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Full Length Research Paper

Co-integration and causality analysis of dynamic linkage between economic forces and equity market: An empirical study of stock returns (KSE) and macroeconomic variables (money supply, inflation, interest rate, exchange rate, industrial production and reserves)

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This study explores the short and long term dynamic relationship between macroeconomic variables and stock returns (KSE) for the period from January 1999 to December 2008. Macroeconomic variables include money supply, consumer price index, treasury bills rates, exchange rate, industrial production and reserves. The time series data have been used to examine by employing Johansen and Juselius multivariate cointegration, bivariate cointegration and Granger causality which indicates long term relationship among money supply, consumer price index and industrial production. Granger Causality test provides evidence about lead lag unidirectional relationship between macroeconomic variables and stock returns (KSE). Vector error correction model explores the short term dynamic negative significant relationship among interest rate, exchange rate and also inflation on Karachi Stock Exchange. Money supply has a positive impact, creates the liquidity and accepts the null hypothesis of positive impact on equity market. Variance decomposition test determined that macroeconomic variables are an important source of volatility for the Karachi Stock Exchange. The contribution of this research is used to identify macroeconomic variables that are considerable factors and determinants of Karachi Stock Exchange movements. It also indicates that policy makers should be more careful and watchful about the sensitivity in designing the monetary policy.

Key words: Karachi Stock Exchange (KSE), dynamic, macroeconomic variables, causality, vector error correction model (VECM), cash inflows, present value, co-integration.

INTRODUCTION

Financial information has significant value for the investors; they have to take economic decisions because the world is moving towards the free market economy. The co-integration and causality relationship between macroeconomic variables and stock returns remained one of the most enduring debates in finance during the last few decades. Equity market returns are used to price assets in an economy and economic conditions sensitivity, abnormal movements and high volatility; therefore,

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fundamental determinants may have unfavorable implications for the economy. Equity stock returns are based on expected future cash flows which are based on expected corporate performance. The corporate performance is influenced by changing the pattern of macroeconomic variables which according to an economic rational can better understand the interrelationship between discounted expected future cash flows techniques and how the assets are priced. The volatility in macroeconomic variables affects the equity stock returns and ultimately affects the equity stock prices. Only efficient asset price can have the best reflection of the fundamental values for corporate sectors, then, equity stock returns can lead as a best indicator for future dimension of economic activity. So, its importance increases manifold. Since economy and market are closely related, information regarding macroeconomic behavior may be very useful. It is a dire need of era to evaluate macroeconomic factors which affect equity market returns.

Stock markets and economy overview

The stock market is of course a significant and vital part of the overall economy. If economy performs badly; most companies will also be doing inadequately, as well as the stock market. Conversely, if the economy is prospering, most companies will also be doing well and the stock market will reflect the investment strength. Pakistan is facing multidimensional problems like, war on terror, political instability, increase in population, sectarian issues, civil riots, external aggression and hidden tax rates that may affect foreign investments which lead to decline in capital flight towards the country.

Karachi stock exchange

The Karachi Stock Exchange (KSE) was established in September 18, 1947 and incorporated as premier stock exchange of the country on March10, 1949. KSE commenced trading by open outcry system with five companies with a paid up capital of Rs 37 million, almost having two hundred brokers with 1850 trading terminals and 651 listed companies in Karachi Stock Exchange. There are four types of indices, the first KSE-100, the second KSE-30, the third KSE all shares index and the fourth KMI-30 with an efficient electronic trading system (ETS). The KSE is the largest and active market with 65 to 70% value of all stocks dealings being transacted in this market with three types of customers, issuer, members or brokers and investors. Karachi Stock Exchange is very sensitive even to remotely connected events in the country. Karachi Stock Exchange is limited by guarantee. It represents 84% of total market capitalization of the exchange. The number of listed companies on Karachi Stock Exchange was 762 in January 2001. In 2002, it was declared as the “best performing stock market of the world” by Business Week, due to its regular and operational aspects. Since 2007, decline in KSE-100 index was observed which is now reversing gradually. The visible causes behind such bearish trend are major political and economic events. During 2007 to 2008, the Lal Mosque incident, restoration of Chief Justice in Pakistan and more prominently, imposition of emergency rule in Pakistan, exploited the rhythm of investors, causing slump in the market. Moreover, Standard and Poor (S and P) and Moody’s put the hammer on the investors by downgrading of credit rating of Pakistan.

Relationship of the stock market with macroeconomic variables

Investment activities are very important for stock markets. They receive special attention from the analysts of those firms who made investments in stock markets. As a result, planning the stock market policies of the firms is getting more and more important. One can see that although volume of stock market investments increases from year to year, the return of investment decreases due to macroeconomic variable instability. Fluctuating macroeconomic variables make life tough for business because it disturbs the tendency of the trade smoothness. This study attempts to analyze the important movements of macroeconomic factors in Pakistan. It examines the pattern and trends in stock returns due to macroeconomic variables volatility. It is observed that in developed countries financial markets are more explained and financial markets of under developed countries are less explained. So, it is still necessary to consider longitudinal analysis and required research attention to facilitate the investor by maximizing the expected value of stock returns. Such expectations cause create flows of capital in the economy and contribute to investment oriented environment.

Therefore, due to the importance of the topic, an empirical attempt is made to examine the impact of macroeconomic variables on Karachi Stock Exchange. The Karachi Stock Exchange (KSE-100) is an emerging open equity and largest and active stock exchange in Pakistan that will provide a showcase to other emerging markets. This study will find the co-integration and causality analysis of dynamic linkage between macroeconomic variables and stock returns (KSE) in Pakistan.

Significance of the study

This study is important in the context of the economy of Pakistan where benefits of getting liberalized economies

and globalization are moving toward free market competition. It is important to evaluate causality in the emerging economies of the world and in order to decide whether the linkage between macroeconomic variables and equity market exists. This study is intended to analyze the impact of macroeconomic variables on stock returns (KSE). The mobilization of direct and indirect investment is welcomed by foreign investors in Pakistan's equity markets. It will create a positive impact to create the best economies of scale to enhance the proficiency of the investments return because stocks in Pakistan now can be traded in international equity markets.

Capital market cannot grow in an isolated environment and is not favorable to the investors, so, policy makers should focus on macroeconomic variables for the best equity market understandings. The investment activities of the firms are forming an important part of their operations. Returns on those investments are the basic source of profits of firms whether those investments are long term or short term such as financial and treasury stock. These returns help to compensate the loss from the risky policies that results in claims to get suitable excess of profits. This will increase the need of tendency to improve productivity and efficiency of stock market returns and enhance the need of competitions faced by foreign companies inside Pakistan, needs some sort of local policy from the Pakistani firms which tend towards suitable rate of return within the existing risks in order to guarantee their ability to pay contingency claim. This will be possible to focus on the real return of the investments of stock holders by maximizing their returns on investment after the new policy implications and control. Good implications provide a good plan for investing the stock market, which will certainly lead to higher rate of return of the national capital in Pakistan to support the Pakistani economy and protect the Pakistani stock market against disaster and reduce the severity of macroeconomic factors.

The benefits of this study for the investor in decision making of investment is necessary to estimate future trends of macroeconomic variables which are helpful to leading direction of stock returns to best assets allocation decisions. If the study has to focus on an efficient market which should have the ability to capture or absorb quickly new information, the policy makers should design policies as the directions of responses of equity market. The important and considerable ways to study macro-economic impact on stock returns especially in Pakistan is that macroeconomic behavior helps investors to achieve considerable outcome.

Objective of the study

Corporate and financial sector face full range of uncer-tainties, especially the variation in the macroeconomic variables and its impact on capital markets. This study basically analyzes the impact of macroeconomic variables by means of estimating stock market returns, degree of returns volatility and estimating the efficiency of policy making to control over macroeconomic variables within Pakistan. The objectives will be:

1. To examine the long run relationship among macroeconomic variables and stock returns (KSE).
2. To examine the short run impact of macroeconomic variables on stock returns (KSE).
3. To facilitate the central bank (State Bank of Pakistan) in designing the monitory policy to cover up gap in Pakistani economic and financial system to make good policy implications.
4. To facilitate the domestic and foreign investor in optimum resource allocation, realignment of portfolio analysis the dynamics of equity market (KSE) of Pakistan.

LITRATURE REVIEW

Equity market and macroeconomic variables

The field of finance has enough literary work that analyzes macroeconomic variables and stock prices behavior. Because it is very important issue that requires an attention by financial analysts and policy makers to study the dynamic linkage between macroeconomic variables and stock returns.

Fama (1981) observed negative relations between real stock returns and inflation. Stock return and inflation are induced by negative relations between inflation and real activity. Real stock returns are positively related to capital expenditures, and output which reflect quantity of capital investment with expected rates of return in excess of costs of capital. Moreover, growth rates of money and real activity eliminates the negative relations between real stock returns, expected inflation rates and fact that most of the variation in real money demanded in response to variation in real activity.

Chen et al. (1986) examined reliable long run correlation between macroeconomic variables equity prices and inflation, industrial production, risk premium, market return, oil prices, term structure and consumption for United States (US). Correlation matrix, auto correlation and multifactor model which also explored consumption, oil prices and the market index are not priced by the financial market. Moreover, industrial production, changes in risk premium and twists in the yield curve are found to be significant in explaining stock returns and asset prices sensitivity to unanticipated movements of economic news.

Mukherjee and Naka (1995) documented co-integration and long-term equilibrium relation exists between Tokyo Stock Exchange (TSE) Index and six Japanese macro-economic variables, namely the exchange rate, money

supply, inflation, industrial production, long-term government bond rate, and call money rate. Vector error correction and co-integration techniques were used to testify a model of seven equations. A negative relationship between inflation and equity prices were found. The changes in exchange rate levels affect the performance of a country's stock market. The currency depreciation of an export-orientated economy will have a favorable impact on the domestic stock market.

Ibrahim (2003) analyzed industrial production, the money supply, the price level and the bilateral exchange rate. The co-integration and vector error correction model (VECM) were used for the data monthly, for the period from January 1977 to August 1998. This resulted in a positive, short- and long-run relationship between the stock prices, and two macroeconomic variables. The exchange rate, however, is negatively associated with money supply, positive liquidity effects and negative long-run effects, a predictive role of the stock prices for the macroeconomic variables. Money supply may create inflation in stabilization, expectations of contractionary and risk factors and, outcome in adverse or uncertain attitude of the stock market.

Al-Sharkas (2004) analyzed long-term equilibrium relationships between a group of macroeconomic variables. Industrial production index, the consumer price index, money supply, and treasury bill rate and the Amman Stock Exchange Index monthly data used sample period consists of 92 quarterly observations for each variable, from March 1980 to December 2003. Johansen's Vector Error Correction Model are used to avoid potential misspecification biases and showed that there exists a co-integration relation among the variables and signs which are consistent with the earlier findings.

Gan (2006) examined the relationships between the New Zealand Stock Index (NZSE40) and consumer price index, exchange rate, gross domestic product (GDP), money supply(m1),long term interest rate(Lr), short term interest rate (Sr), retail oil price (roil) from January 1990 to January 2003. Johansen Multivariate Co-integration test and Granger-Causality test, Impulse Response and Error Variance Decomposition analysis are used for 157 monthly observations for each variable except for the consumer price, real gross domestic product (GDP) and, domestic retail oil price (ROIL). New Zealand Stock Index (NZSE40) is consistently determined by the interest rate, money supply and real gross domestic product (GDP). There is no evidence that the New Zealand Stock Index is a leading indicator for changes in macroeconomic variables but cointigrated in the long run, short run. Consumer price index (CPI) has a negative relationship. Exchange rate (EX), consumer price index (CPI), long term interest rate (Lr) and gross domestic product (GDP) on the NZSE40 was consistent.

Chancharat (2007) described the Stock market volatility for monthly data (1988M1-2004M12). Auto regressive Conditional Heteroscedasticity (ARCH) model and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model utilized Thailand Stock Index and Argentina, Australia, Brazil, Germany, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Russia, Singapore, Taiwan, the United Kingdom and the United States. Thai macroeconomic variables (CPI, EX, IR, M2 and OP) influenced monthly stock market returns in Thailand. Thai stock market is very much influenced by the performance of its neighboring countries stock markets but outside the region have no impact, changes in oil prices negatively impacted on it.

