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Anomalous Behaviour and Volatility in Stock Returns are still Live - Efficient Markets Hypothesis? : Perspective from Pakistan Stock Exchange (PSX)

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ABSTRACT

Purpose: This empirical study investigates the anomalous behaviour and volatility in stock return of PSX-100 index of Pakistan Stock Exchange (PSX).

Design/Methodology/Approach: The data is taken from January, 2006 to December, 2018 to detect variability and predictability of stock returns. ARCH and GARCH models are applied to check the volatility in stock returns using dummy variable.

Findings: It is found that there exists positive and significant September effect in Pakistani equity market. The returns are high in the month of September than other months. The constant returns do not exist during the whole year so the efficient market hypothesis contradicts.

Implications/Originality/Value: The Efficient Market Hypothesis is question mark due to volatility for mispricing the securities. The mispricing may have implications for undervalue or overvalue the securities and overall economic activity of equity – stock returns.

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1. Introduction

Sharpe (1964) and Lintner (1965) proposed (CAPM) worked on capital asset pricing theories. Further, (Malkiel & Fama, 1970) explained the theory of efficient market hypothesis. Efficient market hypothesis (EMH) defined as stock returns absorb all information available in the market and stock returns cannot be predicted. Price changes should be random walk and have no monthly pattern in stock returns

(Bachelier, 1900; Malkiel, 2003). The consistent pattern in stock returns can create arbitrage opportunities that leads towards market inefficiency. Therefore, practitioners and scholars have created attention towards calendar anomalies.

This study is an attempt to evaluate calendar anomaly and volatility in stock returns of Pakistan Stock Exchange by using latest data ranging from January 2006 to December 2016. This would contribute in updating the research. Moreover, the relationship of information and stock returns can be explained by this type of research. The pattern of Pakistan Stock Exchange indices contradicts with efficient market hypothesis (EMH) due to mispricing, anomalies and volatility in stock returns. Calendar anomaly (CA) is major threat to EMH. Month effect predicts different patterns in stock returns at same point (Chandra, 2009). This trend leads towards price predictability and contradiction of EMH. The leading situations in Pakistan like noise trading, political instability, war & terror, fluctuations in inflation rate, difference in natural and market interest rate and exchange rate are some causes to contradict EMH. These types of situations & anomalies are most favourable and provide support to speculators. The speculators play in accordance with market trends and make abnormal return because no one has perfect information. This situation is also due to market imperfection. The imperfection depends upon lack of market information and behaviour of investors. Changes in behaviour of investors create anomaly in market returns (Schwert, 2003). Further, Misinformation creates high risk. "High risk leads towards high returns". Speculators play with such type of situations and make abnormal return. Pakistan Stock Exchange (PSX-100) is a more volatile market due to mispricing in the market where all the information is not fully absorbed by the stock returns and stock returns can be predicted through speculation. However, there exist many anomalies in the market which can contradict the EMH such as day of the week effect, weak of the month effect, holiday effect and month of the year effect especially in such markets that are under developed or emerging markets. These anomalies occur due to the behavioural change and mood of investors by Aggarwal and Tandon (1994) both elucidated that on Friday stock returns are more volatile and less volatile on Monday. So, investors buy more stocks on Friday and sell it on Monday. In developed country like USA, Government collects taxes normally on December and the financial dealers sell the stock to take tax advantage which is financial loss because stock prices move low. Afterwards, in January New Year starts stock returns show abnormal behaviour and prices move up due to excessive demand for the acquisition of shares. This situation is also known as January anomaly. Indian capital markets have abnormal return in April because taxes are collect in March.

The purpose of this study is to investigate the month of the year effect and volatility in Pakistan Stock Exchange (PSX-100) due to abnormal returns. The Pakistan stock exchange has been considered for analyzing the calendar anomaly and volatility in stock returns because it contradicts the EMH due to under developed and emerging economy.

1.1. Overview of Market Efficiency

EMH is the result of random walk theory. (Bachelier, 1900) introduced the idea of random walk. Random walk theory helps to determine the independence of price change. EMH defined that stock returns absorb all information available in the market and stock returns cannot be predicted (Malkiel & Fama, 1970). Following are the three broadly discussed forms of market efficiency.

