RELATIONSHIP BETWEEN STOCK RETURN, TRADING VOLUME AND VOLATILITY: EVIDENCE FROM PAKISTANI STOCK MARKET

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ABSTRACT

This study investigates the relationship between trading volume and returns and volatility of Pakistani market for the period of July 1998 to October 2008. The Dickey-Fuller test is applied to turn the time series stationary. The ARCH and GARCH-M models are used to test the return, volatility and volume relationship. The results indicate that there is evidence of first order autocorrelation in market return and individual stock returns. The results of Granger Causality test suggest that there is feedback relationship between the market return and volume. However, in case of individual stock returns the evidence indicates for more stocks' return causing volume than volume causing returns. The empirical results verify that there is significant interaction between trading volume and return volatility when volume is entered into variance equation of GARCH-M model. The findings suggest that there is significance effect of the previous day trading volume on the current return and this implies that previous day returns and volume has explanatory power in explaining the current market returns. The presence of significant autoregressive process of first order in the GARCH-M model indicates a firm relationship of volume with the future path of returns.

Jel Classification: G10, G15
Key words: Mixture of Distribution Hypothesis, Sequential Information Arrival Hypothesis, GARCH-M

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1. INTRODUCTION

The fluctuations in stock market and trading volume are influenced by the flow of information. The higher the volume, the narrower are the spreads, as a result there is less slippage, and less volatility. Traders keep a close eye on trading volume because it reflects the dynamic interplay between informed traders and uninformed traders who interact with each other in the marketplace in light of their own trading strategies and, ultimately, set market clearing prices. Trading volume is termed as the critical piece of information in the stock market because it either activates or deactivates the price movements. Stock prices are usually influenced by positive trading volume through the available set of relevant information in the market. A revision in investors' expectations usually leads to an increase in trading volume which eventually reflects the sum of investors' reaction to news.

The relationship between stock returns and trading volume and volatility is well researched area in developed markets. There is very little literature available regarding Pakistani market to explore the link between stock returns and trading volume, this study tries to fill this gap by investigating the relationship between the trading volume and the stock prices and returns of three manufacturing sectors of Pakistan listed on Karachi Stock Exchange. This study adds to existing literature on this issue by investigating at market level and at firm level. The study contributes by exploring the causal relationship between stock returns and volume and applying the GARCH-M model for market and at firm level.

The main focus of the study is to explore dynamic interaction between return, volume and volatility both at the market level and at firm level for the Karachi Stock Exchange, the main equity market of Pakistan for the period July 1998 to Oct 2008. The study also investigates the causal relationship between return and trading volume in the second stage. The return distribution is time varying in nature because as new information arrives the investor updates the mean and variance of return distribution. Therefore in the third stage the volatility behavior of stock returns is examined where trading volume and past residual error and past volatility are used as information set.

The plan of the study is as follows. Section two discusses the literature review, section three discusses methodological framework and data. The empirical results are discussed in section four and last section offers conclusion.

II. LITERATURE REVIEW

An extensive research has been conducted for the developed markets to study the relationship between trading volume and security returns and on volume-volatility effects of stocks. The mixture–of-distribution hypothesis (MDH) pioneered by Clark, Epps and Epps (1976), Tauchen and Pitts (1983) and Bollerslev & Jubinski (1999) has always remained the center of attention for researchers conducting research on trading volume and returns. This hypothesis explains an influential variable termed as latent news arrival or information flow. If the news is unexpectedly bad the price of the securities decreases and if the news is unexpectedly good then it has a positive

effect on the price movements of the securities. These movements are supposed to be influenced by the above-average trading activity in the market as it adjusts to a new equilibrium. It further demonstrates that since the volume-volatility variables simultaneously change in response to the arrival of new information thus there shall be no information content in past volatility data that can be used to forecast volume.

On contrary to MDH, the sequential information arrival hypothesis (SIAH), again a focal terminology of volume-volatility relationship explains the role of the lagged values of volatility in predicting current trading volume; a view by Copeland (1976), Jennings *et al.*(1981) and Smirlock and Starks (1985 and Darrat *et al.* (2003). They further explain that traders tend to receive information in a sequential, random manner where all traders revise their expectations accordingly. According to this hypothesis, traders do not receive the information at the same time which creates incomplete equilibrium. To reach the final equilibrium, all traders tend to react to the information signal simultaneously so that current trading volume can be predicted with accuracy. Suominen (2001) has explained the positive correlational effect between trading volume and price variability based on private information. He has demonstrated that price changes are not sufficient source in predicting volatility but the information content on trading volume is also needed. As stressed by Mustafa and Nishat (2008) the non-informational trade based on events, short selling and insider trading has significant effect on prices and trading activity. Lee and Rui (2001) have explained the relation between trading volume and serial correlation of stock returns by including another variable named as shocks i.e. informational and non-informational components. They suggest that trading volume is influenced by non-informational trades and stock returns by informational trades. Lamoureux and Lastrapes (1990) have adopted GARCH model to explain the conditional volatility of returns is influenced by trading volume. Chen *et al.* (2001) find persistence of volatility is not eliminated when trading volume is used in the GARCH model. Bollerslev and Jubinski (1999) suggest that by imposing long memory component on differing short–lived news, the joint volume-volatility relationship can be exercised. Based on the available set of information about a company, its stock prices reflect investors' expectations on the future performance for the company. Since investors' perception varies the interpretations of new information, prices usually remain unchanged even though new information reveals to the market. This is because some investors interpret it as good news and some take it as bad news. Therefore, changes in prices reflect the average reaction of investor to news. Sun (2003) finds negative correlation of returns before earnings announcements indicating that pre-earnings trading is likely non-informational and the availability of asymmetrical information is small. Charavarty, Gulen and Mayhew (2004) stress on the importance of price discovery for the investors interested either in the options market or stock market. They suggest that price discovery is higher when bid-ask spreads are narrow and the trading volume is high.

