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SCIENTIFIC PAPER

SYSTEMATIC RISK FACTORS AND STOCK RETURN VOLATILITY

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Abstract: *This study analyzes the transmission of systematic risk exhaling from macroeconomic fundamentals to volatility of stock market by using auto regressive generalized auto regressive conditional heteroskedastic (AR-GARCH) and vector auto regressive (VAR) models. Systematic risk factors used in this study are industrial production, real interest rate, inflation, money supply and exchange rate from 2000-2014. Results indicate that there exists relationship among the volatility of macroeconomic factors and that of stock returns in Pakistan. The relationship among the volatility of macroeconomic variables and that of stock returns is bidirectional; both affect each other in different dynamics.*

Keywords: *Macroeconomic factors, stock return volatility, GARCH, VAR* (JEL code: *C32, C58, G11, G12*)

INTRODUCTION

The macroeconomic factors have important concerns with stocks traded in the stock market and these factors make investors to choose the stock because investors are interested to know about the factors affecting the working of stock to manage their portfolios. Abrupt variations and unusual movements of macroeconomic variables cause the stock returns to fluctuate due to uncertainty of future gains. Volatility is the risk or uncertainty to stock prices, which can either be measured by using the annualized standard deviation of daily changes in price of stock/ security (Li & Ouya, 2013). Volatility of stock price is a form of market efficiency (Hameed, 2006), which is the reaction to the incomplete information in the market (i.e. uncertainty). If prices of the stocks move up and down rapidly then there would be high volatility existing in the market. If there is almost no changes in stock prices, then there exists low volatility. Prices of stock are highly volatile in Pakistani capital market. This unpredictability of returns may affect the riskiness of stocks. Therefore, investors demand higher return for the increased risk. Companies with high volatile stocks need grow profitably, showing a sudden increase in earnings and stock price over the time, or pay very high dividends. Some investors mistakenly believe that stock price volatility is based on directional trend in the stock price; however, volatility is amount of fluctuation in stock prices (Malkiel & Xu, 1999).

Volatility in macroeconomic fundamentals is existing either in the form of unidirectional or bidirectional. This study has made substantial improvement on modeling the volatility which is changing with time. There is a better understanding of predicting volatility over the short periods of time with a time span of one day to one month. This research is conducted to analyze the relationship among the uncertain behavior of stock market returns and of macroeconomic variables like inflation (INF), real interest rate (RIR), gross domestic production (GDP), money supply (M2) and industrial production growth rate (IP). These macroeconomic fundamentals are chosen through the extensive literature upon the variables and their relationship of dynamic nature with stock market returns. Fascinatingly, although the successive financial econometric volatility is so considerable but it remains silent on the relationships among the volatility of stock returns and its determinants. The relationship between stock market volatility and uncertainty of macroeconomic fundamentals stay unstudied most of the times; often the

modeling and forecasting of capital market volatility is done in separation of volatility of macroeconomic fundamentals. Here the fundamental volatility is defined as the volatility of basic economic indicators. This research has two possible outcomes; it aims to forecast the volatility of factors included in study and to analyze the relationship among the volatility of these factors. This study focus upon the volatility of macroeconomic fundamentals and volatility of stock market returns. Secondly, it investigates the casual relationship between the volatility of stock returns with that of macroeconomic fundamentals like as GDP, interest rate, money supply and industrial production.

From the theoretical perspective, the dividend discount model (DDM) and arbitrage pricing theory (APT) provide the theoretical framework through which the behavior of macroeconomic fundamentals can be linked to the stock market volatility (Chen et al., 1986). These models emphasize that any expected or unexpected arrival of new information and policy decisions regarding macroeconomic variables such as gross domestic product (GDP), interest rates, exchange rates and foreign institutional investments (FIIs), money supply and inflation will change the equity prices and further the volatility of stocks via change in the future cash flows and expected dividends. Intuitively, the essence of the theoretical link between the macroeconomic fundamentals and equity market volatility is that any change or shock in the macroeconomic variables will raise the source of systematic and idiosyncratic risk of the market portfolio, irrespective of how well the portfolio is diversified (Chowdhury and Rahman, 2004).

This study is organized in different chapters, first chapter is the introduction of study, which further comprises of the background of the study and it introduces the study. This chapter also explains the underlying theories of study which support the study. Third chapter is about data description, variable measurement and methodology. Fourth chapter comprises of the interpretations of the results and discussions. Fifth chapter is the discussion and future recommendations for research. At the end references are attached here with and then some terms are also explained in appendix.