Liu (2008) argued that industrial production and money supply have positive impact on stock prices, inflation rate, interest rate and currency value adversely related to the stock prices, he used monthly data covering for the period from January 1992 to December 2001. The sample size has 120 observations of Shanghai Stock Exchange (SHSE) composite index and Shenzhen Stock Exchange (SZSE) composite index. The Co-integration analysis use either the two-step procedure referred to as Engle and Granger (EG) procedure, or the maximum likelihood procedure suggested Johansen and Juselius. In the short run, the Chinese Stock Market show very risky or volatile in nature in time varying volatility, but in the long run, results predict that economic benefits can be prevails.

Kandir (2008) used monthly data for the period from July 1997 to June 2005 by employing multiple regression model and Augmented Dickey Fuller (ADF) and Phillip Perron (PP) stationary tests. The result reveals negative effect of interest rates on stock returns is not surprising, since interest rate represents best alternative investment opportunities, industrial production (IP), money supply (MS) and oil prices (OP) do not have any significant impact on stock returns and significant effect of exchange rate in Turkey Stock Market is considerable.

Gay (2008) employed Augmented Dickey-Fuller (ADF) test on the original time-series data sets of exchange rate and oil price for Brazil, Russia, India, and China (BRIC) using to examine the monthly data of stock market indices, between 1999 and 2006. Although no significant relationship was found between exchange rate and oil price on the stock market index prices of either Brazil, Russia, India, and China (BRIC) country, present and past stock market returns may be due to the influence of other domestic and international macroeconomic factors (inflation, dividend, interest rates trade balance, rates of structure) on stock market returns, suggesting the markets of Brazil, Russia, India, and China the weak-form of market efficiency.

Patraa (2006) described empirical evidence by employing Granger Causality test, Co-integration tests, and the error correction model were employed in the period of period from 1990 to 1999. The money supply (MS), inflation (INF) and trading volume (TV) have a short run and long run equilibrium relationship with the stock prices in the Athens Stock Exchange, also in between the

exchange rate (EXR) and stock prices. Notably, the results are significant and consistent. Athens Stock Exchange (ASE) is ineffective and inefficient due to publicly available information on macroeconomic variables (MV). Trading volumes can be potentially used in predicting stock prices.

Pethe (2000) examined selected macroeconomic variables exchange rate, prime lending rate M1 as narrow money supply, M2 as broad money supply, index of industrial production, Sensex and Nifty indexes. Unit root test, co-integration and error-correction models suggested that there does not seem to be any kind of long-run, stable relationship between the stock prices and the macro- economy. It must be mentioned here that these models concentrated solely on those aspects of stock market behavior that may be hafidled by number crunching. The qualitative or signaling aspect of the whole issue is to make good policy to facilitate the investor and enhance the market efficiency.

Nishat (2004) employed unit root test, Augmented Dickey Fuller (ADF) test, vector error correction model (VECM) and Granger-causality for the period from 1973 to 2004. Industrial production index, the consumer price index (CPI), money supply (M1), and the value of an investment earning and the money market rate used to determine the relationship. A significant relationship exists among industrial production index, the consumer price index, money supply (M1), and the value of an investment earning. Industrial production is the largest positive and inflation is the largest negative determinant of Pakistani stock prices. The reverse causality was observed in case of industrial production and stock prices. Statistically, considerable lag lengths connecting fluctuations in the stock market and transient in the real economy are comparatively short.

Hussain (2001) documented that macroeconomic variables consumption expenditure (CE), investment spending (IS), and economic activity (EA) which is measured by gross domestic product (GDP) in Pakistan for the period from 1959 to 1960 to 1998 to 1999 annual data. Unit root test, Augmented Dickey Fuller (ADF), co-integration and error correction model was used to find long-run relationship between stock prices and macro variables. The fluctuations in Pakistan in macro variables cause changes in stock prices, and influence aggregate demand. This speculation in stock prices arises, suggesting that reforms resulted in significant improvement in the behavior of stock market and economy.

Rjoub (2009) observed relationship on monthly basis for the period from January 2001 to September 2005 in macroeconomic variables interest rate, unanticipated inflation, risk premium, exchange rate and money supply unemployment rate and Istanbul Stock Market (ISE). The statistics techniques, arbitrage pricing theory (APT) model, correlation among explanatory variables and portfolios regression results revealed that there is a significant pricing relationship between the stock return.

Macroeconomic variables have a significant effect in explaining the stock market returns in various portfolios. These results showed a weak explanatory power based on the findings there are other macroeconomic factors affecting stock market returns in Istanbul Stock Market (ISE) other than the tested ones.

Rizwan (2007) used descriptive statistics, (ARCH) approach, EGARCH approach, unit root test, Augmented Dickey Fuller (ADF), VAR model for the data period from July 2000 to June 2005 for series of variables money supply (MS), consumer price index (CPI), industrial production (IP), exchange rate (EXR) and interest rate (IR), while 6-month LIBOR and Morgan Stanley Composite Index (MSCI) as all Countries World Index as global variables. An EGARCH model show that stock returns respond significantly to money supply, consumer price index (CPI) and LIBOR and Morgan Stanley Composite Index (MSCI) World Index and Vector Auto Regressive (VAR) model explained only money supply, consumer price index (CPI) and LIBOR volatility in Pakistan has significant impact on stock price volatility. The industrial production reported by VAR is positive but not significant. The negative signs negative news about macroeconomic variables in Pakistan's stock market affect stock prices more than positive news.

Maysami (2004) suggested that STI and sectoral indices equities property index, equities finance index and hotel index form significant relationships only with selected variables and input monthly observations for the period from January 1989 to December 2001. Unit root tests, Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) and cointegration test, Vector Error Correction Model (VECM) were used to identify, while the equities finance index, real economic activity and money supply were not significant and in the case of equities hotel index, money supply, and short- and long-term interest rates were insignificant. The conclusions of the efficient market hypothesis are in doubt. Autoregressive Distributed Lag (ARDL) test may prove a worthy extension of this study.

Coleman (2008) described quarterly time series data covering for the period of 1991 to 2005 and used unit root test (ADF), co-integration and the error correction model techniques to ascertain both short and long-run relationships between Ghana Stock Exchange (GSE) and inflation, real exchange rate. Ashanti Goldfield Co (AGC) used as dummy variable, Lending rate (Ldr), Treasury bill rate (Tbr). The results explored that lending rates from deposit money banks have an adverse effect, while inflation rate has a negative effect on stock market performance. The investors benefit from exchange-rate losses as a result of domestic currency depreciation. The treasury bill rate was originate to have a positives and but statistically weak cause on the performance of stock markets.

Hasan (2009) studied macroeconomic variables inflation, industrial production, oil prices, short term interest

rate, exchange rates, foreign portfolio investment, money supply and equity prices for the period from June 1998 to June 2008. He used cumulative sum (CUSUM) cumulative sum of squares (CUSUMSQ) tests, unit root by using lag range multiplier (LM) test, Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test and VAR models, error correction model, autoregressive distributed lag (ARDL) test approach to captures industrial production (IP), oil prices (OP) and inflation (INF) which are not significant but interest rate (IR), exchange rate (ER) and money supply (MS) have significance in the long run and error correction model (ECM) captures the short term dynamics of prices effect on equity prices. Foreign portfolio investments (FPI) has significant shortly effect in short term analysis and no long effect in long term analysis.

Shahid (2008) documented the relationship of equity prices and industrial production, money supply, exports, exchange rate, foreign direct investment and interest rates for the period from March 1995 to March 2007 on quarterly data. Co-integration Toda and Yamamoto Granger Causality test was employed to find short run relationships among variables have also been investigated by using bivariate vector autoregressive (VAR) model for variance decomposition and impulse response functions same as long run relationship. Stock prices lead economic activity except interest rate. Interest rate seems to lead the stock prices. Stock prices are outcome of macroeconomic variables and also cause macro dimensions in the economy.

Kazi (2008) used co-integration, multivariate analysis, structural time series and regression, auto regressive distributed lag (ARDL) test approach to find the relationship between Stock Exchange of Singapore (SES), exchange rate (ER), money supply (M2), consumer price index (CPI), industrial production (IP), short term treasury bill rate (STB), long term treasury bill rate (LTB), US stock price index, JPN stock price index, (TDE) total domestic exports of Singapore's suggests the long-run relationship exist between macroeconomic variables that are considered as proxy for systematic risk factors and security market prices.

Shahbaz (2008) employed DF-GLS, and Ng-Perron test to find integrating order of the variables of the study. J-J Co-integration and ARDL, bounds testing techniques are applied to test long-run robustness; Engle-Granger Causality and ARDL tests are applied to find a strong relationship between economic growth and stock market development. Granger causality analysis provides evidence that bi-directional causality exist between stock market development and economic growth to confirm long-run relationship. Moreover, a short run unidirectional causality exists between stock market developments to economic growth that indicated that stock market development is an important wheel for economic growth.

The power to sway of macroeconomic variables on equity market has appealing feature to attract significantly in both developed and emerging market. Many academicians and researchers have been researched to explore the long run equilibrium relationship between macroeconomic variables and equity markets for developed countries but this study focuses on growing emerging market of South Asia like Karachi Stock Exchange of Pakistan. In the current economic screenplay, it is necessary to examine the co-intigrating and causality analysis between economic forces and equity market returns.

DATA AND METHODOLOGY

Data

The study investigated co-integration and causality analysis between macroeconomic variables and equity market of Pakistan. The data were collected from the published sources regarding to stock market KSE-100 (Pakistan) and macroeconomic study variables (inflation, money supply, interest rate, exchange rate and industrial production and reserves) for the period from January 1, 1999 to December 31, 2008 on a monthly basis.

Method

$R_t = f$ (money supply, inflation rate, interest rate, exchange rate, industrial production and reserves)

Equity market

The proxy of equity market used is KSE-100 index. The continuously compounding rate of returns is calculated by using the following formula:

$R_t = \ln (P_t / P_{t-1})$; R_t = Return on month t; P_t = Index closing value on month 't'; P_{t-1} = Index closing value on month't-1'; ln = Natural log.

Money supply

Money circulating in economy or total amount of money available in a given economy is called money supply. The proxy of money supply is used for broad money (M2). Increase in money supply have direct impact on corporate earnings, resultantly increase in future expected cash flows. The increase money supply is an optimistic sign for the investors regarding to earn higher dividend which causes ultimately increase in demand of firm's stock. Growth in money supply would show excess in liquidity higher stock prices returns:

$M.S = \ln (M2_t / M2_{t-1})$

Money supply has positive impact on equity market.

Inflation rate

The act of inflating something or the state of being inflated or an increase in the supply of currency or credit relative to the availability of goods and services, resulting in higher prices and a decrease in purchasing power of money is called inflation. The proxy of inflation is used for consumer price indexes (CPI). Consumer price indexes is a valid measure to account for inflation by taking the change in spending means of goods and services during the certain period and major cause to create nominal interest rates to decrease the

present value of future expected cash flows. Upward shift in inflation rate leads regulatory authorities to make strict economic policies. This upward shift in inflation rate causes rise in nominal risk free rate and leads to increase in discount rate as well. On the other hand, there is a fall in present value of future expected stocks returns. The rise in cash flows would not be balanced by higher discount rate and inflation, due to disequilibrium in growth rate:

$Inf.R = \ln (CPI_t / CPI_{t-1})$

Inflation has a negative relationship with equity market.

Interest rate

Interest rate has a negative relationship with equity market returns. Interest rate have certain effect on required rate of return ,discount rate and finally decreasing the present value of expected future cash flows because investors expectations directly hampered by change in interest rate. On the other hand fall in interest rates lowering down costs of borrowing, so a big cause for expansion which should be optimistic sign on future expected returns for the firm. The proxy of interest rate is used for treasury bill rate (TB):

$Int.R = \ln (TB_t / TB_{t-1})$

Interest rate has a negative relationship with equity market returns.

Exchange rate

The rate at which a unit of the currency of one country can be exchanged for a unit of the currency of another currency is called exchange rate. A fall or devaluation in home currency (Pakistan) will lead to a rise in demand for Pakistani products (exports high) and resultantly increase capital cash inflows and dividends pay off for that firm. But depreciation in home currency would result in costly imported goods, leading to capital flight from country, and finally, a reduction in dividend pay off. International trade (imports and exports) directly affects the exchange rate of a country. This increase and decrease in exchange rate is largely determined by imports and exports of different sectors. Pakistan is an import dominant country, so, a change in exchange rate will tend towards the depreciation of the currency which will negatively affect stock market returns. The proxy of exchange rate to be used is US dollar/Rs:

$EXR = \ln (FER_t / FER_{t-1})$

Exchange rate has a negative relationship with equity market returns.