Barclay and Hendershott (2003) suggests that price discovery first starts from the high volume stocks and then spreads to low volume stocks and the trading volume

after hours is low because of high risks level and high trading costs. Gallant, Rossi and Tauchen (1992) have examined the dynamic interrelationship between the price-volume-volatility of the stock market. They reveal that the daily trading volume and the magnitude of price change is positively and nonlinearly related to each other and also price changes lead to volume movements. Similarly, Fujihara and Mougoue (1997) find strong non-linear causal relationship between futures' price variability and the trading volume indicating the impact of current trading volume in the prediction of future prices.

Through the application of three equation simultaneous structural model, Wang and Yau (2000) demonstrate that the current volume and lagged volume helps in explaining price volatility. Deo *et al.* (2008) demonstrate a significant contemporaneous relationship between trading volume and absolute value of price changes. They have stressed with strong evidence that in their selected Asia-Pacific Stock market return caused volume rather than volume causing returns.

III. DATA AND METHODOLOGY

The main focus of the study is to use the volume as trading activity that has explanatory power in addition to past returns, and investigate the stock return, trading volume and volatility relationship. Since the relationship between the daily return variance and unobservable mixing variables can not be easily estimated, a proper proxy is required. The trading volume could serve as a proxy measure for unobservable amount of information that flows into the market. We investigate the relationship between returns, volatility and trading volume by following model developed by Lamoureux and Lastrapes (1990). The first step is to estimate stock returns (r_i) for individual firms and market return (r_m) where KSE 100 is taken as market index. The return is defined as log first difference of closing price at each day. The trading volume is defined as the log of daily turnover of each stock and the market index. We detrend the trading volume by regressing the volume on time and time square and extract the residuals which represent detrended trading volume.

$$r_t = \ln(P_t) - \ln(P_{t-1}) \quad (1)$$

$$V_t = \alpha + \beta_1 t + \beta_2 t^2 \quad (2)$$

To test the causal relationship between stock return and trading volume both for the market and at the firm level we apply Vector Autoregressive (VAR) model. Before performing VAR we check stock returns, market return, stock volume and market trading volume for stationarity by applying Augmented Dickey Fuller (ADF) test.

We examine whether the stylized fact relating to stock return and trading volume exists in case of Pakistan for we check the contemporaneous autocorrelation by following Bohl and Henke (2003) model as shown below:

$$r_t = \alpha_0 + \alpha_1(L) r_{t-1} + \varepsilon_t \quad (3)$$

$$r_t + \alpha_0 + \alpha_1(L) r_{t-1} + \alpha_2(L) V_{t-1} + \varepsilon_t \quad (4)$$

The L is lag operator in the above equations. The α_1 captures the first order autocorrelation in stock returns and α_2 measures the relationship of past volume on the returns.

To investigate causal relationship between stock returns and trading volume Engle-Granger Causality test is applied by following Chen *et al.* (2001) bivariate auto regression model, as shown below:

$$r_t = \alpha_0 + \sum_{i=1}^{4} r_{t-i} + \sum_{j=1}^{4} \beta_j V_{t-j} + \varepsilon_t$$
$$V_t = \alpha_0 + \sum_{i=1}^{4} \gamma_i V_{t-i} + \sum_{j=1}^{4} \delta_j r_{t-j} + \varepsilon_t \quad (5)$$

If β_j coefficients are statistically significant then past values of volume and return yield a better forecast of future return and trading volume causes stock return. The F-test is used to test the hypothesis that $\beta_j = 0$ for all *j*. If δ_j is different from zero the return causes volume. If β_j and δ_j are different from zero, there is a feedback relation between stock returns and trading volume. The Vector Autoregressive (VAR) method is used for estimation and model with four lags is selected on the basis of Schwarz Bayesian (SBC) Criteria.

