively.

This study unfolds several contributions as (1) the calendar effect anomaly is tested in the context of different market paradigms such as crisis & non-crisis time periods and before & after market reforms time periods to construct market insights to

tailor their investment strategies according to certain crises, (2) dollar-adjusted market returns persuade foreign investors for allocation of their funds in international assets, and (3) investment community in Muslim world can improve their investment decision accuracy in the light of Hijri calendar related findings and increase the investor base as well. From a theoretical point of view, this study contributes in the EMH literature and open door for researchers to broaden their areas of future research.

2 LITERATURE REVIEW

2.1 Day of the week Effect

Day of the week is the characteristic of stock market returns to exhibit a structured trend on a particular day that is among the common anomalies prominent in emerging and developing stock markets. Gbeda & Peprah (2018) compared Nairobi and Ghana stock exchanges to find the day of the week effect by using daily closing index prices from 2005 to 2014. The study provided insight as both markets are inefficient and the day of the week effect is observed in the Nairobi stock exchange only and does not prevail in the Ghana stock exchange. In India, Khanh & Dat (2020) intended to examine daily and monthly abnormal market return in the Indian stock exchange by utilizing data from January 1995 to December 2015. This study uncovered that informational inefficiency prevails in the Indian stock exchange and there exist monthly and daily abnormal stock returns, specifically in December and daily return is significant on Wednesday. Another study highlighted interesting results when studies days of the week affect anomaly at the international level. Statistics provided insight as abnormal positive returns gained on Monday and anomalous negative returns on Friday(Chiah & Zhong, 2019). Further, this study pointed out that, on Monday, there is a stronger propensity for speculative stock and Friday for speculative stock that causing day of the week effect throughout the world. Investors' primary concern is the presence of uncertainty and anomalies changing with time. Adaramola & Adekanmbi (2020) considered the Nigerian stock exchange with time spam of the year 2000-2017 to find out the abnormal return of the inevitable day of the week with the time change. They bifurcated the whole data into two spams, i.e. the Up-period and Down-period, concerning the positive and negative return. Inference explained Monday, Tuesday and Friday are influenced by market conditions in Bullish condition. Monday & Thursday and in Bearish conditions, Tuesday & Friday effects are found, so it is suggested that investors value the time variation; otherwise will suffer the loss.

Yardımcı and Erdem (2020) determined the day of the week effect in nineteen Muslims populated countries. They found abnormal behaviour in most of the county's stock exchanges except a few, which were astonishingly different. These distinctions exist due to different geographical areas, Market capitalization, ethnicity and trading days. After 1950, the foreign researcher found Monday a significant return compared to other days. To explore this phenomenon, Khan et al.(2021) gathered data from different countries from July 2013 to March 2019. Facts elaborated that day of the week influenced the stuck return in Taiwan, China, Indonesia, South Korea, and Pakistan found an insignificant effect in Malaysia. Most of the markets observed fewer trading volumes differing on different days.

H1: Day of the week effect anomaly exist in PSX.

2.2 Gregorian Month of the year effect

The efficient market hypothesis (EMH) performs a significant role in Stock markets. Political reports, public surveys, economic reports and social media, recent information are being included and stock prices are settling down according to new statistics/particulars(Khanh & Dat, 2020). Stock prices exhibit complete information about EMH. Finding stock market anomalies has remained a hot issue in research and has been extensively debated for decades (Malini, 2019). Stock market anomalies are random returns and in the presence of these anomalies, investors can out-perform in stock markets that are antagonistic to the Efficient market hypothesis (Quayyoum et al., 2017). Stock market anomalies are random returns and in the presence of these anomalies, investors can out-perform in stock markets that are antagonistic to the Efficient market hypothesis (Irshad & Taib, 2017). Many studies considered efficient market hypothesis and stock market anomalies from different perspectives.

Enow (2023) investigated TOM effect in six capital markets like Nasdaq, JSE, DAX, BIST100, CAC40

and Nikkei225 index. The time series data of two years from 2017 to 2019and Covid-19 data from the beginning of January 2020 to end of December 2021. The data then segregated to last three ending days of the previous month and starting four days of next month. The statistics concluded that no evidence found for TOM effect and author realized that the TOM cannot be an appropriate strategy to gain extraordinary returns from above mentioned markets.

Stefanescu & Dumitriu (2023) conducted study to examine the transformation of January effect using closing prices in four indexes of United States from 1992 to 2023. The data was divided into two sample groups. First sample group from January 1992 to December 2010 and second sample from January 2011 to January 2023. In the first sample group, the study has not found evidence of seasonality while in second sample group proved the seasonality effect of second half of December found significant. The study also revealed that all indexes proved high abnormal returns from mid of December to mid of February. For the rest of the moths, all indexes evident the significantly high returns. Aleknevičienė, Klasauskaitė, and Aleknevičiūtė (2022) examined the three most famous calendar anomalies to test "Adaptive market hypothesis" in Baltic capital markets. The time frame used for this investigation was from year 2000 to 2017 and applies three statistical techniques such as 1) GARCH (1, 1) model, 2) Kruskal-wallis, and 3) rolling window for the examination of DOW, MOY and TOM anomaly. The outcomes proved the existence of DOW (Friday), MOY (January & July) and TOM in all three markets. This examination also concludes that, these three proven anomalies has shown more time varying trend and disappeared in Global Financial Crises from 2007 to 2009.

Akash et al.(2020) worked on the Pakistan stock exchange to find the abnormal behaviour of stocks and volatility. After analyzing data from 2006 to 2018, revealed that stock returns were positive and significant in the month of September. In an emerging country like Pakistan Afolabi & Bakar (2016) conducted a study from two perspectives. Firm selections were based on market capitalization; the other is free-float stocks and found that free-float random walk exists in the KSE 100 index. To find the monthly calendar anomaly in Pakistan, Rashid & Kausar (2019) segregated firms according to low, medium and high beta to analyze the strange monthly effect on returns of the firm with distinguished risk level returns. This study concluded the presence of the December effect in Pakistan. In January, a bullish trend was observed and it is suggested that investors can invest in firms with low and high beta Quayyoum et al.(2017) studied the movement of the Pakistan stock exchange. They have taken data from the KSE100 index from 1991 to 2014 to find the existence of weekend and intra-month effects on stock returns and concluded the presence of both anomalies. In light of the efficient market hypothesis, the Pakistan stock exchange showed cash flows and accrual anomalies when Bakhsh & Akhtar (2020) examined seven years of data from 2012-2018 of 143 non-financial firms.

H2: Gregorian month of the year effect anomaly exists in PSX.

2.3 Hijri month of the year effect

Religion is a significant drive in the ways of life of people. It alters their priorities, decision-making, and frame of mind. Attitude and sentiments play a crucial part in shareholder behaviour. Muslims believe the spiritual month of Ramadan will give something more valuable to them. They can compensate twice through fasting and positive acts, which they typically can achieve. Muhammad Kashif and Khurrum Faisal Jamal (2019) performed a unique study to investigate the abnormal behaviour of Ramazan and its effect on stock return in the Shariah index of India. The month was divided into three parts: day 1-10 God's mercy, day 11-20 God Forgiveness and day 21-30 as Emancipation from hellfire. This study output that the holy month of Ramazan has a significant effect on stock market returns, but the last ten days substantially influenced stock returns. Ozkan (2019) studied BIPMM and the Foreign exchange market gathered that from Muharram-1424(March 2003) to ZilHajj-1437(September 2016). After Empirical investigation, he harvested that the Gold market was influenced by the Sacred month of Ramazan and Euro markets were affected after the ending of Ramazan, while there was no influence of Hijri months found in the Dollar market. Salman Irag Al-

Najaf et al. (2018) examined the effect of holy months on stock return in Iraqi and Iranian Stock exchanges with a data frame of 2012-2016. Facts show no meaningful returns concerning sacred and non-sacred months in the lunar calendar, but the holy months of Ziqaad and Rajab highlight significant distinctions from Gregorian months.