Industrial production

Industrial production is a parameter to review overall economic activity. Industrial production has effects on stock returns which change in expected future cash flows. Overall organization decision on the dividend causes payment, and growth rate of dividend is affected by industrial production. But this increase in industrial production purely depends on real asset. This increase in industrial production will set the amount of dividend for share holders. Thus, indicating a positive relationship between real economic activities and stock returns. Therefore, the study expects a positive relationship between stock returns and industrial production:

$IPI = \ln (IPI_t / IPI_{t-1})$

Industrial production index (IPI) represent the growth of real sector has positive relationship with equity market.

Reserves

A country's supply of gold and foreign currency, that is held by the central bank against future liabilities, or to support the currency when the exchange rates fluctuate, is called reserves. Monetary reserves are an indication of economic and financial strength. Major contribution of foreign exchange reserves is to stabilize economy. To increase foreign exchange reserves, need to enhance exports which will create favorable exchange rate of home currency. Monetary reserves are economic indicator and have positive relationship with stock market returns:

$RES = \ln (RES_t / RES_{t-1})$

Various methods and techniques are used to identify the long and short run relationship among macroeconomic variables and equity market

Descriptive statistics

To examine the relationship between series, econometrics techniques have been applied. Firstly, data is used to examine the statistical behavior by employing descriptive statistics. Descriptive statistics is performed to examine the distribution of data to account for mean, median, standard deviation, minimum and maximum range, variance, skewness and kurtosis. It is helpful to establish an opinion about the behavior of time series.

Correlation analysis

Correlation analysis is needed to identify the correlation between KSE-100 and incremental changes in money supply, inflation, that is, growth of real sector consumer price index, treasury bills rate, exchange rate, industrial production and change in reserves. However it is a weaker measure to identify the relationship and not an absolute measure to prove the cause and effect relationship.

Unit root analysis

Correlation is a very week technique to identify the cause and effect relationship which will enhance the validity of co-integration analysis to explore the better relationship among equity market and economic forces. The co-integration technique is applied when data is integrated in same order. So stationarity of data is tested. The standard way to test stationarity of data is unit root test, Augmented Dickey Fuller (ADF) to estimating order of integration. Augmented Dickey Fuller (ADF) test is criticized for week test to prove the stationarity of data because of assumption that the errors are statically independent and have a constant variance. This may not be the same case to deal with data in all time, so as a complement, Phillips- Perron (PP) test is employed. The tests can applied on original series of data at level and also by taking first difference.

Augmented dickey fuller

Augmented Dickey Fuller (ADF) methodology equation for the unit root in autoregressive model (AR) model is as given thus:

$w_t = \Omega\, w_{t-1} + \varepsilon_t$

Wt is variable under study for the given time period of 't', Ω is coefficient ε_t is error term.

$\Delta w_t = (\Omega - 1)\, w_{t-1} + \varepsilon_t = \delta\, w_{t-1} + \varepsilon_t$

Δw_t = First difference operator for the underlying variable. Estimation and testability of this model for unit root is equality to $\delta = 0$

Phillip Perron (pp) test

Phillip Perron (PP) test equation is as given further to present the unit root in Autoregressive (AR) model. Augmented Dickey Fuller (ADF) test and Phillips- Perron (PP) test confirms the results to proceeds further for Co-integration analysis:

$Wt = \beta_0 + \beta_1 w_{t-1} + \beta_2 t\,[t - T/2] + \varepsilon_t$

Unit root test is the first step for co-integration analysis which we have completed and the second step to further proceed likelihood ratios is employed here for completion of co-integration analysis which suggest that long run relationship exist in between these series in at least one direction or unidirectional long run relationship. Phillip Perron (PP) test is needed as it allows that error disturbances are heterogeneously distributed and weak dependent. The unit root tests for stationary on the logarithms of the data series in level and 1st difference to do data series in stationary level.

Co-integration analysis

The Johansen (1988, 1991) and Johansen-Juselius (JJ) (1990) tests are used to determine on maximum likelihood ratios based. Engle-Granger (1987) test employed to determine residuals based that long term relationship exist between variables. Johansen-Juselius (JJ) test is used to find the co-integration vectors. This is also a measure to find maximum Eigen value which explores that the null hypothesis of co-integration vector in comparison with alternate hypothesis and co-integration vector by using E.view software. JJ co-integration is employed to select a lag length for vector auto regression (VAR) to determine the long term relationship among study sample:

$\Delta w_t = \alpha + \sum_{t=1} \gamma_t \Delta w_{t-1} + \alpha_t\, \Delta w_{t-1} + \varepsilon_t$

α is a constant, wt is variable column vectors in the matrix to be tested ,γ and α are the coefficients; Δ is change or difference operator for the particular variables in study; The $_n$ denotes the lag length and ε_t is error term or white noise term.

Ґi = - I+ Й¦ 1+ Й¦ 2 +L+ Й¦

Й¦ = - I+ Й¦ 1+ Й¦ 2 +L+ Й¦ k

I = an identity matrix and i=1, 2, k-1 Ґi matrix reveals short term adjustments and Й¦ matrix reveals long term adjustments of information's at the level of equilibrium.

Maximum eigen value

The first test account for the maximum Eigen value that the null hypothesis for null hypothesis co-integration vector r against alternative hypothesis r+1 t co-integration vectors. To prove these hypotheses, maximum Eigen value should be more than critical value to show that co-integration exists and if not then not exist. Maximum Eigen value statistics indicates that three co-integration equations exist at 5% critical level;

$\lambda_{maximum} = -T \ln (1 - \lambda\, k+1)$

In the equation, λ k+1,……., λ k = (n-k) is used for smallest square canonical correlations, T is used for total number of observations under particular area of study.

Trace statistics test

Secondly, we must use the test to calculate trace statistics for null hypothesis co-integration vectors r against alternative hypothesis or more vectors which may be co-integrated. The trace statistics equation must be used:

$\lambda_{trace} = -T \sum \ln (1 - \lambda_j)$

Bivariate co-integration analysis

Bivariate autoregressive process will indicate pair wise co-integration in between the specified data set of series. This model will determine the level of long run relationship among two variables. This equation is used to know the long run affects of one variable on other variables for the specified study period:

$$Wt = K_0 + \sum_{i=1}^{n} K_i\, w_{t-i} + \sum_{i=1}^{n} \delta_i V_{t-i} + \varepsilon_t$$

$$U_t = L_0 + \sum_{i=1}^{n} L_i U_{t-i} + \sum_{i=1}^{n} f_i\, U_{t-i} + \varepsilon_t$$

W_t and U_t are the stationary series K_0 and L_0 constants

$$U_t = L_0 + \sum_{i=1}^{n} L_i U_{t-i} + \sum_{i=1}^{n} f_i\, U_{t-i} + \varepsilon_t$$

Granger causality test (lag - 2)

According to representation of Granger theorem, if two variables are co-integrated, then there will be at least one direction or unidirectional granger causality must exist which tend to the consequences to find the relationship by error correction model (ECM). Granger causality test is used to determine causality relation among variables and direction. So by employing pair-wise Granger causality test technique is helpful to identify each factor causal relationship. Lag four is selected to get appropriate results which are user specified. The time series variables are not stationary at I (0) and no co-integration exist among variables then it would be converted by taking first difference I (1) and applied as follows:

$Q_{prob}(W_{t+n} \mid \Theta_t = Q_{prob}(W_{t+n} \mid \Omega_t)$

Q_{prob} is conditional probability, Θ_t information set at time t on past values of W_{t+n} and Ω_t information set containing values for both $_{Wt}$ $_{and\ Ut}$ for the t period.

This is a unrestricted regression equation after while by running this will help to find out the unrestricted residual sum of square (RSSUR) and also eliminate the lagged values of particular macroeconomic variables (MV) at first difference to find the restricted regression to obtain the restricted sum of square (RSSR), then I (1) should be the zero for all values of I.F test is considerable to testify the null hypothesis as follows:

$$F = \frac{RSSR - RSSUR / k - k0}{RSS / N - k}$$

If the F-value exceeds the critical value at the selected level of significance then null hypothesis is rejected with reference to legged macroeconomic variables relevant to regression. This will improve the causality or prediction relationship. Granger Causality model is proposed by C.J Granger (1969) which is more predictive than causation. The test is used to determine the predictions of future based on past but future cannot predict the past. Then, the study believes that causation behavior in between two variables, means macroeconomic variables (MV) causes stock returns of Karachi Stock Exchange (Rt), so macroeconomic variables are exogenous variables and Rt are endogenous variables, while past values of MV are used to measure the prediction of Rt. There are contradictions about Granger causality, so the result from this test is suggested not to account for the outcome absolutely.

Vector error correction model

Co-integration relation has to build; error correction model is used for the further proceedings. No doubt before this we have employed multivariate, bivariate co-integration, Granger causality but vector error correction model is one of the best model which is used as maximum likelihood ratio and all information absorption model to yield full efficiently assessment of co-integration vectors. Vector error correction model (VECM) is allowed to consider the co-integration of whole system of variables without any normality of variables. Vector error correction model (VECM) worked without specification of endogenous variables and exogenous variables. Vector error correction model evaluates the results of significance in term of t test value. Error correction model is used to determine potential misspecification to discover the short term relation and short term adjustments of processes with respect to current economic activity and significance of error term:

$$\Delta W_t = K + \sum_{i=1}^{n} K_i \Delta W_{t-i} + \sum_{i=1}^{n} \delta_i \Delta W_{t-i} + \gamma E_{i-1} + \varepsilon_t$$

$$\Delta U_t = L + \sum_{i=1}^{n} L_i U_{t-i} + \sum_{i=1}^{n} f U_{t-i} + \Theta E_{i-1} + \varepsilon_t$$

W_t and U_t are the stationary series in the given set of equations, K and L are constants ε_t is an error term and E_i is error correction term, K_i, L_i , δ , f, are coefficients γ ,Θ are error coefficient $_n$ is positive integer and i is number of values.

Impulse response function

The impulse response function (IRF) documents that the dynamic reaction of random shock on the equity markets and returns in sense of impulse responses in different markets to a shock in their self and other market to simulate innovations. The distinctive changes are also examined to evaluate whether shocks are permanent or transitory.

Impulse responses show the impact of shocks for various days separately. Impulse response function (IRF) is employed on the unrestricted vector auto regression (VAR) to capture the time constraints effects of innovations means shocks to see behavior of series. Impulse response function (IRF) is used to map the responses of current as well as future values of dependent or endogenous factor to ascertain at one standard deviation effects due to the value creating structure of vector auto regression (VAR):

$$Z_t = D + \sum_{i=0} U_{jk}(i)\, \varepsilon_{t-1}$$

constant ε_{t-1} is 7 × 1 error vector $U_{jk}(i)$ is 7 × 7 matrix with $U_{jk}(0) = I$ is the effect of multiplier which examined the reactional changes between the variables.

Variance decomposition analysis

Variance decomposition (VDC) confirms all the breakdowns in accordance with changes in values of variables within the specified period. The study variables may be raised due to its own shocks or may be due to others variables shocks. Variance decomposition response analysis is conducted to analyze the shocks to Karachi Stock Exchange which are explained by macroeconomic forces. It facilitates some other evidence of cointegration amongst stock market and macroeconomic variables and extends contribution with reference to systematic shocks over time horizon. The VDC is the best technique to examine the cumulative impact of shocks and see significant changes. The variance decomposition (VDC) is employed on the data series on the analysis of variables responses to shocks. There is a shock that particularly influence the further variables of the system or procedure to formulate information about the time constraints.

RESULTS ANALYSIS AND DISCUSSION

Descriptive statistics

Descriptive statistics for all seven variables used are presented in Table 1. The variables are index that is, KSE-100, increment in money supply (MS), inflation, that is, rate of change of consumer price index (CPI), treasury bills rate (TB), exchange rate (EXR), growth in industrial production (IPI) and reserves (RES).