To measure the persistence in the conditional variance GARCH-M model is used. Fama (1965)) have observed that periods of instability in stock price changes are followed by periods of stability and its unconditional distribution of price changes has tick tails. Autoregressive Conditional Heteroskedasticity (ARCH) model of Engle (1982) characterizes the error term conditional on information set. It can mimic the clustering of large shocks by exhibiting large (small) errors of either sign to be followed by small (large) errors of either sign. The GARCH-M model introduced by Engle, Lilen and Robins (1987) then makes the return of stocks dependent on the time-varying risk premium, when the conditional variance of an asset directly influences the conditional mean. In GARCH-M model residuals are decomposed into heteroskedastic and homoskedastic and express conditional moments because they provide close and parsimonious approximation to the form of heteroskedasticity typically encountered with stock market data. Therefore GARCH(1,1)-M model given below is most suitable choice to investigate the relationship between volatility and stock return using trading volume as information set:

$$r_{it} = \alpha_0 + \alpha_1(L) r_{t-1} + \theta\sigma_t + \varepsilon_t \quad (6)$$
$$\sigma_t^2 = \beta_0 + \beta_1(L)\varepsilon_{t-1}^2 + \beta_2(L)\sigma_{t-1}^2 + \beta_3 V_{t-1} \quad (7)$$

In equation (6) autoregressive in the mean return is allowed, θ_i gives the estimate of risk premium for facing variance risk and all other variables remain the same. The conditional variance in modeled in equation (7) including past error terms, past variances and volume influencing the variance. The β_1 measures the effect of past

error square on volatility, β_2 measures the effect of past volatility and β_3 captures the effect of past volume on volatility and volume of the stock traded. The trading volume is used as an unobserved measure of information that flows into the market as an information arrival component.

The data set comprises of daily returns and volume series of seventy 70 stocks traded at Karachi Stock Exchange for the period of July 1998 to October 2008. The KSE 100 index is taken as market return. The data is obtained from the website of Business Recorder.

IV. EMPIRICAL RESULTS

A. Market Level Analysis:

We start our analysis by summary statistics of the market index (KSE 100). The trading volume of the market is more volatile as shown by higher standard deviation of the volume. There is evidence of negative skewness of market return and market volume. The kurtosis exceeds the normal value of three for returns and volume. The series is non-normal according to the Jarque-Bera test.

The results reported in Table 2 shows the market return and detrended market volume series follow a stationary process at 1 percent level as shown by ADF test. Table 3 shows the results of first order autocorrelation of the market returns following Lamoureux and Lastrapes (1990). The Table 3 reports that there is significant autocorrelation of first order in the market's return. The results indicate that previous day returns significantly affect the current market returns. Mustafa and Nishat (2006) find the evidence of autocorrelation for Pakistani market for the period 1991 to 2001. Table 4 presents the results of contemporaneous relationship between return and trading volume based on VAR model. On the basis of F-test, results show that market volume cause market return and volume is also caused by stock return. These results suggest that there is feedback system prevailing in Pakistani market and both market return and market volume influence each other. These results are consistent with other emerging markets Hong Kong, Indonesia, Malaysia and Taiwan (Deo *et al.*, 2008).

The relationship between market return, volatility and market volume is investigated by estimating GARCH (1, 1)-M model with volume in the conditional variance equation. The mean equation shows that there exists significant autocorrelation of first order. Since the coefficient of standard deviation is not significant in the mean equation, this suggests that there is no compensation of variance risk in Pakistani market. Baklaci and Kasman (2003) come up with same conclusion in case of Turkish market. The conditional variance is estimated by GARCH (1,1)-M model using trading volume as unobserved measure of information that flows into the market. The GARCH-M equation parameterize conditional variance, an intercept of these equations shows the portion of price volatility that remains constant over time. The results indicate a positive autocorrelation of order

one. The ARCH (1) and GARCH (1) terms are found to be present at one percent (1%) significance level. This equation shows the estimates of lag square residual and past variance have significant effect on conditional variance. The lag volume is also showing a positive and significant impact on volatility in case of overall market.

Table 1: Summary Statistics of the Market Returns

	Mean	Std. Dev	Skewness	Kurtosis	Jarque-Bera	Prob	Obs
r_m	0.001	0.048	-0.04	489.29	24827691.07	0.000	2520
V_m	18.93	0.927	-2.67	18.52	28410.77	0.000	2532

Table 2: Stationarity Test of Market (KSE 100)

	r_m	V_m
Market Index	-33.41*	-35.21*

The * indicates significance at 1%,

Table 3: Evidence on the First Order Autocorrelation in Market Return

	c	r_m (-1)	V_m(-1)	R^2
r_m	-0.001 (-1.55)	0.42* (23.65)		0.28
r_m	0.001** (1.91)		0.52* (26.49)	0.27
r_m	-0.04 (-2.29)	0.43* (23.69)	0.002* (2.37)	0.31

Note: The * indicates significance at 1%, ** indicates at 5%.

