RELATIONSHIP BETWEEN STOCK PRICES AND MACROECONOMIC VARIABLES
(A Case Study Of Karachi Stock Exchange)

SUBMITTED BY

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CERTIFICATE

This is to certify that this research dissertation by Mr. Zahid Mehmood Akhtar is accepted in its present form by the Department of Economic and Finance, Pakistan Institute of Development Economics, Islamabad as satisfying the thesis requirements for the Degree of Master of Philosophy in Economic and Finance.

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In the Name of Almighty Allah who is the most Merciful,

the most Beneficent

DEDICATED TO MY PARENTS

Acknowledgment

Millionth gratitude to Allah Almighty the most Merciful and the most Gracious who bestowed me with the potential to seek Knowledge and to explore some of the many aspects of his creation. It is indeed an eve of great pleasure for me that I have successfully completed my research work. With deep respect and affection I owe this opportunity to express my deep sense of gratitude and indebtedness to my supervisor Dr. Fazal Hussain for his inspiring guidance, encouragement and valuable suggestions throughout my research work. Without his continuous support and assistance it would not have been possible for me to complete this dissertation. I am extremely grateful to him for giving me his fruitful suggestions and time.

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Zahid Mehmood Akhtar

Abstract

The intention of this study was to investigate the relationship between the stock prices of KSE and some macroeconomic variables in Pakistan. The monthly data of all macroeconomic variables and stock prices was taken from January 2001 to May 2012. In this study, the variables which have not been previously studied by the researchers in Pakistan were also included. More over this study also incorporated the effect of market crash 2008 and its impact on Karachi Stock Exchange. The statistical techniques, which were employed in this study, include the Augmented Dickey-Fuller (ADF), Johansen Co-integration test, Vector Error Correction Model (VECM) and Granger Causality test. The results of the study revealed the presence of long-run association between macroeconomics variables and stock prices.

Exports, Exchange Rate and Money Supply showed a positive and significant relationship with stock prices, Inflation and Discount Rate indicated a negative and significant impact on stock prices whereas index of industrial production had a positive but insignificant relationship with stock prices. Market crash had a significant and negative relationship with stock prices and prolonged crises effected the stock prices significantly. The error correction term was resulted from VECM which was significant and indicated short term adjustments towards the equilibrium path. The results of Granger Causality Test showed a unidirectional relationship between CPI, ER, D and KSE, no causal relationship between EX, i and KSE, unidirectional causal relationship between KSE and IIP as only KSE granger cause IIP where as a bidirectional causal relationship exhibited between M2 and KSE as both the KSE and M2 granger cause each other.

Abbreviations

KSE	**……..……**	Karachi Stock Exchange
KATS	**……..……**	Karachi Automated Trading System
CDS	**……..……**	Central Depository System
VAR	**……..……**	Vector Auto Regressive
i	**……..……**	Discount Rate
CPI	**……..……**	Consumer Price Index (Inflation)
ER	**……..……**	Exchange Rate
IIP	**……..……**	Index of Industrial Production
M2	**……..……**	Money Supply
EX	**……..……**	Exports
ADF	**……..……**	Augmented Dickey Fuller Test
JJ	**……..……**	Johansen and Juselius Test
VECM	**……..……**	Vector Error Correction Model
AIC	**……..……**	Akaike Information Criteria
SBC	**……..……**	Shwarz Bayesian Criteria

Table of Contents

Chapter 1:

INTRODUCTION

The financial system of a country is comprised of the banking sector, different financial institutions like insurance companies, various pension funds, bond markets and stock exchange markets. This system helps the government as well as the private sector to enhance not only the financial but also their economic activities.

Stock exchange performance has attained much attention due to its twofold effect; one on the finance of the corporate sector and the other on the economic activities of a country. Various projects of investments are activated through the equity generated by the stock exchange markets. Therefore the performance of the stock exchange markets is considered to be an important factor for the prosperous economic conditions of a country. Stock markets play a role of a bridge between the buyers and the sellers for buying and selling of securities. Savings are mobilized by the stock exchange markets which play an important role in channelizing all these saved funds into wide variety of fruitful investment projects. The unfettered forces of demand and supply clear the market and organized market operations harmonize the preferences of buyers and sellers.

In Pakistan there are three stock exchange markets which are growing rapidly and named as Karachi Stock Exchange (KSE), Lahore Stock Exchange (LSE) and Islamabad Stock Exchange (ISE).

1.1: AN OVERVIEW OF KARACHI STOCK EXCHANGE

In the year 1949 KSE was established and is the largest stock exchange market of Pakistan. The regulatory authority of stock exchanges is SECP (Securities and Exchange

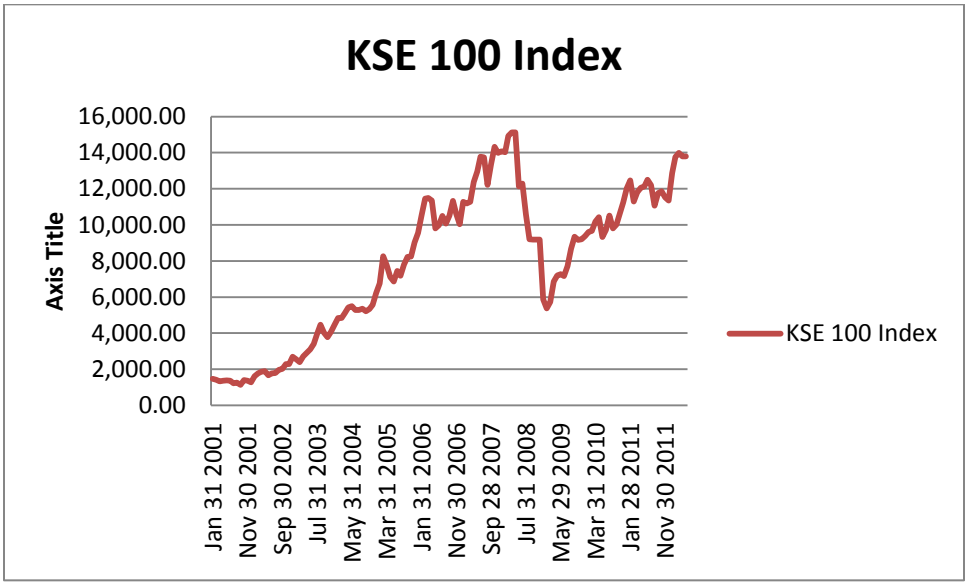
Commission of Pakistan). Initially the trading was taking place in KSE on manual system called outcry system but later on this system was replaced by the new computerized system which is known to be KATS and the CDS in 1998. This system has proved to be transparent and has enhanced the performance and efficiency of the market. KSE became prominent due to this infrastructure development in contrast to other stock markets of the world. In the year 2002 KSE showed its best performance that was acknowledged by the International Magazine "Business Week" and USA News Paper "USA Today" as "The Best Performing Stock Market of the World".

The factors which were mainly responsible for promising conditions in stock markets were economic development, stability in the exchange rate, low discount rates, mergers and acquisition of big companies, incentives for recovery of bad debts and outstanding loans, timely payments of foreign debts, good working relationship with all the nearby countries and specially role of investment banks. The main thing which attracted the investment was privatization, liberalization and deregulation. The foreign investors with massive funds took keen interest and resulted in the major move forward of the market.

1.2: VOLATILITY IN KSE AND ITS EFFECTS

Karachi Stock Exchange is highly volatile market and has faced serious crises in which the market crashed in March 2005, second quarter of 2006, May 2008 to January 2009 which resulted in reduction of market capitalization. A number of incidents like judiciary crises, death of honorable Benazir Bhutto, political unrest and majorly the storm of terrorism were the main factors for this volatile situation of the KSE. KSE usually shows bullish trend and it is argued that degree of volatility is always more in the Bullish market as compared to the Bear market.

The major crash of KSE was in 2008. There were perceptions that this crash was due to the "Global Financial Crisis" in which the credit market and specially the banking sector faced a severe problem of liquidity. It was started in USA when the property started losing value due to excessive liquidity available to the individuals and corporate sector as banks and other lending authorities offered loans on very easy terms. This excessive debt level turned into global financial crises and caused multiple adverse effects on the global economy. Growth rate of the developing countries started shrinking, exports started declining and local currency started depreciating. The massive flight of capital and decrease in foreign remittances resulted in stock market indices to decline.



During the same period Pakistan was also facing low growth rate and its currency was depreciating. Reserves were getting low and both the budget deficit as well as the fiscal deficit were widening. The stream of terrorism and unstable political administration resulted in a declining economy. A fall in FDI and foreign remittances, fall in exports, energy shortages and

hyper food inflation put the economy of Pakistan in a starving situation. Therefore the economy of Pakistan was already facing poor situation before the global financial crises of 2008.