LITERATURE REVIEW

Volatility is a process of change in behavior, value or investment over the time and cumulative persistence of that change to the next phase. An extensive work has been done upon volatility in different types such as modeling, measuring and forecasting the volatilities. Quite huge work has been done upon measuring and modeling the stock market volatilities. Year after year, finance literature is enriched with broad discussions about the volatility in markets which represents that emerging and emerged stock markets are responsive to macroeconomic updates and market players are likely to adhere with the significance of any declaration of changes in policy and economic figures.

Schwert (1989) found that stock market volatility can be explained through macroeconomic fundamentals if macroeconomic variables give information in regard of volatility of future expected cash flows and discount rates. It is of immense importance for understanding the cause of stock market volatility because it helps to predict stock returns and to understand the major determinants of stock market uncertainty and its transmitting effects to the real economy (Corradi et al., 2006). Variance of stock returns is affected by many of other explanatory factors which are deterministic factors for stock returns and macroeconomic variables are also the deterministic factors for stock returns (Schwert, 1989). Christie (1982) examined the relationship between volatility in equity returns and many other descriptive variables and found that equity variances have a significant link with both financial and interest rate, unlikely to the options literature. French and Schwert (1986) examined the link of stock returns with stock market volatility and it was found that there is a theoretical linkage between stock returns and stock return volatility. They found a positive relation of expected capital market risk premium with expected stock returns volatility. They suggested that risk premium in market is caused by macroeconomic fundamentals so there is also relation between variance in macroeconomic fundamentals and uncertainty of stock returns. Chen et al. (1986) studied the influence of economic forces upon stock returns, it was suggested that vector auto regression cause some problems whereas lagged market returns have a strong predictive situation for macroeconomic variables. Study found that lagged market variables can indirectly explain expected returns of portfolio. They found that real and nominal forces change the expected cash flows as variation in anticipated rate of inflation have a significant impact upon predictable cash flows and rates of interest also.

Chen et al. (1986) found that a set of economic variables that has impact on market returns and its influence upon asset pricing and interpreted that price of assets in markets should depend on their experience to macroeconomic fundamentals that portray the economy. Darrat and Mukharjee (1987) conducted a study to analyze the relationship of equity market returns and some macroeconomic factors by employing granger-type causality along other error prediction test and found that there is a strong lagged relationship among stock returns and selected macroeconomic variables. Ross (1989) suggested another source of volatility which is fluctuations in market microstructure of economy. Variance of returns is affected by liquidity of assets and trader's information and here for the proxy role of turnover ratios in explaining the cross-section variability. Many of the models for asset pricing suggest a significantly positive relationship among expected returns and risk, which is mostly predicted through the variance of prices of assets (Baillie & DeGennaro, 1990).

During the different periods of the economy, investors are likely to have probability to react in different manner to the similar news (Li & Hu, 1998). During a period of shortfall, a trivial fall in expected industrial production could give a start to panic in investors if they thought that economy is at an edge. Therefore, they would short their positions and stay for no longer time causing a volatile condition in the capital market. Whereas empirical observations supported the view

that the link between uncertainty in macroeconomic factors and in capital returns was referred to structural breaks at the times of tranquility and financial instability was subjected to developed countries (Hamilton & Li, 1996; Stock & Watson, 2002). It is found that stock market liberalization most of the times increases the correlation between local and international market returns but is unable to derive up market variations at local level (Bekaert & Harvey, 1996). Fraser and Power (1997) conducted a cross-country study to analyze the impact of news disbursement on stock market volatility and suggested that information is one the major factors that have direct impact upon stock markets. Bekaert and Harvey (1997) found that markets which are fully integrated are affected by international macroeconomic fundamentals at several times and periods whereas markets which are segmented and operate at local levels are merely affected by local market forces. These market forces cause the variance in stock returns and a volatile condition is emerged.

Liljeblom and Stenius (1997) explained the relationship of stock market variability and variance in macroeconomic factors by analyzing the data for Finland from 1920-1991, by employing generalized auto regressive conditional heteroscedastic (GARCH) and vector auto regression (VAR) methods and it was found that there was a significant relationship between stock market variability and variances in macroeconomic fundamentals. But Mitchell and Mulherin (1994) found significant and strong relationship of publically available information and activities being done in the stock market, it was reported that the existing relationship is as weak as reported in previous researches and therefore the difficulty of linking volume and volatility to calculated measures of information has been confirmed. Errunza and Hogan (1998) explored the macroeconomic fundamentals affecting European capital market volatility. They found that unlike the previous studies upon USA, in many cases, time variability of European stock market was found to be more significantly influenced by the previous variations in either monetary or real macroeconomic fundamentals. Reinhart and Kaminsky (1999) argued that capital movement in market enhances the opportunity of crises in exchange rate or banking sector. It is because productivity collapsed in this situation and benefits that were to be derived from cash inflows could not be derived.