Table 4: Granger Causality Test Based on Vector Autoregressive Analysis

Volume causes Return		Return causes Volume	
α_0	-0.04* (-2.42)	γ_0	0.50* (3.27)
α_1	0.55* (27.62)	γ_1	0.51* (29.66)
α_2	-0.30 (13.23)	γ_2	0.13* (5.56)
α_3	0.15* (6.67)	γ_3	0.08* (3.59)
α_4	0.07* (-3.64)	γ_4	0.17* (8.62)
β_1	0.01* (4.09)	δ_1	1.00* ((5.86)

			Table 4 contd
β_2	0.02 (1.03)	δ_2	0.39* (2.00)
β_3	0.01 (0.28)	δ_3	0.43* (2.24)
β_4	0.04** (1.69)	δ_4	0.19 (1.09)
F-Stat	97.76**		1760.13*
R^2	0.39		0.85

Note: The * indicates significance at 1%, ** indicates at 5%.

Table 5: Evidence on the Return, Volume and Volatility by GARCH-M Model

	C	**$_{rm}$(-1)**	**GARCH-M**	**c**	**ARCH**	**GARCH**	**V_{t-1}**	**R2**
KSE 100	0.01*** (1.47)	0.31* (7.23)	-0.12 (-1.17)	-0.01* (-6.75)	0.03* (5.58)	0.52* (7.31)	0.001* (6.71)	0.36

Note: The * indicates significance at 1%

B. Firm Level Analysis:

For in depth analysis we have done the same analysis on firm level data. Table 6 shows that individual stock returns and their detrended trading volume are stationary by applying the Augmented Dickey Fuller Test. The result to check for possible autoregressive effects in stock returns as shown in table 7 indicates that in most of the stocks (67 out of 70) there is statistically significant positive autocorrelation of the first order. Baklaci and Kasman (2006) find no autocorrelation in case of individual stocks in Turkish market. The causal relationship between stock return and stock volume is tested by F-test by applying the Granger Causality approach as shown in table 8.

Table 9 reports the findings of relationship between return, volatility and volume. The mean equation allows the autoregressive process with GARCH mean term. The conditional variance is estimated by GARCH-M model using trading volume as unobserved measure of information that flows into the market. The results show presence of significant autoregressive process of first order. This pattern indicates that disturbances experienced as included in information set during any period have permanent effect on future path of returns. In other words, shocks in rate of return experienced during a period have a rigid relationship with future returns. The causal relationship between stock return and trading volume is examined by F-test to test the null hypothesis that volume does not cause return and returns do not cause volume. The result reported in Table 8 show that the volume is influenced by returns for more stocks (24 out of 70), and then reverse relationship holds true for 17

stocks. For 10 stocks the relationship between return and volume is bi-directional and 13 stocks have no relationship at all. The results of AR with GARCH (1, 1)-M model suggests that in almost all stocks there exists autocorrelation of first order. The GARCH equation parameterize conditional variance, an intercept of this equation shows the portion of price volatility that remains constant over time. The ARCH (1) and GARCH (1) effects are found to be present at one percent (1%) significance level. This shows that the lag square residual and lag variances and lag volume have significant impact on conditional variance at firm level. Regarding the GARCH-M term, in 50 percent stocks, investor get reward for variance risk (36 out of 70 stocks). Therefore, the significance of GARCH-M model shows that the variance risk is significantly compensated by the Pakistani market, where the variance risk is influenced by the trading volume as well as past error term and past variances.

Table 6: Stationarity Test

Company	Returns	Volume	Company	Returns	Volume
DBCI	-2.67*	-6.36*	DLL	-47.66*	-7.25*
DADX	-48.25*	-18.65*	CARF	-43.80*	-15.41*
DNCCR	-34.89*	-6.56*	ADMM	-48.92*	-6.80*
FUJI	-56.99	-3.89*	ZHTM	-40.47*	-3.87**
MLCF	-54.99*	-4.18*	SFL	-51.11*	-6.17*
ZELP	-54.23*	-3.28***	MINT	-32.49*	-3.83*
PIOCR	-52.61*	-9.20*	KOIL	-18.75*	-14.67*
PKSL	-52.25	-6.36*	AMAT	-34.32*	-9.60*
MUCL	-40.74*	-3.64**	HKKT	-53.26*	-6.85*
PCCLR	-39.00	-3.30**	SMTM	-51.17*	-12.38*
CHCC	-16.91*	-7.66*	YOUW	-57.36*	-11.24*
DGKC	-49.99*	-3.13***	NAKI	-29.55*	-7.49*
ALTN	-39.56*	-9.69*	ACCM	-40.57*	-7.10*
ATRL	-43.39*	-4.06*	AZAMT	-33.29*	-19.99*
GENP	-41.47*	-6.84*	BILF	-40.34*	-7.67*
HUBC	-48.33*	-3.61*	CWSM	-34.36*	-8.48*
IDEN	-48.01*	-31.82	AWAT	-61.12*	-8.72*
JPGL	-51.61*	-4.62*	ELSM	-53.53*	-17.23*
KESC	-32.24*	-5.16*	DKTM	-30.95*	-5.756*
KOHC	-55.20/*	-7.85*	FZCM	-50.22*	-12.71*
KOHP	-24.79*	-9.93*	ITFT	-47.13*	-16.41*
MARI	-46.04*	-7.74*	NCL	-49.15*	-10.01*
NATR	-48.81*	-5.51*	JATM	-61.78*	-5.18*
PSO	-46.26*	-5.57*	SUCM	-22.37*	-8.08*
POL	-32.23*	-3.60**	ZAHT	-40.61*	-6.87*
PRL	-46.46*	-8.14*	STWS	-53.09*	-9.37*
SGPL	-28.91*	-11.15*	KSTM	-33.90*	-13.59*
SHEL	-48.69*	-7.84*	TAJT	-41.19*	-7.83*
SITE	-52.56*	-9.94*	AQTM	-29.37*	-9.84*
SECP	-55.02*	-7.34*	QAYS	-40.77*	-5.12*
SNGC	-48.92*	-3.33***	RCML	-31.65*	-8.82*
SSGC	-50.35*	-3.41*	OLSM	-31.65	-5.44*