In the year 2008 KSE 100 index faced a massive decline of approximately 6000 points only within three months i.e. from 15,000 points to 9,200 points. The massive decline in KSE 100 index was due to decline in investor's confidence because of apprehensions regarding global financial crises and rise in brutal attacks of terrorism. This huge decline was alarming for the government. Therefore the government placed a floor and its intervention was shown when a bailout plan was proposed.

In the year 2008 the central bank of Pakistan estimated that approximately $500 million in lieu of FDI came in Karachi Stock Exchange which was considered at around 20 percent of the total free float in contrast to fiscal year 2006-2007 when KSE was quite charming for foreign investment and investors were taking keen interest for investing in KSE-listed securities. The KSE 100 index showed a continuous downward trend and reached the lowest level at 5,865 points after a prominent loss of 58.3 percent in the month of Dec 2008 as compared to month of Dec 2007.

Along with all these factors like administrative and Political unrest, poor economic and financial situation, a state of insurgency in the FATA and KPK, rising food inflation, widening budget deficit and trade deficit, depletion of foreign exchange reserves, depreciation of currency etc. as most of the trading of securities was taking place on speculation; the KSE was hit hard when the speculation bubble burst.

1.3: EFFICIENT MARKET HYPOTHESIS

Market efficiency is an important phenomenon in the context of Stock Markets (Fama 1970). Market efficiency explains the relationship between information and share prices. Market efficiency is of three forms which are as follows.

a) **Weak form of efficiency**

   It is a Random Walk Theory and states that all the information is reflected by the current prices of stocks, which is in the historical sequence of stock prices and have a constant mean.

b) **Semi Strong Form of efficiency**

   This form states that the current prices of stocks not only reflects the information regarding historical prices but also the information about the companies which is easily available to the general public.

c) **Strong Form of efficiency**

   This form states that both the public as well as private information is reflected in the current prices of the stocks.

The studies conducted in the light of EMH by Fama and Schwert (1977), Nelson (1977), and Jaffe and Mandelker (1976), all affirming that macroeconomic variables influence stock returns and Stock Exchange Prices always reflect the fundamental macroeconomic indicators.

1.4: OBJECTIVES OF THE STUDY

The objective of this study is twofold as,

Firstly, the study aims to check the association between macroeconomic variables and stock prices of Karachi Stock Market by taking into account the data from Jan 2001 to May 2012. This would be useful to evaluate the bivariate causal association between the stock prices and macroeconomic variables. Secondly the study incorporates the impact of 2008 crises of KSE inorder to know if prolonged crises effects the stock market or not.

1.5: ORGANIZATION OF STUDY

After a brief introduction the remaining part of study is structured as follows. Chapter 2 is composed of literature review which provides enough literature justifying the association between different variables and stock prices and on empirical evidence related to causal relationship (bidirectional and unidirectional) between different variables and stock prices. Chapter 3 discusses data and Methodology used in study, Chapter 4 evaluates long run association as well as short run association between macroeconomic variables and stock prices and significance of market crash 2008 and its impact on stock prices using time series VAR and significance of market crash 2008 and its impact on stock prices. Chapter 5 Concludes and offers policy implications.

Chapter 2

LITERATURE REVIEW:

Macroeconomic variables are the true representatives of the economic performance of a country. These variables have influence on the financial sustainability of the economy. Financial sustainability of economy reflects the financial sustainability of the capital markets. Risk is the key factor that is always prevailing in the capital markets and risk management is very important for the financial sustainability of the capital markets. Risk managers consider both macro and micro economic indicators by using the risk management models to manage the risk. Ross (1976) presented a theory named as "The Arbitrage Pricing Theory" which states that risk premia is a significant factor and return on securities is influenced by the risk premia which is connected with various factors and plays a significant role in the determinations of the asset prices. So inorder to implement systematically the risk management policies the association between economic variables and stock prices must be considered and analyzed deeply by the risk managers. The findings of Chen, Roll and Ross (1986), concluded that economic variables have affect on discount rate which in turn influences future dividend payments and hence affects the cash flow generation ability of the companies. Their study serves as the basis to believe that there is a significant association among macro economic variables and stock prices.

In order to analyze the association between macro economic variables and stock prices a study was conducted by Maysami and Koh (2000) in which they analyzed the long run association between different stock markets like Singapore, Japan and USA. The results conclude that "interest rate" and "exchange rate" were highly significant and the three of the markets were significantly cointegrated to each other.

The association between macroeconomic variables and stock prices was examined by Maysami and Sims (2002) in Hong Kong and Singapore, Maysami and Sims (2001a) in Malaysia and Thailand, Maysami and Sims (2001b) in Japan and Korea. They applied Hendry's (1986) approach in order to assess the convergence towards equilibrium path and also to examine the long-run equilibrium relationship between the macro economic variables and stock prices. The results revealed that there exists short run association as well as long run association between the said variables and stock prices in all of the selected countries depending upon their size of economy and financial structure.

Muhammad and Rasheed (2002) conducted a research inorder to check the relationship between prices of stocks and rate of exchange by taking into account the data from South Asian Countries and found no association between prices of stocks and rate of exchange in case of Pakistan and India, where as there exist bi-directional long run causal association between prices of stocks and variables of macro economics in case of Sri Lanka and Bangladesh but no short run association was found in both the countries.

Chong and Koh (2003) made a research in case of Malaysia in order to explore the long-run relationship between the prices of stocks and other independent variables like IPI "index of industrial production", i "interest rate" and MS "money supply" and found a significant long-run association between the prices of stocks and all the variables.

In case of Pakistan Nishat & Shaheen (2004) tried to explore the bivariate causality between prices of stocks and variables of macro economics and found a positive answer. It was depicted from the results that industrial production index is the most significant positively associated variable with the stock prices whereas inflation is the major significant but negatively associated variable with the stock prices and concluded that movement in the stock prices are

affected by the macroeconomic variables. Another study regarding causal association between economic variables and stock prices was conducted by Imran Ali, et al,. (2010) and found that there was neither any relationship nor any causal association between the macroeconomic variables and prices of stocks.

In the same way a study in India by Chakravarty (2005) who found after examination that IIP was significant and positively related to the prices of stocks and there exist unidirectional causal relationship from IIP to stock prices. However balance of trade proved to be insignificant which was against the findings of Bhattacharya (2002) who concluded balance of trade to be significant and negatively related to stock prices.

A study was conducted by Qayyum and Kamal (2007) in order to inspect the effect of volatility in foreign exchange market on stock exchange market and effect of volatility in stock exchange market on foreign exchange market. The research revealed some interesting outcome that no long run relationship was found between the two markets but the way both the markets behave found to be related. Stock prices found to be sensitive to the volatility of forex market and vice n versa. The study concluded that the volatility of forex market and volatility of stock prices are highly interlinked.

Another study regarding association of economic variables and stock prices was conducted by Sohail and Hussain (2009) taking into account the index of Lahore Stock Exchange i.e. LSE 25 index. The results of the study showed that CPI was significantly negatively related with stock prices where as IIP, ER and MS were significant and positively associated with the prices of stocks in the long run. In case of short run the results showed convergence towards the equilibrium path.

Kanasro et al,. (2009) conducted a study to know that whether concentration of stocks effect the capitalization of market or not. After investigation large concentration of stocks of Cotton and textile industry, Chemical and pharmaceuticals industry, Fuel and energy sector, Transport and communication sector and banking sector was found in KSE and these five groups of companies played a dominant role in capitalization of the market. The research concluded that investors are always looking for negatively correlated securities in order to provide hedge to their investment and to take maximum advantage but if the market is highly concentrated it is very difficult for the investors to choose optimum combination of negatively correlated securities for portfolio investment.

Another interesting research work done by Hussain et al,. (2011) to check the impact of day of the week on the returns of the stocks by taking into account the KSE 100 index. The research was conducted in the light of efficient market hypothesis and it was found that KSE is efficient in weak form and bears a lot of anomalies. The results of the study confirmed the presence of day of the week effect and it was found that returns on Tuesday were highly significant and positive than other days of the week.

Kiymaz (2001) conducted a research to analyze the effects of rumors relating to stock exchange market on returns of the stocks. 355 rumors relating to stock exchange market were taken from Weekly Magazine the contents of which were; Expectations regarding earnings (128), Sales of firms or exports (6), Undervalued stocks (23), Purchases by foreigners (22), Unclassified (108), Rumors without any content (68). It was found that that the effect of rumors is high before and after the publication of the rumors and proved a significant impact of rumors on the stock prices.