A bundle of researchers in Islamic stock markets studied efficient market hypothesis and stock market anomalies and found the Ramzan effect, Zill hajj effect and Islamic events effect. Ashraf & Ramay(2016) worked in the Islamic capital market and found a lunar calendar anomaly. This study has confirmed the abnormality of the Ramzan & Zill Hajj effect and observed small asset growth in these months because Muslims spend much of their time in religious activities Iqbal & Iqbal(2018) intended to determine the influence of Islamic events on stock returns on the Pakistan stock exchange. This study revealed that starting Ramzan, Shiwal and Rabi-ul-Awal is significantly positive, while 10 Zill Hajj and Muharram negatively influence stock returns. Hassan & Kayser(2019) attempted a study to find out the inter-relationship between Ramzan, Muslims' sacred month and trade volume, market return and stock volatility in the Dhaka Stock exchange (DSE). The time frame ranges from January 2002 to August 2018 study concluded that no significant association was found between Ramzan with stock volatility and stock market return, reasoned that banking and trading hours decreased during the holy month of Ramzan. Investors' intentions divert towards religious affairs. Further, it is added that the forecasted trend of market return is the transgression of the efficient market hypothesis.

Stock market returns and volatilities were also examined by Munusamy (2018) in India to find the effect of Ramzan and Non-Ramzan days and different months of the Hijri calendar. Results revealed more returns in the month of Ramzan than non-Ramzan. On Wednesday, Shariah index indices exhibit more mounting returns than on other weekdays. A recent inquiry by Tantisantiwong et al.(2018) has documented that at the moment of holy festivals in Muslim states, such as Ramadan, there is a "festival" influences the market returns. In the Gregorian calendar, December is likewise an occasion of festivals and celebrations, which may be related to trends in the behaviour of share prices. When both Hijri and Gregorian months correlate for religious celebrations, it affects the share prices of companies listed in Muslim countries.

H3: Hijri month of the year effect anomaly exists in PSX.

3 RESEARCH DESIGN

3.1 Data and Sample Description

The primary objective of this study is to investigate measuring market efficiency using the KSE100 index daily and monthly market returns data. The sample period starts from the first trading day of the KSE100 index listed in PSX from November 1991 to May 2021. The data in the Hijri calendar period ranges from Jamadi_us_Sani, 1412, to Shawwal, 1442. The KSE100 index data is converted in harmony with the Hijri calendar, which begins from the month of Muharram and the number of days in the Hijri calendar year is approximately 11 days shorter than the Gregorian calendar year. In order to investigate the market efficiency, the sample period is divided into two clusters, namely; (a) crisis periods data (the list of crisis periods is presented in Table 1) and (b) non-crisis periods data during the sample period. In this study, we only considered those financial crises that significantly affect capital market returns. To investigate the impact of financial reforms on market efficiency, the sample period is divided into two sub-sample periods, namely (a) before the financial reforms period from November 1991 to December 2000 and (b) after the financial reforms period of January 2001 to June 2021. From 1997-98, the Asian Development Bank aids $50 million in Pakistan for capital market liberalization and financial reforms. In 2000, the Securities and Exchange Commission of Pakistan (SECP) was established to regulate. National Clearing Company of Pakistan Limited (NCCPL) surveillance of capital market operations was established to remove manual clearing house operations and shifted to electronic cash settlement among market participants. Central Depository Company (CDC) was established to remove the physical settlement of shares issued by corporations and shifted to electronic shares settlement among market participants. The KSE 100 index data was collected from the official DataStream of PSX.

TABLE 1 The list of financial crisis periods from 1991 to 2021

Sr#	Crisis Period	Crisis Description
1	December 1993 – March 1995	Due to political instability during 1993-95, the Pakistan economy was in poor shape due to poor macroeconomic indicators and Pakistan decide to went to IMF bailout package
2	June 1997 – June 1999	Pakistan economy was in dual troubles due to Asian currency crisis and US sanctions due to Pakistan's nuclear tests
3	January 2000 – November 2000	International Dot-com market collapse which was generated by internet and technology related stocks
4	October 2001 – May 2002	9/11 terrorist attacks on US world trade Centre by Al-Qaeda and US attacks on Afghanistan,
5	February 2005 – May 2006	Heavy economic losses due to highest magnitude earthquake, power crisis and political restoration movements in Pakistan
6	May 2008 – February 2009	Great Recession in economy due to International subprime mortgage crisis of 2008
7	November 2016 – May 2018	Panama Papers Leaks and poor fiscal indicators
8	November 2019 – June 2020	The economic shut down due to Covid-19 pandemic

Source: Crises details compiled from various web sources

This study uses time-series data for various returns series to measure the market efficiency in Gregorian and Hijri periods. The Augmented Dickey-Fuller (ADF) unit root test is employed to examine each series stationarity. The findings reported in Table 2 show that, based on the Schwarz information criteria (SIC), the null hypotheses of unit root tests are rejected in all the series and indices are stationary at the level. We can proceed to model the conditional volatility with ARCH and GARCH models.

TABLE 2 ADF Unit Root Test Results

Series	Daily Market Returns		GMM Returns		HMM Returns	
	ADF Stat	Obs.	ADF Stat	Obs.	ADF Stat	Obs.
Overall Period	-72.6572***	6,929	-18.0984***	355	-18.7463***	365
Crisis Period	-29.2751***	2,238	-11.4379***	113	-13.7018***	120
Non-crisis Period	-59.0161***	4,691	-16.6576***	267	-15.6341***	245
Before Reforms	-26.4219***	1,892	-10.1849***	110	-10.9205***	113
After Reforms	-62.5341***	5,037	-14.5579***	245	-14.6937***	252

*** ADF Statistics are significant at 1% level, GMM & HMM represent Gregorian & Hijri Monthly Market Returns.

The main objective of this study is to investigate the presence of day of the week effect and month of the year anomalies in PSX. For this purpose, the daily market returns (DMR) are estimated by taking the first difference of the natural logarithm of daily KSE100 index values.

$$DMR_t = ln\left[\frac{D_t}{D_{t-1}}\right] \times 100 \qquad (1)$$

Where, in equation (1), DMR_t indicates the daily market returns on the tth day in percentage, D_t is the closing value of the benchmark index on the tth day and D_{t-1} represents the closing value of the benchmark index on the t-1th day.

The Gregorian monthly market returns (GMMR) and Hijri monthly market returns (HMMR) are estimated through the first difference of the natural logarithm of benchmark KSE100 index values.

$$GMMR_t = ln\left[\frac{M_t}{M_{t-1}}\right] \times 100 \quad (2)$$

$$HMMR_t = ln\left[\frac{M_t}{M_{t-1}}\right] \times 100 \quad (3)$$

Where $GMMR_t$ and $HMMR_t$ represents the Gregorian and Hijri monthly market returns on the tth month in percentage, M_t is the closing index on the tth month, and M_{t-1} is the closing index value on the previous month.

The descriptive statistics of daily market returns are reported in Table 3. The findings show that the Wednesday daily market returns are higher than other trading days in the different sample periods. At the same time, Monday produces the worst negative returns in crisis periods and non-crises periods as well. The variation in Monday daily returns is also higher than on other trading days. The findings indicate that investors can avoid financial losses if they stay away on weekends and earn abnormal returns if they put long positions on Tuesday closing prices. Table 3: Descriptive Statistics of Daily Market Returns in different Regimes.