					Table 6 contd
TSPL	-34.17*	-7.43*	SAIF	-51.10*	-5.649
GFIL	-63.86*	-3.14**	SHCM	-57.94*	--21.82*
FTHM	-47.68*	-7.43*	SZTM	-16.87*	-13.30*

Note: The * indicates significance at 1%, ** indicates at 5% and *** indicates significance at 10% level.

Table 7: Evidence on the First Order Autocorrelation in Stock Returns

Comp	**$r_t(-1)$**	**R^2**	**Comp**	**$r_t(-1)$**	**R^2**	**Comp**	**$r_t(-1)$**	**R^2**
DBCI	0.13*	0.26	POL	0.09*	0.27	SGPL	0.08*	0.17
DADX	(0.04*	0.27	PRL	0.01	0.21	SHEL	0.07*	0.25
DNCCR	(0.18)*	0.21	PSO	0.08*	0.27	SITE	0.08*	0.26
FUJI	(0.11)*	0.21	AZAMT	0.13*	0.21	SECP	0.18*	0.23
MLCP	(0.07)*	0.25	BILF	(0.10)*	0.20	SNGC	0.01	0.22
ZELP	(0.04)*	0.29	CWSM	0.10*	0.21	SSGC	0.04*	0.22
PIOCR	(0.04)**	0.24	AWAT	0.08)*	0.26	TSPL	0.08*	0.26
PKSL	(0.11)*	0.21	ELSM	0.15*	0.22	GFIL	0.03**	0.28
MUCL	(0.06)*	0.24	DKTM	(0.11*	0.22	FTHM	0.01	0.14
PCCLR	(0.08)*	0.27	FZCM	(0.19)*	0.24	DLL	0.17*	0.23
CHCC	(0.06)*	0.23	ITFT	(0.06)*	0.24	CARF	0.23*	0.25
DGKC	(0.01)	0.25	NCL	(0.07)*	0.25	ADMM	0.05*	0.23
ALTN	0.01	0.20	JATM	(0.001	0.27	ZHTM	0.05*	0.23
ATRL	0.15*	0.22	SUCM	0.01	0.21	SFL	0.13*	0.27
GENP	0.16*	0.23	ZAHT	0.03	0.26	MINT	0.03***	0.18
HUBC	0.04*	0.22	STWS	0.20*	0.24	KOIL	0.38*	0.24
IDEN	(0.05)*	0.22	KSTM	0.18*	0.23	AMAT	0.02	0.23
JPGL	(0.03)	0.27	TAJT	0.07*	0.25	HKKT	0.13*	0.12
KESC	(-0.01)	0.26	AQTM	0.05*	0.23	SMTM	0.10*	0.15
KOHE	0.09*	0.18	QAYS	0.10*	0.21	YOUW	0.15*	0.22
KOHP	-0.02	0.23	RCML	0.11*	0.21	NAKI	0.06*	0.23
MARI	0.09*	0.27	OLSM	0.05*	0.23	ACCM	0.03***	0.28
NATR	0.01	0.21	SAIF	(0.09)*	0.18	SHCM	0.14*	0.29

Note: The * indicates significance at 1%, ** indicates at 5% and *** indicates significance at 10% level.