A number of studies regarding the association between the variables of macroeconomics and prices of stocks in different countries of the world have been conducted. Riely and Brown (2000) pointed a negative relationship between Discount Rate and Stock Prices, Fama & Shwert (1977), Chen, Roll and Ross (1986), Nelson (1976), Jaffe and Mandelkar (1976) pointed that there exists a relationship between inflation and stock prices and inflation is negatively correlated with the stock prices. According to Mukherjee and Naka (1995) there exists a positive association between the rate of exchange and prices of stocks whereas the association between the prices of stocks and supply of money is an empirical question. Tainer (1993), Fama (1990), Geske and Roll (1983) is of the view that index of industrial production has a positive association with the stock prices. This study is also going to inspect the relationship both long-run and short-run among different variables of macroeconomics and prices of stocks inorder to address the question that stock prices can be predicted by the macroeconomic variables or not. Moreover this study will also consider the effect of market crash by employing a dummy variable inorder to know that prolonged crises significantly effects the stock prices and performance of the stock market.

Chapter 3

DATA AND METHODOLOGY

3.1: DATA

Keeping in view the existing literature and the data availability monthly time series data from January 2001 to May 2012 is used to assess the long run as well as the short run association between the macro economic variables and stock prices (KSE100 index) of Karachi Stock Exchange. The independent variables used in this study are Inflation CPI (Consumer Price Index as a proxy to inflation), Money Supply M2 (M2 is broader money and composed of circulated currency, deposits with commercial banks, deposits with central bank, various time deposits and (FCDs) of the banks), Exchange Rate, Index of industrial production (Proxy for GDP), Discount Rate, Exports and Dummy Variable for 2008 Crash of KSE (D=0 Before Crash & D=1 After Crash) where as KSE 100 index is used as a dependent variable. The data is gleaned from published sources of IFS, SBP and KSE.

The significance and anticipated signs of macroeconomic variables with stock prices are as follows:

3.1.1: Discount Rate:

The rate of interest that is charged to banks and other financial institutions on loans which they take from the central bank is known as Discount Rate. This is the cost that banks are charged for borrowing money from central bank.

The discount rate is negatively related with the stock prices (Reily and Brown 2000). The underlying argument for this is as follows:

The direct effect of increase or decrease in discount rates is on the profits of the companies which in turn effects the dividends and thus prices of the stocks are effected. Increase in Discount rate increases the borrowing cost of the companies where as decrease in discount rate decreases the borrowing cost of the companies and thus serves as an incentive for expansion and leads to increase the expected returns for the firm in the future and results in stock prices to appreciate.

Most of the purchases either for capital assets or current assets are made through borrowing by the companies. With an increase in the discount rate the transactions for purchasing the stock becomes costly and these costly transactions will lure the demand and results in stock prices to depreciate.

3.1.2: Inflation:

There exists a negative association between the inflation and prices of stocks which is justified by the studies of Fama and Schwert (1977), Chen, Roll and Ross (1986), Nelson (1976) and Jaffe and Mandelker (1976) that inflation is negatively related to stock prices. When the inflation rises it forces the authorities to control this by adopting a contractionary monetary policy which ultimately leads to increase the rate of interest and hence the discount rate increases. As the rate of inflation and the rate of cash flows are not the same so the effect of increase in the rate of interest may not be neutralized by an increase in cash flows resulting from inflation. This is because of existence of nominal contracts which hampers the revenues of the firm and costs of the firm to be immediately adjusted, DeFina (1991). Therefore the cost of

inputs increases and it effects the demand which results in cash flows to decrease and thus stock prices depreciate.

3.1.3: Exchange Rate:

The rate at which the conversion of local currency into foreign currency takes place is known as Exchange Rate. The exchange rate is positively related to stock prices and the underlying argument for this relationship is as follows:

If a local currency depreciates this will result in exports of that country to become cheap and hence the demand for exports of that country will increase. Ultimately results in exports of that country to increase. The increased exports lead the cash inflows of that country to increase. As the demand for exports is assumed to be sufficiently elastic and thus raises the revenue for the export oriented industries which ultimately results in a positive mood in the stock exchange market and leads the stock prices to increase. On the other hand the appreciation of a local currency reflects economic stability which ultimately results in increased investment both in the real as well as in the financial sector. The increased demand for local listed securities will push up the level of index of stock exchange market. Therefore there exists a positive correlation between the rate of exchange and prices of stocks (Mukherjee and Naka 1995).

3.1.4: Index Of Industrial Production:

Index of industrial production is a proxy for gross domestic product and indicates economic activity. If there is a rise in industrial production it reflects growth of economy. During the period of expansion in economy the IIP rises and during the period of recession in economy

the IIP falls, Tainer (1993). IIP is positively related to the prices of stocks and the same association was found by the Fama (1990) and Geske and Roll (1983).

It is the economic phenomena that the accumulation of real assets effects the production capability of an economy which ultimately effects the cash flow generation ability of the firms. A rise in production results in an increase in cash inflows of the firms where as decrease in production results in a decrease in cash flows of the firm. Increased revenues leads to increase in profits results in the dividends to increase which leads the stock prices to appreciate and vice n versa. It is depicted by the studies conducted by Chen, Roll & Ross (1986) and Fama (1981) which found the significance of IIP and its positive association with the stock prices.

3.1.5: Money Supply:

Friedman and Schwartz (1963) advocate that money is the centre of gravity in economics and argued that it is the monetary sector which effects the whole economy in aggregate. Increased money supply means increase in liquidity in the hands of individuals and corporate sector and vice n versa which ultimately effects the expected returns of the stocks. Hence provided the basis for belief that an association exists between the money supply and stock prices.

More securities will be bought with the availability of excess liquidity, hence leads to an increase in the demand for securities and the increased demand leads the prices of the securities to increase. So a positive and significant association was found by Hamburger and Kochin (1972) and Kraft (1977). It is an economic phenomenon that inflation is caused by an increase in money supply which leads to contractionary monetary policy and results in discount rate to increase. The increased discount rates lead the stock prices to depreciate (Fama, 1981). On the

other hand the economic stimulus generated by an increase in money supply may dissolve the negative effects of inflation results in an increase in the cash flows and stock prices of the firms which are due to the effect of corporate earnings. Maysami and Koh (2000) in case of singapore also found that money supply is positively associated with the stock prices.

3.1.6: Exports

Any country may increase the reserves of its foreign exchange by increasing the exports. The increased foreign exchange reserves imply the currency to become stable which ultimately results in price stability. Therefore Exports have a positive association with the stock prices i.e. when exports increase the stock prices also increase vice n versa (Krugmen). The increase or decrease in exports is coupled with changes in price level of the country. When price level increases leads to a decrease in exports because due to increase in cost of production the exports become expensive so the profits of the export oriented companies decrease. The decrease in profits implies a decrease in revenues as well as a decrease in dividends which ultimately leads the stock prices to depreciate.

3.2: METHODOLOGY

3.2.1: Estimation Technique

Monthly time series data from January 2001 to May 2012 is used to assess the relationship between the macroeconomic variables and KSE100 index. A time series VAR model is estimated by testing for stationarity by the ADF test, Johansen test for conintegration and long run equilibrium, VECM for short run adjustments and convergence and Granger Causality for unidirectional and bidirectional causality between the dependent and independent variables.

The methodology is used as follows:

3.2.2: Stationarity Checks

Generally, the variables which are used for research in "macro economics", "monetary economics" and "financial economics" most of them are not stationary (Hill et al., 2001). If the variables are not stationary the robust results cannot be found. In order to get rid of spurious regression it is necessary to covert the non stationery time series into stationery time series. Once the variables of a time series become stationary, then any fluctuation is considered temporary and mean reverting to their long run path. If the time series is non stationery then the mean as well as the variance of the series are time dependent or only the mean or the variance is time dependent and as the time becomes infinite the variance of the series also reaches infinity (Asteriou and Hall, 2006).

