Market Efficiency Anomalies: A Study of January Effect In Karachi Stock Market

Irfan Ullah*, Sabeeh Ullah**, and Farzand Ali***

Abstract

This study aimed at finding the presence of January effect in Karachi stock market. Logarithmic daily data of KSE-100 index for period ranging from 1st January 2004 to 31st December 2014 was used. KSE-100 index was selected because index represents the market. Kolmogorov-Smirnov, Shapiro-Wilk, Jarque-Bera tests were used for normality and ADF test for data stationarity. To analyze the data OLS regression, GARCH, EGARCH and TGARCH models were used to test the presence of seasonality. The results revealed a positive significant January effect along with significant negative May and August returns. Furthermore it was observed that highest returns occur in the month of January and lowest returns occur in the month of May. The outcome of this study can be used by investors to formulate better strategies to generate excess returns considering presence of monthly effects. Since market efficiency anomalies work as a gauge or a yard stick to measure the market efficiency, we can conclude that Karachi stock market is an inefficient market.

Keywords: January effect, efficient market hypothesis, KSE-100 index, seasonality, Karachi stock market.

Introduction

The concept of market efficiency was first seen by Bachelier (1900). He investigated the prices of commodity and stocks to find out if they fluctuate randomly. Fama (1970) came up with the efficient market hypothesis which states that stock prices show all the available information and no one can beat the market continuously.

After the development of efficient market hypothesis, it was practically tested by the CAPM (capital asset pricing model). The results showed various deviations from the theoretic approach of EMH. Presence of these deviations shows inefficiency of the market and these deviations were named as Anomalies (Ullah et al, 2012).

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According to George and Elton (2001) anomalies mean irregularities, deviation or diversion from the normal or routine order. Anomalies mean the difference between the actual and the expected results. Anomalies are strange myth and hard to predict as they can appear, disappear and reappear (Schwert, 2003).

To test the market efficiency one should test the presence of market efficiency anomalies. The more the market is efficient in all aspect, the more it is credible and reliable for investors although investors are in a continuous hunt for some irregularity or some pattern like the market efficiency anomalies for higher return or abnormal profit (Ahsan and Sarkar, 2013).

According to Guo and Wang (2007) anomalies are against the efficient market hypothesis (EMH) and it contradicts the efficient market hypothesis. January effect and the other anomalies in the stock market, its presence violates the efficient market hypothesis witnessing the presence of inefficiency, irregularities in the stock market.

Wachtel (1942) was the first one to observe this seasonal effect. Ahsan and Sarkar (2013) reported that January effect is based on the belief that stock prices tends to go higher in January and also giving higher returns on average than the rest of the months.

The month of the year effect or January effect is defined as a particular month of the year in which some pattern is present in stock returns most likely in the month of January, in which higher average stock returns occur comparing with the rest of the months of the year (Mills and Coutts, 1995). January effect is also named as turn of the year effect as New Year starts securities price increase leading to positive abnormal stock returns comparing with other months of the year. It also creates a window for the investors to purchase stock at low price before the month of January and sell them when there is a hike in their value.

This study particularly investigates the presence of January effect in KSE-100 index. The question of this research is: Does January effect exist in Karachi stock exchange 100 index? The objective of this study is to investigate the presence of January effect in KSE-100 index.

Literature Review

According to Rozeff and Kinney (1976) seasonality was seen in New York stock exchange stock returns for period starting from 1904 to 1974 using monthly return rates for an equal weighted NYSE index. According to them the seasonality found was higher returns in the month of January as compared to the other months of the year.

Glutekin and Glutekin (1983) investigated presence of January effect for 17 countries using value weighted indices. They found that the average rate of return was high in the month of January usually and their results documented the January effect in 13 countries stock markets out of 17 making it a global issue.

Hansen et al. (2005) investigated for January effect in stock indices of Denmark, France, Germany, Hong Kong, Italy, Japan, Norway, Sweden, United Kingdom and USA. Their study revealed that calendar anomalies were significant in most series; however the end of the year effect or January effect was the most prominent one that was observed. They also concluded in their findings that calendar anomalies were observed only in small cap indices in recent years and in large cap indices these anomalies diminished.