Table 8: Granger Causality between Stock Return and Volume Based on F-Test

Com	**rt**→Vt	Com	**Vt**→rt	Com	Feedback	Com	No Causality
DBCI	3.35***	DADX	9.44*	FUJI	3.46*** 1.23*	ALTN	1.80, 0.08
ZELP	5.20*	DNCCR	5.19*	MLCP	9.20*, 10.36*	KOHE	0.66, 0.73
PCCLR	5.42***	PKSL	6.39*	MUCL	8.69*, 4.74*	NATR	2.00, 1.62
CHCC	4.82**	SITE	3.35	PIOCR	4.46*, 4.55*	SGPL	1.12. 2.33
DGKC	17.10*	CARF	8.64*	JPGL	4.47*, 2.86**	SHEL	0.13, 3.16
IDEN	14.00*	ADMM	4.50*	SUCM	14.82*, 9.89*	SECP	4.30, 0.06
KESC	6.13*	NAKI	7.95*	OLSM	3.75*, 5.10**	HKKT	2.2.7, 1.88
KOHP	7.76*	AWAT	7.09*	SAIF	11.06*, 6.62*	ACCM	5.07, 2.99
MARI	11.31*	ELSM	5.44**	ZHTM	3.89**, 4.07*	AZAMT	1.83, 2.55
PSO	4.32*	NCL	7.50*	SFL	3.51**, 7.69*	ITFT	12.24, 9.56
POL	6.81*	JATM	9.01*			QAYS	2.08, 3.51
PRL	5.11*	ZAHT	5.42*			SZTM	3.73, 2.92

SNGC	6.11*	STWS	11.74*			ATRL	2.54, 2.04
TSPL	7.81*	SHCM	7.69***				
GFIL	9.06*	MINT	5.53*				
FTHM	19.62*	GENP	5.70*				
DLL	33.17**	HUBC	14.37*				
AMAT	6.06*	KOIL	17.42*				
SMTM	4.50*						
YOUW	7.28*						
BIFL	4.21**						
DKTM	6.73*						
FZCM	5.85*						

Note: The * indicates significance at 1%, ** indicates at 5% and *** indicates significance at 10% level

Table 9: Evidence on the Return, Volume and Volatility by GARCH-M Model

Company	c	$r_t(-1)$	GARCH-M	c	ARCH	GARCH	V_{t-1}	R^2
DBCI	0.001	0.08*	0.01	0.002*	0.09*	0.85*	-0.001*	0.24
DADX	0.001*	0.02*	0.24*	0.001*	0.002*	0.28*	0.001*	0.31
DNCCR	0.002	0.04**	0.09	0.001*	0.15*	0.81*	0.001*	0.24
FUJI	0.001	0.06*	0.04	0.002*	0.11*	0.87*	0.001*	0.29
MLCP	0.003	0.002	0.02	0.001*	0.10*	0.86*	0.002*	0.06
ZELP	0.002	0.31*	-0.07*	0.001*	0.39*	-0.02*	0.001*	0.07
PIOCR	0.002*	0.11*	0.05*	0.002*	0.06*	-0.01*	0.001*	-0.02
PKSL	0.002	(0.13)*	0.07	0.001*	0.04*	0.94*	0.002*	0.10
MUCL	0.001	(0.002)	-0.01	0.001*	0.09*	0.91*	0.001*	0.34
PCCLR	0.001	(0.05)	0.01	0.00	0.05	0.94*	0.001*	0.06
CHCC	0.001	(0.06)	0.03	0.00	0.06	0.90*	0.002*	0.31
DGKC	0.001	(0.01)	0.01	0.00	0.18	0.74*	0.002*	0.31
ALTN	0.002	(0.37)	-0.19	0.001	0.62	0.35*	0.002*	0.19
ATRL	0.003	(0.20)	0.12	0.00	0.16	-0.03*	0.003*	0.21
GENP	0.002	(0.24)	-0.02	0.00	0.30	0.30*	0.001*	0.17
HUBC	0.001	(0.04)	0.20	0.00	0.16	0.61*	0.001*	0.16
IDEN	-0.01	(0.001	0.29	0.00	0.00	-0.01*	0.001*	0.40
JPGL	0.001	(0.05)*	-0.12	0.00	0.20	0.58*	0.002*	0.01
KESC	0.001**	0.001	-0.19*	0.001*	0.23*	0.55**	0.001*	0.28
KOHE	0.002*	0.09*	0.14*	0.001*	0.06*	-0.11**	0.001*	0.12
KOHP	0.003	0.04	0.20*	0.02*	0.09*	0.63*	0.001	0.08
MARI	0.002	(0.07)*	0.06**	0.002*	0.07*	-0.08*	0.001*	0.08
NATR	0.001	(0.02)	0.09	0.001*	0.18*	0.71*	0.001*	0.05
PSO	0.002**	(0.03)**	0.08**	0.002*	0.22*	0.75*	0.001*	0.05
POL	0.001	(0.16)*	0.03	0.001*	0.37*	0.63*	0.001*	0.11
PRL	0.001	(0.12)*	0.09	0.001*	0.06*	0.91*	0.001*	0.51
SGPL	0.002	(0.13)*	-0.04*	0.001*	0.06*	0.08*	0.001*	0.28
SHEL	-0.01*	(0.01)	0.39*	0.001*	0.18*	0.56*	0.001*	0.08
SITE	0.002**	(0.07)*	-0.18**	0.001*	0.12*	0.81*	0.001*	0.07
SECP	0.001	(0.01)	0.02	0.001*	0.17*	0.68*	0.001*	0.07
SNGC	0.001	(0.04)**	0.10***	0.001*	0.12*	0.82*	0.001*	0.11
SSGC	0.001	(0.04)***	0.05	0.002*	0.16*	0.78*	0.001*	0.14
TSPL	0.002	(0.19)*	0.06	0.001*	0.06*	0.92*	0.001*	0.28
GFIL	0.01*	(0.08)*	-0.43*	0.002*	0.11*	-0.02*	0.001*	0.07
FTHM	0.01*	(0.49)*	0.45*	0.001*	1.82*	0.36*	0.002*	0.26
DLL	0.02	(0.09)*	-0.11*	0.001*	0.13*	0.88*	0.001*	0.04
CARF	0.001	(0.13)*	0.09***	0.001*	0.14*	0.57*	0.00*	0.04
ADMM	0.002**	(0.01)	0.04**	0.001*	0.001**	-0.05*	0.001*	0.04
ZHTM	0.01*	(0.002)*	0.04	0.001*	1.28*	0.08*	0.001*	0.03
SFL	0.002*	(0.07)*	-0.03*	0.001*	1.01*	0.001*	0.002*	0.02
MINT	0.002	(0.01)*	-0.03***	0.002*	0.05*	0.28*	0.001*	0.14
KOIL	0.01	(0.12)*	-0.01	0.002*	0.53*	0.39*	0.002*	0.09