There are three renowned tests which are applied to detect the unit root and are as follows:

1. ADF Test presented by Dickey and Fuller, 1981
2. PP Test presented by Phillips and Perron, 1988
3. KPSS presented by Kwiatkowski, Phillips Schmidt and Shin, 1992

When these tests detect the unit root in variables at level then first difference is taken and the variables are said to be integrated of order one i.e. I(1) if still unit root exists then the second difference is taken and the variables are said to be integrated of order two i.e. I(2) and so on. It is a pre-requisite of the cointegration that all the variables must be integrated of the same order i.e. either I(1) or I(2). Inorder to test for unit roots this study uses the ADF test which takes into account the assumption of error term ε_t that it should be asymptotically normal and the null hypothesis is tested as:

$H_0 : \beta = 0$ in

$$\Delta y_t = a_0 + \beta y_{t-1} + \sum \lambda_i \Delta y_{t-i+1}^{P} + \varepsilon_t$$

3.2.3: Lag Length:

Sims likelihood ratio test is used for the decision of optimum lag length. It is important to take optimum lag length by suitable lag length criteria so that additional parameters may not be estimated and DFs "Degrees of Freedom" may not be lost, the test remains powerful and spurious regression may be avoided. Appropriate lag selection is very important to analyze the true dynamics of the VECM Vector error correction process and this will give rise to exact estimates and true figures of standard errors. In this study Akaike Information Cretia (AIC) and

Shwarz Bayesian Criteria (SBC) are employed for using appropriate lag lengths. Both of these criterion are used for selection of appropriate model and developed for Maximum Likelihood Estimations, where:

AIC = "T" in (sum of squares of residuals) + II n

SBC = "T" in (sum of squares of residuals) + n in "T"

3.2.4: Cointegration Test and Vector Error Correction Model:

Cointegration test is used to identify association and equilibrium between the variables in the long-run. The existence of association between the variables in the long run confirms that the variables are cointegrated and association of variables in the short run dynamics shows the convergence towards long run equilibrium path.

Inorder to assess the dynamics of association between the macroeconomic variables and stock prices two approaches can be used:

1. Engle and Granger Approach (1987)
2. Johansen and Juselius Approach (1990)

The Engle and Granger Approach is used in the context of multi variables and the errors are corrected in two steps where as the conintegration between the variables using "Johansen's Approach" is tested only in one step by taking into account the entire system of equations. Johansen's VECM is a model which gives full information and gives the more efficient estimates of vectors of cointegration so there is no need to carry the errors of first step into the second step as in case of Engle and Granger Approach. Moreover the Johansen Approach allows the assumptions of any endogeniety/exogeneity of the variables to be avoided. Therefore Johansen

Approach is considered superior to Engel and Ganger Approach. Johansen approach tests the cointegration between the variables in the light of VAR "Vector Autoregressive Approach".

The VAR specification tested by Johansen Approach is used as follows:

$$x_t = A_0 + \sum_{j=1}^{k} A_j x_{t-j} + D_t + \varepsilon_t$$

Where A_0 represents the constant vector, x_t represents the vector of variables which are integrated of order one i.e. I(1), the lags are represented by *k*, the coefficient matrix is represented by A_j and ε_t represents the error term also known as idiosyncratic error term or Gaussian error term. D_t is a vector of dummy for market crash in which D=0 before crash and D=1 after crash. The reformulation of vector autoregressive process into Vector Error Correction Model (VECM) is in the following way:

$$\Delta x_t = A_0 + \sum_{j=1}^{k-1} \Gamma_j \Delta x_{t-j} + \Pi x_{t-k} + \sum_{i-1}^{P} \sigma_{1i} D_{t-1} + \varepsilon_t$$

Where $\Gamma_j = -\sum_{i=j+1}^{k} A_j$ and

$$\Pi = -I + \sum_{i=j+1}^{k} A_j$$

'I' represents the identity matrix whereas Δ represents the difference. The number of cointegrating vectors are found using Trace statistics and the Maximum Eigen Values. Those number of Characteristic Roots are used that are significantly alike the unity.

3.2.5: Granger Causality Test

In this study Granger causality test is applied to analyze the direction of causality between the variables. The causal association between the variables tells that which variables predict the other variable and causality runs from one variable to another.

3.2.6: Model Specification

This study analyzes the long-run association between the macroeconomic variables and KSE 100 index and is depicted by employing the following model:

$$LKSE_t = \beta_0 + \beta_1 LCPI_t + \beta_2 LM2_t + \beta_3 LER_t + \beta_4 LIIP_t + \beta_5 Li_t + \beta_6 LEX_t + \beta_7 D_t + \varepsilon_t \qquad 3.1$$

The dynamics of the short run association and behavior of the variables i.e. convergence towards long run equilibrium path is estimated by employing the following model:

$$\Delta LKSE_t = \alpha_1 + \gamma_1 U_{t-1} + \sum_{i-1}^{P} \theta_{1i} \Delta LCPI_{t-1} + \sum_{i-1}^{P} \beta_{1i} \Delta LM2_{t-1} + \sum_{i-1}^{P} \mu_{1i} \Delta LER_{t-1} +$$

$$\sum_{i-1}^{P} \eta_{1i} \Delta LIIP_{t-1} + \sum_{i-1}^{P} \lambda_{1i} \Delta Li_{t-1} + \sum_{i-1}^{P} \phi_{1i} \Delta LEX_{t-1} + \sum_{i-1}^{P} \rho_{1i} D_{t-1} + \varepsilon_t \qquad 3.2$$

The variables used in this study are described as follows:

LKSE	=	Log values of KSE100 index (Karachi Stock Exchange)
LCPI	=	Log values of Consumer Price Index
LM2	=	Log values of Money Supply
LER	=	Log values of Exchange Rate
LIIP	=	Log values of Industrial Production index
Li	=	Log values of Discount Rate
LEX	=	Log values of Exports
D	=	Dummy Variable (D=0 before crash and D=1 otherwise)

Chapter 4

RESULTS AND DISCUSSION

This section concerns the discussion of results.

4.1: STATIONARITY RESULTS

For cointegration analysis the stationarity of the variables is a pre requisite. A non stationary time series gives spurious estimates of regression parameters, therefore, it is necessary to perform unit root test so that variable which are not stationary may become stationary. The ADF test is applied for the stationarity of macroeconomic variables and stock prices. The results of ADF Test are as follows:

TABLE 4.1

Variables	**Augmented Dickey Fuller Test Statistic**	
	Null Hypothesis: Variable is non stationary	
	Level	**1st Difference**
KSE 100 Index	-1.26	-10.50*
IIP	-0.38	-4.69*
M2	-1.64	-3.68*
CPI	-2.16	-9.39*
ER	-1.94	-5.13*
I	-2.38	-11.65*
Ex	-0.50	-4.46*
Test Critical values (MacKinnon, 1996)		
5% Level	-2.90	
10% Level	-2.59	

*implies that coefficient is significant at 5% level of probability and
** implies that coefficient is significant at 10% level of probability.

It can be seen in Table 4.1 that none of the variables is stationary at level but when the variables are taken to their 1st difference level than all the variables become stationary. Therefore the variables are said to be integrated of order 1 i.e. I(1) which confirms the possible cointegration between the variables.

4.2: COINTEGRATION ANALYSIS

The pre requisite of the Johansen Approach is that the same order of integration must be existed between all the variables used in the model i.e. all of the variables must be I(1) or I(2) and so on. As all the variables of the model are integrated of order 1 i.e. I(1) as depicted by the results of ADF Test in Table 4.1 therefore Johansen Approach is applied in the study to assess the association between the macro economic variables and stock prices in the long run.

The selection of optimum/appropriate lag length is the first step for the analysis of cointegration in the multivariate context.

4.2.1: Lag Length

Inorder to select the optimum/appropriate lag length two criteria are used in the study. One is Akaike Information Criteria (AIC) and the other is Schwarz Bayesian Criteria (SBC). The appropriate lag length is one which is depicted in following table.

TABLE 4.2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	744.8398	NA	4.57e-14	-10.85059	-10.70067	-10.78966
1	2085.236	2523.098*	2.59e-22*	-29.84170*	-28.64237*	-29.35433*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.2.2: Johansen and Juselius Coinegration Test

The relationship between the macro economic variables and stock prices in the long run is determined by JJ cointegration test. For long run relationship to exist among the variables there must be at least one cointegrating vector. The results of the trace statistics tell the number of cointegrating vectors. The results of the test are given in table 4.3.

TABLE 4.3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.433298	270.3954	159.5297	0.0000
At most 1 *	0.405443	193.7260	125.6154	0.0000
At most 2 *	0.262724	123.5343	95.75366	0.0002
At most 3 *	0.217802	82.38721	69.81889	0.0036
At most 4 *	0.191214	49.22481	47.85613	0.0370
At most 5	0.084224	20.57499	29.79707	0.3847
At most 6	0.056932	8.697194	15.49471	0.3941
At most 7	0.005790	0.783969	3.841466	0.3759

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

According to the results of Trace Statistics test given in table 4.3, there exist five cointegrating equations. Therefore five cointegrating equations are used in the study to establish a long run relationship among the macroeconomic variables and KSE 100 index.

