Calendar Effects in Pakistani Stock Market

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ABSTRACT

The paper investigates calendar anomalies in the Pakistani stock market by taking a data of stock returns of fifteen years from November 1991 to October 2006. The existence of calendar anomalies could endanger the assumption of Efficient Market Hypothesis. Using one Factor ANOVA the main hypotheses about equality in returns on daily, weekly and monthly basis are tested using F-test and are found to be insignificant, Autoregressive Integrated Moving Averages (ARIMA) and Ordinary Least Squares (OLS) are also extended as an alternate procedure to look for any above average returns reaped by market players. An AR(1) model is fitted on the data along with a simple linear regression model to test the slopes. Before using an estimated equation for our stated hypotheses an examination of residuals is made for evidence of serial correlation using the Durbin-Watson statistic. Anderson-Darling test of normality is applied as a prerequisite before computing interval estimates and using the one factor ANOVA. The study concludes that there are no weekly effects or monthly effects in stock returns in Pakistani equity market however the market is inefficient in the short run and there is existence of daily effects where the fourth and fifty days of a week show abnormal returns using autoregressive modeling.

1. INTRODUCTION

Calendar effects have remained as an area of growing interest for researchers in the last three decades as the presence of the phenomena has been evidenced even in the most developed capital markets of the world. Calendar effects are the stock price anomalies that are attributed to calendar. Day-of-the- week, the end of the month, the month of the year and holidays' effects are the most prominent of these stock price anomalies.

Fama (1965; 1970) introduced the random walk theory which is the basis of market efficiency i.e. Efficient Market Hypothesis (EMH). According to this theory stock prices can not be precisely predicted. It is assumed that the market participants are rational and stock prices are determined by demand and supply. If stock price is to be predicted for the next day, the best prediction will be the market price prevailing today adjusted with a drift term. In other words, there can not be any trends, either seasonal or calendar, in stock prices. If there are any seasonal or calendar effects present in the market that will allow market players to make abnormal profits. This negates the weak form of market efficiency that states that stock prices are independent of past information.

The EMH requires that all pertinent information is available in the market to market participants enabling them to incorporate this information in quoting the price of the stock. Thus the market is said to be efficient to a particular set of information if its disclosure does not affect stock prices and does not allow an opportunity to market participants to trade on any such information to earn abnormal profits (Malkiel, B. as reported by Marquering 2002). The EMH proposes that stock returns should be constant i.e. there should be no abnormality in stock prices and hence in stock returns. However, evidence collected over time suggests that stock returns do not remain constant and the market can be out performed using seasonal or calendar dummies. This has enticed many researchers (e.g. Balaban & Bulu, 1996; Gao & Kling, 2005; Berg, 2003; Marquering, 2002;

Priestley, 1997) to explore the presence of these anomalies in stock prices. Gu and Finnerty (2002) concluded for the Dow 30 Index after analyzing 103 years daily data that

"Current period's autocorrelation is related to previous period's autocorrelation and to both the previous and the current period's volatility and rate of return, which implies that investors incorporate previous period's pattern of market behavior into their trading strategy". (p. 219).

The end of the year effect most commonly referred to as "January Effect" is the most prominent of all monthly calendar anomalies. Evidence generated from the most developed capital markets of the world depict the presence of January Effect. Glutekin and Glutekin (1983) using value weighted indices for a total of 17 countries found the presence of January effect for 13 countries. Jaffe and Westerfield (1985) found for the US market that on average returns in January are higher than other months of the year. Anderson, Gerlach and DiTraglia (2003) also confirmed the January effect and found that returns in January were higher in an experimental setting. Hansen and Lunde (2003) concluded for stock indices from Denmark, France, Germany, Hong Kong, Italy, Japan, Norway, Sweden, UK, and USA that calendar effects were significant in most series, and that it was primarily the end of the year effects that exhibited the largest anomalies. They also concluded that in recent years it seemed that the calendar effects had diminished except in small cap stock indices.

Van Der Sar (2003) using daily data on a value-weighted index of all shares in the Netherlands (1981 to 1998) found abnormally high returns in the second half of December and around the month and negative returns and higher volatility on Monday. Alagidede and Panagiotidis (2006) found an April effect for Ghana stock prices contrary to the usual January effect. Pandey (2002) confirmed the existence of seasonality in stock returns in India and the January effect and that the capital market in India was inefficient, and hence, investors can time their capital investment in Indian stock market to improve returns. However, the magnitude of the January effect depends

upon the country and the composition of the index (Hawanini and Keim as reported by Marquering, 2002). Though the end of year effect is more pronounced for small firms' stocks and consequently for equally weighted indices, it is also present in value-weighted indices (Marquering 2002).