The procedure through which market returns move within an economy depicts the level of economic development as the economy develops more it becomes more diverse and variations in stock returns inclined to uplift with changes in macroeconomic fundaments. But when the index is moving then the volatility should decrease but its negative relation may not exist in emerged economies (Stiglitz, 1999). It resulted in providing significant interconnections among emerging financial markets regardless of the geographical closeness. It was also observed that those states which were more under the effect of financial liberalization were seen to have combined moves to high volatile conditions. These states of uncertainty were observed during periods of financial crises, as it raises the volatility also increase as the financial situation of a state stabilize, uncertain movements of interest rate also stabilized (Edwards & Susmel, 2001). It was documented by Spyrou (2001) in the study that inflation rate is a response to the fluctuations in commodity market happening due to different economic forces. During the period 1995-2000 a negative but insignificant result was shown whereas from 1990-1995 a negative but significant relation was reported. It can also be deducted that there exists negative correlation between inflation and real output. Chinzara (2011) found that financial crises increase the volatility in both of stock market as well as macroeconomic variables. Chinzara (2011) linked variations in stock market and persistence of this variation to next period with instability of macroeconomic factors. Chowdhury and Rahman (2004) also conducted a study to analyze the relationship between volatility of macroeconomic fundamentals and uncertainty of stock returns. They used vector auto regression and seasonality-adjusted predicting model to determine the unidirectional impact from macroeconomic uncertainty to stock market volatility for Bangladesh. Whereas, Chowdhury et al. (2006) used GARCH and VAR models to determine a weak relationship among macroeconomic and capital market uncertainty for the similar country but in opposite to efficient market hypothesis, they also predict that inflation volatility is being influenced by stock market uncertainty. Beltratti and Morana (2005) found a twofold relationship between stock market volatility and volatility of macroeconomic fundamentals. It was found in this study that uncertainty of capital market is linked with uncertainty of macroeconomic fundamentals like as federal funds rate and M1 growth. The other fact was found about the relationship of volatility of output and volatility of inflation with capital market volatility, it makes the break-free volatility series.

When the economy of country is suffering from different factors and monitory policy is not plausible then money supply may have a significantly negative effect upon stock returns as it has direct relation with inflation variability (Abugri, 2006). Diebold and Yilmaz (2008) estimated the association between the macroeconomic variables and uncertainty of stock returns in African and Asian under developed countries. Their study showed a positive link between stock returns, GDP and consumption. Sohail and Hussain (2009) found that industrial production, real exchange rate and money have a significantly positive link with stock return movements in both scenario long run as well as short run. Buyuksalvarci (2010) found that there exists a significantly negative relationship between oil price and exchange rate whereas a positive relation was there between money supply and returns. Inflation rate was also not having any significant relation with Istanbul stock exchange. Attari and Safdar (2013) study suggested that there is no longer association in between GDP and Karachi stock exchange and stock returns move towards the independent direction and there is no effect of volatility of inflation with volatility of stock market in Pakistan. But inflation rate has casual association with variance in stock returns. They found a unidirectional link in between the variance of interest rate and stock returns. Issahaku, Ustarz and Domanban (2013)

studied the movement of macroeconomic variables and its impact upon stock market fluctuations and concluded that money supply has negative role in the uncertain conditions of capital market of Ghana (GSE) whereas consumer price index, exchange rate and foreign direct investment show a positive link with market fluctuations. The negative relation of money supply with stock market volatility is consistent with the prior studies. Kumari and Mahakud (2014) made an empirical observation to study the theoretical associations among capital market variance and macroeconomic uncertainty in emerging Indian capital market. They found unidirectional and bidirectional relations among variance of stock returns and of macroeconomic fundamentals. Results of this study show the increasing interdependence of financial markets in India like as stock returns and macroeconomic fundamentals.