Table 3 Descriptive Statistics of Daily Market Returns in Different Time Periods

	Mean	Median	SD	Skewness	Kurtosis	Q1	Q3	N
Panel A: Daily Market Returns for Overall Period								
Monday	-0.1342	-0.0181	1.7946	-0.3885	4.1843	-0.9448	0.7454	1455
Tuesday	0.1169	0.0966	1.5129	0.8933	11.4961	-0.5363	0.8135	1442
Wednesday	0.1711	0.1688	1.4258	0.2167	8.0793	-0.4806	0.8864	1457
Thursday	0.0836	0.0739	1.3015	-0.1679	3.4643	-0.5469	0.7058	1413
Friday	0.1067	0.1063	1.3464	-0.1357	6.2156	-0.4506	0.6917	1162
Panel B: Daily Market Returns During Crises Periods								
Monday	-0.2634	-0.0809	2.2607	-0.6577	3.5047	-1.2880	0.9090	461
Tuesday	0.0623	0.1043	1.9078	0.1584	4.7103	-0.7233	1.0006	464
Wednesday	0.1155	0.1053	1.8826	0.3892	7.0209	-0.6186	0.9988	468
Thursday	-0.0107	0.0000	1.5774	-0.1371	2.1956	-0.7631	0.7862	462
Friday	0.0598	0.0000	1.8302	-0.0825	4.0184	-0.6489	0.9778	383
Panel C: Daily Market Returns During Non-Crises Periods								
Monday	-0.0384	0.0073	1.7641	0.2667	2.2522	-0.9463	0.8345	994
Tuesday	0.1498	0.0966	1.2841	2.1133	18.9064	-0.5345	0.8112	978
Wednesday	0.2004	0.2118	1.2832	-0.0812	1.5202	-0.4279	0.9460	989
Thursday	0.1351	0.1083	1.2680	-0.1113	3.7848	-0.4967	0.7203	951
Friday	0.1724	0.1791	1.0782	-0.0775	3.2552	-0.3041	0.6570	779
Panel D: Daily Market Returns Before Capital Market Reforms Period								
Monday	-0.1605	-0.1463	2.3027	-0.4389	3.3530	-1.3317	1.1021	439
Tuesday	0.1517	0.1017	1.9222	1.4949	11.8536	-0.7633	0.9063	436
Wednesday	0.1868	-0.4258	1.7775	0.8652	8.7206	-0.7242	1.0051	442
Thursday	0.0713	0.0571	1.5243	-0.1957	3.6731	-0.6407	0.7819	401
Friday	-0.1761	-0.2270	2.0859	-0.2048	2.9114	-1.0999	0.9800	174
Panel E: Daily Market Returns After Capital Market Reforms Period								
Monday	-0.1228	0.0006	1.5247	-0.2286	2.5554	-0.8055	0.6429	1016
Tuesday	0.1017	0.0960	1.2968	-0.1090	4.5014	-0.4787	0.7763	1006
Wednesday	0.1642	0.1676	1.2430	-0.6451	3.3396	-0.4161	0.8344	1015
Thursday	0.0885	0.0883	1.2027	-0.1329	2.6276	-0.4999	0.6965	1012
Friday	0.1565	0.1455	1.1633	0.2430	5.5225	-0.3527	0.6824	988

Source: Author's Computations

The descriptive statistics of GMM and HMM returns are reported in Table A1 and A2 (see Annexures). The findings of Table A1 show that December and January produce higher monthly market returns than

other months in the overall period, while May is the worst month in crisis periods and December is a favourite month in non-crises periods. In Table A2, Ramzan produces higher monthly market returns in Islamic calendar data. At the same time, Jamad_us_Sani is the worst month in crisis periods and Ramzan produces more prudent returns in non-crises periods.

3.2 The Day of the Week Effect

Extant literature (Bayer and Kan, 2002; Kiymaz and Berument, 2003; Munusamy, 2018, 2019; Rahman, 2009) employed the ordinary least square models to examine the calendar effect anomalies. There are several limitations of the OLS methodology. First, OLS assumes that residual errors must be serially uncorrelated otherwise causing unreliable inferences. Second, the variance of residual errors must be constant over time. Last, the residual errors must be normally distributed and homoscedastic. In this study, we employ the GARCH (1, 1) model to control the issues of autocorrelation and heteroscedasticity which is comparable with (Rasheed, Sohail and Nafees, 2019; Akif et al., 2017). Modeling the volatility, the GARCH methodology improves the efficiency of parameter estimation, particularly when volatility clustering is present in the data. GARCH is a natural generalized form of ARCH which allows the conditional variance to change over time as a function of past residual errors leaving the unconditional variance constant. In equation 4, the lagged value of DMR_t is included to control the autocorrelation problem which is one of the deterministic variables. The intercept is also omitted to avoid the dummy variable trap of perfect multicollinearity (Brooks, 2008). Now daily returns have the following stochastic process as:

$$\begin{aligned} DMR_t = {} & \beta_1 Monday_t + \beta_2 Tuesday_t \\ & + \beta_3 Wednessday_t \\ & + \beta_4 Thursday_t \\ & + \beta_5 Friday_t \\ & + \sum_{I=1}^{n} \beta_i DMR_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

Where

$$\varepsilon_t \mid \psi_{t-1} \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (5)$$

Where DMR_t represents the daily market returns of the benchmark index on the tth trading day in percentage, Monday to Friday are the dummy variables used in the model, if the trading day is Monday, then its value equals 1 and 0 otherwise, if the trading day is Tuesday then its value equals 1 and 0 otherwise and so on for the remaining weekdays. β_1 to β_5 are the slope coefficients for all dummy variables used in equation (4). ε_t is the residual error term which is assumed to be normally distributed with zero mean and conditional variance σ_t^2. $\sum_{I=1}^{n} DMR_{t-1}$ is the summation of lag values of daily market returns to remove trend in daily returns data. Equation (5) is the variance equation that captures the clustering and time-varying volatility in the daily market returns. In equation (5), ε_{t-1}^2 is the ARCH term and σ_{t-1}^2 is the GARCH term, and $\alpha_0, \alpha_1, and\ \beta_1$ are the coefficients to be estimated in this method.

3.3 The Month of the Year Effect

To investigate the presence of Gregorian and Hijri month of the year effect anomaly in data, we employ the following GARCH (1,1) model which is comparable with (Rasheed, Sohail and Nafees, 2019; Munusamy (2018); Tantisantiwong et al., 2017; Oncu et al., 2017). Now monthly returns have the following stochastic process as:

$$\begin{aligned} GMMR_t = {} & \beta_1 January_t + \beta_2 February_t \\ & + \beta_3 March_t + \beta_4 April_t \\ & + \beta_5 May_t + \beta_6 June_t \\ & + \beta_7 July_t + \beta_8 August_t \\ & + \beta_9 Septem_t \\ & + \beta_{10} October_t \\ & + \beta_{11} November_t \\ & + \beta_{12} December_t \\ & + \sum_{I=1}^{n} \beta_i GMMR_{t-i} + \varepsilon_t \end{aligned} \quad (6)$$

$$HMMR_t = \beta_1 Muharram_t + \beta_2 Safar_t + \beta_3 Rabi\_ul\_Awal_t + \beta_4 Rabi\_us\_sani_t + \beta_5 Jamadi\_ul\_Awal_t + \beta_6 Jamadi\_us\_sani_t + \beta_7 Rajab_t + \beta_8 Shuban_t + \beta_9 Ramzan_t + \beta_{10} Shawal_t + \beta_{11} Zilqaad_t + \beta_{12} Zilhajj_t + \sum_{I=1}^{n} \beta_i HMMR_{t-i} + \varepsilon_t \quad (7)$$

Where

$$\varepsilon_t \mid \psi_{t-1} \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (8)$$

Where, in equation (6), $GMMR_t$ is the Gregorian monthly market return of the benchmark KSE100 index on the tth trading month. January to December are the dummy variables for January, February, March, April, May, June, July, August, September, October, November, and December respectively. The value of the January dummy variable is 1 if the trading month is January otherwise 0 for other months. The value of the February dummy variable is 1 if the trading month is February otherwise 0 for other months and so on for therest months of the year. β_1 to β_{12} are the slope coefficients of all dummy variables. $\beta_i \sum_{I=1}^{n} GMMR_{t-i}$ is the cumulative Gregorian monthly market return where ε_t is the error term.

