RISK, RETURN AND TRADING VOLUME RELATIONSHIP IN AN EMERGING STOCK MARKET: A CASE STUDY OF KARACHI STOCK EXCHANGE

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Abstract

The paper determines the empirical relationship between risk, return and trading volume in the Karachi Stock Exchange (KSE) using the GARCH-M technique, and data for the time period December 1991 to December 2010. The paper contributes by introducing the trading volume as a proxy for the flow of information to explain the return in Pakistan's stock exchange. Such information affects, at the same time, risk and return. The work considers a long time period, based on daily data. This study attempts to incorporate the changing settlement period during the study period. Results show that daily return volatility is time-varying and highly persistent. Contemporaneous changes in trading volume have a positive effect on returns. The previous day's change in trading volume affects the conditional volatility of returns positively. Therefore, trading volumes have positive information content in predicting returns in all settlement periods except settlement period T+2. Moreover, as settlement period reduced, the day of the week anomalies disappeared, as identified by Nishat and Mustafa (2002). If settlement period T+1 is introduced, we expect that weekdays anomalies will disappear.

Keywords: Risk, return, volume and GARCH-M model.

JEL Classification: C22, G11.

1 INTRODUCTION

Karachi stock exchange (KSE) was been hailed as one of the best performing emerging markets during 1990. Before 1990, the Karachi stock exchange (KSE) could not play its crucial role in economic development. The KSE was

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narrow and unable to cater the long-term capital needs of the economy. Commercial banks and development financial institutions provided the long-term capital needs. The stock market was no more a 'side show', a hunting ground for the rich where fortunes were made or lost. Due to these reasons the efficient working of stock market was a big question mark. The KSE had been characterized as a speculative market, where preferential treatment was given to members of stock markets for their role as market makers[1]; time span of trade settlements[2] was large. From the regulatory side, there was only loose enforcement of rules and regulation[3] and foreign investors were not allowed to invest in KSE without the prior approval of the government. Moreover, restriction on outflow and inflow of foreign exchange[4]; liquidity constraints, narrow trading base and limited use of technology[5] were constrained to develop the market. Like many other emerging markets KSE is considered a shallow market[6], plays a limited role in raising funds[7] and is a fairly volatile[8] market. The market has experienced the booms and bursts of comparatively short time duration, which may be due to poor information, weak institutional supports and lack of compliance with regulating authority requirements. As a result information played a limited role in stock market.

The importance of Karachi Stock market has been increasing since 1990 after the structural changes to the stock market, such as the construction of a new stock price index, i.e. KSE-100 index[9], volume, market capitalization

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[1] There were no margin requirements for members in their mutual trade, and as a result a considerable part of trade was between members themselves. It did not necessarily represent the true small investors. Moreover, members were involved in speculative trade among them and took command on stock positions.

[2] At that time it took time seven to fourteen days for settlements of shares and transfers the registration of share from seller to buyers. As a result *badla* financing and other informal trade began which ultimately increase the uncertainty in stock market.

[3] This raised the problems of insider trading through unchecked marginal requirements. These marginal requirements were neither regulated nor rigorously enforced. As a result the trade in stock market takes place with too much leverage, which could easily force a trader into bankruptcy if his expectations about the future prices were not materialized.

[4] This policy kept the foreign investors away from Pakistani stock markets.

[5] These constraints limited the number of listed companies and their market capitalization.

[6] The market capitalization to GDP ratio (293.67%) is less than turns over to GDP ratio (457%) in 2009. Pakistan stock market in contrast to developed market such as US capital where market capitalization to GDP ratio is 92 percent turnover is 65 percent. It implies that the size of the market is less than the size of the economy in Pakistan.

[7] In 2009 four new companies were listed in KSE which raised Rs. 8.76 billion.

[8] During 2009, standard deviation of KSE-100 was 1351.43.

[9] Before the KSE-100 index there was KSE-50 index.

and changes in new settlement periods[10]. These were the result of financial liberalisation and deregulation policy and have a greater impact in the form of uncertainty and risk aversion. To play a required role in mobilization of capital in the economy, many policies were taken to open the market to foreign investors as well as to attract the local investors. The institutional development and reforms resulted in more disclosure of information through frequent issue of quarterly and annual reports, the announcement of dividends, annual general meetings and the issue of the daily quotation.