The tax loss hypothesis is presented as the most prominent explanation for the presence of end of year effect and it is argued that small stocks being relatively more risky are used to gain tax advantage by offsetting capital losses from these small stocks against income. Window dressing by institutional investors has been labeled as another explanation for the end of year effect. Here the proposition is that institutional investors sell 'losers' to show a better picture at the end of the year. However, in January, they again buy these or similar stocks to meet their portfolio requirements. This abnormally increases the demand for such stocks in the market and thus results in greater price volatility.

Day of the week is another important calendar anomaly. It describes Monday as a bad day because on average the market is bearish on the first day of the week, while Friday as a good day because the market is bullish on the last day of the week. Hussain (1999) reported no weekday effect from a study of Pakistani equity market by considering a period from January 1, 1989 to December 30, 1993. Nishat and Mustafa (2002) found no significant day of the week effect on stock returns and on conditional variance by considering a period from December 14, 1991 to December 31, 2001 for stock returns on KSE 100 index. Empirical research (e.g. Pearce, 1995) has provided evidence in support of end of week anomaly. Jarret and Kyper (2005) using closing stock prices for 49 randomly selected firms listed in United States (i.e. NYSE and NASDAQ) confirmed daily anomalies for the capital market in United States. Galai and Kadar-Levy (2005) also evidenced the presence of a day of the week effect for the Tel-Aviv Stock Exchange. Gao and Kling (2005) found for the Chinese stock market that Fridays are more profitable than other days of the week in

the short-term. They have presented speculation by investors, whether individual or institutional, as an explanation of day of the week effect. Coutts (1997) concluded for the UK that though calendar anomalies were persistent but they were not exploitable due to the "round trip" transaction costs. (p. 1212).

In this paper our purpose is to investigate the daily, weekly and monthly calendar effects in Pakistani stock market using daily, weekly and monthly returns calculated from the data of KSE (Karachi Stock Exchange) 100 index. As an emerging market, we expect that the market to be inefficient. We are analyzing data from 1991 to 2006, this has been overall a mixed period for Pakistani equity market, where the market was subject to a number of anomalies, there have been policy implications by the successive governments, legislative changes and structural reforms. The real focus should have been on the period since 1997 to 2006, however a comparative shift could be observed by comparing the three sub-periods.

The rest of the paper is organized as follows. Part 2 describes the data and the methodology used for the study. Part 3 discusses the daily effects. We provide descriptive statistics and regression analyses to analyze daily effects. In part 4 and 5 we provide empirical findings of week of the month and month of the year effects. Part 6 provides explanation of calendar effects in the Pakistani stock market. The final section provides a concluding summary of our findings on calendar effects in the Pakistani stock market.

2. DATA & METHODOLOGY

2.1 Data

We use closing daily, weekly and monthly data of the KSE 100 index of the Karachi Stock Exchange (KSE). The KSE 100 index is a market value weighted index and accounts for approximately 85 percent of the total market capitalization. Data for period starting November

1991 to October 2006 on daily, monthly and weekly bases was obtained from Taurus Securities (Pvt.) Ltd. which is a subsidiary of National Bank of Pakistan and a leading brokerage house in the country. To reduce the effect of size of daily, weekly and monthly stock prices we calculate log returns using the following formula.

$$SR = (\ln KSE100_t - \ln KSE100_{t-1}) * 100$$

Where SR is the stock return, $KSE100_t$ is the index value on time t and $KSE100_{t-1}$ is the value of index on time t-1. For monthly returns, we use the month ending day returns and for weekly returns we use week ending day returns. Pakistani equity market has been subject to reforms and there have been rescheduling of public holidays on three occasions in our considered data series. The following table informs about the market rescheduling in terms of operational days for the respective periods.

Chronologically	***Period***	***Working Days***	***Public Holidays***
November 02, 1991 to June 06, 1992	I	Saturday, Sunday, Monday, Tuesday, Wednesday	Thursday, Friday
June 7, 1992 to February 27, 1997	II	Sunday, Monday, Tuesday, Wednesday, Thursday	Friday, Saturday
February 28, 1997 to October 31, 2006	III	Monday, Tuesday, Wednesday, Thursday, Friday	Saturday, Sunday

2.2 Hypotheses

The following hypotheses could be tested using a one-factor ANOVA.