In equation (7), $HMMR_t$ is Hijri monthly market return of the benchmark KSE100 index on the tth Islamic trading month. Muharrum to Zilhajj are the dummy variables for the month of Muharram, Safar, Rabi-ul Awal, Rabi_us_sani, Jamadi Awal, Jamadi-us-Sani, Rajab, Shuban, Ramzan, Shawal, Ziqaad and Zilhajj respectively. The dummy model for Hijri monthly returns is followed by (Ozkan, 2019). The value of the Muharrum dummy variable is 1 if the trading month is Muharrum otherwise 0 for other months. The value of the Safar dummy variable is 1 if the trading month is Safar otherwise 0 for other months and so on for the rest Islamic months of the year. β_1 to β_{12} are the slope coefficients of all dummy variables. $\beta_i \sum_{I=1}^{n} HMMR_{t-i}$ is the cumulative Hijri monthly market return where ε_t is the error term.

4 RESULTS AND DISCUSSION

4.1 The Day of the Week Effect Analysis

The primary objective of this study is to investigate market efficiency using the daily and monthly market returns data of the KSE100 index. The sample period starts from the first trading day of the KSE100 index listed in PSX from November 1991 to May 2021. The data in the Hijri calendar period is ranging.

Table 4 Day of the Week Effect Results in Different Time Periods

Variable	Overall	Non-Crisis	Crisis	B-Reforms	After-Reforms
MONDAY	-0.076071***	-0.05978***	-0.12225***	-0.244734***	-0.033736
	(-3.4512)	(-2.3572)	(-2.5554)	(-4.5186)	(-1.3312)
TUESDAY	0.1275***	0.130882***	0.108929***	0.097166	0.131245***
	(4.5725)	(4.0021)	(1.8187)	(1.3252)	(4.3744)
WEDNESDAY	0.1998***	0.22024***	0.128586***	0.169765***	0.203262***
	(7.1404)	(6.8755)	(2.1528)	(2.3093)	(6.6391)
THURSDAY	0.1265***	0.143536***	0.058804	0.061338	0.141588***
	(4.3068)	(4.2994)	(0.9247)	(0.7686)	(4.5009)
FRIDAY	0.1436***	0.152036***	0.131643***	-0.19245***	0.175409***
	(4.3600)	(3.9041)	(2.2460)	(-1.6705)	(5.3575)
Variance Equation					
C	0.053152***	0.049702***	0.071102***	0.101466***	0.066069***
	(18.7057)	(10.0987)	(15.1957)	(7.2778)	(14.4980)

RESID(-1)^2	0.150013*** (24.1593)	0.118134*** (16.4351)	0.210222*** (17.6765)	0.143057*** (12.2534)	0.158478*** (17.1835)
GARCH(-1)	0.832084*** (154.8219)	0.851731*** (110.2429)	0.793986*** (104.6274)	0.838088*** (87.7530)	0.803777*** (87.9790)
R-Square	0.004512	0.0056	0.0033	0.0052	0.0049
Durbin-Watson stat	1.7252	1.7015	1.7428	1.7037	1.7407
Wald Test:					
F-statistic	24.60287***	19.97705***	4.377624***	6.629576***	23.02103***
Chi-square	123.0144***	99.88526***	21.88812***	33.14788***	115.1051***
N	6929	4691	2238	1892	5037

*, ** & *** are significant at 10%, 5% & 1% level

Results for the day of the weak effect anomaly found in this paper embraced the overall period, crises and non-crises period as well as stock returns before stock market reforms and after stock market reforms. Statistics exhibit that, in the overall period, Monday returns are negative and significant at 1%, in crises and during the non-crises period, negatively significant at 5% and before reforms negatively significant at 1% in the KSE100 index. Most past studies (Lakonishok & Maberly, 1990; Ritter, 1988) elaborate that institutions make less trading on Monday which causes negative stock returns. It was also suggested that institutions often make strategies on Monday which spurs investors less to trade on Monday that cause day of the week effect. Further, it was argued that companies announced negative news after the day closing on Friday, which led to negative stock returns on Monday. A similar trend was found in South Korea, Thailand and Indonesia in the study conducted by (M. S. Iqbal et al., 2013; Khan et al., 2021). Tuesday stock returns were found positive throughout the overall period, crises & non-crises period as well as before and after stock market reforms. Tuesday returns are significant at 1% in the overall non-crises period and after stock market reforms and at 10% in crises. As mentioned above, investors often do not indulge in investing activities and make strategies, so they start investment activities on Tuesday that cause positive Tuesday stock returns.

On Wednesday, stock returns were positive and higher than other trading days in all regimes and significant at 1% overall during the crisis period and after the stock market reforms were significant at 5% in crises and before stock market reforms. Thursday returns are positively significant at 1% in overall, non-crises and after stock market reforms period. Friday returns are positive and significant at 1% overall, non-crises and after the reforms period, in the crises period at 5% and significant at 10% before the stock market reforms period. Friday is the closing day of the trading week.

4.2 Month of the Year Effect Analysis

Table 5 represents the Gregorian monthly market stock returns in overall, crises & non-crises and before and after stock market reforms periods. Results show that monthly returns of January are positive and significant at 1% in the overall period and after stock market reforms, 5% significant in the non-crises period and 10% significant in the crises period. March returns are positive and significant at 1%, while April returns are significant at 5% only in the non-crises period. Returns in May were negatively significant before stock market reforms at 5% and in the crisis period at 1%, respectively. Abnormal stock returns are also found positively significant in the month overall and non-crises at 1%, before stock market reforms at 10%, while 5% significant after stock market reforms. In the Gregorian calendar, December stock returns were also found positive and significant in the overall period and before stock market reforms at 5% while significant at 1% in the non-crises regime. Results show abnormal stock returns in different months and periods.