- I. Weak Form of Efficiency.**
This form of efficiency argues that all current information regarding stock prices on the basis of historical prices contains constant mean.
- II. Semi Strong Form of Efficiency.**
This form of efficiency states that all current information regarding stock prices on the basis of historical prices contains constant mean plus publicly available information about companies are also reflected.
- III. Strong Form of Efficiency.**

This form explains that whether it is publicly or privately available information are fully reflected by current market prices.

2. Literature Review

Abbas (2017) empirically investigated calendar anomalies in South Asian stock markets such as Karachi, Colombo, Dhaka, Maldives and Bombay stock exchange. The data set ranges from January, 2005 to December, 2014. Ordinary Least Square (OLS) model was applied to analyse the daily, weekly and monthly anomalies in South Asian stock markets. GARCH-M methodology was also applied to investigate the day of week, month and year effect. Overall results suggested that daily, weekly and monthly anomalies exist in South Asian stock markets.

Akhtar, Ansari, and Ansari (2017) empirically analysed day of the week effect in India. Nifty-50 index for the period from March 2009 to February 2016 was taken in analysis. GARCH (1, 1) and OLS methods were applied to investigate the day of the week effects. They found significant positive Monday effect, negative Tuesday and Thursday effect.

Khanna and Mittal (2016) analysed the major indices of South Africa, Russia, China, India and Brazil, which are also known as BRICS countries, to know the day of the week effect anomaly for the period ranging from 1st January 2001 to 31st December 2014 using unit root testing approach. It is found that day of the week effect anomaly only exist in Chinese and Indian stock markets. The investors can hit the market, get abnormal returns and adjust their portfolios in accordance with trend.

Ariss, Rezvanian, and Mehdian (2011) analysed the day of the week and month of the year effect for Gulf Corporation Council. Countries were Bahrain, Muscat, Abu Dhabi, Kuwait, Saudi Arabia, Dubai and Qatar. The results suggested positive high correlation between Dubai and Abu Dhabi. They also documented significant and positive Friday effect for these countries which is contrary to the western countries.

Hoffman (2012) investigated the presence of stock return anomalies in returns of stocks listed in Johannesburg stock exchange for the period of 1985 to 2010. Sorted return approach was applied which is considered suitable as compare to regression and correlation. Anomalous behaviour has been found in stock a return which is similar to the behaviour found by Fama and French for the New York stock exchange.

Anwar and Mulyadi (2009) used AR-EGARCH model to find the day of the week effect in stock markets of Singapore, Malaysia and Indonesia. Daily returns from KLSE, JKSE, STI and S&P Global 1200 indices were taken for analysis. Indonesia has shown positive abnormal return on Friday. Malaysia has shown positive abnormal return on Friday. Singapore has also shown abnormal return on other than Monday and Friday. The Monday negative effect do not exist in all countries. But, positive Friday effect exists in Indonesia and Malaysia.

Onoh and Ndu-Okereke (2016) investigated day of the week effect in Nigerian stock exchange. Daily all-share index (ASI) data was collected from Nigerian Stock Exchange. The data period was from January 05, 2009 to December 31, 2015. Ordinary least square (OLS) method for sample set consisting of 2nd January 2009 to 31st December 2015 has been applied. Results suggest that Friday effect was higher and significant than other days of the week.

Cengiz, Bilen, Büyüklü, and Damgacı (2017) analysed the stock market anomalies and day of the week effect in Istanbul. Daily stock prices of 289 companies listed in Bosra Istanbul Index ranging from 2010 to 2014 were taken. ANOVA test has been used to investigate the anomalies. It is found that returns of other days affect the returns on Monday. Tuesday effect was least. Highest affect has been observed for Thursday and Friday.

Depenchuk, Compton, and Kunkel (2010) empirically analysed the Calendar anomalies for Ukraine financial markets. Study was conducted to observe January effect, weekend effect and month of the year effect. Non-Parametric and wilcoxon rank sum tests were applied to determine the month of the year effect. January and weekend effect do not exist in stock & bond markets of Ukraine.

Dicle and Levendis (2014) analysed day of the week effect for 37631 stocks listed in 51 stock markets of 33 countries to determine day of the week effect. Sample period was from January, 2000 to December, 2007. OLS regression was applied. Overall results suggest statistically significant day of the week effect.

Bashir, Ilyas, and Furrukh (2011) examined the weak form of efficiency of banking sector in Pakistan. They have used data from eleven high volume trading banks listed on Karachi Stock Exchange. The data set ranges from June, 1997 to April 15, 2009. Augmented Dickey Fuller and Phillips-Perron tests to detect stationarity. Whereas, Co integration and VAR tests are applied to examine the weak form efficiency. The result indicated that the null hypothesis was accepted because stock prices exhibit predictable patterns concluding inefficiency of banking sector for KSE.