AMAT	0.02-*	(0.01)*	0.002*	0.001*	16.25*	0.001*	0.01*	0.30
HKKT	0.002*	(0.01)*	0.002*	0.001*	28.87*	0.001*	0.002*	0.33
SMTM	0.003**	(0.01)*	0.002*	0.001*	0.54*	0.11*	0.001*	0.20
YOUW	0.001*	(0.002)*	-0.01*	0.002*	0.02*	0.01*	0.002*	0.29
NAKI	0.001*	(0.01)*	-0.09*	0.001*	16.21*	-0.01*	0.001*	0.22
ACCM	0.002*	(0.01)*	0.001*	0.001*	164.21	0.001*	0.001*	0.15
AZAMT	0.002	(0.002)*	0.001*	0.002*	0.04*	0.35*	0.002*	0.15
BILF	0.004*	(0.11)*	0.11*	0.001*	0.33*	0.002*	0.001*	0.21
CWSM	0.002*	(0.04)*	0.02*	0.002*	3.76*	0.10*	0.001*	0.09
AWAT	0.001/*	(0.04)*	-0.16/*	0.001*	3.12*	0.002*	0.001*	0.21
ELSM	0.001*	(-0.01)*	0.002*	0.001*	24.79*	0.002*	0.001*	0.06
DKTM	0.003*	(0.07)*	-0.10/*	0.002*	1.67*	0.002*	0.001*	0.34
FZCM	0.001*	(0.01)	0.02*	0.001*	0.03*	0.14*	0.001*	0.59
ITFT	0.001	(0.12)*	0.06*	0.001*	0.62*	0.002*	0.002*	0.19
NCL	0.002**	(0.23)*	0.04*	0.001*	0.90*	0.03*	0.002*	0.43
JATM	0.002*	(0.01)*	0.001*	0.001*	75.68*	0.002*	0.001*	0.29
SUCM	0.003*	(0.01)*	0.001*	0.002*	14.26*	0.001*	0.01*	0.22
ZAHT	0.001	(-0.12)*	0.06*	0.001*	0.62*	0.001*	0.002*	0.19
STWS	0.001*	(0.01)*	0.001*	0.001*	11.88*	0.02*	0.01*	0.44
KSTM	0.01*	(0.01)*	0.001*	0.002*	22.61*	0.001*	0.001*	0.16
TAJT	0.01	(-0.04)*	0.04	0.001*	0.01*	-0.09*	0.001*	0.59
AQTM	0.001*	(0.001)*	-0.07*	0.001*	0.49*	0.23*	0.002*	0.09
QAYS	0.002*	(0.01)*	0.001**	0.002*	26.13*	0.001*	0.01*	0.12
RCML	0.002*	(0.01)*	0.001*	0.001*	29.81*	0.001*	0.002*	0.13
OLSM	0.002*	(0.001)*	0.001*	0.002*	63.25*	0.001*	0.001*	0.12
SAIF	0.001*	(0.09)*	0.14*	0.003*	0.46*	0.01*	0.001*	0.69
SHCM	0.002*	(0.001)*	0.002*	0.00	16.02*	0.002*	0.001*	0.52
SZTM	0.002*	(0.06)*	-0.05*	0.002*	1.99*	0.40*	0.001*	0.02

Note: The * indicates significance at 1%, ** indicates at 5% and *** indicates significance at 10% level.