Guo (2006) investigated the January effect in the indices of five countries (Canada, France, Germany, Japan and United Kingdom) of the G7 group for the period 1970 to 2000. His results revealed that January effect was present before 1990 in all the market returns of the five countries of the G7 group. A declining January effect was also reported for the countries.

Giovanis (2009) in his studies examined 55 indices of 51 countries to observe the month of the year effect globally using symmetric GARCH models. He found December effect in 21 stock markets followed by February effect in 9 stock markets, January effect in 7 stock markets while April effect in 6 stock markets calling it stock market inefficiency globally and documented December effect to be more prominent then January effect.

Ariss et al. (2011) investigated about the January effect for the indices of the Gulf cooperation council also called GCC and they are also oil producing countries. He observed a pattern which was pretty interesting that instead of the January effect, higher returns in the month of December were detected. The returns in December they observed were higher than the rest of the months in the GCC. He concluded that unlike the rest of the world having January effect, the Gulf Cooperation Council has a December effect.

Guler (2012) investigated the presence of January effect in the major indices of 5 emerging markets (Argentina, Brazil, India, Shanghai and Turkey) using the power ratio method. His result indicated the presence of January effect in returns of the Argentina, China and Turkey. Abnormal January returns were documented for the specified periods 1993, 1994, 1997, 2002 for Argentina, Brazil, China and Turkey respectively.

Zafar et al. (2010) investigated the Karachi stock exchange 100 index for the presence of monthly seasonality for the period 1991—2007 using regression analysis. Their result revealed negative May month returns as compared to the month of January. The same results were revealed by Rafique and Shah (2012).

Hashmi (2014) investigated the KSE-100 index for the presence of January effect for the period ranging from 2004 to 2009. His studies revealed the presence of January effect in KSE-100 index for the sample period but he concluded that returns were not that huge to offset the transaction cost.

Research Methodology

Description of the empirical models, methodology and data set has been given in this section of the study. The data set used by this study is the daily closing values of KSE-100 index from 1st January 2004 to 31st December 2014. Daily stock returns are calculated as follows.

$R_t = \ln (P_t / P_{t-1})$ --- (1)

Where R_t= Daily returns of KSE-100 index, Ln= Natural log P_t = Index closing value at time 't', P_{t-1}=Index closing value at time t-1

The ADF test is applied to test data for stationary.

$$\Delta pit = \alpha 0 + \alpha 1t + \rho 0 pit-1 + \sum_{i-1}^{q} \rho ipit-1 + \varepsilon it \quad \text{--------(2)}$$

p= coefficients to be estimated, p it= price of the i market at time t,
α0= constant & white noise, α1= estimated coefficient for trend
q= number of lagged terms, t= trend term

Following regression model is used to test presence of seasonality

Rt =C +β2 Dfeb + β3 Dmar + β4 Dapr + β5 Dmay + β6 Djune + β7 Djuly + β8 Daug + β9 Dsept + β10 Doct + β11 Dnov + β12 Ddec + μt---------------- (3)

Where Rt = monthly return, C= intercept term for January average return,

Di= dummy variable,β = OLS coefficient, μt = disturbance error term.

A dummy variable is assigned to each month of the year to check the seasonality. The intercept term is representing an omitted month which is January which also act us benchmark month. Thus we can measure the incremental effect of each month with the coefficient of the dummy variable of that month comparing with the benchmark month.

The OLS model with dummy variables has been used in many studies. According to Connolly (1989, 1991) linear regression have problems like autocorrelation, non-normal residuals, heteroskedasticity and high/low value outliers which might present misleading results. OLS regression residuals are checked for presence heteroskedasticity, ARCH effects and serial correlation. Connolly (1989) also suggested use of GARCH model.

Following the methodology used by Agathee (2008), this study incorporated GARCH, EGARCH and TGARCH to test January effect as it has advantage over the OLS in sense that along with mean, it also considers the volatility or risk. GARCH model cannot deal with leverage effect; EGARCH and TGARCH are used for this purpose. In addition GARCH family models can significantly reduce excess skewness, kurtosis and ARCH effects. ARCH model was extended to GARCH model by Bollerslev (1986) and Connolly (1989) used it in the study of calendar effects.

GARCH

The following GARCH (1, 1) model is used to test for monthly anomalies.