The average monthly return in percentage of Karachi Stock Exchange Index (KSE-100) shows high average change of 1.56% which is equal to annualized return 18.72% per year with standard deviation of 9.59%. KSE earn maximum (return) of 24% in one month and maximum increase (loss) 44%. Money supply (M2) shows the 1.12% change per month which is significantly high, consumer price index (CPI) shows .6% change, treasury bill rate (TB) 0.097%and exchange rate shows the 0.4% change, industrial production (IPI) also exhibits the low average return within one month.

Standard deviation shows that M2 deviate from mean 1.6%, CPI .77%, EXR 1.9%, TB 10.07%, IPI 9.9% and RES 6.07% to show volatility to hedge these variables to mitigate the risk. The exchange rate shows average change in term of minimum -3.5% and maximum 12.07. Skewness is showing that the returns of Karachi Stock

Exchange Index (KSE-100), treasury bills rates (TB) and industrial production (IPI) are negatively skewed and money supply (M2), consumer price index, exchange rate (EXR) and reserves (RES) are positively skewed. The maximum decrease in Pakistani currency is 3.4% and maximum increase 12%. However significant variability is observed in macroeconomic variables of study and equity market. The summary of statistics of all this is given in Table 1.

Table 2 incorporates correlation among macroeconomic

Table 1. Descriptive statistics.

Statistics	Δ KSE	Δ M2	Δ CPI	Δ TB	Δ EXR	Δ IPI	Δ RES
Mean	0.0156	0.0112	0.00607	0.0009	0.0045	0.0036	0.0121
Median	0.0128	0.0094	0.00473	0	0.0003	0.0015	0.0088
Maximum	0.2411	0.0592	0.03282	0.3108	0.1207	0.2831	0.3134
Minimum	-0.4487	-0.029	-0.0088	-0.4231	-0.0348	-0.3076	-0.2100
Std.Dev	0.0959	0.0164	0.00775	0.1007	0.0193	0.0995	0.0678
Skewness	-0.9536	0.3142	1.02590	-0.7122	3.780	-0.0399	0.7068
Kurtosis	6.8612	3.2179	4.52129	7.1903	22.314	4.0600	7.1639
Probability	0	0.3308	0	0	0	0.0592	0
Jarque-Bera	92.734	2.2122	32.6213	97.938	2150.97	5.6505	96.6835

Table 2. Correlation matrix of Karachi stock exchange with macroeconomic variables.

	Δ KSE	Δ M2	Δ CPI	Δ TB	Δ EXR	Δ IPI	Δ RES
Δ KSE	1.0000						
Δ M2	-0.0558	1.0000					
Δ CPI	-0.1830	-0.2341	1.0000				
Δ TB	-0.1814	0.0837	0.1866	1.0000			
Δ EXR	-0.1396	-0.0677	0.2673	0.1045	1.0000		
Δ IPI	0.0398	0.2235	-0.1566	-0.1366	-0.1395		
Δ RES	0.0899	0.3781	-0.3753	-0.0613	-0.4165	1.0000	
						0.0435	1.0000

variables and equity returns. Results reveal that there is no significant relationship among macroeconomic variables and Karachi Stock Exchange. Correlation coefficient between KSE-100 and other macroeconomic variables showed the weak relationship. Money supply, consumer price index, treasury bill rate and exchange rate are negatively correlated with KSE-100 where as industrial production, and reserves are positively correlated. Treasury bill rate and consumer price are negatively correlated with Karachi Stock Exchange Index (KSE-100) in accordance economic theories that provide the increase discount rate leads in reduction in the present values of expected future cash flows. There is 0.39 and 0.89 correlation among Industrial production, reserves and Karachi Stock Exchange Index. Treasury bill rate and exchange rate shows negative relationship with country reserves and industrial production. Data series are examined to see stationarity of data for proper selection, the econometric models for exploration of long term relationship. Firstly we tested seven variables Karachi Stock Exchange Index (KSE-100), money supply (M), consumer price index (CPI), treasury bill rate (TB), exchange rate (EXR), industrial production (IPI) and reserves (RES). Unit root tests, Augment Dickey Fuller (ADF) and Phillip Perron (PP) are employed to find non-stationarity.

Tables 3 and 4 display the result about the stationarity of data. The Augmented Dickey Fuller requires the error term (ET) be Independent Identically Distributed (IDD) and stationary homoskedostic which may not be true for all time series data. So Phillip Perron (PP) test is applied to test stationary of data which confirms the result derived from Augmented Dickey Fuller (ADF) that data is I (1). Augment Dickey Fuller test and Phillip Perron test are applied at level and at first difference. At the level, data series are not stationary but at first difference it is found stationary. Hence the model is applied a constant trend and appropriate lag length are chosen in accordance with Schwarz Information Criterion (SIC). These indices of data are found integrated at first difference in order one. The exploration of existence of long run relationship within Karachi Stock Exchange Index (KSE-100) and money supply (M), consumer price index (CPI), treasury bill rate (TB), exchange rate (EXR), industrial production(IPI) and reserves (RES). The Multivariate Cointegration analysis of Trace Statistics which is used to testify the null hypothesis of r vector of co-integration against the r or other vector of co-intigrating proposed by maximum likelihood - based on Johansen (1988, 1991). Johansen Juselius (1990), under the assumption of intercept, shows that there is no trend in co-integration equation (CE). A lag length interval (first difference) 1 to 4 is chosen in cointegration equation. The results of Multi-variate cointegration for entire sample period reveals

Table 3. Unit root analysis.

	ADF (level)	ADF (1st difference)	PP (level)	PP (1st difference)
KSE	-0.14213	-8.485876	-0.716547	-8.635245
M2	-1.95942	-8.75338	-1.716445	-29.81545
CPI	-0.89099	-6.80015	1.948368	-7.08799
TB	-1.17767	-9.29194	-1.103076	-9.634163
EXR	-1.735427	-5.543809	-1.178481	-9.847182
IPI	-6.17935	-4.28121	-4.573589	-13.31741
RES	-0.09769	-9.43309	-0.656597	-9.537499

Table 4. Critical values at 1, 5 and 10%.

1	-4.036983	-4.036983	-4.036983	-4.036983
5	-3.448021	-3.448021	-3.448021	-3.448021
10	-3.149135	-3.149135	-3.149135	-3.149135

Table 5. Multivariate co-integration analysis trace statistics.

	Hypothesis	Eigen value	Trace statistics	Critical value 5%	Remarks
KSE	r = 0*	0.373438	174.0387	125.6154	
M2	r ≤ 1*	0.323461	120.2752	95.75366	
CPI	r ≤ 2*	0.22905	75.33732	69.81889	Trace statistics indicates three cointegration Eq(s) at 5% level of significance.
TB	r ≤ 3	0.176021	45.42214	47.85613	
EXR	r ≤ 4	0.106018	23.15694	29.79707	
IPI	r ≤ 5	0.069537	10.26896	15.49471	
RES	r ≤ 6	0.017075	1.980549	3.841466	

Table 6. Multivariate co-integration analysis max-eigen value.

	Hypothesis	Eigen value	Max Eigen value	Critical value 5%	Remarks
KSE	r = 0*	0.373438	53.76343	46.23142	
M2	r ≤ 1*	0.323461	44.93793	40.07757	
CPI	r ≤ 2*	0.22905	29.91518	33.87687	Max Eigen statistics indicates two cointegration Eq(s) at 5% level of significance
TB	r ≤ 3	0.176021	22.2652	27.58434	
EXR	r ≤ 4	0.106018	12.88799	21.13162	
IPI	r ≤ 5	0.069537	8.288406	14.2646	
RES	r ≤ 6	0.017075	1.980549	3.841466	

in Table 5

Then, there are three cases where the trace statistics is greater than 5% critical value so there are three co-integration equations at 5% level of significance which helps to determine the multivariate co-integration. This confirms that there is long term relationship between macroeconomic variables and equity market returns. In the further proceedings multivariate co-integration analysis of maximum eigen value is applied to confirm the long run relationship. It also provides evidence about presence of two co-integration vectors. Maximum statistics is used to examine the null hypothesis of "r" cointegration vector against other alternative hypothesis of "r+1" co-integration vector. Table 6 reflects the multivariate co-integration analysis on bases of maximum Eigen value.

Table 6 reports the results on maximum Eigen value test where the maximum Eigen value is greater than

Table 7. Bivariate co-integration analysis trace statistics.

Pair wise co-integration	Hypothesis	Eigen value	Trace statistics	Critical value (5%)	Remarks
	r = 0	0.267783	36.32153	15.49471	
KSE – M2	r ≤ 1	0.004152	0.478487	3.841466	Cointegration
	r = 0	0.180655	23.51432	15.49471	
KSE – CP	r ≤ 1	0.005208	0.600527	3.841466	Cointegration
	r = 0	0.056525	9.902334	15.49471	
KSE – TB	r ≤ 1	0.027535	3.210972	3.841466	No Cointegration
	r = 0	0.089887	13.29224	15.49471	
KSE – EXR	r ≤ 1	0.021171	2.460833	3.841466	No Cointegration
	r = 0	0.209605	28.7311	15.49471	
KSE – IPI	r ≤ 1	0.014507	1.680533	3.841466	Cointegration
	r = 0	0.039207	7.585454	15.49471	
KSE – RES	r ≤ 1	0.02563	2.985838	3.841466	No Cointegration

critical value which then suggests that co-integration vectors exist. Maximum Eigen value statistics indicates two co-integration equations at 5% level of significance. Table 7 reports the pair wise co-integration exist or does not between the given set of variables within the specified period of study. The critical point of measure $\alpha = 0.05$ is used to explore the pair wise long run relationship. In the particular bivariate co-integration analysis, r is also taken as co-integration vector to prove the null hypothesis and alternative hypothesis. If the trace statistics > $\alpha = 0.05$ then the study considers bivariate co-integration exist among bivariables, results are shown in Table 7.

Bivariate co-integration analysis explores that Karachi Stock Exchange Index (KSE-100) has pair wise co-integration with money supply (M2) and industrial production (IPI) because trace statistics is greater than critical value at $\alpha = 0.05$. The results suggested that KSE have long run equilibrium with money supply (M2), consumer price index (CPI) and industrial production (IPI). No pair wise co-integration found between treasury bill rate (TB), exchange rate (EXR) and reserves (RES). So KSE have long run relationship with money supply, consumer price index and industrial production.

Table 8 rejects the null hypotheses of no causation for the period of January 1999 to December 2008 between Karachi Stock Exchange and macroeconomic variables in equity market of Pakistan. The representation theorem describes if co-integration exist among variables then variable should be granger cause at least one direction within co-integrated variables. Granger causality test confirms the long run direction of causality between given KSE-100 and other set of macroeconomic variables at first difference. Maximum lag length operator is settled in accordance with AIC. The decision criteria is here again the critical value which is $\alpha = 0.05$ if the probability should be less than critical value $P < \alpha = 0.05$ then the null hypothesis should be rejected and there should exist Granger causality.

Table 8 reject the null hypothesis at 5% level of significance and indicates unidirectional granger causality exist at 5% level of significance between Karachi Stock Exchange Index and money supply, exchange rate, industrial production, consumer price index and reserves. However, it should be noted that the structural breaks in data are not captured by Johansen co-integration technique. Since it is observed long run association between Karachi Stock Exchange and macroeconomic variables. Vector error correction model (VECM) explores the short run dynamics between the variables to show the short term relationship of variables. Error correction model is helpful to identify error term at 5% level of significance and also determine the coefficients of Karachi Stock Exchange Index. Tables 9 and 10 showed the level of adjustment of volatility or disturbance which may be absorbed by the given variables own or self adjustment capability within the specified period. Results show that 39% of variability is adjustable within one period. Variance decomposition analysis captured the system wide shocks and volatility between the given set of study variables. Variance decomposition (VDC) also helpful to determine responses – pattern propagation over time and error variance between variables set of study. Karachi Stock Exchange Index (KSE-100) could be attribute to money supply (M2), consumer price index (CPI), treasury bill rate (TB) and exchange rate (EXR) dynamics months 1 to 10 of 79% of Karachi Stock

Table 8. Granger causality test.