Moreover, the Karachi stock market has taken many measures to protect investor's interest from excessive volatility in prices. These include the introduction of Karachi Automated Transaction Systems (KATS), which is an upgrade to handle excessive trading volume; Central Depository System (CDS), which is helping to deal more than one million shares per day, and National Clearing System that handles the clearing and settlement of the three exchanges of the country under one roof. These measures have eliminated the chances of forgery frauds and delays in transfer, and thus have caused a decline in the volatility of stock prices. In addition to that, the exchange provides information on real time basis to investors through the Internet. The Security and Exchange Commission of Pakistan (SECP) provides guidelines to reinforce good corporate governance, with the aim of enhancing investor confidence by increasing transparency in the business practices of listed companies. In order to minimize the organizational weakness and to improve the financial soundness the government has privatized the financial and non-financial institution. They generated the funds from stock markets that ultimately improved the performance of stock market. Further, they also helped in linking information about the ever changing political and economic environment, and helped investors to relate all such information to the trading activity of the market in a gainful manner; this has minimized the chances for investors earning above normal profit.

As discussed in the literature, price and trading volume are the two most important variables in analysis of efficient market hypothesis because the chartists watch both price and trading volume. Because stock price pattern provides the signals, many technicians believed that the trading volume should rise to reinforce the trend. Such reinforcement indicates buyers' or sellers' interest, and this interest might be related to a change in fundamentals. A number of studies have been conducted regarding to the link between

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[10] During December 14, 1991 to April 02, 2001 the settlement periods were T+5 and T+7, during April 03, 2001 to August 06, 2007 the settlement period were T+3 and since August 07, 2007 settlement period is T+2.

trading volume and stock return[11]. Most of these studies found the empirical relationship between trading volume and returns to be linear as well as non-linear.

In Karachi stock exchange information is available on a real time basis with trading volume and it controls the return. That is why it is interesting to investigate the relationship between risk and return with information in Karachi stock exchange. It is expected that, in the KSE, return is positively related to both risk and trading volume. For estimation and testing the validity of the hypothesis the ARCH which is Generalised ARCH in Mean (GARCH – M) specification has been used following Lamourex and Lastrapes (1990), which differentiates this study to other studies in the context of Pakistan. The main purpose of using ARCH is that a conditional stochastic process generates the return data with a changing variance which is required in this analysis.

A few studies (Ali, 1997, Nishat and Mustafa, 2008) have been conducted on the topic with reference to Pakistan. Ali (1997), who studied the relationship between stock prices and trading volume in the context of the Karachi Stock Market, used daily data for a very small time period (nine months data). He found the significance of non-informational trade in explaining the fluctuations in stock prices. Nishat and Mustafa (2008) examined the relationship between aggregate stock market trading volume and serial correlation of daily stock returns. They reported that the non-informational trade has a significant effect on prices and trading activity in addition to present returns, non-linear volume and volatility. Both studies used trading volume as a non-informational variable. Hussain, (1999) and Nishat, and Mustafa, (2002) also investigated day of the week effect. The literature provided the evidence that one of the major reasons for the day of the week effect is the settlement period. However, neither of these studies considered the settlement period. We have considered the settlement period, which differentiates this study from other studies. The main objective of this study is to empirically determine the relationship between risk, return and trading volume in KSE. This study is different to previous studies in two aspects. First, trading volume is used as informational variable with risk, and secondly the GARCH – M model is used in context of Pakistani stock market.

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[11] Some of these studies are Granger and Morgenstern (1963), Ying (1966), Copeland (1976), Epps and Epps (1976), Morgan (1976), Morse (1980), Fellingham *et al*. (1981), Hinich and Patterson (1985), Delong *et al*. (1990), Brock *et al*. (1991), Hsieh (1991), Duffee (1992), LeBaron (1992), Sentana and Sushil (1992), Brock (1993), Campbell *et al*. (1993), Hiemstra and Jones (1994), Omran and Mckenzie (2000), Chen *et al*. (2001), Kamath and Wang (2006), and Kamath (2008).

The rest of the paper is organized as follows: Section 2 describes the research methodology and data. The empirical results are given in Section 3 followed by the concluding remarks in Section 4.

2. RESEARCH METHODOLOGY AND DATA

The GARCH model (Bollerslev, 1986) and the ARCH in Mean (ARCH-M) (Engel, Lilien and Robins 1987) provide the forecast variance. This variance varies over time and lagged values and incorporated in the variance equation. The justification for the preference of the GARCH model over the ARCH-M model is the higher order ARCH representation in GARCH model which is parsimonious and easier to identify and estimate (Enders, 1995). The modified version of GARCH–M(1,1) is specified by introducing trading volume into the equation and termed as Augmented GARCH–M(1,1) estimation. Lamourex and Lastrapes (1990) suggested on the basis of empirical evidence that for the risk and return relationship GARCH-M provides a reasonable starting point. To search for the relationship between risk, return and trading volume in the KSE the GARCH–M(1,1) procedure is specified.