MATERIALS AND METHODS

Macroeconomic variables are interconnected. Change in one variable also affects others and these overall affect the economy of a country. These have impact over working of equity market. Their linkage is mostly short in nature and get volatile early. So analyze the volatility of macroeconomic factors and that of equity market GARCH model is used. After having the volatility values, their relationship is found through VAR model. In order to analyze the different dynamics of VAR system impulse response function and vector decomposition is also carried out. In this study, different macroeconomic variables are used. Industrial production growth is also used as a country specific factor by Mody, Taylor and Kim (2001), so this factor also affect on volatility of stock returns. Industrial production shows the overall economic activity and stock prices are affected by it. It is measured through industrial production index as it was in previous studies. Interest rate differential plays crucial role in fluctuation of returns of a market. Investors are interested to invest in those securities where high interest rate is offered than those where interest rate is low. This data is collected from WDI. The relationship between stock returns and inflation was theorized by Fisher (1930) and here inflation is calculated as consumer price index. If any change happens in supply of money, then it creates relative change in the level of price either negatively or positively in the value of money through variation in the volatility of expected future cash flows and supply of credit by the monetary aggregates in the economy (Friedman and Schwartz 1970). Here the rupee-dollar exchange rates are used taking into consideration the relative importance of dollar as main currency in Pakistan's trade and investment.

In current study, different comprehensive classes of Bollerslev's (1986) GARCH model are used. This model is fairly known to capture the volatility clustering and volatility symmetry impacts in the equation of conditional variance. As GARCH model is the most suitable model for volatility estimation so classes of its different models have been used to predict volatility in macroeconomic fundamentals and volatility in stock returns also. The GARCH (1, 1) proceeds with normal distribution and it is the most famous generalized ARCH requirement in the empirical research. This model supposes some power on previous squared residuals to turn down geometrically at a rate to be measured from the data.

$$R_t = \beta_0 + \beta_1 R_{t-1} + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 u_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 \quad (2)$$

To analyze the relationship among those volatility series vector auto regression model was applied. Sims (1980) developed the vector auto regression model which is a dynamic model establishing the linkage between economic variables.

$$hs_t = \alpha_0 + \sum_{i=1}^{4} \lambda hs_{t-1} + \sum_{i=1}^{4} \delta h\, mv_{jt-1} + \varepsilon_t \quad (3)$$

$$hmv_{jt} = \omega_0 + \sum_{i=1}^{4} \theta h\, mv_{jt-1} + \sum_{i=1}^{4} \Psi hs_{t-1} + \varepsilon_t \quad (4)$$

RESULTS AND DISCUSSION

Table 1 exhibits the statistical behavior of the data for the period of 2000-2014. The mean is range from -0.0096 of money supply to 0.0056 of consumer price index. Standard deviation which is the measure of dispersion or deviation from mean is range from 0.0059of exchange rate to 0.0475 of real interest rate. Skewness indicates that some of the values are positively skewed whereas CPI, EX and RI are negatively skewed. In case of Kurtosis, if the value is equal to 3 then normal distribution and pattern is called mesokurtic. If the value is $>$ 3 then pattern is called leptokurtic that are associated with simultaneously peaked and fat tail. But when value of kurtosis is less than 3 it is called platykurtic and is associated with simultaneously less peaked and have thinner tail. All the values in the table are showing the platykurtic behavior that is less that 3 with the maximum value of 2.9898 and minimum value of 1.8979. Furthermore, kurtosis shows that the data is flat and have thinner tail.

Table 1 Descriptive Statistics

	M2	RCPI	REX	RI	RIGP	RRIR
Mean	-0.0096	0.0056	-0.0027	0.0008	0.0032	0.0124
Median	-0.0031	0.0070	-0.0008	0.0010	-0.0009	0.0090
Maximum	0.0594	0.0351	0.0055	0.0045	0.4461	0.0965
Minimum	-0.0726	-0.0297	-0.0144	-0.0039	-0.4925	-0.0631
Std. Dev.	0.0419	0.0175	0.0059	0.0026	0.0270	0.0475

Table 2 presents results of correlation analysis. Result indicates that volatility all macroeconomic variables are positively correlated with volatility of stock returns whereas volatility of real interest is negatively correlated with stock returns. Results are consistent with previous studies of Morelli (2002), Chinzara (2011) and Kumari and Mahakud (2014). The value of money

supply to inflation is comparatively showing that there may the problem of multicollinearity in the data. To eliminate any kind of ambiguity regarding the multicollinearity in the data, variance inflation factor test is also applied. As it is evident from the table that all values are below the threshold point showing that there is no multicollinearity problem in the data.