Null hypothesis	F-Statistic	Probability
Δ M2 does not Granger cause of Δ KSE	3.13844	0.04715
Δ KSE does not Granger cause of Δ M2	2.43034	0.09259
Δ CPI does not Granger cause of Δ KSE	6.59201	0.00196
Δ KSE does not Granger cause of Δ CPI	0.1555	0.85617
Δ TB does not Granger cause of Δ KSE	2.37153	0.09797
Δ KSE does not Granger cause of Δ TB	1.73029	0.1819
Δ EXR does not Granger cause of Δ KSE	4.5873	0.01215
Δ KSE does not Granger cause of Δ EXR	0.30364	0.73872
Δ IPI does not Granger cause of Δ KSE	3.50205	0.03345
Δ KSE does not Granger cause of Δ IPI	0.00097	0.99903
Δ RES does not Granger cause of Δ KSE	4.78327	0.01014
Δ KSE does not Granger cause of Δ RES	1.04523	0.35499

Table 9. Vector error correction model (VECM).

Error correction	D(KSE)	D(M2)	D(CPI)	D(TB)	D(EXR)	D(IPI)	D(RES)
CointEq1	-0.13124	-0.138434	-0.000478	-7.10E-05	-8.51E-07	0.000738	0.045102
	-0.03372	-3.13147	-0.00014	-3.40E-05	-7.30E-05	-0.00053	-0.03656
	[-3.89223]	[-0.04421]	[-3.40745]	[-2.09251]	[-0.01162]	[1.39513]	[1.23365]
D(KSE(-1))	-0.00815	-9.85157	7.91E-05	-2.50E-05	-0.00019	0.001649	-0.06467
	-0.09713	-9.02095	-0.0004	-9.80E-05	-0.00021	-0.00152	-0.10532
	[-0.08387]	[-1.09208]	[0.19552]	[-0.25557]	[-0.87888]	[1.08277]	[-0.61406]
D(KSE(-2))	-0.22715	35.86417	-0.000247	0.000197	-0.00011	0.000436	0.1993
	-0.09516	-8.83724	-0.0004	-9.60E-05	-0.00021	-0.00149	-0.10317
	[-2.38709]	[4.05830]	[-0.62427]	[2.05601]	[-0.52756]	[0.29214]	[1.93167]
D(M2(-1))	0.00029	-0.312547	-7.95E-06	-2.48E-06	-2.15E-06	2.70E-05	0.000594
	-0.00151	-0.1405	-6.30E-06	-1.50E-06	-3.30E-06	-2.40E-05	-0.00164
	[0.19139]	[-2.22452]	[-1.26294]	[-1.62769]	[-0.65479]	[1.14002]	[0.36191]
D(M2(-2))	-0.00118	-0.157537	1.19E-05	-1.36E-06	3.92E-06	1.53E-05	-0.00311
	-0.00111	-0.10337	-4.60E-06	-1.10E-06	-2.40E-06	-1.70E-05	-0.00121
	[-1.06342]	[-1.52399]	[2.57778]	[-1.21434]	[1.61879]	[0.87623]	[-2.57455]
D(CPI(-1))	2.755143	1783.631	0.537104	0.017914	0.01157	-0.622392	-50.7253
	-24.2371	-2250.93	-0.10089	-0.0244	-0.05268	-0.37998	-26.2796
	[0.11367]	[0.79240]	[5.32341]	[0.73432]	[0.21962]	[-1.63795]	[-1.93021]
D(CPI(-2))	-87.462	6548.536	0.191681	0.046744	0.118482	0.018308	-40.6087
	-27.4706	-2551.23	-0.11436	-0.02765	-0.05971	-0.43068	-29.7856
	[-3.18384]	[2.56682]	[1.67619]	[1.69060]	[1.98424]	[0.04251]	[-1.36337]
D(TB(-1))	-54.1124	6338.155	0.354003	0.190063	-0.06323	2.408964	-32.8936
	-90.4806	-8403.04	-0.37665	-0.09107	-0.19667	-1.41853	-98.1054
	[-0.59806]	[0.75427]	[0.93986]	[2.08700]	[-0.32152]	[1.69822]	[-0.33529]
D(TB(-2))	23.39094	10426.93	-0.57895	0.093619	-0.12332	0.084875	123.3999

Table 9. Contd.

	-82.1658	-7630.83	-0.34204	-0.0827	-0.1786	-1.28817	-89.0899
	[0.28468]	[1.36642]	[-1.69262]	[1.13202]	[-0.69050]	[0.06589]	[1.38512]
D(EXR(-1))	-22.045	-6792.53	0.182504	0.246623	-0.03081	-0.90034	-18.8863
	-50.8124	-4719.01	-0.21152	-0.05114	-0.11045	-0.79662	-55.0944
	[-0.43385]	[-1.43940]	[0.86281]	[4.82219]	[-0.27895]	[-1.13020]	[-0.34280]
D(EXR(-2))	-62.6397	-8535.42	0.279847	-0.04698	0.058153	-1.74791	-27.563
	-56.9577	-5289.73	-0.2371	-0.05733	-0.12381	-0.89297	-61.7576
	[-1.09976]	[-1.61358]	[1.18027]	[-0.81945]	[0.46971]	[-1.95742]	[-0.44631]
D(IPI(-1))	6.565924	-397.703	0.011388	-0.0028	-0.01915	-0.10274	3.349203
	-6.54942	-608.253	-0.02726	-0.00659	-0.01424	-0.10268	-7.10134
	[1.00252]	[-0.65385]	[0.41769]	[-0.42528]	[-1.34534]	[-1.00059]	[0.47163]
D(IPI(-2))	-5.29098	-409.898	-0.00987	-0.00579	-0.00195	-0.03566	0.005416
	-6.59213	-612.219	-0.02744	-0.00664	-0.01433	-0.10335	-7.14765
	[-0.80262]	[-0.66953]	[-0.35956]	[-0.87253]	[-0.13628]	[-0.34505]	[0.00076]
D(RES(-1))	-0.35354	-1.5506	0.000406	0.000136	-1.80E-05	-0.00388	-0.01203
	-0.11541	-10.7181	-0.00048	-0.00012	-0.00025	-0.00181	-0.12513
	[-3.06342]	[-0.14467]	[0.84418]	[1.17148]	[-0.07175]	[-2.14437]	[-0.09616]
D(RES(-2))	-0.208	2.829497	-0.00132	-0.00019	-0.00023	-4.91E-05	0.066121
	-0.1193	-11.0792	-0.0005	-0.00012	-0.00026	-0.00187	-0.12935
	[-1.74359]	[0.25539]	[-2.66063]	[-1.55574]	[-0.86862]	[-0.02623]	[0.51118]
C	309.4599	30195.05	0.306894	-0.06098	0.003049	1.14934	323.8371
	-84.5619	-7853.36	-0.35202	-0.08511	-0.18381	-1.32574	-91.688
	[3.65957]	[3.84486]	[0.87182]	[-0.71645]	[0.01659]	[0.86694]	[3.53195]

Exchange (returns) is due to its own dynamics. Money supply (M2), consumer price index (CPI), and reserves (RES) contribute to account for considerable in setting dynamics of Karachi Stock Exchange Index (KSE-100). Impulse response analysis is also performed for the dynamic shocks between variables of study and results are presented in Table 12.

Impulse response analysis captured the one time shock to one time innovation on future values as well as current values of endogenous variables. The graphical presentation of multiple graphs shows the one of the variable Impulse Response Function (IRF) on other variables. So, Karachi Stock Exchange is a like exogenous variable which most of the part of shocks is explained by its own innovations. If the study takes a bird view of other macroeconomic variables which have also some exerting impact on Karachi Stock Exchange (KSE). Figure 1 captured the shocks in money supply, consumer price index, treasury bill rate, exchange rate, industrial production and reserves on Karachi Stock Exchange (returns). Impulse Response Function (IRF) of KSE (returns) from one standard deviation in innovation to macroeconomic variables. The statically 84% of Impulse Response Function (IRF) has been analyzed at significant confidence bounds. Money supply creates liquidity and increase in equity prices. Increase in treasury bill rate (TB) decreases the equity market returns by increasing the discount rates and falling present value of expected future cash flows. Industrial production positively affects the KSE and creates high level of cash flows. Exchange rate has negative impact on KSE but it is not significant.

Conclusion

This study explores co-integration and causality relationship among stock market returns (KSE) and six important macroeconomic variables which include money supply (M2), consumer price index (CPI), treasury bill rate (TB),

Table 10. Vector error correction model (VECM).

Error correction	D(KSE)	D(M2)	D(CPI)	D(TB)	D(EXR)	D(IPI)	D(RES)
R-squared	0.47108	0.36379	0.52774	0.38826	0.22099	0.113032	0.2893
Adj. R-squared	0.39253	0.26931	0.45760	0.29741	0.10530	-0.01869	0.1838
Sum sq. resids	2586482	2.23E+1	448.212	26.2028	122.204	6357.32	304077
S.E. equation	506.050	46997.5	2.10659	0.50934	1.09997	7.93371	548.695
F-statistic	5.99714	3.85027	7.52434	4.27358	1.91016	0.85807	2.74171
Log likelihood	-885.93	-1416.08	-244.586	-78.4819	-168.56	-399.734	-895.39
Akaike AIC	15.4176	24.4800	4.45447	1.61507	3.15490	7.10657	15.5794
Schwarz SC	15.7953	24.8577	4.83220	1.99281	3.53263	7.48430	15.9571
Mean dependent	41.0962	30286.3	1.96495	0.02273	0.28288	0.26704	68.6923
S.D. dependent	649.281	54980.5	2.86037	0.60766	1.16290	7.86057	607.350
Determinant resid covariance (D.adj.)		6.49E+2					
Determinant resid covariance		2.32E+2					
Log likelihood		-4040					
Akaike information criterion		71.0940					
Schwarz criterion		73.9034					

Table 11. Variance decomposition analysis of Karachi stock exchange (KSE).

Period	S.E.	KSE	M2	CPI	TB	EXR	IPI	RES
1	0.0842	100	0	0	0	0	0	0
2	0.0948	79.823	4.0917	0.4255	1.0033	0.48	2.379	11.792
3	0.1028	68.380	6.0320	7.8158	1.0041	3.32	2.036	11.404
4	0.1033	67.872	6.0233	7.8886	1.0793	3.71	2.026	11.399
5	0.1043	66.628	6.3189	8.3378	1.2253	4.18	1.990	11.314
6	0.1046	66.227	6.3947	8.7553	1.2181	4.16	1.984	11.256
7	0.1048	65.925	6.3654	9.1495	1.2127	4.15	1.980	11.214
8	0.1049	65.798	6.3658	9.2469	1.2124	4.17	1.978	11.221
9	0.1050	65.763	6.3626	9.2785	1.2118	4.17	1.980	11.224
10	0.1050	65.729	6.3592	9.3206	1.2113	4.17	1.979	11.221

Table 12. Impulse response analysis.