$\varepsilon / \vartheta t - 1 \sim N(0, h_t)$

Mean equation

$$\mathbf{Rt} = \sum_{t=1}^{12} \beta_i D_{it} + \varepsilon_t \text{--} (4)$$

Where $R_t$is the logarithmic returns, $D_{it}$is dummy variable for respective month, $\beta_i$measures mean daily return of respective month. ε is an error term

Variance equation

$$h_t = \beta_0 + \beta_1 \varepsilon^2{}_{t-1} + \beta_2 h_{t-1} \text{-----------------} (5)$$

Whereh_t denotes conditional variance,$\beta_1$measures the arch effect and $\beta_2$measures the GARCH effect of the volatility.

For conditional variance to be positive, the following restriction must be met

$$\beta_0 > 0; \beta_1 \geq 0; \beta_2 \geq 0 \text{ and } \beta_1 + \beta_2 < 1$$

EGARCH

Nelson (1990) proposed EGARCH model.

$$\ln(h_t) = \beta_0 + \beta_1 \left[\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}} \right] + \beta_2 \ln(h_{t-1}) + \beta_3 \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \text{ --- } (6)$$

TGARCH

TGARCH model was proposed by Glosten, Jaganathan and Runkle (1993).

$$h_t = \beta_0 + \beta_1 \varepsilon^2{}_{t-1} + \beta_2 h_{t-1} + \beta_3 \varepsilon^2{}_{t-1} I_{t-1} \text{ --- } (7)$$

Where ht denotes the conditional variance,

I_{t-1}=1 is a dummy variable if $\varepsilon_{t-1} < 0$, or zero otherwise.

Restrictions are imposed on parameters of TGARCH to be non-negative, for h_t to be non-negative and to be greater than zero. Furthermore β_3 parameter should be > 0.

The EGARCH does need non-negative restrictions. The leverage effect is dealt if there is negative relationship between volatility and returns such that β_3 will be negative.

According to Samson and Mercy (2015) Akaike information criteria is generally treated as model selection criterion and model selection tool. To check model fitness and validity Ljung -Box Q statistic on squared residuals is used, the log-likelihood values, skewness, kurtosis of the residuals, Akaike information criterion, Schwartz criterion and arch effects are used to choose the best model to describe the results.

Results & Discussion

Figure 1: Movement of KSE 100 index during 2004-2014

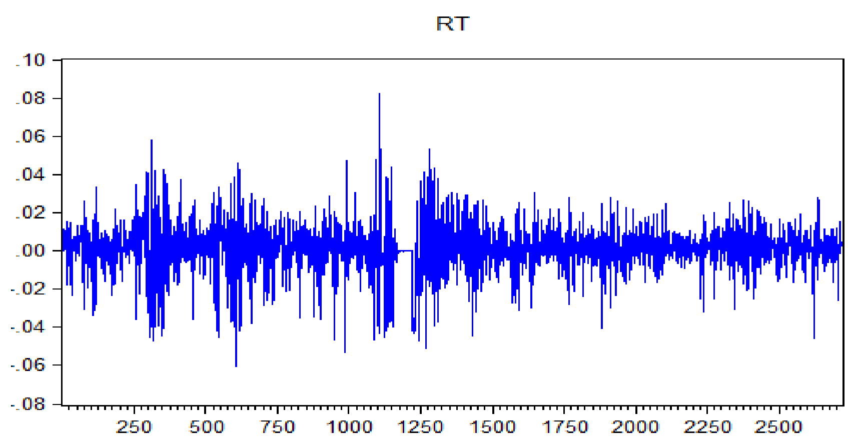

Figure 1 presents the daily movement of KSE-100 index for the sample period and it indicates presence of volatility clustering that changes over time.

Table 1: Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
RT	.192	2468	.000	.385	2468	.000

Table 1 shows results of the tests of normality. The significance value of both the tests strongly rejects the null hypothesis of data normality.

Therefore we accept the alternate hypothesis that data is not following the normal distribution.