Table 2 Correlation Matrix

	RI	RIGP	M2	RCPI	RRIR	REXP
RI	1					
RIGP	0.0189	1				
M2	0.0157	0.0211	1			
RCPI	0.0514	-0.0198	0.1142	1		
RRIR	-0.0767	-0.001	0.2793	0.0237	1	
REXP	0.1119	0.0003	-0.1123	-0.1105	-0.2459	1

The GARCH (1,1) specification is selected based on AIC criteria. Table 3 shows that variance equation is significant at GARCH (1,1) level. Once it is judged that volatility in the data then volatility series have been generated using GARCH model. Then these volatility series are used to analyze the relationship among the volatility of macroeconomic fundamentals and stock market returns.

Table 3 GARCH estimates

Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Index return	0.4156	0.1051	25.4696	0.0000
M2	0.6621	0.0120	55.2304	0.0000
CPI	0.4072	0.0146	27.8698	0.0000
EX	0.5993	0.0128	46.7951	0.0000
IGP	0.6227	0.0125	49.7555	0.0000
RIR	0.8904	0.0073	122.2878	0.0000

In time series analysis, stationary or non-stationary procedure is carried out to observe the integration level of the factors under observation. In the present study data set the Augmented Dickey Fuller (ADF) test is carried out. Above given table shows that all six variables are stationary at level with constant so linear trend, i.e. *I (0)* is existing here. It shows that the variables are having constant mean, variance and covariance and results are significant now. It shows that all effects of the shocks are eradicated and now these are helpful in making an accurate decision for the future forecasting. All the volatility series are stationary at level so we apply VAR model to analyze the relationship of these volatility series.

Table 4 Unit Root Test

Variable	t-stat	p-value	Decision
M2	7.01251	0.000	I (0)
CPI	10.3906	0.000	I (0)
EX	5.32571	00.000	I (0)
Index return	9.00551	00.000	I (0)
IGP	10.6379	00.000	I (0)
RIR	3.08405	0.0279	I (0)

To apply the VAR model first of all lags length criteria is find out. Then at most appropriate lag the vector auto regression model is applied. According to the above given table (5) the VAR model is to be applied at lag four because most of the information criteria suggest the fitness of this model at this stage.

Table (6) presents the relationship of volatility of macroeconomic factors with volatility of stock market returns and vice-verse. It shows the relationship among different volatility series of macroeconomic fundamentals generated through GARCH model. Vector auto regressive model shows the influence of one variable upon other along with its lagged terms. To capture the combined effect of volatility of one macroeconomic variable upon volatility of stock market returns Wald's coefficient test is also applied in this study. This table shows the influence or predictability of macroeconomic factors upon the volatility of stock market returns. Money supply shows that it has no influence upon volatility of stock returns with p-value of 0.5277, 0.5408, 0.8744 and 0.9847 at four different lags. It is argued that money supply is settled by the central bank and it has no specific time to be adjusted with the stock returns. Thus it does not have influence on variations of stock returns. Volatility of inflation is significant which shows that in Pakistani economy volatility in inflation causes volatility in stock returns. Its coefficient is positive showing that variations in inflation rate influence the variations in stock returns positively although at little rate. Industrial growth production is positive and significant depicting that any variations in industrial growth production will also enhance the variation of stock returns in similar direction. Volatility in exchange rate is also positively and significantly influences the variations in stock returns and it happens to move in the similar direction if any cause is happening there. But real interest rate has insignificant affect; means volatility occurred in exports

Table 5 Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	53854.97	NA	3.76e-20	-27.70009	-27.69042	-27.69666
1	113297.9	118671.9	2.01e-33	-58.25922	-58.19154	-58.23520
2	126850.9	27015.22	1.92e-36	-65.21237	-65.08667	-65.16775
3	127276.1	846.2449	1.57e-36	-65.41258	-65.22886*	-65.34736
4	127410.6	267.4315*	1.50e-36*	-65.46329*	-65.22156	-65.37748*