The long run relationship can be depicted in Table 4.4

TABLE 4.4

Normalized cointegrating coefficients (standard error in parentheses)							
LKSE	**LCPI**	**LER**	**LEX**	**LI**	**LIIP**	**LM2**	**D**
1.000000	5.989276	-6.522014	-0.826443	0.669376	-0.053846	-4.007396	1.425650
SE	(0.85076)	(1.03154)	(0.21556)	(0.16204)	(0.20182)	(0.41199)	(0.16677)
t value	7.04	6.32	3.83	4.13	0.26	9.73	8.54

The normalized equation can be written as:

$$LKSE_t = -5.98LCPI_t + 4.007.LM2_t + 6.52LER_t + 0.05LIIP_t - 0.66Li_t + 0.82LEX_t - 1.42D_t$$

The results obtained from the analysis of cointegration are as follows:

The estimated coefficient of CPI is significant and has a negative sign. This indicates negative relation with stock prices. A possible explanation for this relation can be the decrease in disposable income which reduces savings that are being invested in the stock market. Hence the resultant decrease in demand for stock market products lowers their price. When the inflation rises it forces the authorities to control this by adopting a contractionary monetary policy which ultimately leads to increase the rate of interest and hence the discount rate increases. It is an economic phenomenon that inflation is caused by an increase in money supply which leads to contractionary monetary policy and results in discount rate to increase. The increased discount rate leads the stock prices to depreciate. As the rate of inflation and the rate of cash flows are not the same so the effect to increase the rate of interest may not be neutralized by an increase in cash flows resulting from inflation. This is because of existence of nominal contracts which hampers the revenues of the firm and costs of the firm to be immediately adjusted. Therefore the

cost of inputs increases and it effects the demand which results in cash flows to decrease and thus stock prices depreciates.

M2 is significant and positively related with the stock prices. More securities will be bought with the availability of excess liquidity, hence leads to an increase in the demand for securities and the increased demand leads the prices of the securities to increase. On the other hand the economic stimulus generated by an increase in money supply may dissolve the negative effects of inflation results in an increase in the cash flows and stock prices of the firms which are due to the effect of corporate earnings.

ER (Price of foreign currency in local currency) is significant and positively associated with stock prices. Theoretically exchange rate has twofold relation with the stock market prices. Firstly, a lower price of stocks in terms of foreign currency is an attraction for portfolio investment in the stock market. Secondly, if a local currency depreciates this will result in exports of that country to become cheap and hence the demand for exports of that country will increase. Ultimately results in exports of that country to increase. The increased exports lead the cash inflows of that country to increase. As the demand for exports is assumed to be sufficiently elastic and thus raises the revenue for the export oriented industries which ultimately results in a positive mood in the stock exchange market and leads the stock prices to increase. On the other hand the appreciation of a local currency reflects economic stability which ultimately results in increased investment both in the real as well as in the financial sector. The increased demand for local listed securities will push up the level of index of stock exchange market. Therefore there exists a positive correlation between the exchange rate and stock prices

IIP is positively related with the stock prices but insignificant. The result is inconsistent with Nishat and Shaheen (2004), indicated that a positive significant relationship exists between

the stock prices and IIP. Because in the last decade a continuous decline in the economy and GDP was observed and the real sector of the economy remained effected mainly because of poor law and order situation, political unrest and severe energy crises. Therefore impact of IIP is insignificant.

A negative and significant relation is indicated between the discount rate and the stock prices. The effect of increase or decrease in discount rates is on the profits of the companies which in turn affect the dividends and thus prices of the stocks. Increase in Discount rate increases the borrowing cost of the companies where as decrease in discount rate decreases the borrowing cost of the companies and thus serves as an incentive for expansion and leads to increase the expected returns for the firm in the future and results in stock prices to appreciate.

The results reveal that exports are significant and positively related with the stock prices. The increase in exports results in foreign exchange reserves to improve due to which the exchange rate and prices become stable. The exports become cheap due to the reduced domestic prices and the demand for exports increases. This increased demand generates cash inflows and results in increased dividends thus shows a positive impact on stock prices.

The results show that there is a significant negative long run relationship between the crises and the stock prices. Prolong crises have greater effects as the overall economic activity is depressed for a longer period, lowering output supply and decreasing productivity. This directly reduces growth and longetivity of this will result in the economy entering a recession persisting for a longer duration. The Great Depression of 1929 was a manifestation of this phenomenon.

4.2.3: Granger Causality Test Results

Granger causality is applied to find the causal relationship among the dependent and independent variables. The variables can predict each other if there exists causal relationship between them Granger (1969). The results of the Granger Causality are as follows:

Null Hypothesis:	F-Statistic	Prob.
LCPI does not Granger Cause LKSE	2.49229	0.0125
LKSE does not Granger Cause LCPI	1.60122	0.1237
LER does not Granger Cause LKSE	4.33955	8.E-05
LKSE does not Granger Cause LER	1.21418	0.2937
LEX does not Granger Cause LKSE	0.80695	0.6107
LKSE does not Granger Cause LEX	0.85068	0.5715
Li does not Granger Cause LKSE	1.73581	0.0893
LKSE does not Granger Cause Li	1.70139	0.0972
LIIP does not Granger Cause LKSE	1.00258	0.4425
LKSE does not Granger Cause LIIP	3.26140	0.0015
LM2 does not Granger Cause LKSE	2.42848	0.0148
LKSE does not Granger Cause LM2	2.07254	0.0381
D does not Granger Cause LKSE	7.42219	2.E-08
LKSE does not Granger Cause SER01	0.41114	0.9268

The results of Granger Causality Test showed that there is a unidirectional relationship between CPI and KSE, ER and KSE, D and KSE as CPI, ER and D granger cause KSE but KSE does not granger cause CPI, ER and D. There is no causal relationship between EX and KSE and i and KSE. Neither EX granger cause KSE nor KSE granger cause EX similarly neither i granger cause KSE nor KSE granger cause i. KSE granger cause IIP but IIP does not granger cause KSE so there is also a unidirectional causal relationship between KSE and IIP. There is a bidirectional causal relationship between M2 and KSE as both the KSE and M2 granger cause each other.

These results are generalized indicators of causality and may not give the actual dynamics of the relation as stock indices and prices are affected by a plethora of variables through multiple channels. Comparatively, the Johansen results may be considered to be of higher value and may be explored further by changing data frequency and addition of more variables.

4.2.4: VECM Results

The error correction equation is estimated by using the differences of variables/ lagged values of long-run relationship. The estimated equation of VECM is as follows:

$$\Delta LKSE100_t = 0.012 + \sum_{i-1}^{P} \theta_{1i} \Delta LCPI_{t-1} + \sum_{i-1}^{P} \beta_{1i} \Delta LM2_{t-1} + \sum_{i-1}^{P} \mu_{1i} \Delta LER_{t-1} +$$

$$\sum_{i-1}^{P} \eta_{1i} \Delta LIIP_{t-1} + \sum_{i-1}^{P} \lambda_{1i} \Delta Li_{t-1} + \sum_{i-1}^{P} \phi_{1i} \Delta LEX_{t-1} + \sum_{i-1}^{P} \rho_{1i} D_{t-1} - 0.15$$

The convergence towards equilibrium path in the long run and its speed to adjust is depicted by the adjustment coefficient of KSE in VECM. The results given in above equation shows that the coefficient of error term of KSE is less than one with a negative sign and is significant.

The KSE 100 index is adjusted by 15.73 percent which is depicted by the coefficient of error term. The time required to remove the disequilibrium is calculated as (1/0.1573 = 6.00) i.e. approximately 6 months are required to achieve the equilibrium path in the long run.

Significant relations in the Table A5 are indicated in BOLD face. KSE index has a negative and significant relation with the one period lagged exchange rate i.e., the previous period exchange rate negatively affects the stock price. One of the possible reasons for this behavior in case of Pakistan can be the addition to the national debt by exchange rate

depreciation. Higher outflow of funds will therefore leave lesser for investment in the industry and stocks. The relation between exchange rate and stock index may be bidirectional as is indicated by the ER relation with the lagged stock index (in the second column). The negative and significant relation indicates this relation.