Table 5 Gregorian Month of the Year Effect Results in Different Time Periods

VARIABLES	Overall	Non-Crisis	Crisis	B-Reforms	After- Reforms
January	4.4666**	4.055693***	4.323976***	2.636332	4.908185***
	(3.1124)	(2.3540)	(1.6626)	(0.9860)	(2.7664)
February	1.5605	-0.374237	5.297366	4.008663	1.134883
	(1.1715)	(0.0286)	(1.3123)	(0.6580)	(0.8944)
March	0.5677	2.814646***	-1.306031	-1.960629	0.99554
	(0.4062)	(2.2423)	(-0.3942)	(-0.4510)	(0.7011)
April	3.0374	3.923126	0.71215	-0.288789	3.65143***
	(1.4823)	(2.0102)	(0.1336)	(-0.0416)	(1.7541)
May	-1.1522	1.357429	-9.544403***	-5.117139***	0.148302
	(-1.1726)	(1.1132)	(-3.5412)	(-2.0701)	(0.1500)
June	0.7332	0.967834	-2.001046	0.236541	0.710927
	(0.3588)	(0.6286)	(-0.4466)	(0.0556)	(0.3423)
July	3.3677**	4.076325***	1.606642	4.227591***	3.181641***
	(2.9070)	(3.6831)	(0.4717)	(1.7408)	(2.0865)
August	-1.8239	-1.319683	-3.717138	-3.988935	-1.531718
	(-1.1636)	(-0.5920)	(-0.7562)	(-0.6295)	(-1.0396)
September	1.3829	1.039872	4.862005	2.581112	1.44083
	(0.6989)	(0.7982)	(0.5414)	(0.4842)	(0.7600)
October	2.0333	2.60993	-1.447365	-0.771778	2.682199
	(1.2348)	(1.5217)	(-0.4747)	(-0.2377)	(1.4451)
November	1.8687	1.664115	2.890515	-1.006145	2.326067
	(1.2818)	(1.2358)	(0.8521)	(-0.3100)	(1.3933)
December	2.8592**	3.502404***	-2.307276	6.21063***	1.79405
	(2.4798)	(-0.4346)	(-0.6977)	(2.4234)	(1.4582)
Variance Equation					
C	3.370992***	2.316204***	54.04833	26.05123	4.609723***
	(2.1811)	(1.7341)	(0.9826)	(0.9337)	(1.8281)
RESID(-1)^2	0.088694***	0.095534***	0.014019	0.047307	0.126112***
	(2.8998)	(1.8670)	(0.1411)	(0.6389)	(2.0981)
GARCH(-1)	0.85902***	0.851989***	0.460977	0.671145	0.790347***
	(20.6455)	(13.3910)	(0.8731)	(2.111)	(9.0282)
R-Square	0.039537	0.0361	0.1364	0.079841	0.0417
Durbin-Watson stat	1.8579	1.9539	2.0074	1.7974	1.8440
Wald Test					
F-statistic	2.657936***	4.19102***	1.631632***	1.198395***	2.042732***
Chi-square	31.89523***	50.29224***	19.57958***	14.38074	24.51278***
N	355	267	113	110	245

*, ** & *** are significant at 10%, 5% & 1% level

Pakistan is a Muslim country, and investors' sentiments usually change regarding religious affairs. Statistical results of Hijri's monthly stock returns are exhibited in Table 6.

Table 6 Hijri Month of the Year Effect Results in Different Time Periods.

VARIABLES	Overall	Non-Crisis	Crisis	B-Reforms	After-Reforms
Muharram	2.611872***	2.342081	-1.84704	-2.217235	3.97149***
	(2.0954)	(0.5272)	(-0.6092)	(-0.9154)	(2.2094)
Safar	0.752898	1.866646	-18.31429***	-4.060451	1.507391
	(0.4707)	(0.3870)	(-8.4236)	(-1.5363)	(0.8044)
Rabi ul Awal	2.131758	6.687831***	1.735411	1.32933	2.46839
	(1.2827)	(4.6146)	(0.2286)	(0.3111)	(1.5796)
Rabi ul Sani	0.930092	1.621439	2.585229	0.107303	1.250883
	(0.5195)	(0.3361)	(0.6943)	(0.0214)	(0.7509)
Jamadi ul Awal	1.718315	1.183053	-1.402799	1.970962	1.749508
	(1.3337)	(0.5218)	(-0.2522)	(0.6445)	(1.2214)
Jamadi ul Sani	1.565506	2.545105	-3.554175	0.853804	2.07346
	(1.0909)	(0.7512)	(-0.8731)	(0.2930)	(1.4924)
Rajab	0.136756	-0.163376	5.601414***	2.478542	0.265383
	(0.1106)	(-0.0416)	(1.6876)	(0.8407)	(0.2166)
Shuban	0.367329	1.194412	-2.270182	-3.437962	2.09419
	(0.2306)	(0.2224)	(-0.4923)	(-0.6911)	(1.2481)
Ramzan	3.945532***	3.87524***	-2.492606	8.079039***	1.669239
	(3.4929)	(1.6665)	(-0.5743)	(3.0341)	(1.1277)
Shawal	-0.109958	-0.40624	2.026918	-0.705425	0.481422
	(-0.0743)	(-0.1235)	(0.3398)	(-0.2440)	(0.3033)
Zilqaad	2.133651	0.72976	5.065029	0.171866	2.174888***
	(1.6095)	(0.2001)	(1.6346)	(0.0462)	(1.7380)
Zilhajj	0.481285	1.397763	-7.953251***	2.153223	0.205295
	(0.2961)	(0.2667)	(-2.6425)	(0.3643)	(0.1227)
Variance Equation					
C	11.0386***	30.49488***	103.249***	26.2921***	6.698215***
	(2.8081)	(2.2377)	(3.2799)	(2.4851)	(2.1138)
RESID(-1)^2	0.146968***	-0.002484	0.672021***	-0.003108	0.203087***
	(2.9751)	(-0.2141)	(2.7547)	(-0.0472)	(2.8159)
GARCH(-1)	0.686507***	0.708686***	-0.050981	0.685036***	0.692819***
	(8.5845)	(0.1303)	(-0.4029)	(5.6255)	(9.1114)
R-Square	0.01642	0.0295	0.1139	0.072051	0.0160
Durbin-Watson stat	1.8809	1.9814	2.6098	2.0469	1.8371
Wald Test					
F-statistic	2.01987***	2.205547***	9.438184***	1.218643	1.381045
Chi-square	24.23844***	26.46656***	113.2582***	14.62371	16.57254
N	266	245	120	113	252

*, ** & *** are significant at 10%, 5% & 1% level

In the overall period and after stock market reforms, Muharram was found to be positively significant at 5%. In the crisis period, only the month of Safar was found to be negatively significant at 1%, while in the non-crises period, Rabi-ul-Awal was also found significant at 1%. In the crisis period, Rajab returns are significant at 10%. Ramazan is the holy month of Muslims and investors keep their self in fasting and other religious activities. Ramzan stock returns were found to be significant at 1% in the overall period and before stock market reforms, while in the non-crises period found significant at 10%. Zilqaad stock

returns are significant at 10% after stock market reforms. In the month of Zilhajj, Muslims worldwide offer pilgrim and do not indulge in investing activities. So the results of the current study revealed that Zilhajj is negatively significant at 1% in crises.

Table 7 Robustness; Daily Dollar adjusted stock returns and KSE all share index returns with KSE 100 index

Variable	KSE 100	KSE All-shares	Dollar Adjusted
MONDAY	-0.076071***	-0.0886***	-0.1585***
	(-3.4512)	(-3.3710)	(-6.0634)
TUESDAY	0.1275***	0.1151***	0.0836***
	(4.5725)	(3.8032)	(2.7497)
WEDNESDAY	0.1998***	0.1677***	0.1627***
	(7.1404)	(5.4516)	(5.3419)
THURSDAY	0.1265***	0.1049***	0.0685**
	(4.3068)	(3.3358)	(2.0275)
FRIDAY	0.1436***	0.1730***	0.0760**
	(4.3600)	(5.0712)	(2.0972)
Variance Equation			
C	0.053152***	0.0530***	0.0710***
	(18.7057)	(13.7590)	(18.4291)
RESID(-1)^2	0.150013***	0.1515***	0.1507***
	(24.1593)	(4.7309)	(24.5790)
GARCH(-1)	0.832084***	0.8055***	0.8253***
	(154.8219)	(79.2683)	(150.8715)
R-Square	0.004512	0.0327	0.0165
Durbin-Watson stat	1.7252	1.9887	2.0125

*, ** & *** are significant at 10%, 5% & 1% level

4.3 ROBUSTNESS CHECK

We have performed robustness of results through US dollar-adjusted stock returns and contrast to KSE All Shares Index returns followed by Seif et al. (2017) and Al-khazali et al.(2017) because these dollar-adjusted stock returns allow us to check anomalies from the perspectives of foreign investors. Table 3, Table A3 and Table 7 shows that Monday is more vulnerable in stock returns than other weak days. These results are also statistically significant in all category of frames. On flipside, Wednesday stock returns are highest and statistically significant than other week days. These findings are consistent with initial day of the week findings. The initial finding of Gregorian monthly returns investigates the existence of Budget and January effects in KSE100 index. Table A1 and Table A5 exhibits least returns in May as compared to January. These finding statistically significant that validate the presence of Budget and January effect. From the perspective of Hijri Monthly calendar effect, Ramzan effect was investigated. Table A2, Table A4 and Table A6 show that the stock returns are worse in the month of Rajab as compared to rest of the months and Ramzan stock returns are comparatively high. These statistics are proved significant and are harmonious with initial finding.