V. CONCLUSION

This study analyzes the relationship between stock returns, volatility and trading volume based on the daily data of the market described by KSE 100 index and on the firm level in case of Pakistani Market. The sample size comprises of seventy firms of the three manufacturing sectors of Pakistan for the period of July 1998 to October 2008. The results indicate there is evidence of first order autocorrelation in market return and individual stock returns. The findings suggest that there is significant effect of the previous day trading volume on the current return and this implies that previous day returns and volume has explanatory power in explaining the current market returns. The results of Granger Causality test suggest that there is feedback relationship between market return and trading volume. However, in case of individual stock returns the evidence indicates stronger return causing volume than volume causing returns. The empirical results verify that there is significant interaction between trading volume and return volatility when volume is entered into variance equation of GARCH-M model. The results of our study are supported by previous empirical evidence by Doe *et al.* (2008) for Asia Pacific market, Baklaci and Kasman (2003) for Turkish market and Mustafa and Nishat (2006) for Pakistani market.

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APPENDIX

List of 70 Manufacturing Firms with their Symbols

Serial No.	Company Name	Symbol
1	Dadabhoy Cement Industries Ltd	DBCI
2	Dadex Eternit Ltd	DNCCR
3	Dandot Cement Co Ltd	DNCCR
4	Fauji Cement Co Ltd	FUJI
5	Maple Leaf Cement Factory Ltd	MLCP
6	Zeal-Pak Cement Factory Ltd	ZELP
7	Mustehkam Cement Ltd	MUCL
8	Pakistan Slag Cement	PKSL
9	Pioneer Cement Ltd	PIOCR
10	Pakistan Cement Company Limited	PCCLR
11	Cherat Cement Co Ltd	CHCC
12	D.G. Khan Cement Co Ltd	DGKC

13	Altern Energy Ltd	ALTN
14	Ideal Energy Ltd	IDEN
15	Japan Power Generation Ltd	JPGL
16	Karachi Electric Supply Company Ltd	KESC
17	Kohinoor Energy Ltd	KOHE
18	Kohinoor Power Co Ltd	KOHP
19	Mari Gas Co Ltd	MARI
20	National Refinery Ltd	NATR
21	Pakistan State Oil Co Ltd	PSO
22	Pakistan Oilfields Ltd	POL
23	Pakistan Refinery Ltd	PRL
24	S.G. Power Ltd	SGPL
25	Shell Pakistan Ltd	SHEL
26	Sitara Energy Ltd	SITE
27	Southern Electric Power Co Ltd	SECP
28	Sui Northern Gas Pipelines Co Ltd	SNGC
29	Sui SouthernGas Pipelines Co Ltd	SSGC
30	Tri-Star Power Co Ltd	TSPL
31	Ghazi Fabrics International Ltd	GFIL
32	Fateh Textile Mills Ltd	FTHM
33	Dawood Lawrencepur	DLL
34	Caravan East Fabrics Ltd	CARF
35	Artistic Denim Mills Ltd	ADMM
36	Amazai Textile Mills Ltd	AMAT
37	Hakkim Textile Mills Ltd	HKKT
38	Samin Textile Mills Ltd	SMTM
39	Yousaf Weaving Mills Ltd	YOUW

40	Nakshbandi Industries Ltd	NAKI
41	Accord Textile Mills Ltd	ACCM
42	Azam Textile Mills Ltd	AZAMT
43	Bilal Fibers Ltd	BIFL
44	Chakwal Spinning Millls Ltd	CWSM
45	Awan Textile Mills Ltd	AWAT
46	Ellcot Spinning Mills Ltd	ELSM
47	Dewan Khalid Textile Mills Ltd	DKTM
48	Fazal Texitile Mills Ltd	FZCM
49	Ittefaq Textile Mills Ltd	ITFT
50	Nishat (Chunian) Ltd	NCL
51	J.A. Textile Mills	JATM
52	Sunshine Cotton Mills Ltd	SUCM
53	Zahidjee Textile Mills Ltd	ZAHT
54	Saritow Spinning Mills Ltd	STWS
55	Khalid Siraj Textile Mills Ltd	KSTM
56	Taj Textile Mills Ltd	TAJT
57	Al-Qaim Textile Mills Ltd	AQTM
58	Qayyum Spinning Mills Ltd	QAYS
59	Reliance Cotton Spinning Mills Ltd	RCML
60	Olympia Spinning & Weaving Mills Ltd	OLSM
61	Saif Textile Mills Ltd	SAIF
62	Shadman Cotton Mills Ltd	SHCM
63	Shahzad Textile Mills Ltd	SZTM
64	Zahur Textile Mills Ltd	ZHTM
65	Sapphire Fibres Ltd	SFL
66	Mian Textile (Industries) Ltd	MINT

67	Attock Refinery Limited	ATRL
68	Genertech Pakistan	GENP
69	Hub Power Company Limited	HUBC
70	Kohinoor Industries Limited	KOIL