Histogram, Descriptive Statistics and Jarque-Bera Test

Figure 2: Histogram, descriptive statistics& Jarque-Bera

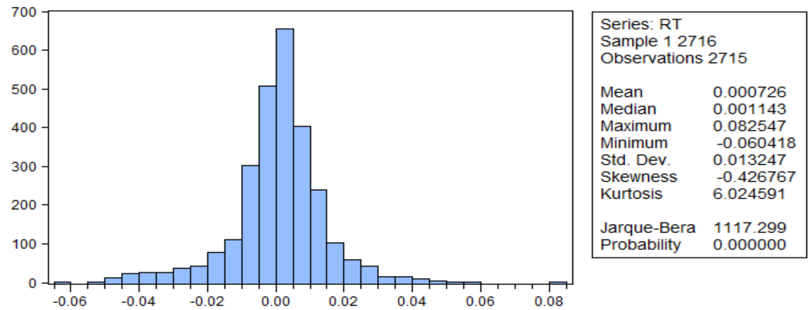

Figure 2 presents histogram, additional test of normality Jarque-Bera and descriptive statistics for the sample period.

The probability value of Jarque-Bera test rejects the null hypothesis and accepts the alternate hypothesis that data is not normally distributed. The Histogram shows that the series is leptokurtic i.e. kurtosis is greater than 3. Non normal distribution of data after log transformation shows the presence of outliers preventing data from normality. Deletion of such outliers may result in inefficient or misleading conclusions (Cook and Weisberg, 1982).

Augmented Dickey Fuller Test

Table 2: ADF test for unit root

Trend and Intercept				intercept	
Augmented Dicky Fuller		t-statistic	Prob.	t-statistic	Prob.
		-45.20331	0.0000	-45.2111	0.0001
Test Statistic					
Test Critical Values:	1%	-3.961424		-3.43257	
	5%	-3.411463		-2.86241	
	10%	-3.127588		-2.56728	

Table 2 shows the statistics of ADF test for the sample period. The corresponding probability values are significant at 1% level. The result of the Augmented Dickey Fuller test leads to rejection of null hypothesis, thus we accept the alternate hypothesis that data is stationary at level which is desirable.

Monthly Descriptive Statistics
Table 3: Summary Statistics of mean monthly returns of KSE-100 index

Mon	Mean	Std. Dev.	Skewness	Kurtosis	Jarque -Bera	Prob.	Obs
Jan	0.002	0.00294	-0.793	3.479	1.258	0.533	11
Feb	0.001	0.00394	0.342	3.124	0.221	0.895	11
Mar	0.001	0.00293	1.133	4.685	3.659	0.160	11
Apr	0.001	0.00235	-1.072	4.062	2.627	0.268	11
May	-0.001	0.00464	-0.541	2.823	0.55	0.759	11
Jun	0.000	0.00180	0.196	2.180	0.378	0.827	11
Jul	0.000	0.00313	-1.002	3.541	1.975	0.372	11
Aug	-0.001	0.00408	0.465	2.010	0.845	0.655	11
Sepr	0.001	0.00186	0.083	1.805	0.666	0.716	11
Oct	0.001	0.00165	0.502	2.406	0.625	0.731	11
Nov	0.001	0.00243	-0.144	2.099	0.410	0.814	11
Dec	-0.001	0.008149	-2.538	8.066	23.57	0.000	11

As shown in table 4.3 May, August and December have negative mean returns. Maximum average returns occur in the month of January while minimum average returns occur in the month of August followed by May.

Standard deviation is commonly used to analyze the dispersion around the mean while it also operates as a risk indicator since the higher the volatility the higher the risk. Months having negative returns have higher standard deviation. December has the highest standard deviation followed by May and August.

6 out of 12 months i.e. January, April, May, July, November and December are negatively skewed while rest of the months are positively skewed. 6 months i.e. January, February, March, April, July and December are leptokurtic (K>3) while remaining 6 months are platykurtic (K<3). According to Vaihekoski (2004) for stocks negative skewness is common while higher kurtosis shows peaked distribution.

The Jarque-Bera probability indicates that monthly returns are following normal distribution except for the month of December that is significant and shows non-normality. Possible reason for this can be the crash of Karachi stock exchange in 2008.