The daily stock return R_t are calculated as

$$R_t = LnP_t - LnP_{t-1} \tag{1}$$

Since stock return (R_t) and trading volume (V_t) in their level form are random walk, the daily stock return and daily trading volume are defined and calculated in their (log) first difference form as:

$$\Delta R_t = Ln(R_t / R_{t-1}) \tag{2}$$

$$\Delta V_t = Ln(V_t / V_{t-1}) \tag{3}$$

Risk and trading volume are treated as explanatory variables in the system. Empirical evidence provides a significant day of the week effect in the KSE (Nishat and Mustafa, 2002). Hence, the specification includes the dummy variables reflecting the daily pattern. In order to avoid multi-collinearity trap constant term is dropped from the equation D_t. are dummy variables representing the days of the week and h_t is the estimated square root of variance taken to be a proxy for risk as suggested by ARCH-M specification and e_t is the stochastic process and assumed to be distributed normally conditional on the information set I_{t-1} given to the individual at time t-1.

$$\Delta R_t = \sum_{i=1}^{5} \delta_t D_i + \sum_{i=0}^{N} \alpha_i \Delta R_{t-1-i} + \pi_1 h_t + \pi_2 \Delta V_t + e_t \tag{4}$$

$$h_t^2 = \sum_{i=1}^{q} \alpha e_{t-i}^2 + \sum_{i=0}^{p} \beta h_{t-1-i}^2 + \gamma \Delta V_{t-1} + u_t \tag{5}$$

$$e_t \Big/ \Psi_{t-1} \cong N(0, h_t) \tag{6}$$

where α, $\beta > 0$ and the sum $\alpha + \beta < 1$ should be satisfied for the model not to be explosive and to guarantee positive variances. However, with the inclusion of one period lag value of trading volume the equation may fail, but we test it empirically.

Daily data on KSE-100 index is used to calculate return. Total trading volume is taken as number of shares sold in a day. The sample size is taken to be 4580. The return is empirically determined by taking risk and information factors, as the trading volume is a proxy for information which is influenced by exogenous and endogenous variables in the economy. Trading volume is incorporated as an explanatory variable in the equations. Moreover, because trading volume has direct impact on risk, it is introduced in the variance equation with one period lag.

3   DISCUSSION OF RESULTS

Table 1 shows the descriptive statistics of daily data for KSE-100 index returns of full sample period and settlement time periods. It indicates that the frequency distribution of the return series of KSE-100 index for the full sample period and different settlement periods (T+2 and T+3) are not normal. The evidence of the coefficient of Kurtosis values ranges from 5.4202 to 11.7594. These fall under the Leptokurtic distribution. The highest coefficient of Kurtosis is observed during settlement period T+3 (11.7594) that indicates the extreme Leptokurtic. The lowest coefficient of Kurtosis is observed during settlement period T+2 (5.4202), which indicates that the series is slim, and has a long tail. The Joruque Berra (JB) test also shows the clear pattern of the series is normally distributed. All return series including full sample period and during different settlement sub-periods show positive and higher

Table 1: Descriptive Statistics of Daily Market Return

This table presents mean value, standard deviation, minimum value, maximum value, Skewness, Kurtosis, Jorque Bera and coefficient of variation of KSE-100 returns, and the returns of all settlement periods full sample period.

	Full sample	T+5 periods	T+3 periods	T+2 periods
Mean	0.0004	-0.0001	0.0015	-0.0002
Median	0.0007	-0.0001	0.0023	0.0000
Maximum	0.1582	0.1276	0.1582	0.0825
Minimum	-0.1321	-0.1321	-0.1086	-0.0528
Std. Dev.	0.0166	0.0173	0.0162	0.0154
Skewness	-0.0843	-0.1189	0.0415	-0.2016
Kurtosis	9.6887	9.458	11.7594	5.4201
CV	41.5	-173	10.8	-77
Jarque-Bera	8541	3816	4990	206
Observations	4579	2193	1561	825

Table 2: Descriptive Statistics of Daily Volume

This table presents mean value, standard deviation, minimum value, maximum value, Skewness, Kurtosis, Jorque Bera and coefficient of variation of daily trading volume of all settlement periods and full sample period.

	Full sample	T+5 periods	T+3 periods	T+2 periods
Mean	17.9551	16.9953	19.1431	18.2584
Median	18.4655	17.1581	19.2373	18.7513
Maximum	20.8388	20.1003	20.8388	20.0162
Minimum	8.2161	13.3375	15.11	8.2161
Std. Dev.	1.6562	1.4943	0.7589	1.73
Skewness	-1.0296	-0.0815	-0.7426	-2.9004
Kurtosis	3.8991	1.7244	4.0671	11.8665
CV	0.0922	0.0879	0.0396	0.0948
Jarque-Bera	963	151	217	3859
Observations	4579	2193	1561	825

values of Joruque Berra (JB). Generally, values for Skewness are (zero), and Kurtosis value (3) and JB (zero) indicate that the observed distribution is perfectly normally distributed. Hence, Skewness and Leptokurtic frequency distribution of stock return series of full period indicates that the distribution is not normal. However, the lowest JB (206) observed during sub-sample period T+2 shows reduction in risk. The highest coefficient of variation is observed before settlement period T+3 and the lowest observed during settlement period T+3. This sugests that the return is more volatile before settlement period T+3 than during settlement period T+3. The reason is that risk and uncertainty prevails before settlement period T+3. The returns of full sample periods and settlement period T+3 show positive mean returns, and other two sub-periods show the negative mean return. It implies that in KSE the investors occasionally earn capital gains.