Ho: The average stock returns are equal on all days of the week or there is no daily effect

Ho: The average stock returns are equal on all weeks of the month there is no weekly effect

Ho: The average stock returns are equal on all months of the year or there is no monthly effect

2.3 Methodology

Testing for daily effects we divide our analysis into three parts; For Period I when market remained closed on Thursdays & Fridays, For Period II when market remained closed on Fridays & Saturdays. For Period III when market remained closed on Saturdays & Sundays. An overall analysis is also carried out for five days for all the periods where data for first, second, third, fourth and fifth day are grouped in a dummy fashion, this would help looking at any abnormal stock returns on any sequential working days for the entire period.

For testing weekly effects we assume a week comprising of all seven days in the calendar for a month and avoid weeks in a month having less than seven days. This would suggest taking five days as a proxy for a week on which stocks were traded in the market and denoting a normal weekend in a month. Weeks are denoted as W_1, W_2, W_3 and W_4 and stock returns are collected on the last day of the week. Since weekly effect could be monitored irrespective of the fact what was the closing day in a week for each month therefore the analysis is extended logically to the entire period from November 2, 1991 to October 31, 2006.

Testing for the monthly effects provide a limited data for the said period for all the months of a year since the data only covers fifteen years; suggesting that the month closing stock returns should consist at the most of fifteen observations. However statistical significance could be checked using t-test for all the twelve months.

We take log returns so the resulting series of log returns contains no trend. The series is stationary having zero mean and constant variance. Therefore, we use the following Ordinary Least Squares (OLS) model for estimation.

$$SR = \alpha + \sum \beta_{ij} D + \varepsilon_{it} \qquad (1)$$

Where $SR = 100*(\ln KSE100_t - \ln KSE100_{t-1})$ and D is a dummy variable denoting month of the year/week of the month/day of the week. For monthly returns, we take June as a reference month.

If we conclude that the efficient market hypothesis is valid this would mean that calendar effects do not exist. A regression with an autoregressive process of order p assuming d = 0 and q = 0 becomes;

$$y_t = x_t \beta + u_t$$

$$u_t = p_1 u_{t-1} + p_2 u_{t-2} + p_3 u_{t-3} + \ldots\ldots + p_P u_{t-P} \quad \varepsilon_t$$

To account for serial correlation the simplest and most widely used model of serial correlation is the first-order autoregressive AR(1) model, which is used as a model for testing the significance of daily/weekly/monthly effects, the model is assumed as follows;

$$y_t = x_t \beta + u_t$$

$$u_t = p u_{t-1} + \varepsilon_t$$

The parameter p is the first-order serial correlation coefficient. Before we use an estimated equation for our stated hypotheses we examine the residuals for evidence of serial correlation using the Durbin-Watson statistic. Anderson-Darling test of normality is applied as a prerequisite before the interval estimates and the one factor ANOVA.

3. DAILY EFFECTS IN KARACHI STOCK EXCHANGE

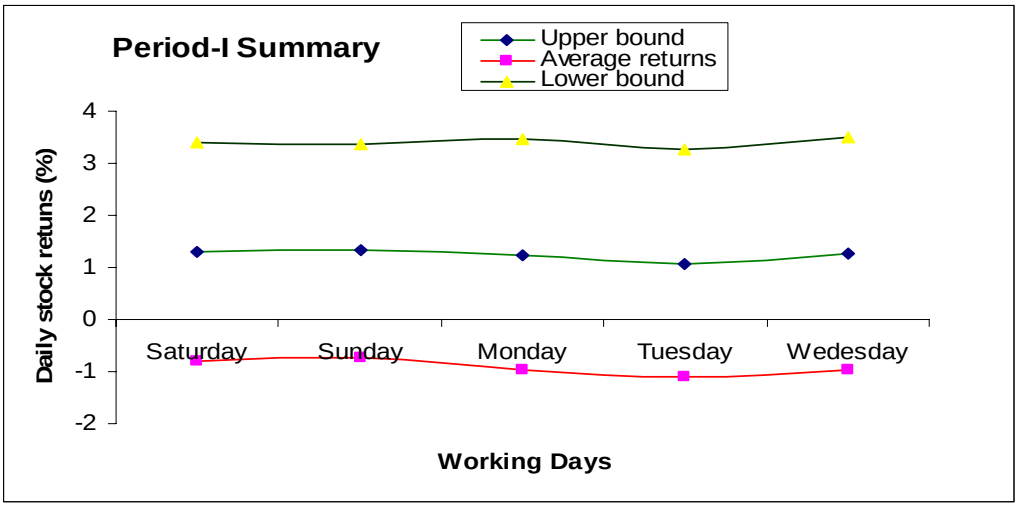
Using KSE 100 index daily data, we investigate the day of the week effect in Karachi stock exchange. We calculate daily market returns for each day of the week. Table 3.1 provides summary of mean returns on each day and the upper and lower bounds based on 95% confidence interval along with results of Anderson-Darling test. Figure 3.1 gives a graphical view of the average daily returns and upper and lower bounds as calculated in Table1.