5 SUMMARY AND CONCLUSION

This study has examined the day-of-the-week effect, the Gregorian month-of-the-year and the Hijri month-of-the-year effect anomaly in different economic regimes. In the study, the data has been gathered from the KSE10 index from November 1991 to May 2021 and segregated into multiple periods such as overall time period, Crises periods (Government Fiscal Crisis and IMF Bailout Package, Asian Currency Crisis and Pakistan Atomic Tests crisis, Internet Crisis, Earthquake Crisis, Global Sub-Prime Mortgage Financial Crisis, Panama Leaks Crisis, Covid-19 first wave crisis) and non-crises

period as well as Stock returns before stock market reforms and after stock market reforms to find the stock market efficiency in KSE100 index. Due to the time bifurcation mentioned above, the re-examination of market efficiency is important in many ways. Secondly, the observed sample data put forward a unique investigation to test seasonal anomalies and examine hypotheses that tend to foresee trends in stock returns. The investigation has suggested anomalous behavior of stock returns in the KSE100 index during different regimes.

Research has found evidence for a negative Monday while positive Tuesday, Wednesday, Thursday and Friday effect on stock returns that delineates the existence of the day of the week effect in the KSE100 index. This study has also affirmed the evidence of negative May stock returns and significantly positive returns in January, March, April, July and December. This exceptional monthly return pattern also reveals the effect of the Gregorian month of the year. The present study has also found the anomalous behaviour of stocks return from Islamic months and statistics has proved the abnormal trend of stock returns in other Hijri months. Facts have confirmed the presence of an unusual pattern of stock returns in Muharram, Safar, Rabi-ul-Awal, Rajab, and Ramzan positively, while negative returns in the month of Zilhajj.

This study's results have contributed to the efficient market hypothesis literature and provide evidence regarding the day of the week, Gregorian month of the year and Hijri month of the year effect anomaly in KSE 100 index from November 1991-May 2021. This study has broadly provided insight into stock returns on a daily and monthly basis that would be beneficial for institutional investors, investment companies, banks, corporate sectors and financial institutions in investment decision-making. This study would also be advantageous to the academicians to understand the abnormal behavior of stock return in different economic regimes that could open new research corridors for further research.

5.1 Limitation

This study is not free from limitations. This study has only been conducted to find the anomalous behavior of stock returns in the KSE100 index. Future studies can conduct the same study in other indexes. The study is limited to Pakistan, while further research can be conducted in cross-country comparison. It could be much better if future studies include the week of the month anomaly and anomalies analyzed in the current study.

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Annexures

Table A1 Descriptive Statistics of Gregorian Monthly Market Returns in Different Time Periods

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Panel A: Monthly Market Returns for Overall Period												
Mean	3.55	1.87	0.53	2.55	-2.18	0.71	2.78	-1.83	1.75	1.86	1.43	3.56
Median	3.25	0.34	1.05	2.24	0.01	1.45	2.25	-2.56	2.24	1.59	0.75	2.50
SD	9.63	7.09	8.41	5.80	10.10	6.11	9.71	7.45	5.71	8.26	7.90	12.24
Skewness	0.41	0.57	-0.34	0.60	-1.17	-0.96	0.17	0.43	-0.20	-0.32	0.60	-0.69
Kurtosis	0.93	0.91	1.43	0.50	2.04	1.08	0.50	-0.54	0.13	3.99	1.74	3.14
N	30	30	30	30	30	29	29	29	29	29	30	30
Panel B: Monthly Market Returns During Crises Periods												
Mean	4.17	6.63	-1.34	0.81	-9.45	-2.13	1.62	-3.76	4.98	-1.51	2.82	-0.43
Median	2.20	6.51	0.26	0.22	-8.73	1.31	-1.19	-2.36	3.15	-1.00	0.52	1.49
SD	13.21	6.57	9.97	6.77	12.12	8.34	12.67	8.61	4.68	13.22	11.49	16.48
Skewness	0.71	1.25	-0.85	1.34	-0.37	-0.65	1.43	0.36	1.58	0.39	0.55	-0.67
Kurtosis	-0.29	2.75	1.31	3.25	0.37	-0.89	3.27	-1.56	3.42	2.92	0.20	2.49
N	11	12	11	10	11	9	7	7	7	8	10	10
Panel C: Monthly Market Returns During Non-Crises Periods												
Mean	2.27	-0.13	1.85	3.35	0.73	0.63	4.21	-1.40	1.51	1.88	2.78	4.68
Median	2.80	-0.42	1.28	2.99	1.25	1.93	4.60	-2.70	1.94	2.20	2.74	2.50
SD	7.45	5.55	7.78	5.01	9.66	6.37	9.80	7.35	6.22	7.63	9.76	9.51
Skewness	-0.60	0.04	0.51	0.45	-2.22	-1.03	-0.01	0.47	-0.08	-1.65	1.32	0.53
Kurtosis	0.27	-0.75	0.10	0.25	7.64	1.17	0.63	-0.43	-0.31	5.77	2.51	0.49
N	21	20	21	22	21	23	24	24	24	23	22	22
Panel D: Monthly Market Returns Before Capital Market Reforms Period												
Mean	0.89	3.18	-1.40	0.65	-4.60	-0.56	4.09	-3.90	3.30	-1.43	2.85	7.55
Median	-0.80	4.42	-2.32	-2.28	-2.01	3.74	4.65	-2.56	3.15	-0.83	-0.13	5.62
SD	13.39	6.97	7.90	6.36	14.24	8.64	14.02	5.79	6.23	10.54	14.97	14.19
Skewness	0.67	-1.16	0.73	1.73	-1.10	-1.00	0.08	-0.22	0.26	-0.99	0.81	0.26
Kurtosis	-0.03	0.38	0.51	3.17	0.86	-0.19	-0.50	-0.12	0.35	2.98	-0.33	-1.22
N	9	9	9	9	9	9	9	9	9	9	10	10
Panel E: Monthly Market Returns After Capital Market Reforms Period												
Mean	4.69	1.31	1.36	3.36	-1.15	1.29	1.57	-0.90	1.05	3.35	2.21	1.57
Median	4.65	-0.46	1.28	2.45	0.54	1.38	1.91	-2.56	1.94	2.19	1.85	2.50
SD	7.62	7.24	8.68	5.50	7.95	4.74	7.06	8.05	5.49	6.81	5.42	10.98
Skewness	0.95	1.19	-0.72	0.26	-0.53	-0.07	-0.29	0.36	-0.58	1.41	0.42	-2.11
Kurtosis	2.87	2.27	2.66	1.21	0.72	-0.50	0.49	-0.96	-0.13	3.64	0.01	7.13
N	21	21	21	21	21	20	19	20	20	20	20	20

Source: Author's Computations

Table A2 Robustness; Monthly Dollar adjusted stock returns and KSE all share index returns with KSE 100 index