Table 2 shows the descriptive statistics of daily trading volume for full sample period and settlement time periods. The evidence shows the highest coefficient of variation during settlement period T+2 (0.948) and the lowest during settlement period T+3 (0.0396). It indicates that the trading volume during settlement period of T+2 is comparatively more volatile than during settlement period T+3. The reason may be that the SECP capped KSE-100 index at 9550 during 2008[12], whereas settlement period T+3 shows a consistent pattern. The highest mean volume was observed during settlement period T+3 and the lowest before settlement period T+3.

The Pakistan's trading days were changed during study period[13]. The change in trading days during the study period caused some problems to the investigation of the day of the week effect for the full sample period. In order to overcome this difficulty we treated the trading days as the sequence of the days, that is, first trading day, second trading day etc., instead of using the names of the days i.e. Monday, Tuesday etc. Moreover, settlement periods were also changed during the study periods[14]. These two factors affect the day of the week effects. It is also important to note that due to change in settlement cycle during study period, the week effect identified by Nishat

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[12] Due to the negative trend in KSE for past several months during calendar year 2008 the joint committee of SECP and KSE decided to freeze KSE-100 index at 9550 to prevent further decline of the KSE-100 index.

[13] During December 14, 1991 to June 06, 1992 the trading days were Saturday to Wednesday, during June 07, 1992 to February 27, 1997 the trading days were Sunday to Thursday and since February 28, 1997 the trading days have beenMonday to Friday.

[14] During December 14, 1991 to April 02, 2001 the settlement periods were T+5 and T+7, during April 03, 2001 to August 06, 2007 the settlement period were T+3 and since August 07, 2007 settlement period is T+2.

Table 3: Correlation Coefficient between Returns in Days of the Week For Full Sample Period

The table shows the correlation coefficient between returns in days of the week for full sample period. Stock returns are calculated from differences between log of daily stock prices.

		First day	Second day	Third day	Fourth day	Fifth day
First day	Coefficient	1				
	p-values	0.0000				
Second day	Coefficient	-0.0004	1			
	p-values	0.980	0.0000			
Third day	Coefficient	0.0035	0.0032	1		
	p-values	0.815	0.828	0.0000		
Fourth day	Coefficient	0.0018	0.0036	0.0179	1	
	p-values	0.902	0.808	0.227	0.0000	
Fifth day	Coefficient	0.0081	0.0004	-0.0005	-0.0009	1
	p-values	0.584	0.977	0.974	0.951	0.0000

Table 4: Correlation Coefficient between Returns in Days of the Week before T+3 Settlement Period

The table shows the correlation coefficient between returns in days of the week for T+5 Settlement period. Stock returns are calculated from differences between log of daily stock prices.

		First day	Second day	Third day	Fourth day	Fifth day
First day	Coefficient	1				
	p-values	0.0000				
Second day	Coefficient	-0.0011	1			
	p-values	.960	0.0000			
Third day	Coefficient	0.0057	0.0064	1		
	p-values	.791	.764	0.0000		
Fourth day	Coefficient	0.0004	0.0071	0.037	1	
	p-values	.987	.740	.083	0.0000	
Fifth day	Coefficient	0.0136	-0.0001	0.0001	0	1
	p-values	.524	.997	.998	.999	0.0000

Table 5: Correlation Coefficient between Returns in Days of the Week During T+3 Settlement Period

The table shows the correlation coefficient between returns in days of the week for T+3 Settlement period. Stock returns are calculated from differences between log of daily stock prices.

		First day	Second day	Third day	Fourth day	Fifth day
First day	Coefficient	1				
	p-values	0.0000				
Second day	Coefficient	0	1			
	p-values	0.999	0.0000			
Third day	Coefficient	0.0001	-0.0009	1		
	p-values	0.996	0.972	0.0000		
Fourth day	Coefficient	0.0029	-0.0011	-0.0044	1	
	p-values	0.910	0.965	0.862	0.0000	
Fifth day	Coefficient	0.0003	-0.0011	-0.0042	-0.0052	1
	p-values	0.991	0.966	0.868	0.837	0.0000

Table 6: Correlation Coefficient between Returns in Days of the Week During T+2 Settlement Period

The table shows the correlation coefficient between returns in days of the week for T+2 Settlement period. Stock returns are calculated from differences between log of daily stock prices.