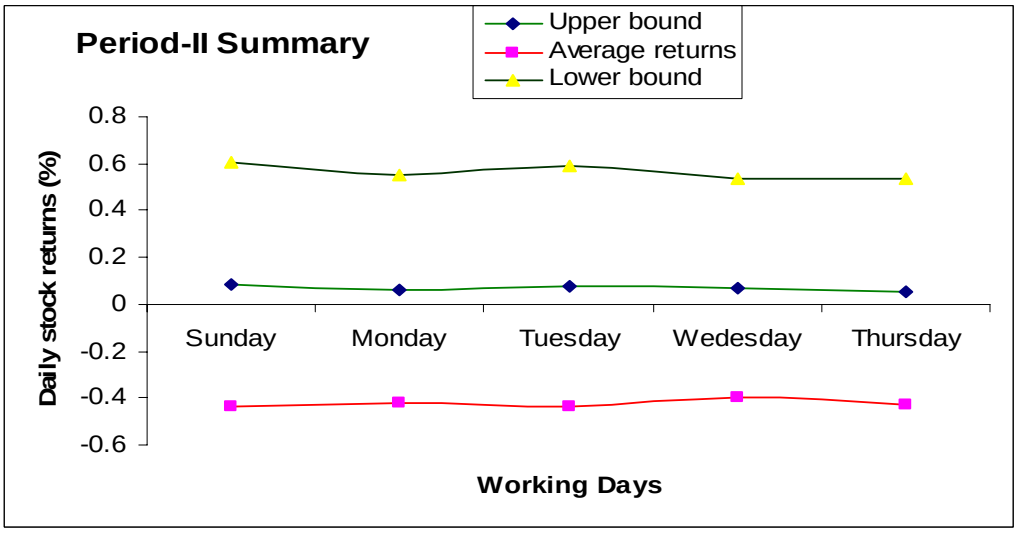
TABLE 3.1

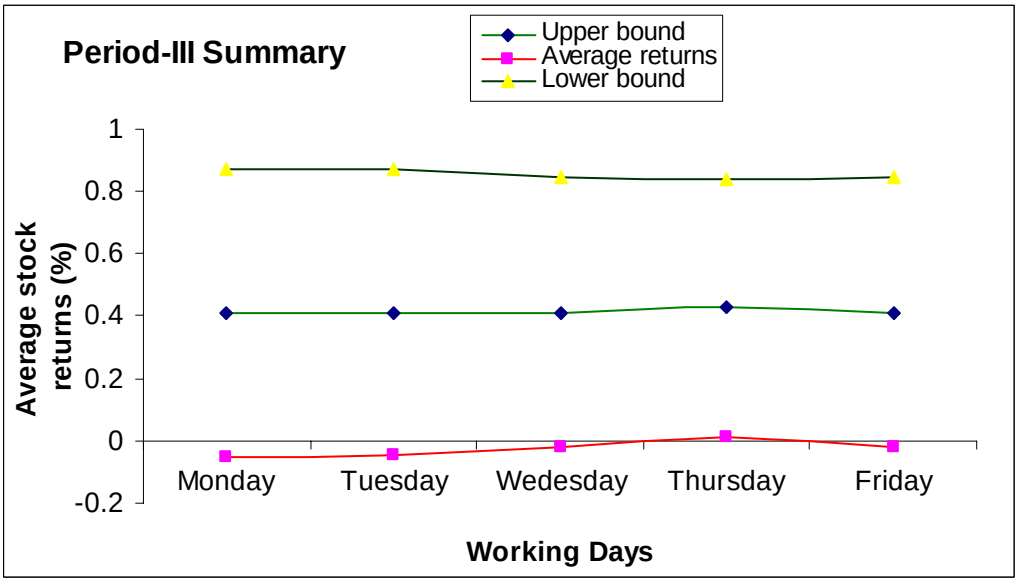
Periods	***Days***	***Mean***	***Median***	***Standard deviation***	***A-Squared with p-value***	***95% C.I for mean returns***	***N***
	Saturday	1.29986	0.4134	5.48293	0.298 (.565)	-0.7857 to 3.3855	29
	Sunday	1.32422	0.4144	5.16173	0.233 (0.777)	-0.7177 to 3.3661	27
	Monday	1.24475	0.4925	5.71272	0.558 (0.135)	-0.9704 to 3.4599	28
	Tuesday	1.07985	0.8031	5.65405	0.304 (0.548)	-1.1126 to 3.2723	28
Period I	Wednesday	1.26838	1.3289	5.66511	0.242 (0.746)	-0.9727 to 3.5094	27
	Sunday	0.08579	-0.1538	3.8177	1.620 (0.000)	-0.4374 to 0.6089	207
	Monday	0.06387	-0.0986	3.65129	0.925 (0.018)	-0.4202 to 0.5479	221
	Tuesday	0.07449	-0.2345	3.85661	1.638 (0.000)	-0.4380 to 0.5869	220
	Wednesday	0.06827	-0.092	3.53371	0.888 (0.023)	-0.3991 to 0.5357	222
Period II	Thursday	0.05673	-0.0627	3.57694	0.928 (0.018)	-0.4253 to 0.5387	214
	Monday	0.40856	0.9518	5.1632	8.839 (0.000)	-0.0555 to 0.8726	478
	Tuesday	0.41241	0.8479	5.06118	9.414 (0.000)	-0.0454 to 0.8702	472
	Wednesday	0.40705	0.7391	4.8447	8.282 (0.000)	-0.0228 to 0.8429	477
	Thursday	0.42702	0.7049	4.52388	7.402 (0.000)	0.0148 to 0.8393	465
Period III	Friday	0.41227	0.6483	4.71683	7.230 (0.000)	-0.0218 to 0.8464	456

Derived from the data

FIGURE 3.1


Period-I Summary
Upper bound
Average returns
Lower bound
Daily stock returns (%)
4
3
2
1
0
-1
-2
Saturday
Sunday
Monday
Tuesday
Wedesday
Working Days


Period-II Summary
Upper bound
Average returns
Lower bound
Daily stock returns (%)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
Sunday
Monday
Tuesday
Wedesday
Thursday
Working Days


Period-III Summary
Upper bound
Average returns
Lower bound
Average stock returns (%)
1
0.8
0.6
0.4
0.2
0
-0.2
Monday
Tuesday
Wedesday
Thursday
Friday
Working Days

The above analysis unveils that there are no daily effects visible in all of the periods and rather in all periods it seems that all market participants have been gaining similar returns. We can infer at this moment that there is no statistical reason to believe that there are days of the week effects in Pakistani equity market on the basis of above analysis. Figure 2 shows for all days that average stock returns for the entire period are clustered around 0.