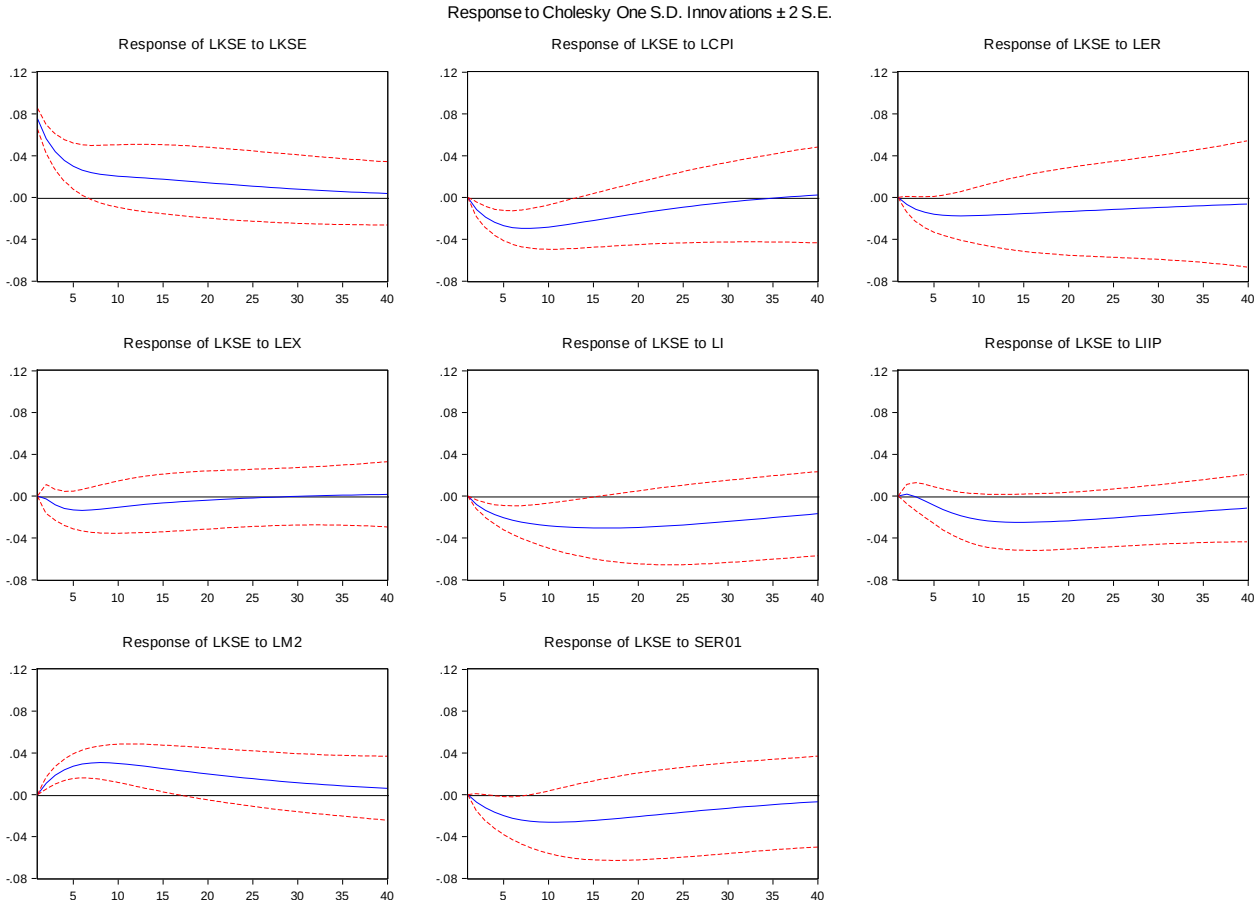
The direct relation of the remaining variables with stock prices is insignificant. This can be interpreted theoretically by taking into account the short term relation of the stock prices and economic variables. The data frequency time period is one month, This time period is significant for the stock indices as they are highly sensitive to information whereas may not be very significant for the economic variables which operate over a longer time period. The process of stock market adjustment to economic variables is thus a longer time period than one month. In other words it may be hypothesized that stock incorporates the change in economic variable over a longer time period and hence the relation is insignificant over the frequency of the data.

4.2.5: Impulse Response and Variance Decomposition

For further verification of the results of the already conducted tests impulse response and variance decomposition analysis have also been carried out. The response of KSE to impulses of significant variables is shown in the Fig 4.1. The response of log value of KSE index to one standard deviation shock of the variables for the ensuing period of 40 months (data frequency) is shown. Response to CPI shock was also significant in the VECM framework is also exhibited here. The index responds negatively to any inflationary shock and then regains its normal path after an approximate duration of 7 time period. Except for the money supply M2 the response of KSE to other variables follows identical track – initially declines and then in the 10 to 18 months

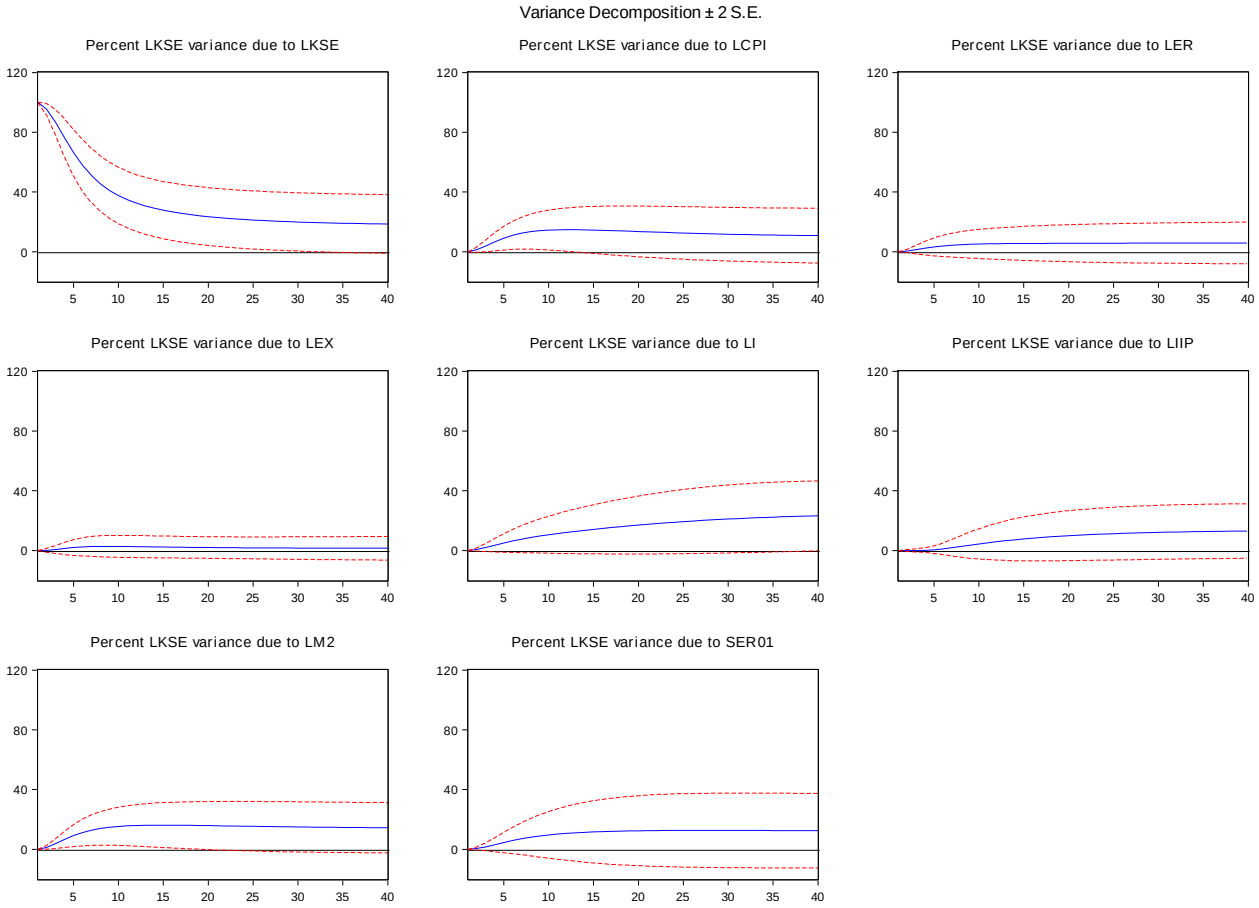
time period resume the original path. For the M2 the response is identical but with opposite sign .i.e., positive change in response to M2 deviation shock.

Figure 4.1



The results of variance decomposition are shown in Fig 4.2. The results exhibit pattern in conformance with the already obtained results. The variance in KSE index is significant and persistent to CPI, discount rate and M2. These variables positively and approximately identically contribute to the variance of KSE index. Exports confirm the previous results of not significant contribution to the KSE.