Variables	KSE 100	KSEALL Shares	Dollar Adjusted	VARIABLES	Overall	KSEALL Shares	Dollar Adjusted
January	4.4666** (3.1124)	3.7397* (1.9382)	-0.0833 (-0.2499)	Muharram	2.611872*** (2.0954)	2.5791 (1.6456)	0.1605 (-0.1194)
February	1.5605 (1.1715)	-1.1222 (-0.8288)	-0.1659 (-0.4660)	Safar	0.752898 (0.4707)	1.2605 (0.7787)	-0.0322 (-0.1194)
March	0.5677 (0.4062)	0.9020 (0.6711)	0.4402** (2.1781)	Rabi ul Awal	2.131758 (1.2827)	3.1618** (2.2249)	0.2941* (-0.2272)

April	3.0374 (1.4823)	3.5740** (2.3747)	0.2460 (1.0347)	Rabi ul Sani	0.930092 (0.5195)	1.2819 (0.7277)	-0.1124* (-0.4785)
May	-1.1522 (-1.1726)	-0.7391 (-0.7450)	0.0736 (0.2825)	Jamadi ul Awal	1.718315 (1.3337)	0.9809 (0.8051)	0.0257* (-0.0070)
June	0.7332 (0.3588)	-0.0240 (0.0118)	0.2736 (0.5730)	Jamadi ul Sani	1.565506 (1.0909)	1.8931 (1.1757)	-0.1712* (-0.7579)
July	3.3677** (2.9070)	3.0181* (1.9472)	-0.1867 (-0.8247)	Rajab	0.136756 (0.1106)	0.4588 (0.3957)	-0.1837 (-0.6830)
August	-1.8239 (-1.1636)	-3.0351* (-1.8300)	-0.2444 (-0.9343)	Shuban	0.367329 (0.2306)	1.7263 (1.0327)	-0.0097* (-0.0389)
September	1.3829 (0.6989)	2.2163 (1.2035)	0.1560 (0.4076)	Ramzan	3.945532*** (3.4929)	0.6308 (0.4527)	0.8185** (-0.8814)
October	2.0333 (1.2348)	1.2323 (0.5809)	-0.1010 (-0.4058)	Shawal	-0.109958 (-0.0743)	0.2644 (0.1727)	0.5783* (-0.5529)
November	1.8687 (1.2818)	2.3230* (1.7598)	-0.2212 (-0.7532)	Zilqaad	2.133651 (1.6095)	0.7599 (0.4952)	-0.3435* (-1.2609)
December	2.8592** (2.4798)	0.9031 (0.5090)	-0.0930 (-0.3650)	Zilhajj	0.481285 (0.2961)	1.3116 (0.5855)	-0.1618* (-0.5358)
Variance							
C	3.370992*** (2.1811)	2.2955 (1.1925)	2.0049*** (6.5142)	C	11.0386*** (2.8081)	2.4539 (1.3406)	0.0828** (2.4726)
RESID(-1)^2	0.088694*** (2.8998)	0.0941* (1.8557)	0.2462*** (3.7323)	RESID(-1)^2	0.146968*** (2.9751)	0.1579* (1.7437)	0.1005*** (3.6222)
GARCH(-1)	0.85902*** (20.6455)	0.8489*** (9.8696)	-0.1060 (-0.8126)	GARCH(-1)	0.686507*** (8.5845)	0.7919*** (8.2162)	0.0309*** (28.2795)
R-Square	0.039537	0.1080	0.0182	R-Square	0.01642	0.0161	0.0589
Durbin-Watson stat	1.8579	1.9070	2.0564	Durbin-Watson stat	1.8809	1.8175	1.9592

*, ** & *** are significant at 10%, 5% & 1% level

Table A3 Robustness check: descriptive statistics for Day of the week

KSE All Shares index					
	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	-0.1875	0.0964	0.1313	0.0642	0.1517
Median	-0.0371	0.0692	0.1481	0.0654	0.1288
SD	1.2693	1.1313	1.1123	1.0290	1.0235
Skewness	-0.5682	0.0257	-0.7149	-0.1154	0.0811
Kurtosis	1.9040	5.8253	4.1537	2.9967	4.7596
Q1	-0.7218	-0.4167	-0.3416	-0.4747	-0.2914
Q2	-0.0371	0.0692	0.1481	0.0654	0.1288
SQ3	0.5125	0.6732	0.6984	0.6150	0.6243
Dollar Adjusted stocks return					
Mean	-0.1767	0.0492	0.1556	0.0664	0.0907
Median	-0.0774	0.0884	0.1633	0.0871	0.1127
SD	1.8733	1.5258	1.4675	1.3501	1.3834
Skewness	-0.4078	-0.1972	0.2032	-0.2707	-0.1618

Kurtosis	4.9150	5.7659	7.8059	3.2192	5.6975
Q1	-1.0253	-0.6002	-0.5303	-0.5568	-0.4935
Q2	-0.0774	0.0884	0.1633	0.0871	0.1127
Q3	0.7606	0.8128	0.9169	0.7265	0.7415

Source: Author's Computations

Table A: Descriptive Statistics of Hijri Monthly Market Returns in Different Time Periods

	محرم MUH	صفر SAF	ربيع الأول RUA	ربيع الثاني RUS	جمادى الأولى JUA	جمادى الثانية JUS	رجب RAJ	شعبان SHU	رمضان RAM	شوال SHA	ذو القعدة ZQD	ذو الحجة ZHJ
Panel A: Monthly Market Returns for Overall Period												
Mean	1.60	0.01	2.23	1.11	1.60	2.60	-0.07	0.13	4.29	0.39	2.00	1.02
Median	2.51	-0.35	2.75	0.23	0.68	1.27	-0.52	-0.74	2.57	-0.77	0.50	2.49
SD	11.56	9.58	6.05	5.82	7.49	13.14	10.65	6.57	8.64	7.83	8.34	7.33
Skewness	-0.18	-0.58	0.02	0.47	0.47	2.42	-0.13	0.06	0.58	0.62	1.07	-2.45
Kurtosis	3.02	1.17	-0.35	-0.03	0.53	11.08	1.74	-0.73	0.35	0.50	1.52	9.78
N	30	30	30	31	30	31	31	31	31	30	30	30
Panel B: Monthly Market Returns During Crises Periods												
Mean	0.37	-2.63	3.37	1.23	0.25	-2.27	0.85	-0.92	1.54	1.24	3.90	-0.01
Median	-1.03	-1.66	2.88	1.17	0.01	-0.67	2.36	-2.73	0.95	-0.77	2.64	2.72
SD	18.79	13.55	7.03	6.70	7.04	9.24	15.34	8.79	7.74	8.24	12.87	11.97
Skewness	0.17	-0.01	0.20	-0.07	0.06	-1.29	-0.28	0.41	0.13	1.17	0.87	-2.18
Kurtosis	0.20	-0.47	-1.45	-0.84	-0.59	3.20	0.47	-1.24	0.94	2.83	0.03	5.42
N	10	12	10	10	9	10	11	11	10	10	8	9
Panel C: Monthly Market Returns During Non-Crises Periods												
Mean	2.22	1.77	-0.14	1.32	4.89	2.03	-0.82	0.85	5.98	-0.03	1.14	1.46
Median	3.66	0.88	1.95	0.26	2.34	2.57	-1.16	1.34	3.09	-1.29	0.29	2.09
SD	5.95	5.43	19.60	5.51	11.61	6.79	7.02	4.95	9.02	7.80	6.24	4.46
Skewness	-1.34	-0.02	0.18	0.77	2.26	-0.27	-0.08	-0.19	0.57	0.41	0.40	0.06
Kurtosis	2.39	-0.28	5.79	0.59	6.75	-0.25	0.93	-0.73	-0.26	-0.14	-0.91	0.40
N	20	18	20	21	21	21	20	20	21	20	22	21
Panel D: Monthly Market Returns Before Capital Market Reforms Period												
Mean	-2.51	-4.09	1.35	0.77	1.88	5.94	0.86	-3.86	7.61	0.13	0.22	2.23
Median	-1.96	-0.48	3.14	1.32	-1.60	3.15	-3.41	-4.33	6.56	-3.12	-1.25	2.59
SD	13.55	11.64	6.88	5.92	9.93	21.00	12.73	5.84	10.69	11.31	7.91	4.96
Skewness	-0.28	-0.49	-0.31	-0.53	1.14	1.68	1.04	0.63	0.39	0.77	0.97	0.59
Kurtosis	1.33	-1.07	0.57	-1.13	0.60	4.93	0.96	0.69	-1.30	-0.25	1.21	0.54
N	9	9	9	10	9	10	10	10	10	9	9	9
Panel E: Monthly Market Returns After Capital Market Reforms Period												
Mean	3.37	1.77	2.61	1.87	1.48	0.89	-0.75	2.17	2.51	0.50	2.77	0.50
Median	4.20	-0.05	2.61	0.26	2.34	-0.08	0.97	3.19	2.00	0.03	0.96	2.43
SD	10.45	8.25	5.81	5.99	6.47	6.60	9.57	5.95	6.98	6.15	8.59	8.19
Skewness	0.19	-0.23	0.28	0.61	-0.39	0.16	-1.28	-0.17	0.21	0.42	1.14	-2.54
Kurtosis	5.75	3.13	-0.80	-0.23	-0.03	-0.16	2.72	-0.39	1.50	0.39	1.90	8.83
N	21	21	21	21	21	21	21	21	21	21	21	21