Table 6 VAR Results

	M2		CPI		EXP		RI		IGP		RIR	
	C	p-stat	C	p-stat	C	p-stat	C	p-stat	C	p-stat	C	p-stat
M2(-1)	2.004	0.0000	0.09	0.0087	0.165	0.3459	0.86	0.5277	0.005	0.7697	0.074	0.3634
M2(-2)	-1.305	0.0000	0.23	0.0006	1.210	0.0011	0.49	0.5408	0.003	0.4214	0.131	0.4729
M2(-3)	0.387	0.0000	0.28	0.0009	1.906	0.0000	0.10	0.8744	0.006	0.3593	0.126	0.4897
M2(-4)	-0.082	0.0000	0.07	0.0193	0.869	0.0000	0.08	0.9847	0.07	0.5767	0.067	0.4068
CPI(-1)	0.028	0.0001	1.95	0.0000	1.939	0.0000	0.08	0.0000	0.001	0.7912	0.106	0.3421
CPI(-2)	0.099	0.0000	06.jan	0.0000	4.601	0.0000	0.01	0.0000	-0.01	0.5227	-0.09	0.2055
CPI(-3)	0.123	0.0000	0.06	0.0313	3.478	0.0000	0.02	0.0000	0.006	0.3894	0.027	0.2398
CPI(-4)	0.052	0.0000	0.02	0.0886	0.813	0.0000	0.06	0.0000	-0.05	0.4616	0.009	0.4560
EXP(-1)	0.005	0.0003	0.04	0.2021	1.771	0.0000	-0.03	0.1146	-0.001	0.4856	-0.005	0.4654
EXP(-2)	-0.015	0.0000	-0.01	0.0103	-0.657	0.0000	0.05	0.0607	0.000	0.0175	0.008	0.6224
EXP(-3)	0.017	0.0000	0.02	0.0007	-0.152	0.0000	0.09	0.0839	0.054	0.0002	-0.006	0.7020
EXP(-4)	-0.007	0.0000	-0.09	0.0022	0.035	0.0440	0.06	0.0568	0.068	0.0005	0.007	0.6386
RI(-1)	-4.64	0.5610	0.01	0.4093	-0.002	0.8455	-0.07	0.0000	-0.022	0.8189	0.132	0.0024
RI(-2)	-0.003	0.3933	-0.01	0.4037	-0.019	0.8333	0.97	0.0702	-0.067	0.6487	0.097	0.0127
RI (-3)	0.0119	0.5103	0.02	0.6934	-0.037	0.4393	0.87	0.1730	0.094	0.6596	-0.178	0.3896
RI (-4)	0.0092	0.8660	-0.01	0.8577	0.118	0.3359	0.00	0.1689	-0.087	0.8569	0.061	0.5330
IGP (-1)	-0.013	0.9241	0.25	0.3978	-0.690	0.6504	0.06	0.0576	1.830	0.0000	-0.054	0.9381
IGP (-2)	-0.053	0.8638	-0.47	0.4524	1.435	0.6556	0.37	0.0469	-0.769	0.0000	0.324	0.8380
IGP (-3)	0.1165	0.7067	0.38	0.5420	-2.768	0.4129	0.02	0.0664	-0.094	0.0049	-0.94	0.5507
IGP (-4)	-0.046	0.7398	-0.14	0.6136	2.047	0.2129	-0.57	0.1280	0.027	0.0918	0.676	0.3387
RIR (-1)	0.0070	0.0264	-0.01	0.6705	0.007	0.9851	-0.00	0.8550	0.009	0.7679	2.013	0.0000
RIR (-2)	-0.015	0.0337	0.05	0.6866	-0.033	0.6457	0.00	0.8388	-0.056	0.4623	-1.104	0.0000
RIR (-3)	0.0091	0.1965	-0.03	0.9203	0.043	0.5752	-0.00	0.9489	0.044	0.1623	0.075	0.0379
RIR (-4)	-0.001	0.6639	-0.00	0.7311	-0.010	0.7880	0.00	0.9040	-0.000	0.1106	0.015	0.3426

has no influence upon the volatility of stock returns. Results of this study are consistent with previous studies of Morelli (2002), Chinzara (2011) and Kumari and Mahakud (2014). This model shows the simultaneity of relationship, as in previous table it shows the influence of volatility of macroeconomic factors upon volatility of stock market returns.

Volatility of stock indices is explained 100% by itself in first period and it is also explained by other variables in second period. Similarly, variance decomposition function is applied on each of the variable mention that how it is explained by other variables included in the study. It can also be explained that stock returns are sensitive to the macroeconomic variables for most of the times. As the variations in interest rate changes the cost of capital and which will consequently affect the investments, if the level of investment enhances it also increase the industrial production growth rate and simultaneously the consumer price index will be declined. The volatility of money supply makes transfer in the future strength of the variations of expected future cash flows in the country. Therefore, it is clear from results of the study that individual variation in the macroeconomic variables cause to happen variations in overall stock returns. Results of this study are consistent with previous studies of Morelli (2002) and Chinzara (2011).