FIGURE 3.2

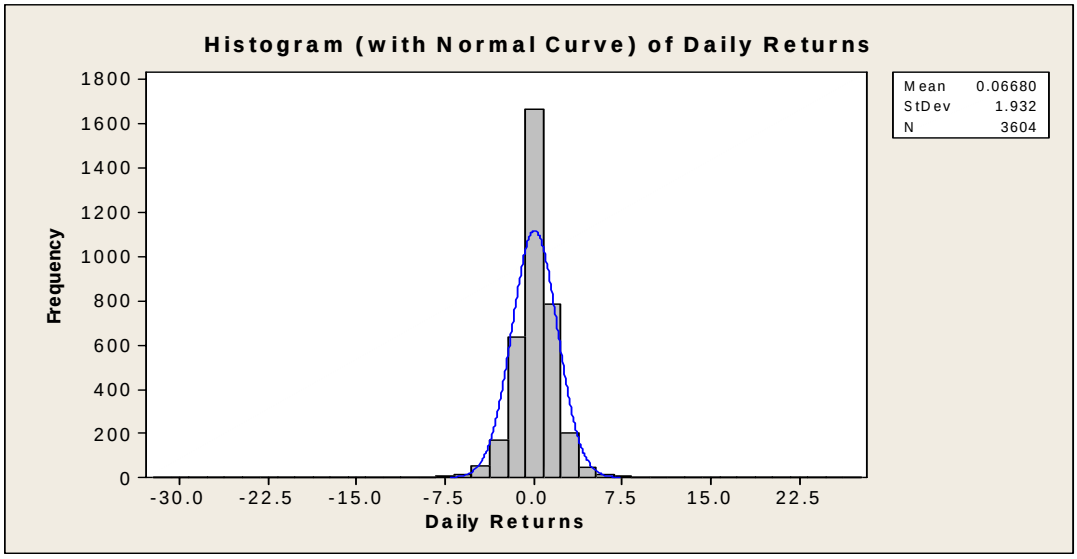


TABLE 3.2 OLS and AR(1) for daily effects (t-values)

Period – I			***Period – II***			***Period – III***		
Days	OLS	AR(1)	Days	OLS	AR(1)	Days	OLS	AR(1)
Saturday	-1.59 (0.124)	3.58 (0.001)	Sunday	0.03 (0.973)	2.05 (0.042)	Monday	1.61 (0.107)	0.19 (0.85)
Sunday	-1.38 (0.179)	3.25 (0.003)	Monday	-0.07 (0.945)	2.08 (0.039)	Tuesday	1.60 (0.109)	-0.04 (0.967)
Monday	1.69 (0.206)	1.77 (0.088)	Tuesday	-0.01 (0.988)	1.24 (0.215)	Wednesday	1.75 (0.081)	0.77 (0.442)
Tuesday	-1.04 (0.307)	2.80 (0.01)	Wednesday	0.01 (0.996)	2.53 (0.012)	Thursday	1.87 (0.062)	2.42 (0.016)
Wednesday	-1.15 (0.262)	2.93 (0.007)	Thursday	-0.17 (0.869)	1.59 (0.114)	Friday	1.68 (0.094)	2.51 (0.012)

In the first period OLS for all days confirms the insignificance of linearity which is supported by AR(1) only on Monday, however since the number of observations are small in Period-I therefore the results cannot be endorsed.

Period II justifies that none of the days are significant according to OLS however Sunday, Monday and Wednesday appear significant according to the auto-regressive model, The third period composed of the largest number of observations and exhibits that none of the days are significant according to OLS at 5% level, however Thursday and Friday seem to be significant according to AR(1,0,0). These findings support the generally assumed notions that it is possible to beat the market in short run whereas in the long run market prevails. Now after applying the same methodology on all the five days for all the periods to see which day in the sequence showed any abnormality in returns summarized in Table 3.2 we conclude that OLS again negates any daily effect however AR(1) model supports the significance of Fourth and Fifth days.

TABLE 3.3

OLS and AR(1) for daily effects (t-values) ***For all Periods combined***		
Days	**OLS**	**AR(1)**
First Day	1.17 (0.241)	1.58 (0.114)
Second Day	1.24 (0.217)	1.37 (0.171)
Third Day	-0.12 (0.202)	1.76 (0.079)
Fourth Day	-0.24 (0.149)	3.67 (0.000)
Fifth Day	1.27 (0.205)	3.79 (0.000)

Derived from the data

4. WEEKLY EFFECTS IN KARACHI STOCK EXCHANGE

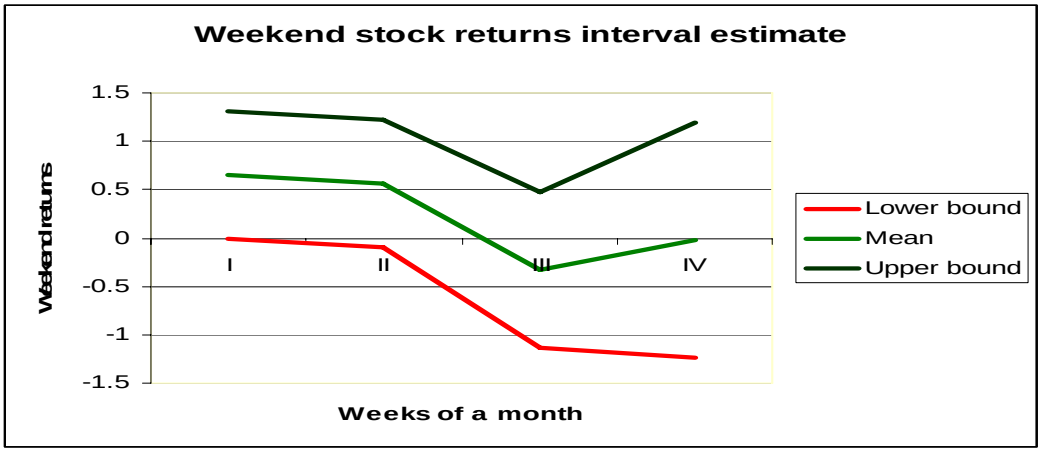
We go with certain assumptions while we try to find weekend effect, for the ease of handling the available time series we divide each month in four weeks and define week consisting of all five days on which stocks were traded and the last day returns are used for testing the weekend effect. Since our analysis for weekend is not affected by the sequence of working days and market correction for holidays therefore the entire data from November 1991 to October 2006 is formatted in the same fashion. Market closed on Wednesday in the first period, on Thursday in the second period and on Friday in the third period.