Response of KSE							
Period	KSE	M2	CPI	TB	EXR	IPI	RES
1	0.0842	0	0	0	0	0	0
2	-0.0093	0.0191	-0.006	-0.0095	-0.006	0.0146	-0.0325
3	-0.0071	0.0164	-0.028	0.0039	-0.017	-0.001	0.0120
4	0.0035	0.0022	-0.003	-0.0030	-0.006	0.001	0.0032
5	0.00132	-0.00665	-0.008	0.00425	-0.007	0.0005	0.0037
6	0.00017	0.00353	-0.007	-0.0001	-0.000	0.0008	0.0010
7	-0.0010	0.0003	-0.006	-0.0002	-0.000	0.000	0.0017
8	0.0006	-0.0012	-0.003	0.0004	-0.001	-4E-04	0.0018
9	-4.19E	-9.61E	-0.002	-1.90E	-0.000	0.0005	0.0009
10	-0.0003	5.63E	-0.002	0.0001	-0.000	0.000	0.0006

exchange rate (EXR), industrial production (IPI) and reserves (RES) for the period of January 1999 to December 2008. Descriptive statistics reveal reasonable change in Karachi Stock Exchange (KSE-100) and

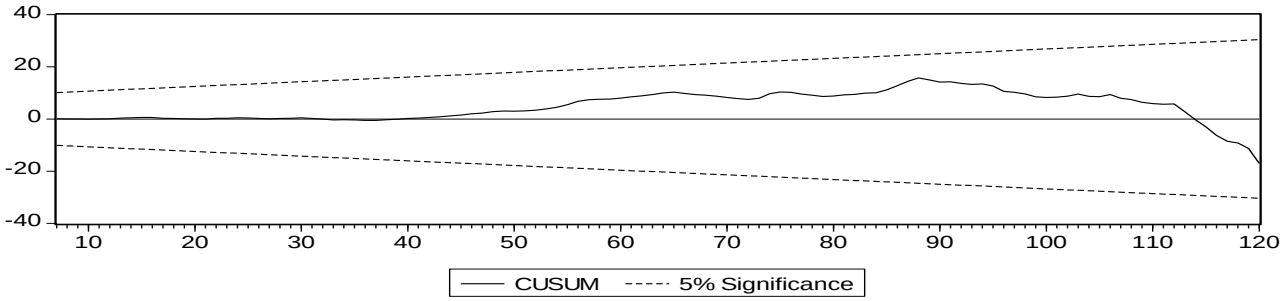

Figure 1. CUSUM.

provide evidence about maximum increase (return) 24% and maximum decrease (loss) 44%. Money supply (M2), consumer price index (CPI), treasury bill rate (TB) and exchange rate (EXR) have negative correlation with KSE (100-index).However relationship is found weak. Unit root tests, Augment Dickey Fuller (ADF) test and Phillip Perron test (PP) are employed to prove that is non stationary. Multivariate co-integration analysis determines that three co-integration equations in trace statistics and maximum Eigen value to confirm that there is long run relationship among three co-integration vectors also observed. Bivariate co-integration examines that Karachi Stock Exchange (KSE) co-integrated with money supply (M2), consumer price index (CPI), and industrial production (IPI) because trace statistics is greater than 5% significance value. So, KSE has long term relationship with money supply (M2), consumer price index (CPI) and industrial production (IPI). These aspects must be considered in terms of designs policies to facilitate the investors and financial agents to focus the role of these macroeconomic factors while making a decision regarding resource allocation. No bivariate co-integration between treasury bill rate (TB) and reserve (RES) and exchange rate found. Karachi Stock Exchange (KSE-100) has long run relationship with M2, CPI, and IPI. A unidirectional Granger causality exists between all macroeconomic variable and Karachi Stock Exchange Index (KSE-100). Hence movement of Karachi Stock Exchange Index (KSE-100) statistically significant the cause and effect relationship with money supply (M2) which causes increase in inflation to increase discount rates, ultimately a cause of reduction in present values of future cash flows. Vector Error Correction Model explores short term dynamic significant relationship with treasury bill rate and exchange rate, which have negative short term co-integration with Karachi Stock Exchange (KSE). Variance decomposition analysis (VDC) applied to take overall view of level of change which describes KSE attribute to money supply, consumer price index, and treasury bill rate and exchange rate to account for its own innovation or shocks. Karachi Stock Exchange (KSE) returns volatility is explained by its own innovation. Money supply (M2), consumer price index (CPI), treasury bill rate (TB), exchange rate (EXR), industrial production (IPI) and reserves (RES) contribute considerable error variance in one year. Graphs of the impulse response function (IRF) shows most of the part of shocks is explained by its own innovations of KSE and other macroeconomic variables also exerting impact on Karachi Stock Exchange Index (KSE).

Finally, it can be said that money supply (M), inflation (CP1) and industrial production (IPI) have significant long term relationship whereas treasury bill rate and exchange rate have short term significant relationship with Karachi Stock Exchange Index (KSE). So according to theoretical back ground of treasury bill rate will lead towards decrease in present value by increasing rates of discounts. So, it is concluded that these monetary and real variables have long term lead lag relationship as well as short term relationship with Karachi Stock Exchange Index. The results suggest that macroeconomic variables as money supply (M2), consumer price index (CPI), treasury bill rate (TB), exchange rate (EXR) as monetary policy variables, industrial production (IPI) and reserves (RES) as real variables sentiments are very important to contribute to identify the behavior on Karachi Stock Exchange.

The outcome of this study describes that variability in macroeconomic variables have impact on Karachi Stock Exchange. So macroeconomic variables as money supply, treasury bills rate, consumer price index, exchange rate, industrial production and reserves, can be used by investors, fund managers and financial analysts to forecast or estimate the future direction of Karachi Stock Exchange for allocation of resources. So, it is needed by the national and international (agents, investors or fund managers) to consider these severest fundamental variables to enhance the efficiency and effectiveness of investments such as money supply (M2), consumer price index (CPI), treasury bill rate (TB), exchange rate (EXR), industrial production (IPI) which can destabilize the equity market (KSE) returns. It is very important to stabilize these variables to make efficient portfolio performance of investors and best resource utilization. According to an efficient market theory it is hypothesized that capital market responds quickly to

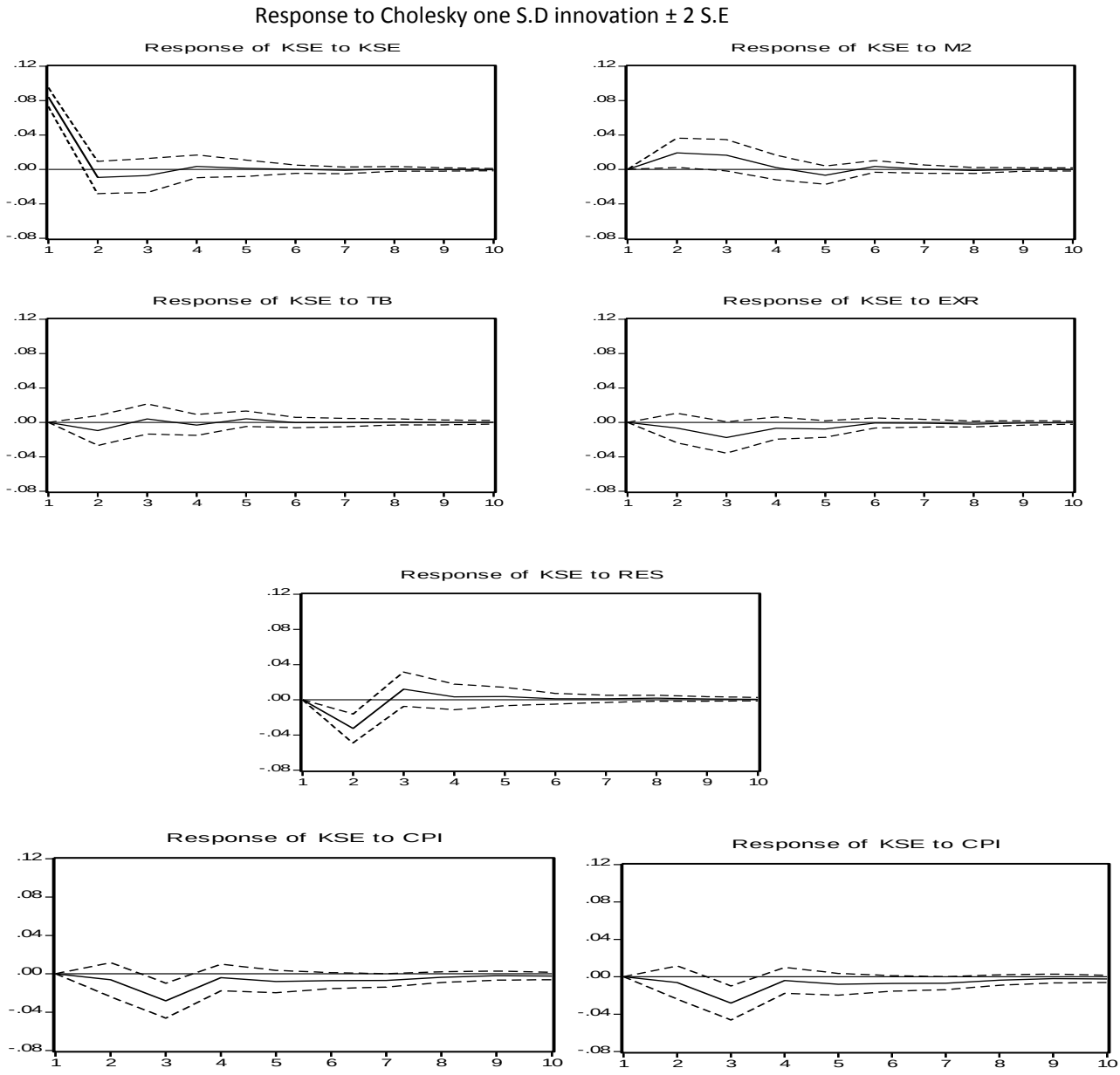

Figure 2. Impulse responses

the new information. So, it is highly needed to make an efficient and well conceived to keep in view the capital market responses. The policy makers should be sensitive in revision of these variables which negatively affect the stock market investment. Similarly, central bank of Pakistan (State Bank of Pakistan) should consider these aspects in designing the good monetary policy. It will help to strengthen the financial system.

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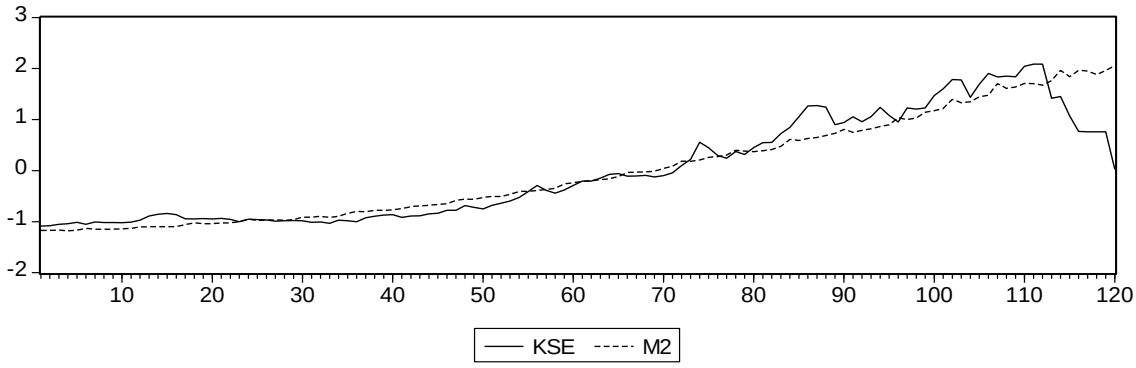
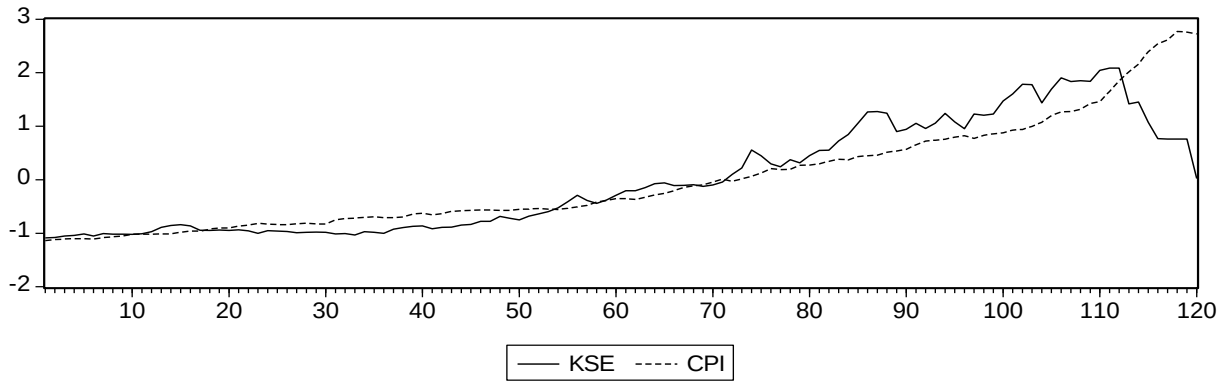
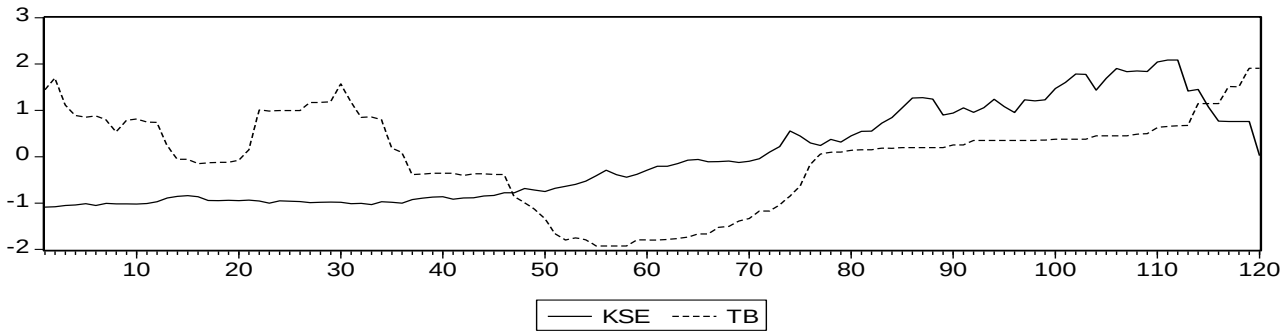
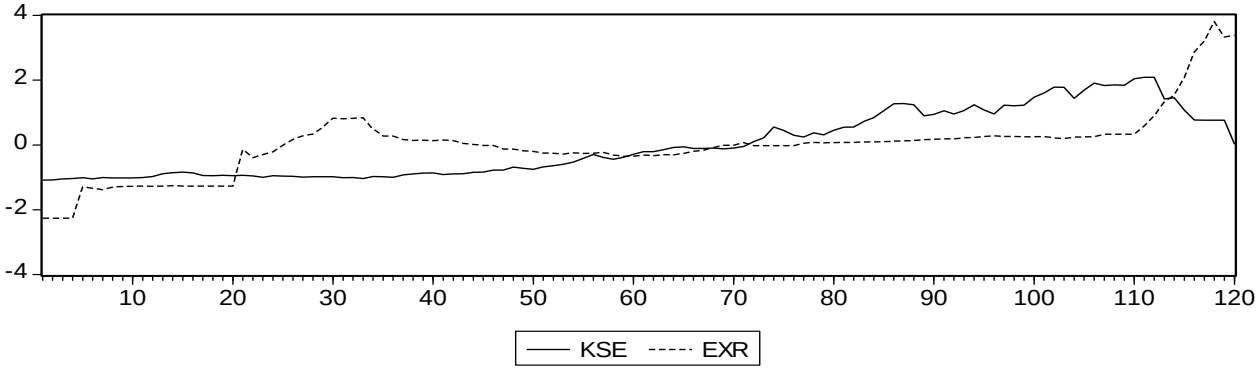
APPENDIX