		First day	Second day	Third day	Fourth day	Fifth day
First day	Coefficient	1				
	p-values	0.0000				
Second day	Coefficient	0.0015	1			
	p-values	0.964	0.0000			
Third day	Coefficient	0.0012	-0.0003	1		
	p-values	0.972	0.9930	0.0000		
Fourth day	Coefficient	-0.0019	0.0005	0.0004	1	
	p-values	0.955	0.989	0.992	0.0000	
Fifth day	Coefficient	0.0046	-0.0011	0.0025	0.0014	1
	p-values	0.892	0.975	0.943	0.967	0.0000

and Mustafa (2002), may also show different patterns after taking the settlement cycle into consideration. For these reasons it is necessary to check the correlation analysis among days in full sample period and all other settlement periods. The correlation coefficients are reported in table 3, 4, 5, and 6. As observed there is no significant correlation between full sample period and all other settlement sub-periods in week days.

The return and risk relationships (equations 4 and 5) were estimated as a system. We followed the approach suggested by Bollerslev and Woolridge (1992). Based on Akaike and Schwarz Criteria, the three lagged values of return are included. The ARCH – LM statistics indicated no ARCH in the residuals. Equations were first estimated without trading volume and these results are reported in column 2 of table 7 under GARCH-M(1,1). Risk (h_t) is positively related with return but the coefficient is statistically insignificant which implies no plausible signal of misspecification. This is because during the sample period different settlement periods were observed before T+3, during T+3 and T+2 which would imply a variation in risk but not the elimination of risk. However, when same criteria is applied for different time periods such as before settlement period T+3, during settlement period T+3 and settlement period T+2, different results are revealed. The empirical results of different settlement sub-periods are presented in table 8, 9, and 10, which indicate that there is no difference between before settlement period T+3, during settlement period T+3 and settlement period T+2 and full sample period regarding the relationship between risk and return. However, the Risk (h_t) is negatively and insignificantly related to return during settlement period T+2. One possible explanation may be that during this time period the KSE-100 Index declined over 45 per cent from January 2008 to August 2008, including 12 per cent in just one week[15].

In case of the day of the week effects as shown in tables 7 to 10, the first day dummy are statistically significant and negatively related with return and the rest of the days are statistically insignificant and positively related to return except second day[16]. First day effect in KSE supports the evidence of developed countries' stock market behavior. This is possibly due to the changes in settlement periods in the KSE during the study periods. The positive sign of dummy indicates that the payments of the shares are made

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[15] Due to the negative trend in KSE-100 index for past several months during calendar 2008 the joint committee of SECP and KSE decided to freeze KSE-100 index at 9500 to prevent further decline to the KSE-100 index.

[16] Nowadays the KSE practice is for T+2 settlement periodsin. Before T+2 settlement periods, T+3, T+5 and T+7 settlement systems were practiced during study period.

Table 7: Empirical Results of the Risk,
Return and Trading Volume Relationship (Full Sample Size)

Table shows the Empirical Results of the Risk, Return and Trading Volume Relationship for full sample size. Third column presents estimation without trading volume. Fourth column shows the augmented GARCH-M (1,1) without incorporation of volume. Fifth column depicted augmented GARCH-M (1,1) with incorporation of trading volume.

		GARCH-M (1,1)	Augmented GARCH-M (1,1)	Augmented GARCH-M (1,1)
R_{t-1}	Coefficient	0.1101[a]	0.1128[a]	0.1094[a]
	t-values	6.9623	7.0660	6.7081
R_{t-2}	Coefficient	0.0510[a]	0.0508[a]	0.0413[a]
	t-values	3.1602	3.1176	2.4983
R_{t-3}	Coefficient	0.0331[b]	0.0345[b]	0.0286[c]
	t-values	2.1775	2.2358	1.7988
V_t	Coefficient	—	—	0.0004[a]
	t-values	—	—	7.3982
h_t	Coefficient	0.0580	0.0752[c]	-0.0232
	t-values	1.2995	1.6977	-0.4536
D_{first}	Coefficient	-0.0016[b]	-0.0018[a]	-0.0075[a]
	t-values	-2.4802	-2.7346	-8.536
D_{second}	Coefficient	-0.001	-0.0012[b]	-0.0072[a]
	t-values	-1.4364	-1.7926	-8.6862
D_{third}	Coefficient	0.0009	0.0007	-0.0052[a]
	t-values	1.3583	1.0957	-5.8831
D_{fourth}	Coefficient	0.0003	0.0001	-0.0058[a]
	t-values	0.3791	0.0769	-7.376
D_{fifth}	Coefficient	0.0004	0.0003	-0.0058[a]
	t-values	0.6453	0.3901	-6.8324