TABLE 4.1 95% bounds with average

Week	Lower bound	Mean	Upper bound
I	-0.0111	0.65264	1.3163
II	-0.0900	0.56571	1.2214
III	-1.1403	-0.33560	0.4691
IV	-1.2396	-0.02468	1.1902

All values are in percentage points.

FIGURE 4.1



Pakistani stock market on the basis of this finding clearly reveals that first and second week portray positive average returns while the third and fourth week portray average negative returns.

However Table 4.2 suggests that OLS and AR(1) does not show any significant returns on any weekends during the study period.

TABLE 4.2

OLS and AR(1) for Weekly effects (t-values)		
Weekends	**OLS**	**AR(1)**
Week I	0.05 (0.963)	-0.55 (0.584)
Week II	0.67 (0.505)	-0.72 (0.471)
Week III	0.38 (0.705)	0.74 (0.463)
Week IV	-0.87 (0.390)	0.40 (0.689)

5. MONTHLY EFFECTS IN KARACHI STOCK EXCHANGE

A look at the descriptive statistics in Table 5.1 reveals that market returns for different months do not exhibit monthly effects. Table 5.1 also summarizes average monthly returns along upper and lower bounds at a 95% confidence interval. Table 5.2 summarizes the OLS and AR (1) coefficients. It is visible from p-values that none of the coefficients for the twelve months is significant. It leads to conclude that the market is efficient and there are no monthly calendar effects in the market.

TABLE 5.1 95% Confidence interval with average

Month	Lower bound	Mean	Upper bound
January	-3.049	3.338	9.725
February	-.701	3.386	7.474
March	-4.21	-0.255	3.698
April	-1.54	1.531	4.61
May	-11.794	-4.63	2.537
June	-2.94	1.169	5.28
July	-3.749	2.178	8.106
August	-5.35	-1.186	2.98
September	-2.015	1.591	5.196
October	-4.16	1.65	7.45
November	-4.96	0.11	5.17
December	-1.097	4.48	10.06

All values are in percentage points.

FIGURE 5.1

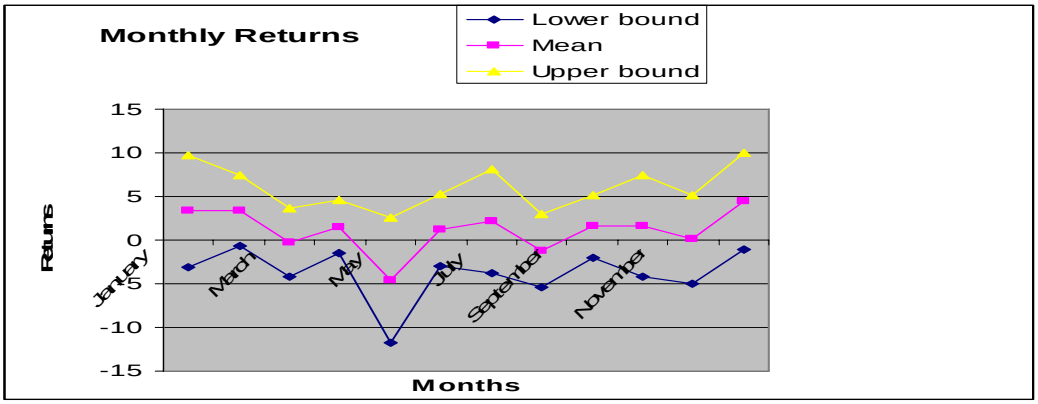


Table 5.2 shows that all months show insignificant returns over the period of analysis and there are no abnormal monthly returns at 5% level of significance. The hypothesis of equal mean returns for all months is accepted since all tests show insignificance.