Figure 4.2


Variance Decomposition ± 2 S.E.
Percent LKSE variance due to LKSE
Percent LKSE variance due to LCPI
Percent LKSE variance due to LER
Percent LKSE variance due to LEX
Percent LKSE variance due to LI
Percent LKSE variance due to LIIP
Percent LKSE variance due to LM2
Percent LKSE variance due to SER01
120
80
40
0
5
10
15
20
25
30
35
40

Chapter 5

CONCLUSION

This study analyzes the empirical association between macro economic variables and stock prices of KSE. In order to explore the dynamics in the long-run as well as in the short run the monthly data of KSE 100 index, CPI (Consumer Price Index), ER (Exchange Rate), EX (Exports), i (Discount Rate), M2 (Money Supply), IIP (Index of Industrial Production) have been studied covering a time period from January 2001 to May 2012. The market crash of 2008 have been captured by using a dummy variable (D) i.e. (D=0 before crash and D=1 after Crash). The model used by Maysami and Sims (2002) have been used and econometric techniques of Granger causality, Johensen and Jesulius cointegration and VECM have been used to estimate results. The outcome of this analysis have been further verified by using impulse response and variance decomposition analysis.

The results of ADF implies that the whole time series is non-stationary at level but after taking the first difference the series becomes stationary i.e. I(1). The trace statistics show five conintegrating equations that confirms the existence of long run association between the variables. In the long run CPI, i and D shows negative and significant effect on stock prices while ER, EX and M2 shows a positive and significant impact on stock prices where as IIP has a positive but insignificant impact on stock prices. The significant negative effect of market crash 2008 on stock prices is depicted by the dummy variable used in the model. The analysis of VECM describes the convergence which is depicted by the error correction term which shows the speed of adjustment towards the equilibrium path in the long run i.e. it will take approximately 6 months to eliminate any disequilibrium and converge towards long-run path of equilibrium. The outcome of Granger Causality shows that there is a unidirectional relationship

between CPI, ER, D and KSE. There is no causal relationship between ER, i and KSE. There is also a unidirectional causal relationship between KSE and IIP as only KSE granger cause IIP where as a bidirectional causal relationship exists between M2 and KSE as both the KSE and M2 granger cause each other.

The findings of the study are in line with the economic theory and no apparent contradiction has been found. The performance of KSE may be taken as an indicator of the underlying economy specially of exchange rate and inflation behavior, both being financial variables with deeper effects on the other macroeconomic variables. These indications of the results after further robust studies can be used for pre-emptive adjustment in the monetary and fiscal policies to avert recessions, inflations and may be spikes and crashes in the stock market.

The study can be further extended by using data of different frequencies to find the synchronized time duration between the economic variables and stock indices. Another extension of the study can be made by inclusion of variables for information and also integration with international stock markets.

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APPENDIX

Table A 1. Summary Statistics

Variable	Mean	Median	S.D	Max	Min
LKSE	8.759	9.122512	9.624163	7.033004	0.755452
LCPI	4.77891	4.703023	5.406773	4.374413	0.329672
LER	4.209735	4.105823	4.513718	4.048897	0.164616
LEX	11.39326	11.39342	12.26953	10.58547	0.456771
LI	2.333507	2.302585	2.70805	2.014903	0.228832
LIIP	4.565036	4.670405	4.927717	3.894753	0.253998
LM2	15.01912	15.04493	15.79468	14.18991	0.476342

Table A2. Cross Correlation between variables

	LKSE	LCPI	LEX	LER	LI	LIIP	LM2
LKSE	1	0.7268	0.803935	0.454385	0.245765	0.900603	0.879793
LCPI	0.7268	1	0.960354	0.935152	0.720068	0.716619	0.961909
LEX	0.803935	0.960354	1	0.850291	0.647203	0.768008	0.96231
LER	0.454385	0.935152	0.850291	1	0.819709	0.493421	0.813415
LI	0.245765	0.720068	0.647203	0.819709	1	0.35028	0.589936
LIIP	0.900603	0.716619	0.768008	0.493421	0.35028	1	0.841853
LM2	0.879793	0.961909	0.96231	0.813415	0.589936	0.841853	1

Table A 3. ADF Test

Variables	Augmented Dickey Fuller Test Statistic	
	Null Hypothesis: Variable is non stationary	
	Level	1st Difference
KSE 100 Index	-1.26	-10.50*
IIP	-0.38	-4.69*
M2	-1.64	-3.68*
CPI	-2.16	-9.39*
ER	-1.94	-5.13*
I	-2.38	-11.65*
Ex	-0.50	-4.46*
Test Critical values (MacKinnon, 1996)		
5% Level	-2.90	
10% Level	-2.59	

Table A 4. Trace Statistics

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.433298	270.3954	159.5297	0.0000
At most 1 *	0.405443	193.7260	125.6154	0.0000
At most 2 *	0.262724	123.5343	95.75366	0.0002
At most 3 *	0.217802	82.38721	69.81889	0.0036
At most 4 *	0.191214	49.22481	47.85613	0.0370
At most 5	0.084224	20.57499	29.79707	0.3847
At most 6	0.056932	8.697194	15.49471	0.3941
At most 7	0.005790	0.783969	3.841466	0.3759

Table A 5. VECM Results

Error Correction:	D(LKSE)	D(LCPI)	D(LER)	D(LEX)	D(LI)	D(LIIP)	D(LM2)	D(D)
CointEq1	-0.157386	-0.002092	0.022365	0.099560	0.041509	0.020508	0.008789	-0.037923
	(0.03782)	(0.00380)	(0.00399)	(0.05439)	(0.01886)	(0.03748)	(0.00715)	(0.04182)
	[-4.16103]	[-0.54995]	[5.60712]	[1.83060]	[2.20133]	[0.54713]	[1.22937]	[-0.90685]
D(LKSE(-1))	0.113210	0.005739	**-0.019745**	0.175713	-0.021050	0.104006	-0.002927	-0.013861
	(0.08527)	(0.00858)	**(0.00899)**	(0.12261)	(0.04251)	(0.08450)	(0.01612)	(0.09428)
	[1.32766]	[0.66915]	**[-2.19585]**	[1.43311]	[-0.49518]	[1.23081]	[-0.18163]	[-0.14702]
D(LCPI(-1))	-0.591888	0.272832	0.173389	-1.766177	1.153827	-0.847466	-0.079648	**2.861014**
	(0.97882)	(0.09846)	(0.10322)	(1.40743)	(0.48797)	(0.97000)	(0.18501)	**(1.08220)**
	[-0.60470]	[2.77112]	[1.67979]	[-1.25490]	[2.36454]	[-0.87367]	[-0.43050]	**[2.64370]**
D(LER(-1))	1.475251	0.152384	0.446761	-0.136185	-0.039258	0.047395	**-0.326385**	0.317928
	(0.75591)	(0.07603)	(0.07971)	(1.08692)	(0.37685)	(0.74911)	**(0.14288)**	(0.83575)
	[1.95162]	[2.00414]	[5.60453]	[-0.12529]	[-0.10418]	[0.06327]	**[-2.28435]**	[0.38041]
D(LEX(-1))	**-0.144990**	0.006125	0.009956	**-0.422342**	0.033668	**-0.322329**	0.004351	0.022066
	(0.06186)	(0.00622)	(0.00652)	**(0.08895)**	(0.03084)	**(0.06130)**	(0.01169)	(0.06839)
	[-2.34390]	[0.98432]	[1.52625]	**[-4.74834]**	[1.09177]	**[-5.25812]**	[0.37216]	[0.32264]
D(LI(-1))	-0.353108	0.014059	-0.031411	0.075293	-0.066916	0.128236	-0.030110	-0.054149
	(0.19156)	(0.01927)	(0.02020)	(0.27544)	(0.09550)	(0.18983)	(0.03621)	(0.21179)
	[-1.84335]	[0.72966]	[-1.55497]	[0.27336]	[-0.70071]	[0.67552]	[-0.83159]	[-0.25567]
D(LIIP(-1))	0.110433	-0.000842	-0.013001	-0.066905	0.001869	0.067945	-0.010077	-0.061743
	(0.08369)	(0.00842)	(0.00883)	(0.12034)	(0.04172)	(0.08294)	(0.01582)	(0.09253)
	[1.31953]	[-0.09997]	[-1.47312]	[-0.55598]	[0.04479]	[0.81922]	[-0.63700]	[-0.66727]
D(LM2(-1))	0.220216	0.035559	**0.131759**	0.116166	0.427149	**2.092107**	-0.193560	0.075129
	(0.50551)	(0.05085)	**(0.05331)**	(0.72687)	(0.25202)	**(0.50096)**	(0.09555)	(0.55891)
	[0.43563]	[0.69932]	**[2.47162]**	[0.15982]	[1.69493]	**[4.17617]**	[-2.02575]	[0.13442]
D(D(-1))	0.160162	-0.000507	-0.061350	0.070777	-0.060181	-0.038644	0.019059	-0.045372
	(0.09271)	(0.00933)	(0.00978)	(0.13330)	(0.04622)	(0.09187)	(0.01752)	(0.10250)
	[1.72759]	[-0.05436]	[-6.27521]	[0.53095]	[-1.30212]	[-0.42062]	[1.08766]	[-0.44265]
C	0.011937	0.004539	-0.000417	0.024315	**-0.013808**	-0.013738	**0.015635**	-0.015590
	(0.01273)	(0.00128)	(0.00134)	(0.01831)	**(0.00635)**	(0.01262)	**(0.00241)**	(0.01408)
	[0.93756]	[3.54410]	[-0.31028]	[1.32811]	**[-2.17529]**	[-1.08879]	**[6.49681]**	[-1.10749]