Variance Equation				
Constant	Coefficient	0.0000[a]	0.0000[a]	0.0000[a]
	t-values	15.8474	-2.8663	3.1547
ARCH(1,1)	Coefficient	0.1669[a]	0.1744[a]	0.1671[a]
	t-values	20.2059	20.1166	7.1099
GARCH	Coefficient	0.8038[a]	0.7864[a]	0.8015[a]
	t-values	118.502	109.6339	40.992
V_{t-1}	Coefficient	—	0.0000[a]	0.0000
	t-values	—	8.4328	0.3095
Adjusted R^2		0.0140	0.0131	0.0187
$\alpha + \beta$		0.9707	0.9608	0.9686

a   Significant level at 1%

b   Significant level at 5%

c   Significant level at 10%

three businesses days after the transaction is made. So the payments of first day transaction are made on the third day, fourth day and fifth day. It implies that on the first day already accrued profit is realized where sales are mostly made on these three days. There may be a possibility that in the full sample period different settlement periods were practiced in which T+7, T+5[17] was dominant; that is why profit is realized on first day after five working days. However, as the settlement period changed to T+1 the day of the week effect would disappear. The results are given in first column of Table 8, 9, and 10.

The explanatory variables in the variance equation (5) are all positively related to risk and it's coefficients satisfy the positive conditions. The sum of the coefficients is less than one in all settlement periods. It indicates that the process is not explosive and conditional variance is positive for the sample.

When one period lag value of trading volume V_{t-1} is introduced as an explanatory variable in the variance, the specification of GARCH–M is as represented by equation (4) where π_2 is equal to zero in the mean equation. The

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[17] Due to the unavailable date of T+7 and T+5 settlement period, we have considered the time period as before T+3 settlement, during T+3 settlement and T+2 settlement.

Table 8: Empirical Results of the Risk,
Return and Trading Volume Relationship (Before T+3 Settlement Period)

Table shows the Empirical Results of the Risk, Return and Trading Volume Relationship before T+3 settlement period full sample size. Third column presents estimation without trading volume. Fourth column shows the augmented GARCH-M (1,1) without incorporation of volume. Fifth column depicted augmented GARCH-M (1,1) with incorporation of trading volume.

		GARCH-M (1,1)	Augmented GARCH-M (1,1)	Augmented GARCH-M (1,1)
R_{t-1}	Coefficient	0.1787[a]	0.1867[a]	0.1849[a]
	t-values	7.8024	7.7597	7.7207
R_{t-2}	Coefficient	0.0466[b]	0.0515[b]	0.0459[c]
	t-values	1.9819	2.0617	1.8495
R_{t-3}	Coefficient	0.0259	0.0378	0.0398[c]
	t-values	1.1390	1.6161	1.7162
V_t	Coefficient	—	—	0.0003[b]
	t-values	—	—	2.4714
h_t	Coefficient	0.0656	0.0713	-0.0389
	t-values	1.0900	1.3166	-0.5094
D_{first}	Coefficient	-0.0019[b]	-0.0018[b]	-0.0046[a]
	t-values	-2.1003	-2.0867	-3.3797
D_{second}	Coefficient	-0.0025	-0.0026[a]	-0.0055[a]
	t-values	-2.6830	-2.9731	-3.9763
D_{third}	Coefficient	0.0006	0.0007	-0.0021
	t-values	0.6490	0.9112	-1.5471
D_{fourth}	Coefficient	-0.0001	-0.0002	-0.003[b]
	t-values	-0.1604	-0.2016	-2.2138
D_{fifth}	Coefficient	-0.0005	-0.0004	-0.0033[b]
	t-values	-0.5067	-0.3923	-2.3552

Variance Equation				
Constant	Coefficient	0.0000[a]	-0.0001[a]	0.0000[b]
	t-values	6.8220	-8.3976	2.1549
ARCH(1,1)	Coefficient	0.1471[a]	0.1859[a]	0.2507[a]
	t-values	12.9769	12.0094	10.8745
GARCH	Coefficient	0.8413[a]	0.7254[a]	0.6959[a]
	t-values	91.7130	53.204	29.9825
V_{t-1}	Coefficient	-0.0004	0.0000[a]	0.0000
	t-values	-0.5833	8.9800	-1.3277
Adjusted R^2		0.0180	0.0217	-0.0031
$\alpha + \beta$		0.9884	0.9113	0.9466

a   Significant level at 1%

b   Significant level at 5%

c   Significant level at 10%

results are reported in column 4 of table 7 for full sample period and table 8, 9, and 10 for different sub-periods sample under the Augmented GARCH–M (1). It is interesting to note that the coefficient of V_{t-1} is statistically significant. However, the coefficient of V_{t-1} is statistically insignificant during settlement sub-periods T+3 and T+2. It implies that the role of volume is minimized when settlement time period is reduced. It is also important to note that the signs of the coefficients of the day of the week effect dummy remain the same as observed before introducing volume for all settlement periods. The reason could be that the trading volume did not affect the calendar anomalies, and is unimportant for the day of the week effects. The result indicates that the volatility of return is not affected by the information content in the lag value of trading volume on the Karachi Stock Exchange. The increasing volatility in the market through non-informational factor increases risk and eventually returns. Moreover, the day dummies for first day and second day have a stronger negative effect than the other three day dummies. The system is still not explosive since the coefficients satisfy the positive values and the sum is less than one.