TABLE 5.2

Monthly effects in KSE 100 Index (t-values)		
Months	**OLS**	**AR(1)**
Jan	1.21 (0.058)	-0.3131 (0.241)
Feb	0.469 (.275)	0.0427 (0.876)
Mar	0.416 (.317)	0.2069 (.442)
Apr	0.045 (.892)	-0.2179 (0.447)
May	-0.116 (.088)	-0.4446 (0.090)
June	0.081 (.853)	0.3110 (0.248)
July	0.236 (.710)	-0.4383 (0.086)
Aug	0.558 (.197)	0.3681 (0.187)
Sep	-0.090 (.816)	0.1272 (0.653)
Oct	0.275 (.657)	0.0495 (0.857)
Nov	0.173 (.075)	-0.1341 (0.621)
Dec	-0.070 (..907)	-0.2602 (0.333)

A fixed effects one way model is also applied to look for any significance of the considered periodical returns. The test unveils that all the hypotheses assumed in section 2.2 are rejected for Pakistani Stock Exchange for the said period. The results of the fixed effect model are summarized in Table 5.3.

TABLE 5.3

ANOVA Test			
Analysis Periods	***F-value***	***P-value***	***Conclusion***
Daily (Period I)	0.006892	0.999904	Test insignificant
Daily (Period II)	0.001886	0.999993	Test insignificant
Daily (Period III)	0.001241	0.999997	Test insignificant
All Days	0.001762	0.999994	Test insignificant
Weekly	1.581888	0.192691	Test insignificant
Monthly	1.04	0.412	Test insignificant

6. CONCLUSIONS

EMH states that past stock information can not be used to forecast future stock prices and hence stock returns. However, in case of the Karachi stock exchange the presence of a Fourth and Fifth day effect as confirmed by AR (1) negates the prevalence and validity of an efficient stock market. Some explanations can be provided for the presence of this effect in the Karachi stock exchange. Firstly, as the last two days conclude the week. It may be argued that this abnormal pattern of returns is due to the holiday or end of week effect. Secondly, a possible explanation could be that investors take their time during the week to decide upon their investment decision. As last two days are just above half way in the trading week, it allows them to speculate on their investment

position before the weekend. Thirdly, these last two days of the week might suit the institutional investors' investment bucket for short term investment of excess liquid funds. Also it can be argued that investors are aware of the Friday effect and as a result prefer to trade more on Thursday as stocks normally become more expensive on last day-of-the- week. Therefore a possible explanation can be that in Karachi stock exchange the weekend effect is experienced earlier than the actual weekend i.e. Friday. Our findings contradict the findings of earlier studies where a Friday and Monday effect has been widely reported for different stock markets of the world. Mehdian and Perry (2001) reconfirmed the Monday effect for US stock market. Sun and Tong (2002) found that the Monday effect was more evident for the fourth week of the month. Board and Sutcliffe (1988) also found a strong weekend effect for the UK stock market. Thursday effect can be considered as an exception to the market efficiency premise for Karachi stock exchange. Other than this Thursday effect, the market shows weak form of market efficiency for weekly as well as monthly time lags. Only daily calendar effects are exhibited by the Pakistani stock market where Thursday' returns are found significant. The finding differs from findings of other studies on different stock markets of the world where either a Friday or Monday or both a Friday and a Monday effect has been reported. However, the brokerage costs and tax may leave Thursdays unattractive. AR (1) reveals that Sunday, Wednesday and Friday are also important. However, OLS does not reveal the significance of these days. Additionally Sunday is no more a trading day after 23 February 1997. Therefore, Sunday is not relevant. We conclude on the basis of our data analyses that there are no weekly effects present in the Pakistani stock market. Our analyses for the monthly returns for Karachi stock exchange shows that no monthly returns are significant at the five percent confidence interval. Therefore, we conclude that there are no monthly calendar anomalies present in Karachi stock exchange that investors can exploit to earn abnormal returns. However, as we have taken only fifteen years data and at best have fifteen

values for each month's returns, we believe further research is needed in the area based on more observations particularly to include individual stock returns of all the stocks for the sample period.

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