Fig A 1. Response of Stock Prices to Macroeconomic Variables

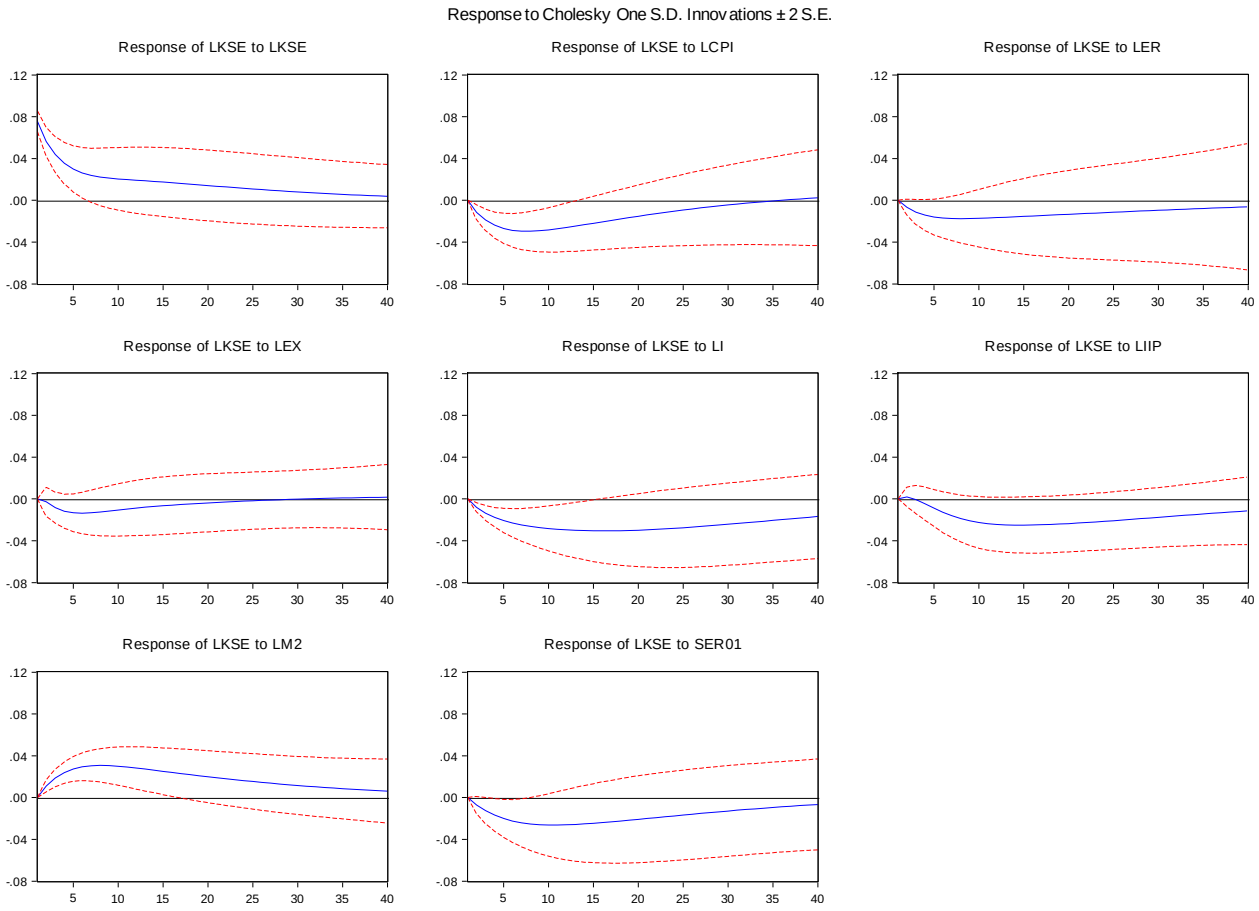

Figure A 2. Response of Macroeconomic Variables to Stock Prices

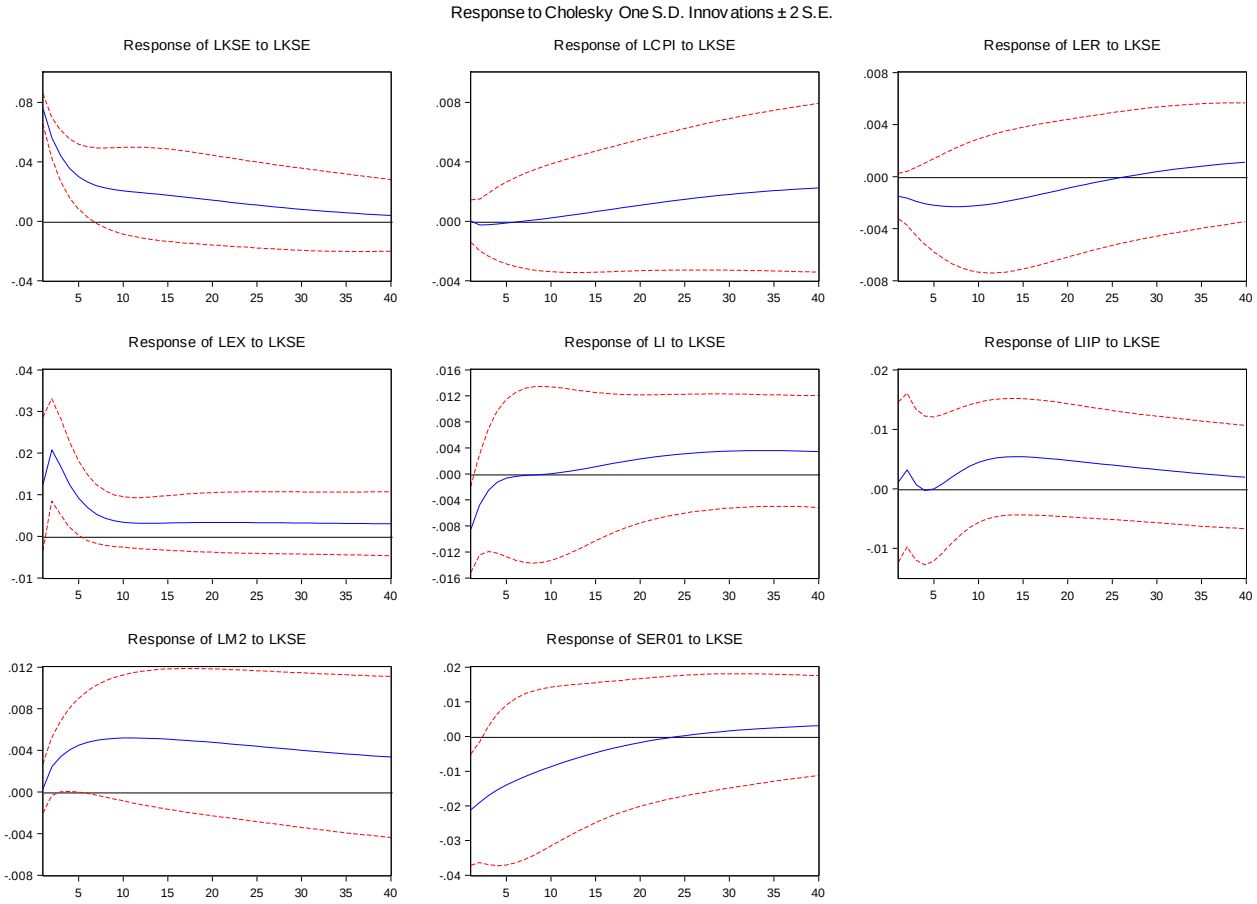

Figure A 3. Variance Decomposition