Finally, the specification augmented GARCH–M (1,1) incorporates the contemporaneous value of trading volume (V_t) in the mean equation. The re-

Table 9: Empirical Results of the Risk,
Return and Trading Volume Relationship (T+3 Settlement Period)

Table shows the Empirical Results of the Risk, Return and Trading Volume Relationship during T+3 settlement period full sample size. Third column presents estimation without trading volume. Fourth column shows the augmented GARCH-M (1,1) without incorporation of volume. Fifth column depicted augmented GARCH-M (1,1) with incorporation of trading volume.

		GARCH-M (1,1)	Augmented GARCH-M (1,1)	Augmented GARCH-M (1,1)
R_{t-1}	Coefficient	0.0049	0.0009	-0.0098
	t-values	0.1632	0.0334	-0.3322
R_{t-2}	Coefficient	0.0266	0.0162	0.0023
	t-values	0.9288	0.6097	0.0828
R_{t-3}	Coefficient	0.0499c	0.0333	0.0460
	t-values	1.8010	1.2876	1.6435
V_t	Coefficient	—	—	0.0010a
	t-values	—	—	13.2562
h_t	Coefficient	0.1437	0.1959a	0.0014
	t-values	1.6255	2.0228	0.0172
D_{first}	Coefficient	-0.0010	-0.0016	-0.0180a
	t-values	-0.7653	-1.078	-14.8578
D_{second}	Coefficient	-0.0009	-0.0017	-0.0176a
	t-values	-0.6770	-1.177	-16.2986
D_{third}	Coefficient	0.0006	-0.0001	-0.0164a
	t-values	0.4269	-0.0937	-13.1889
D_{fourth}	Coefficient	0.0000	-0.0005	-0.0165a
	t-values	0.0318	-0.3232	-13.9666
D_{fifth}	Coefficient	0.0002	-0.0005	-0.0167a
	t-values	0.1152	-0.3132	-14.7149

Variance Equation				
Constant	Coefficient	0.0000[a]	0.0000	0.0000[b]
	t-values	8.0542	0.3972	2.1549
ARCH(1,1)	Coefficient	0.2152[a]	0.1969[a]	0.2507[a]
	t-values	9.9887	9.7091	10.8745
GARCH	Coefficient	0.7073[a]	0.6277[a]	0.6959[a]
	t-values	29.8604	20.3151	29.9825
V_{t-1}	Coefficient	—	0.0000	0.0000
	t-values	—	0.4663	-1.3277
Adjusted R^2		-0.006	0.0027	-0.0031
$\alpha + \beta$		0.9225	0.8246	0.9466

a   Significant level at 1%

b   Significant level at 5%

c   Significant level at 10%

sults of this specification are reported in column 5 of tables 7 to 10. The results for day dummies are similar to as observed in full sample period and all other settlement sub-periods. The coefficient of trading volume V_t is statistically significant and positively related to return in full sample period, before settlement period T+3 and during settlement period T+3 where the daily information also affects return. During settlement period T+2 the coefficient of trading volume V_t is statistically insignificant and positively related to return. The reason for this could be the freezing of KSE-100 index during this time period. The daily information also affects return, and still there is an insignificant positive interaction between return and risk in all periods except settlement period T+2. There is a significant negative interaction between return and risk during settlement period T+2, which reflects the signal of misspecification. The system is still not explosive in all periods.

Our empirical results provide evidence that the trading volume has both direct and indirect effects on return in full sample period and all other settlement periods except settlement period T+2. The first is the direct contemporaneous effect through the return equation, which is positive and statistically significant. The indirect effect, through information content at time (t-1) in the risk equation, is also positive and statistically significant. It indicates that

Table 10: Empirical Results of the Risk,
Return and Trading Volume Relationship (T+2 Settlement Period)

Table shows the Empirical Results of the Risk, Return and Trading Volume Relationship during T+2 settlement period full sample size. Third column presents estimation without trading volume. Fourth column shows the augmented GARCH-M (1,1) without incorporation of volume. Fifth column depicted augmented GARCH-M (1,1) with incorporation of trading volume.