Source: Author's Computations

Table A5 Robustness check: Descriptive statistics for Gregorian month of the year effect

	KSE All Shares Index											
	January	February	March	April	May	June	July	August	September	October	November	December
Mean	3.2569	-0.1327	1.1932	3.8432	-1.0761	0.4141	2.3685	-3.0767	2.4026	1.8915	2.3518	0.3523
Median	3.3367	-1.1279	1.0545	2.6002	0.7130	0.9213	3.4544	-4.1620	2.9682	1.5880	1.8841	2.3021
SD	5.0510	5.4675	8.0107	5.3378	8.0206	3.6208	6.6936	6.7991	4.1818	3.8691	5.5280	10.0107
Skewness	-0.6643	0.1183	-0.9760	0.8889	-0.6591	-0.3909	-0.9098	0.6522	-0.4174	-0.2485	0.2994	-2.8663
Kurtosis	0.8882	-0.6768	3.0653	0.7266	0.9803	0.1458	1.1167	0.0087	0.1616	-0.6306	-0.8615	9.8911
Q1	0.4066	-3.5299	-0.5394	0.3800	-4.4752	-2.3960	0.1716	-8.9502	-0.2303	-0.9102	-2.6091	-1.1226
Q2	3.3367	-1.1279	1.0545	2.6002	0.7130	0.9213	3.4544	-4.1620	2.9682	1.5880	1.8841	2.3021
Q3	6.4524	4.9723	5.3184	5.7727	2.7469	3.3445	7.6970	1.7488	6.0509	5.4412	7.6281	6.0717
	Dollar adjusted stocks return											
Mean	0.1178	-0.0904	0.3791	0.1667	0.1989	0.3884	-0.1143	-0.0277	0.0722	-0.0793	-0.0230	0.0066
Median	0.0344	-0.1222	0.2555	-0.0570	-0.0729	0.0111	0.1071	-0.2966	0.1894	-0.0472	0.0637	0.2481
SD	1.2633	1.0909	1.8222	1.5586	2.0808	1.6803	1.5425	1.4983	0.8806	1.9543	1.3277	1.4929
Skewness	-0.0853	0.1554	0.5538	0.0875	1.1223	4.0719	-0.3201	0.2377	-1.4522	-1.6968	-0.6932	-1.8480
Kurtosis	3.4689	-0.1366	1.4959	1.6741	5.2356	19.5037	0.3217	0.3956	2.6210	6.2438	1.3065	4.7858
Q1	-0.4385	-0.7634	-0.7113	-0.5652	-0.6524	-0.4415	-0.9783	-0.9420	-0.1853	-0.6769	-0.4963	-0.3007
Q2	0.0344	-0.1222	0.2555	-0.0570	-0.0729	0.0111	0.1071	-0.2966	0.1894	-0.0472	0.0637	0.2481
Q3	0.7241	0.5117	0.9016	0.8540	1.0910	0.7522	0.7963	1.0720	0.6983	0.9407	0.6160	0.8430

Source: Author's Computations

Table A6 Robustness check: Hijri Month of the year effect

	KSE all Share index											
	Moharam	Safar	Rabi_ul_Awal	Rabi_us_sani	Jamadi_Awal	Jamadi_us_Sani	Rajab	Shuban	Ramzan	Shawal	Ziqaad	Zilhaujj
Mean	1.4515	2.5509	3.7506	2.2282	0.2492	18175.8069	-1.3787	0.6740	2.2937	-0.2454	1.1018	0.2224
Median	4.7960	0.8434	3.7822	1.3051	0.5021	17628.3850	0.3181	1.1692	2.4422	-0.6491	1.1788	2.2855
SD	8.3136	6.0580	5.3777	5.6753	6.4660	10391.3488	9.5017	4.7553	7.3892	5.2389	5.9200	8.1471
Skewness	-2.0763	1.2135	-0.1098	0.5616	-0.3593	0.1666	-1.0807	-0.3106	0.2744	-0.2368	-0.0136	-2.8607
Kurtosis	5.7107	2.0099	-1.4362	0.2253	-0.9220	-1.7715	1.3464	0.3213	0.5568	-1.0221	-1.0163	9.8650
Q1	-2.6484	-1.8511	-0.7257	-1.3563	-5.4057	8567.7250	-5.1573	-2.2099	-1.1341	-4.8520	-4.9677	-0.7274
Q2	4.7960	0.8434	3.7822	1.3051	0.5021	17628.3850	0.3181	0.3089	2.2723	-0.0328	1.1788	2.2855
Q3	6.5678	6.2712	9.6869	6.2246	5.9313	28603.6000	5.0538	3.7795	4.8846	4.0963	6.3500	4.0189
	Dollar Adjust stocks return											
Mean	0.3644	-0.1166	0.3327	0.0074	0.1835	-0.2121	-0.3228	0.0542	1.0450	0.4633	-0.2418	-0.1258

Median	0.4171	0.1102	0.0766	-0.0795	0.0856	0.1255	0.0709	0.4306	0.7755	0.4442	-0.2364	0.0210
SD	1.1693	1.4695	1.8545	1.8674	1.3546	1.5772	1.9741	1.4121	1.4970	1.4687	1.3000	1.4242
Skewness	-0.5301	-1.7048	0.9249	0.0222	0.6612	-0.9075	-1.7540	-0.9300	2.7365	0.9538	-0.5034	1.4679
Kurtosis	0.2084	5.2419	2.0098	0.4272	5.8755	1.9438	4.3682	1.3789	10.9009	1.9679	1.4014	5.5336
Q1	-0.4315	-0.7132	-0.6420	-0.8445	-0.3618	-0.9541	-0.6008	-0.6907	0.1056	-0.5947	-0.8897	-0.8816
Q2	0.4171	0.1102	0.0766	-0.0795	0.0856	0.1255	0.0709	0.4306	0.7755	0.4442	-0.2364	0.0210

Source: Author's Computations