CONCLUSION

From above given discussion it is inferred that different macroeconomic fundamentals have different behavior and nature of relationship also differs from factor to factor. As arbitrage pricing theory mention that multiple factors are there to determine the stock returns and influence the movement of stock indices, it is find out how variations in different macroeconomic fundamentals affect the movement of stock indices and stock returns. This study analyzed the influence of volatility in macroeconomic factors upon volatility of stock market volatility and showed the direction of relationship. This study is based upon different GARCH models and vector auto regressive models. To analyze the GARCH models a dummy was also used to check the influence of abrupt happing in economy. This dummy was ranging from 2008 to 2013 encompassing the Zardari government era and results showed that volatility in stock market and in macroeconomic variables was different in this period as it was low from other periods. Results show the existence of relationship among the volatility of stock market and volatility of macroeconomic factors analyzed through vector auto regressive models. It is shown in the results that volatility of some macroeconomic factors has relationship with variations in stock returns. Some macroeconomic factors have deterministic role for future returns in stock market but some have not. Money supply have no direct effect with movements

Table 7 Variance Decomposition

Period	S.E.	M2	CPI	EX	RI	IGP	RIR
Variance decomposition of M2							
1	0.001868	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.004183	99.95844	0.030846	0.004164	0.001968	0.000323	0.004258
3	0.006576	99.93646	0.035502	0.013863	0.002887	0.000933	0.010354
4	0.008906	99.87953	0.033197	0.055554	0.003173	0.005957	0.022586
Variance decomposition of CPI							
1	0.000859	0.003074		0.000000	0.000000	0.000000	0.000000
2	0.001880	0.285203	96.63365	3.074889	0.001137	0.000251	0.004871
3	0.003013	0.161768	96.44070	3.393617	0.001109	0.000123	0.002680
4	0.004198	0.104588	96.42064	3.468580	0.000774	0.004033	0.001381
Variance decomposition of EX							
1	0.000173	1.340124	1.707349	96.95253	0.000000	0.000000	0.000000
2	0.000352	0.843639	1.942594	97.20624	0.000824	0.003363	0.003335
3	0.000553	0.881754	1.722056	97.37004	0.002577	0.015430	0.008147
4	0.000768	0.917767	1.569459	97.46070	0.003929	0.030636	0.017512
Variance decomposition of RI							
1	0.000735	0.005552	6.42E-05	0.023957	99.97043	0.000000	0.000000
2	0.001028	0.002895	0.007935	0.034348	99.83080	0.001913	0.122106
3	0.001245	0.007523	0.009300	0.051728	99.73701	0.001500	0.192937
4	0.001421	0.022803	0.007809	0.055278	99.70086	0.002021	0.211228
Variance decomposition of IGP							
1	0.016189	0.013881	0.007979	0.005074	0.020976	99.95209	0.000000
2	0.033774	0.013160	0.002257	0.010609	0.024993	99.94894	3.76E-05
3	0.053741	0.009033	0.000933	0.015724	0.046135	99.92811	6.57E-05
4	0.074923	0.006271	0.001188	0.029315	0.082490	99.88063	0.000109
Variance decomposition of RIR							
1	0.000370	0.026128	0.147459	0.278661	0.006113	0.245994	99.29565
2	0.000832	0.097247	0.127544	0.277274	0.004491	0.227577	99.26587
3	0.001374	0.133755	0.115394	0.304153	0.004129	0.252410	99.19016
4	0.001965	0.147639	0.111467	0.343227	0.004110	0.255157	99.13840

in stock market as it is also suggested in previous studies and analyzed in this study also. It is a settlement adjusted through central bank of any state so it does not have relationship with movement of stock indices. Similarly, volatility in real interest rate does not have relationship with volatility in stock returns at any lag in vector auto regression model. But volatility in inflation measured through consumer price index proves to have significant relationship with volatility of stock returns. It shows that happening of any fluctuation in inflation also affects the movement of stock index and consequently it influences the variations of stock returns. Exports have significant relationship at some level with variations of stock indices and influence the stock returns. Exports increase the flow of money inward and improve the efficiency of central bank and consequently increase the business level in the state. So theoretically it does have relationship with movement of stock indices also. Industrial growth production measured through industrial production index also has relationship with variations in stock returns. So from this study it is inferred that volatility in different macroeconomic fundamentals exists and some of them also relationship with variations of stock returns.

This study has covered the span of fourteen years for Karachi stock market and five macroeconomic fundamentals only. It is a vast area for future research as there are many other macroeconomic variables which may be analyzed with a huge span of time to understand the nature of relationship among volatility of macroeconomic fundamentals with volatility of stock returns. There three stock exchanges in Pakistan so this study may be conducted while using stock returns from any other stock exchange other than Karachi stock exchange or it is also possible to analyze all these three stock exchanges at a time with different macroeconomic variables.