		GARCH-M (1,1)	Augmented GARCH-M (1,1)	Augmented GARCH-M (1,1)
R_{t-1}	Coefficient	0.1382a	0.1382a	0.1681a
	t-values	3.4343	3.4366	4.0303
R_{t-2}	Coefficient	0.0705	0.0688	0.0637
	t-values	1.6328	1.5854	1.4917
R_{t-3}	Coefficient	-0.0285	-0.0282	-0.0195
	t-values	-0.6864	-0.6797	-0.5068
V_t	Coefficient	—	—	0.0004
	t-values	—	—	0.9223
h_t	Coefficient	-0.0654	-0.0612	-0.2468c
	t-values	-0.6283	-0.5714	-1.9441
D_{first}	Coefficient	-0.0012	-0.0013	-0.0066
	t-values	-0.9148	-0.9280	-0.8442
D_{second}	Coefficient	0.0014	0.0013	-0.0036
	t-values	0.9477	0.9068	-0.4641
D_{third}	Coefficient	0.0022	0.0022	-0.0029
	t-values	1.4924	1.4233	-0.3632
D_{fourth}	Coefficient	0.0016	0.0015	-0.0037
	t-values	1.0044	0.9183	-0.4636
D_{fifth}	Coefficient	0.0035	0.0035	-0.0019
	t-values	2.5347b	2.1341b	-0.2375

Variance Equation				
Constant	Coefficient	0.0000[a]	0.0000[a]	0.0000[a]
	t-values	7.7870	3.1547	3.1975
ARCH(1,1)	Coefficient	0.1672[a]	0.1671[a]	0.1940[a]
	t-values	7.1686	7.1099	6.8003
GARCH	Coefficient	0.8039[a]	0.8015[a]	0.7251[a]
	t-values	42.7309	40.992	26.832
V_{t-1}	Coefficient	—	0.0000	0.0000
	t-values	—	0.3095	0.9751
Adjusted R^2		0.0445	0.0572	0.0538
$\alpha + \beta$		0.9711	0.9686	0.9191

a   Significant level at 1%
b   Significant level at 5%
c   Significant level at 10%

the risk and returns are determined by the flow of information in the market. However, risk has no impact on return through imperfect information in the KSE. It can be said that the investors are making their choices directed by the perfect information generated by the economy. The results also indicate that the day of the week effects where the daily pattern is also being followed by the stock market which gradually decreases as settlement time periods decline. It means that the arrival of new information does not only determine risk in the market but it also generates the uncertainty. It suggests that the return is affected by the arrival of information beside the market inherent stock market risk. However, information also affects return through variance equation which implies that increase in trading volume may also be felt in the volatility of the market and constitutes one of the factors of uncertainty. It infers that uncertainty associated with trading volume determines return in the KSE market. During settlement period T+2 the trading volume has no direct or indirect effects on return. The reason may be the freezing of the KSE-100 index during settlement periods.

4   SUMMARY AND CONCLUDING REMARKS

The paper empirically examined the existence of risk, return and trading volume relationship by using a GARCH-M model. Trading volume is used as a proxy for the arrival of information to the market and is incorporated both in the return and variance equations. Our results show that the daily return volatility is time-varying and highly persistent: but it depends on settlement periods. Contemporaneous changes in trading volume have a positive effect on returns. The previous day's change in trading volume affects the conditional volatility of returns positively. Therefore, trading volumes have positive information content in predicting returns in all settlement periods except settlement period T+2. The possible reason could be the freezing of KSE-100 during 2008 calendar year. The work considers a long time period, based on daily data. This study attempts to incorporate the changing settlement period during study period. It is concluded that, as settlement period was reduced the day of the week anomalies would disappear.

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Résumé

Cette étude détermine la relation empirique entre le risque, le rendement et le volume des transactions à la Bourse de Karachi en utilisant la technique GARCH-M, et des données pour la période Décembre 1991 - Décembre 2010.

L'étude introduit le volume des transactions en tant que proxy pour le flux d'information pour expliquer le rendement à la Bourse du Pakistan. Ces informations affectent en même temps le risque et le rendement.

L'étude considère une longue période, sur la base de données quotidiennes. Cette étude tente d'intégrer l'évolution de la période de règlement au cours de la période d'étude. Les résultats montrent que la volatilité du rendement quotidien est variable dans le temps et très persistante.

Les changements contemporains du volume des transactions ont un effet positif sur le rendement. Le changement du volume des transactions le jour précédent affecte positivement la volatilité conditionnelle des rendements. Par conséquent, les volumes de transactions ont un contenu d'information positif dans la prévision des rendements dans toutes les périodes de règlement, sauf période de règlement T+2. En outre, lorsque la période de règlement a été réduite, les anomalies "the-day-of-the-week" ont disparu, tels qu'identifiées par Nishat et Mustafa (2002). Si la période de règlement T +1 est introduite, nous espérons que les anomalies semaine vont disparaître.

Mots clés: Risque, rendement, volume, modèle GARCH-M.

Classification JEL: C22, G11.