Hussain, Hamid, Akash, Shahid, and Imdad Khan (2011) investigated the day of the week effect to check the response of stock prices behaviour. Data was taken from Karachi Stock Exchange for the period ranging from January 2006 to December 2010. Five days were considered as working days. Regression analysis results depict that there was constant trend in market returns for whole week. Further, significant Tuesday exists. The returns on Tuesday were more volatile instead of other days.

Yat, Keong, and Ling (2011) elucidated a study on Sector analysis of calendar effects in Malaysia for Post financial crises (1998-2008). Various statistical tests like unit root test, OLS analysis and GARCH model were applied. They have also concluded that Augmented Dickey Fuller test was strongly rejected the null hypothesis. Malaysian stock market exhibit anomalies and investors can take benefits from these anomalies.

Raja, Sudhahar, and Selvam (2009) conducted study to “Test the Semi-Strong form of Efficiency for Indian Stock Market”. They performed statistical techniques (Security returns variability, Average security returns variability, Average abnormal returns, cumulative abnormal returns and T-test) to check the market efficiency. Data was taken from Indian stock market for the period from 2000 to 2007. They concluded that the security prices were reacted to the announcement of stock split. Literature justifies that calendar anomalies and volatility in stock returns were determined by regression analysis in Pakistani context. In this study, ARCH family models by using dummy variables are applied to determine the calendar anomaly.

3. Data and Methodology

The data used in the study consists of monthly stock index of Pakistan Stock Exchange in Pakistan taken from yahoo finance, from January, 2006 to December, 2018. Monday to Friday trading period is to be considered during this study period. Monthly returns was to be calculated by the following expression.

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where the is the value of return for the period ‘t’ , is the price index value at the end of month and is the price index at the end of previous month.

3.1 Unit Root Test: (For ARIMA (p, d, q) model):

For fulfilling the conditions of GARCH (m, k) model to check the volatility, ARIMA (p, d, q) model will be applied to check the diagnostic of model. Unit root test will be applied to test that either the data stationary or not because the first assumption to run the ARIMA (p, d, q) model is to make the series should be integrated at same order. For this, more powerful test, Dickey and Fuller (1981) "ADF" and PP tests will be applied to test the stationarity of the data and to determine the value of d. D should be the no. of difference used to obtain significant results from Dickey and Fuller (1981) "ADF" and PP test. Stationarity of the data should be checked by using the following equation. To test the data stream either it may be stationary or not, simple AR model will be applied for ADF and PP test.

(1)

Where y_t will be denoted in the equation as dependent variable, $t-1$ is a lag length, b is the coefficient of variable and ϵ_t is an error term in the equation. If the data stream y_t will be stationary then the variance and mean of return should be constant. Following model will be applied in standardized form and rewrite as, to test the data as stationary.

(2)

Where Δ will be as the operator at 1st difference in the equation, by this model estimate that the Unit root test will be equivalent to test the α and β (β is used as coefficient in the equation. For stationary series, the ADF value should be greater than critical value. The next step to decide about the p and q value by using Autocorrelation function (ACF) and Partial Autocorrelation function (PACF). P and Q values can be determined by analysing the behaviour of "ACF" and "PACF" respectively. It can be explained in three steps. First step explains that if the "ACF" gives exponential decay and some of "PACF" are significant then q will be equal to zero and p will be equal to no. of significant "PACF". Second step explains that if "PACF" shows the exponential decay and some of AC'S will be significant then $P=0$ and q will be no. of significant "AC'S". Last step to identify the p and q values explain that if some of the AC'S and some of the PAC'S will be significant then p will be no. of significant "PAC'S and q no. of Significant AC'S. Third step of ARIMA (p, d, q) model should be to estimate the model and to check the invert ability. In this analysis parameters should be real and their absolute term should be less than 1 then the model will be ok. Last step in ARIMA (p, d, q) will be the model diagnostics. In this step check the normality of error, no autocorrelation of errors and no autocorrelation of squared errors by applying the ACF and PACF. If the diagnostics of the ARIMA (p, d, q) model does not support the model, are to be failed then move towards GARCH (m, k) model to test the volatility in the stock returns of Pakistan Stock Exchange index (PSX-100) by using the lag values.