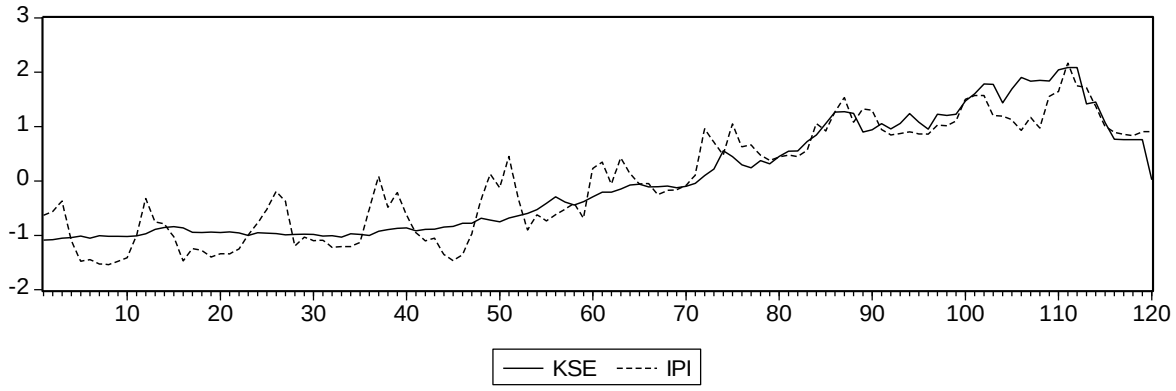
Appendix A: Indices movement of KSE with macroeconomic variables

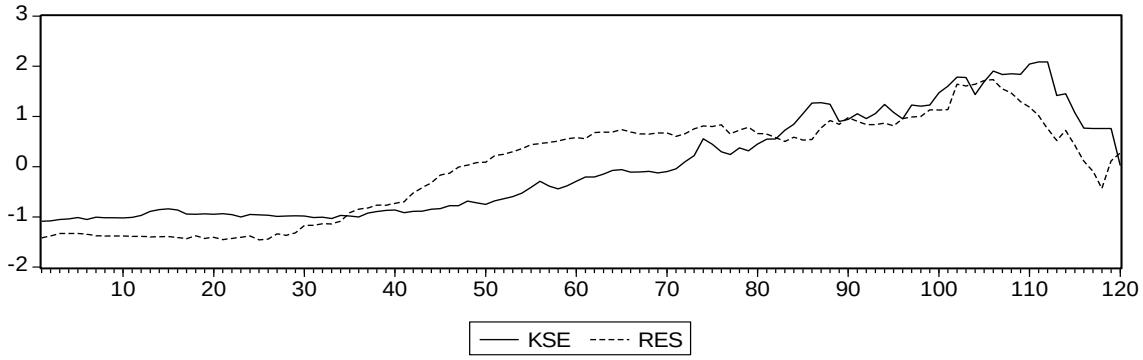




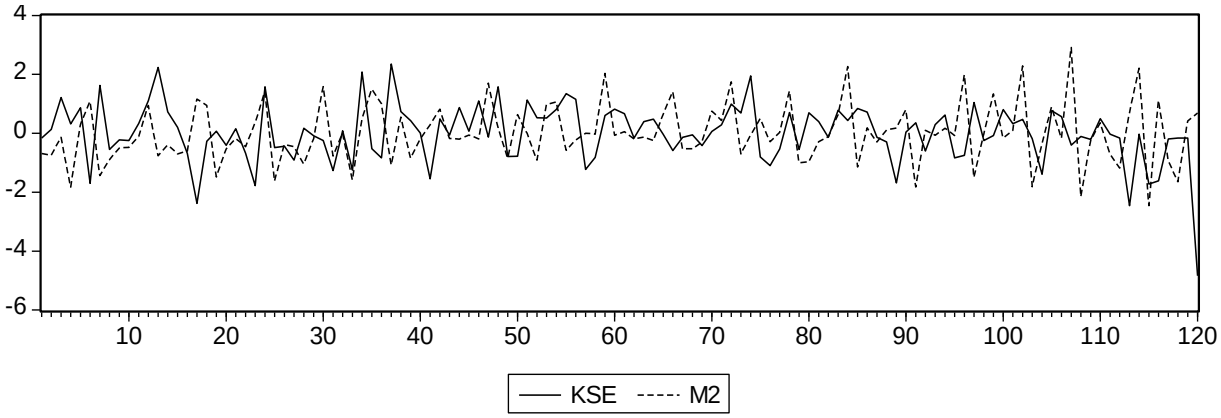


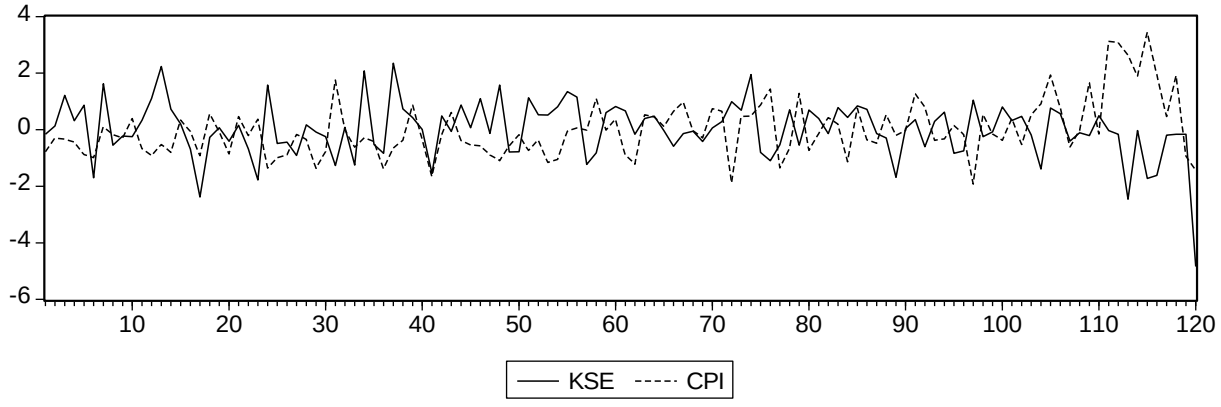


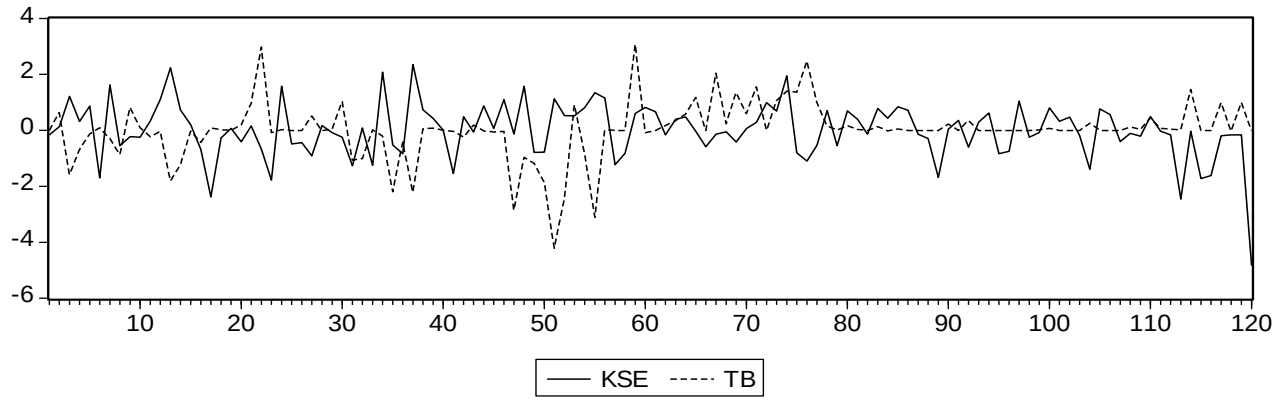


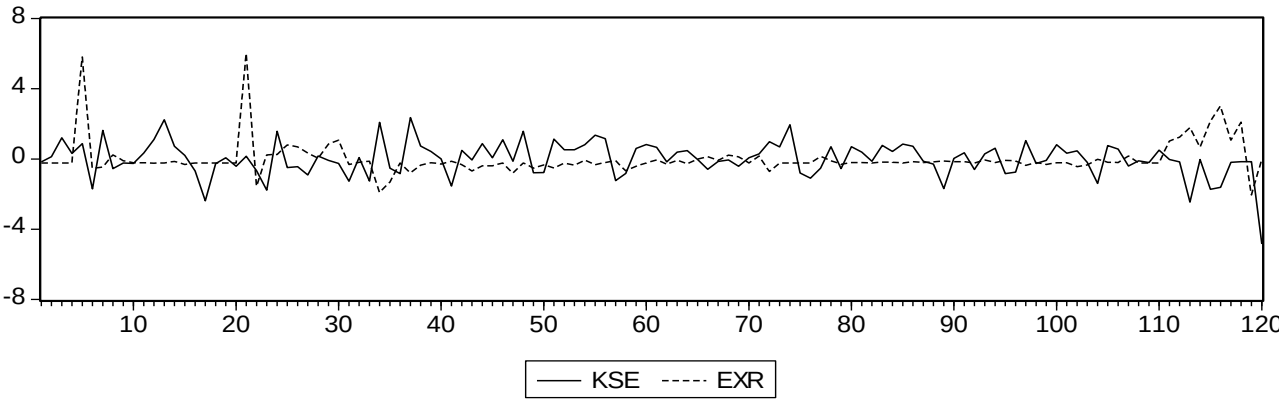


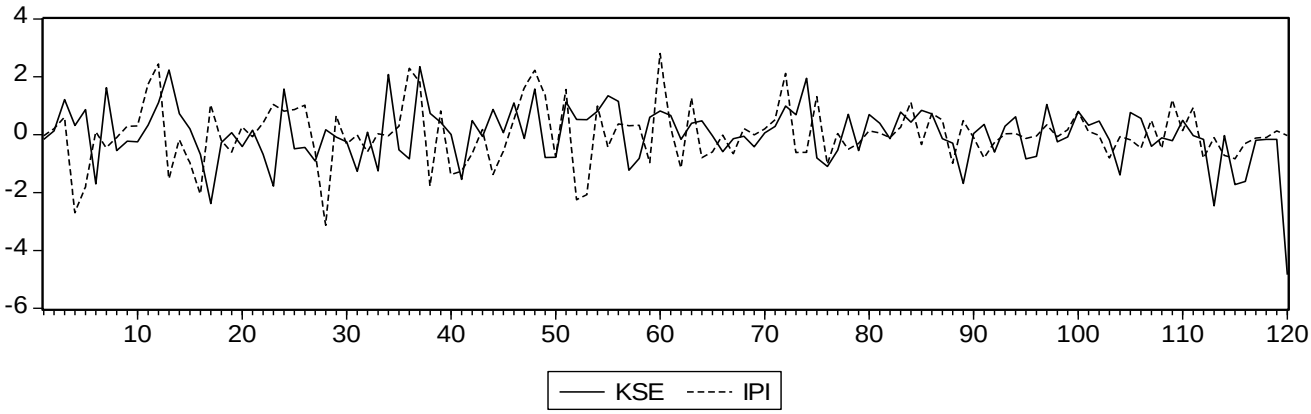
Appendix B: Returns movement of KSE with macroeconomic variables