As mentioned above due to time constraint sample size is limited, it is a limited study consisted of only fourteen-year data from Karachi stock exchange and from some macroeconomic variables. This study is only limited to one stock exchange but it may be extended to more ones. This study has undertaken only a few statistical techniques to analyze the data but many others may also be used to more refine the results of study.

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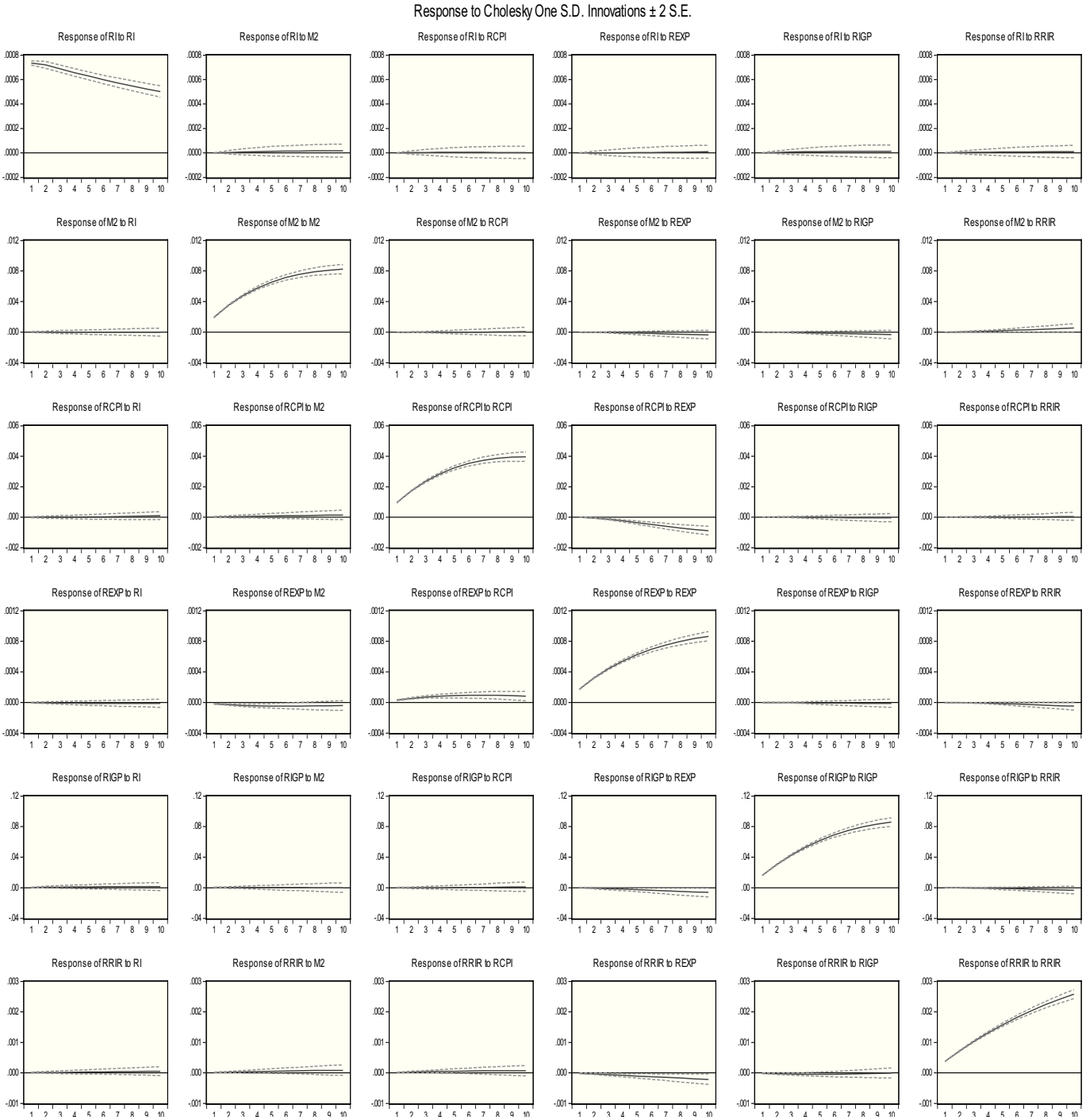
Figure 4.1


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of RI to RI
Response of RI to M2
Response of RI to RCPI
Response of RI to REXP
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