3.2 GARCH Models

GARCH models are very powerful in forecasting the variability of the response variable. For the prediction of variable in regression, GARCH (m, k) model will be applied. GARCH model was developed by the Bollerslev in (1986) after extending the ARCH assumption. Lag values of squared errors are added after making the variance for a lag values function and become a ARCH (GARCH) model. This is a most powerful test to predict the variation in the variance. The effect of monthly stock index of Pakistan Stock Exchange (PSX) and volatility can be examined by using the GARCH model specification. GARCH model should be applied when squared errors after classical regression or ARIMA (p, d, q) model will be correlated. GARCH models will also be applied when the error of variance is not constant. GARCH model should be used because ARCH model does not permit a wide range of behaviour. The simple symmetric GARCH (1,1) model can be defined as the following expression.

(3)

Where ϵ_t can be defined as error term derived from mean equation and will be determined by the following equation and model is the collection of two equations called mean and variance equation by using different lag length. The regression for mean equation can be written as follow.

(4)

This equation was not fit for considering the volatility which was found in the errors. For this there will be applied another equation which can effectively consider the volatility in the errors and this is a linear regression model with ARMA/ GARCH model to consider the errors effectively into a single step.

(5)

Equation (5) can be rewrite as follow.

$$\sum \quad \quad \quad \sum \quad \quad \quad (6)$$

To investigate the month of the year effect, following regression equation will be used for estimation. For each month separate regression will be used to identify the monthly effect after including the dummy variables in the equation.

The model can be rewrite as

$$\sum$$

Where is the monthly return at time t, used as coefficients and are the dummy variables for *January, February, March,.....December* respectively. was indicating the error term. If there is a January then *January* = 1 and “0” for all other month, if *February* = 1 and “0” for all other month including *January* and so on.

4. Empirical Results and Analysis:

In Table -4.1 outputs contained the information of summery statistics to understand the description of the data. Values of mean return and median for all the month were found to be negative instead of September which was 0.056 and 0.015 with a positive standard deviation of 9.5% followed by February's standard deviation of 15.6% that mean the return was high in February and September in comparison with other variables with a P- values of 0.000 and 0.523 respectively shown in the table. So, stock in September and February are to be found more volatile because variability can be assessed from the standard deviation. The results indicate that more the September mean return differ from other variables then more will be the volatility, shown in the table-4.1. The finance quotation more the risk in the stock leads toward more return can be confirmed from the September effect. Information regarding the range shown in Maximum and Minimum column which were to be found positive and negative respectively for all the month. Skewness, Kurtosis and Jarque- Berra tests were applied to check the normality of the data, higher the value of Jarque -Berra indicates higher the normality of the data as February in comparison with other variables of the study. Total observations for summery statistics were 13 for all the months.

Table-4.1
Descriptive Statistics

Variables	Mean	Med	Max.	Min.	Std. D	Skew.	Kurtosis	Jar-Bera	Prob.	Obs.
JAN	-0.042	-0.028	0.087	-0.241	0.085	-0.687	3.521	1.169	0.557	13
FEB	-0.009	-0.020	0.449	-0.167	0.156	1.978	6.880	16.632	0.000	13
MARCH	-0.001	-0.003	0.155	-0.090	0.065	0.835	3.542	1.669	0.434	13
APRIL	-0.036	-0.022	0.063	-0.216	0.074	-0.977	3.729	2.357	0.308	13
MAY	-0.013	-0.022	0.105	-0.089	0.060	0.895	2.872	1.744	0.418	13
JUNE	-0.002	-0.011	0.139	-0.126	0.091	0.104	1.676	0.973	0.615	13
JULY	-0.009	-0.010	0.149	-0.145	0.078	0.424	2.901	0.394	0.821	13
AUG	-0.025	-0.019	0.041	-0.093	0.041	-0.190	1.968	0.655	0.721	13
SEP	0.056	0.015	0.220	-0.066	0.097	0.537	1.887	1.296	0.523	13
OCT	-0.017	-0.021	0.090	-0.093	0.049	0.673	3.126	0.989	0.610	13
NOV	-0.039	-0.045	0.072	-0.180	0.067	-0.302	3.161	0.212	0.900	13
DEC	-0.037	-0.063	0.091	-0.202	0.077	-0.281	2.879	0.179	0.914	13

Table - 4.2 indicates the result of Augmented Dickey Fuller and Philip-Perron tests for Unit root to test the stationarity of the data. Results reveal that the ADF values and Philip-Perron values are greater than from the critical value that means the null hypothesis is rejected and data is stationary at level.