From the descriptive statistics it can be concluded that there exist January effect since returns are relatively higher. In Pakistan the tax year ends in June and new tax year starts as July starts. The descriptive

statistics are significant with tax loss hypothesis since returns are low in May and budget is presented in the month of June (Iqbal et al. 2013).
The result of OLS regression is presented in Annexure A. Intercept term represents month of January. Significant and positive January effect is detected. However significant negative May, August and December effects are also detected. R^2 is 0.008 which is low and the F-Statistic both suggests poor model fit. According to Montgomery et al (2001) time series data shows positive correlation. The Durbin Watson statistic is 1.73 which indicates the presence of serial correlation. The results might be influenced by the presence of serial correlation which is indicated by the Durbin Watson test.

The Breusch-Godfrey test for serial correlation presented in Annexure B suggests presence of serial correlation. For heteroskedasticity White test is used which can be observed in Annexure C suggests presence of heteroskedasticity and the ARCH LM in Annexure D test shows presence of ARCH effects.

GARCH, EGARCH & TGARCH Results

Table 4: Results of GARCH, EGARCH & TGARCH

Coefficient	GARCH	P Value	EGARCH	P Value	TGARCH	P Value
Intercept(Jan)	0.0027	0.0000	0.002	0.0013	0.0023	0.0006
Feb	-0.0008	0.4042	-0.0003	0.6814	-0.0002	0.7668
Mar	-0.0008	0.4295	-0.0007	0.4821	-0.0010	0.3100
Apr	-0.0007	0.4502	-0.0008	0.3708	-0.0006	0.5166
May	-0.0026	0.0026	-0.0016	0.0864	-0.0023	0.0152
Jun	-0.0017	0.0928	-0.0019	0.0593	-0.0020	0.0545
Jul	-0.0011	0.2367	-0.0014	0.1036	-0.0011	0.2272
Aug	-0.0021	0.0206	-0.0017	0.0635	-0.0019	0.0377
Sept	-0.0017	0.0922	-0.0022	0.0173	-0.0018	0.0653
Oct	-0.0011	0.2191	-0.0021	0.0237	-0.0007	0.4061
Nov	-0.0011	0.3210	-0.0001	0.8943	-0.0014	0.1912
Dec	-0.0012	0.1219	-0.0030	0.0000	-0.0006	0.4714
H	0.1070	0.0000	0.12209	0.0000	0.1317	0.0000
β_0	7.45E-	0.0000	-1.0976	0.0000	9.25E-	0.0000
β_1	0.170	0.0000	0.3144	0.0000	0.0825	0.0000
β_2	0.7853	0.0000	0.9037	0.0000	0.7553	0.0000
β_3			-0.1315	0.0000	0.2111	0.0000
AIC	-6.1699		-6.1824		-6.189	
SBIC	-6.1351		-6.1454		-6.1523	
Log likelihood	8388.67		8406.6		8415.9	
Skewness	-0.550		-0.573		-0.4815	
Kurtosis	5.739		6.3468		5.6866	
ARCH LM	5.0604	0.5361	2.3074	0.8894	2.9025	0.8210
LBQ^2 (12)	7.027	0.856	5.4682	0.940	5.146	0.953

(AIC= Akaike Information Criterion, SBIC=Schwarz criterion, $LBQ^2(12)$=Ljung-Box statistics for serial correlation on squared standardized residuals at 5% level of order 12 lags, ARCH(6)= order of 6 lags used to test conditional heteroskedasticity)

It is certain from the Ljung-Box statistics presented in table 4.4 that none of the model suffers from serial correlation problem after correcting them indicating no misspecification. It is also clear from the results that if GARCH family models are properly applied and utilized, it reduces the excessive skewness and kurtosis. The result of ARCH LM test shows thatnone of the model suffers from ARCH effects unlike the OLS model in this study indicating that all the models have been specified correctly.

The ARCH and GARCH effects are statistically significant in all the three models. The sum of coefficients of ARCH GARCH in TGARCH model is less than one which means that shocks decay after few lags to volatility and it's not highly persistent while in case of GARCH it is close to 1 and EGARCH where its value is more than 1 which means shocks are highly persistent to the variance.

TGARCH is the most appropriate model since it has the highest log-likelihood value, lowest Akaike information criterion and Schwarz criterion. Furthermore TGARCH has the lowest excessive skewness and kurtosis value.

Based on results of TGARCH, the coefficient β_3 representing the leverage effect in the model shows a positive and statistically significant leverage effect which means that negative news has more impact on the volatility of returns than the positive news.