So the Value of d for ARIMA (p, d, q) model is found equal to zero. Then Autocorrelation and Partial Autocorrelation function applied to determine the value of p and q and were found $p = 1$ and $q = 0$. So the model become as ARIMA (1, 0, 0). By the estimation of model, check the invert ability and found that the roots were be real that indicated the model was ok. The model diagnostics to run the model was unfit that mean residuals and squared residuals were found correlated. For this, GARCH model was applied to test the variability.

Table - 4.2
ADF and PP tests for Unit root

Variable	ADF Test at Level	Philip - Perron Test at Level
PSX-100	-11.2271	-11.23153

Table - 2.1 Critical Values

Probabilities	At 1%	At 5%	At 10%
ADF Values	-3.47281	-2.88009	-2.57674
PP Values	-3.472813	-2.880088	-2.576739

To test the variability of the variables, table-3 reveals the result of GARCH model and found that the volatility exists in the return. The Z-statistics of ARCH and GARCH is significant at 1%. The presence of volatility proved and contradicted efficient market hypothesis that market is imperfect. Regression model with dummy variables is applied for better predictability.

Table - 4.3 GARCH MODEL

Dependent Variable: RETURN

Method: ML - ARCH (Marquardt) - Normal distribution

GARCH = $C(1) + C(2)*RESID(-1)^2 + C(3)*GARCH(-1)$

Variables	Coefficients	Std. Error	Z-Statistics	Prob.
Variance Equation				
C	0.00015	0.00007	1.94765	0.05150
RESID(-1)^2	-0.05425	0.00780	-6.95727	0.00000
GARCH(-1)	1.04936	0.02200	47.69124	0.00000

R-Squared	-0.0300	Mean Dependent Variable	-0.0146
Adjusted R-Squared	-0.0234	S.D. Dependent Variable	0.0844
S.E. of Regression	0.0853	Akaike Info Criterion	-2.2631
Sum Squared Resid	1.1359	Schwarz Criterion	-2.2045
Log Likelihood	179.5230	Hannan-Quinn Criterion.	-2.2393
Durbin-Watson Stat	1.7550		

Table-4.4 reveals the result of Regression analysis and found that the value of t-statistics of September was significant at 1% and for all other months was insignificant. The ANOVA results presented in table-4.5 show the overall significance of F-statistics at 1%. Table-5 presented only for September because F-statistics for all other months were insignificant.

Table - 4.4 Regression Analyses

Variables	Coefficients	Std. Errors	T- Statistics	P. Values
January	-0.0300	0.0244	-1.2308	0.2203

February	0.0056	0.0245	0.2282	0.8198
March	0.0151	0.0245	0.6168	0.5383
April	0.0028	0.0074	0.3749	0.7083
May	0.0022	0.0245	0.0893	0.9290
June	0.0138	0.0245	0.5648	0.5730
July	0.0060	0.0245	0.2459	0.8061
August	-0.0117	0.0245	-0.4788	0.6327
September	0.0768	0.0237	3.2367	0.0015
October	-0.0031	0.0245	-0.1259	0.9000
November	-0.0264	0.0244	-1.0802	0.2817
December	-0.0249	0.0244	-1.0188	0.3099

Table-4.5 ANOVA

ANOVA	DF	SS	MS	F	SIG. F
Regression	12.0000	0.0702	0.0059	10.4760	0.0000
Residual	154.0000	1.0326	0.0067		
Total	166.0000	1.1028			

5. Conclusion

The study is conducted on monthly returns of PSX-100 index for the period from 2006 to 2018 to check the calendar anomaly and volatility in stock returns. According to efficient market hypothesis there are constant returns during the whole year in stock market. The results suggest concluded that there exists significant September effect in stock returns. In September, the returns are high. Whereas, in other months returns are low and negative. Returns in September are more volatile than other months. According to the empirical results EMH hypothesis contradicts in Pakistan. The month of the year effect is present in stock market of Pakistan because constant returns do not exist for all months. The policy maker in stock market should also consider our results for better policies. The existence of September effect might be due to implementation of budget which is approved in June and implemented in July. The budget projects are at peak in September and trading activities may increase due to these projects. The market efficiency hypothesis is question mark due to anomaly and investors can attain best profits through the predictability of market with arbitrage process.

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