The intercept term represents the month of January which is statistically significant and its coefficient is higher than the other months. Based on results of TGARCH it can be concluded that significant January returns are higher than other months providing evidence of January seasonality in KSE-100 index. Beside evident January effect, negative May and August effects are also present there which are statistically significant. It can be concluded from the results that month of May is with the lowest negative returns followed by month of August providing further evidence of monthly seasonality in Karachi stock exchange 100-index. The presence of January effect in Karachi stock exchange is in line with the findings of Bilal (2009). Negative May returns are in line with findings of Zafar et al (2010), Rafique and Shah (2012), and Iqbal et al,. (2013).

Summary

January effect is a belief that stock returns are higher in the month of January and investors utilize huge or abnormal profits from January effect. January effect is contradiction of the efficient market hypothesis violating its weak form. To asses presence of January effect in Karachi stock exchange, daily closing prices of KSE-100 index for period 1st January 2004 to 31st December 2014 are used.

The summary statistics indicated some non-normal characteristics and anomalous behavior like positive higher returns in January and negative return for the month of May, August and December. The OLS regression provided evidence of positive significant January effect along with significant negative May, August and December returns. The results of the OLS were not authentic since the data was not following normal distribution. Furthermore presence of serial correlation, heteroskedasticity and ARCH effects were detected in the residuals after OLS regression.

GARCH, EGARCH and TGARCH are employed following the study of Agathee (2008) to present better picture of the anomalies in KSE.According to the results, TGARCH model is the most appropriate model in this study. Strong January effect is detected along with negative May and August returns. One possible explanation for the negative May effect is the tax hypothesis since budget is presented in the month of June in Pakistan. Furthermore leverage effect is also present in Karachi stock exchange 100-index.

Conclusion

This study investigated the presence of January effect in Karachi stock exchange using different GARCH models. January effect is based on the belief that stock returns are higher in the month of January generating high profit and in this study January month has the highest returns comparing with returns of other months of year. Furthermore these high stock returns of January are statistically significant. The stock returns of month of May and August are negative and statistically significant with month of May with the lowest returns recorded. One of the reasons for lowest returns in the month of May is the tax loss hypothesis because in Pakistan budget for the New Year is presented in the month of June. All these results indicate evidence of strong January effect along with negative May and August effect providing evidence of presence of market efficiency anomalies violating the weak form of efficient market hypothesis. It can be concluded that considering these anomalies before formulating investing strategies can help in generating huge abnormal profits.

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Annexure

Annexure A: Result of OLS Regression

Variable	Coefficient	Std.Error	t-Statistics	Prob.
Intercept	0.002434	0.000852	2.857204	0.0043
FEB	-0.00044	0.001251	-0.351424	0.7253
MAR	-0.000702	0.001213	-0.578809	0.5628
APR	-0.001252	0.001215	-1.030278	0.3030
MAY	-0.003651	0.001212	-3.011514	0.0026
JUN	-0.001794	0.001211	-1.481373	0.1386
JUL	-0.00171	0.001207	-1.417097	0.1566
AUG	-0.003693	0.001179	-3.131954	0.0018
SEPT	-0.00131	0.001155	-1.134373	0.2567
OCT	-0.001033	0.001233	-0.837751	0.4022
NOV	-0.001416	0.001248	-1.134541	0.2567
DEC	-0.003208	0.001229	-2.611346	0.0091

R^2	0.008	F-Statistic	2.000
D-W stat	1.732	Prob (F-Stat)	0.024

Annexure B: Testing for Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	25.31060	Prob. F(2,2701)	0.000
Obs*R-squared	49.94748	Prob. Chi-Square(2)	0.000

Annexure C: Testing For Heteroskedasticity

Heteroskedasticity Test: White			
F-statistic	8.587135	Prob. F(12,2702)	0.000
Obs*R-squared	99.73772	Prob. Chi-Square(12)	0.000
Scaled Explained SS	247.9556	Prob. Chi-Square(12)	0.000

Annexure D: Testing For ARCH Effects

Heteroskedasticity Test: ARCH			
F-statistic	492.2613	Prob. F(1,2712)	0.000
Obs*R-squared	416.9439	Prob. Chi-Square(1)	0.000