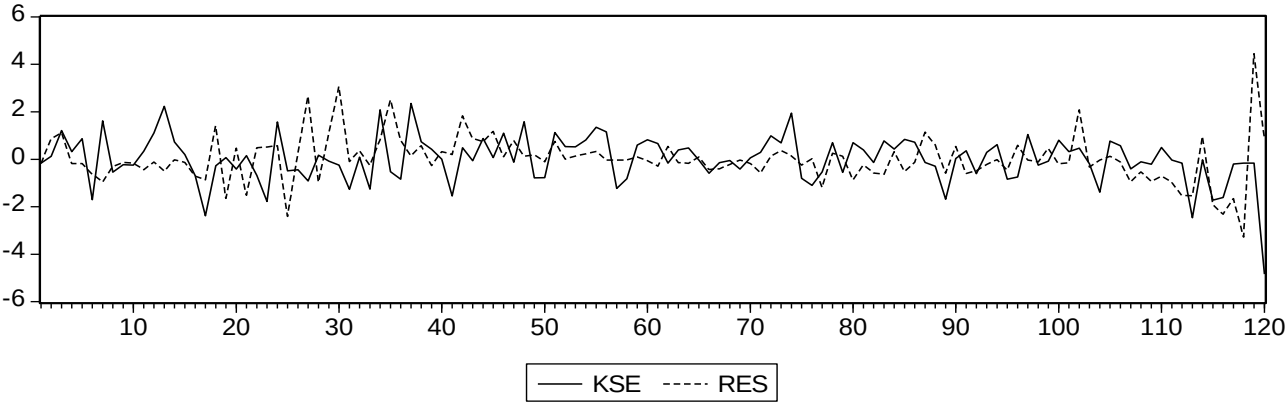




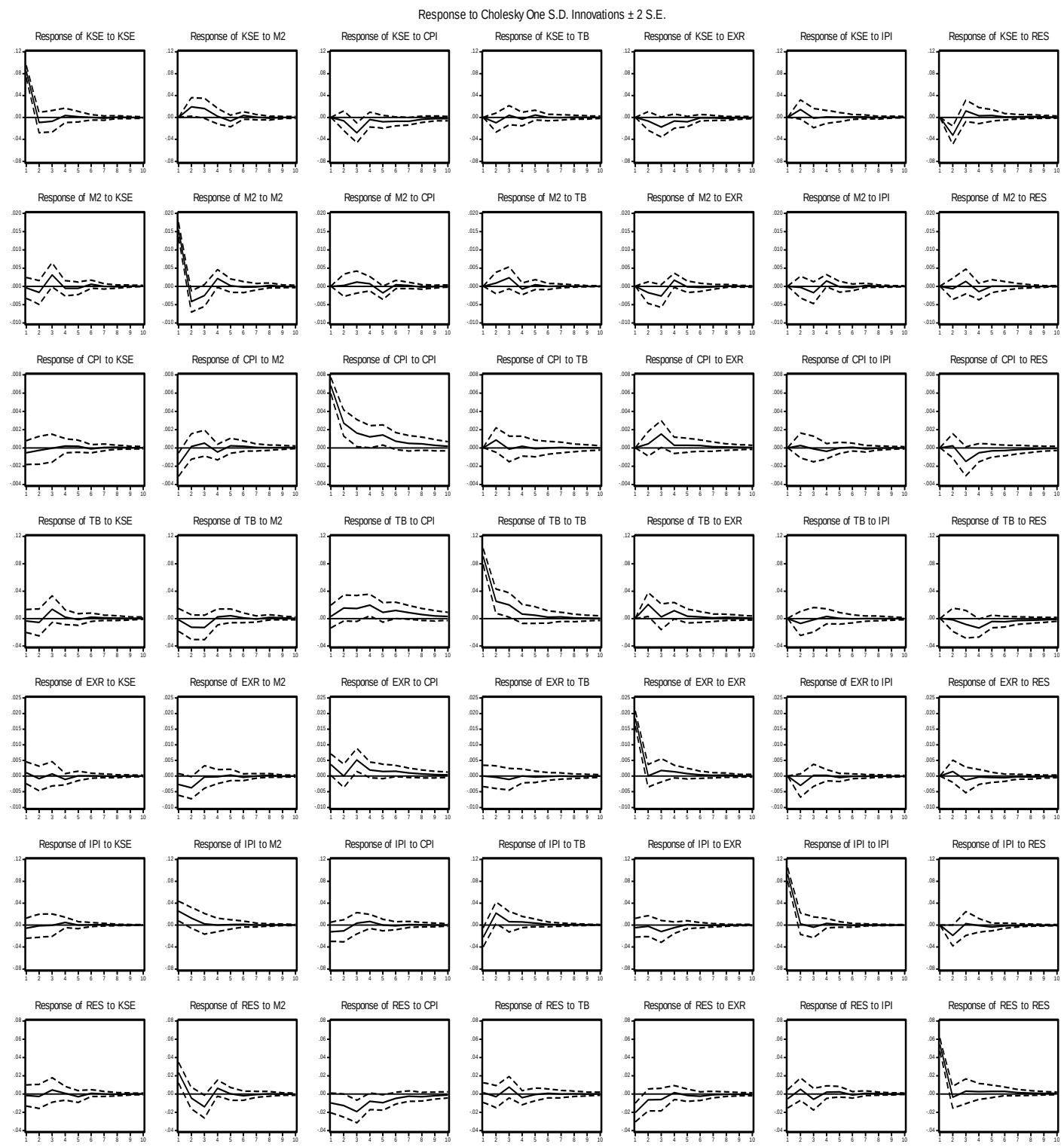

4
2
0
-2
-4
-6
10 20 30 40 50 60 70 80 90 100 110 120
KSE
TB


8
4
0
-4
-8
10 20 30 40 50 60 70 80 90 100 110 120
KSE
EXR

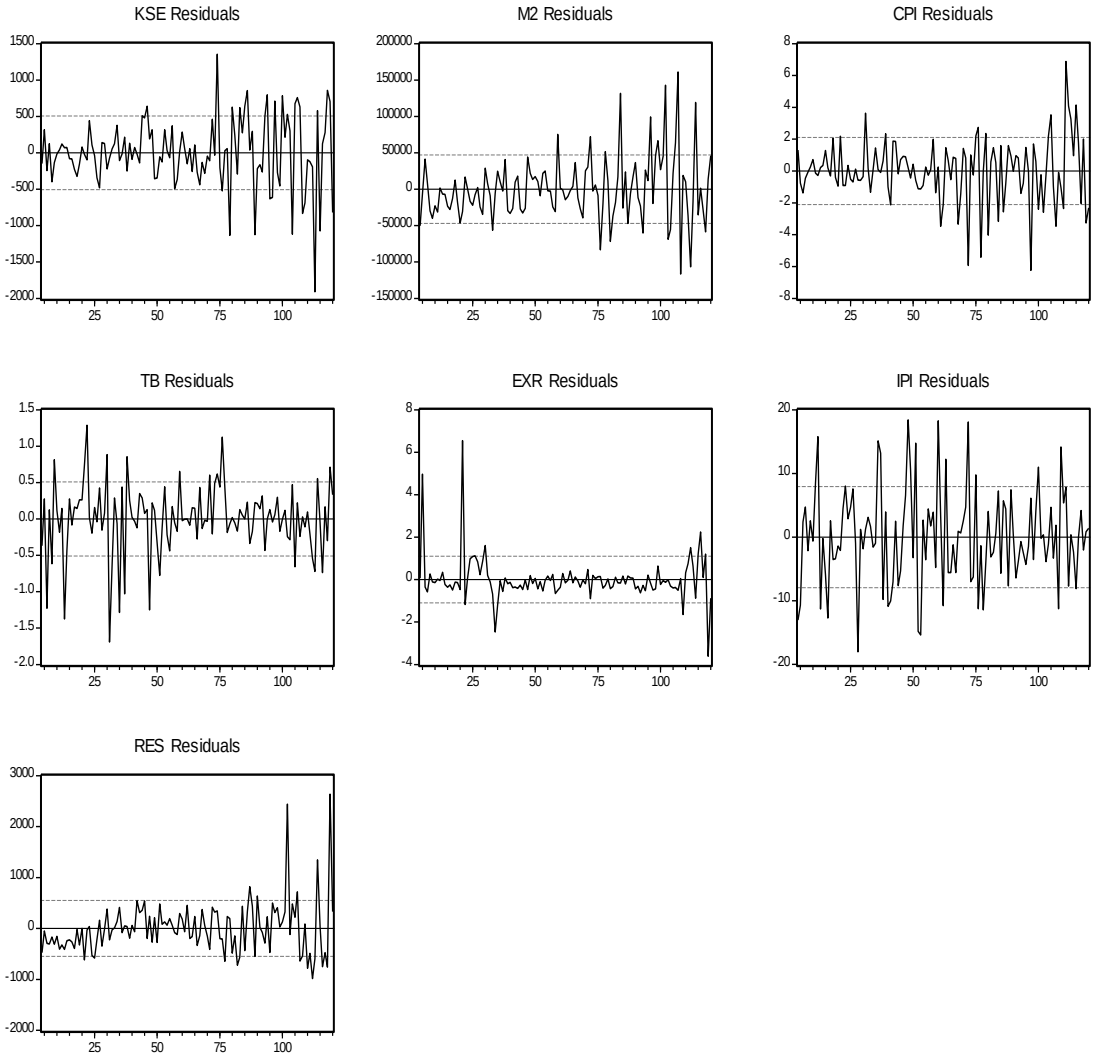

4
2
0
-2
-4
-6
10 20 30 40 50 60 70 80 90 100 110 120
KSE
IPI


6
4
2
0
-2
-4
-6
10 20 30 40 50 60 70 80 90 100 110 120
KSE
RES

Appendix C: Impulse response curves of economic forces and equity market.



Appendix D: Residuals curves of economic forces and equity market.



Appendix E. Granger causality among macroeconomic variables.

Null Hypothesis:	Obs	F-Statistic	Probability
CPI does not Granger Cause M2	118	0.2694	0.76433
M2 does not Granger Cause CPI		1.85073	0.16185
TB does not Granger Cause M2	118	0.94635	0.39121
M2 does not Granger Cause TB		1.83036	0.16508
EXR does not Granger Cause M2	118	2.0275	0.13643
M2 does not Granger Cause EXR		1.61673	0.2031
IPI does not Granger Cause M2	118	0.89212	0.41265
M2 does not Granger Cause IPI		1.13237	0.3259
RES does not Granger Cause M2	118	0.81375	0.44577
M2 does not Granger Cause RES		5.34518	0.00605
TB does not Granger Cause CPI	118	1.76843	0.17529
CPI does not Granger Cause TB		3.07656	0.05
EXR does not Granger Cause CPI	118	2.12532	0.12414
CPI does not Granger Cause EXR		3.82639	0.02466
IPI does not Granger Cause CPI	118	0.27752	0.75817

Appendix E. Contd.

CPI does not Granger Cause IPI		0.85187	0.42934
RES does not Granger Cause CPI	118	2.59697	0.07894
CPI does not Granger Cause RES		5.8181	0.00394
EXR does not Granger Cause TB	118	4.65714	0.01139
TB does not Granger Cause EXR		0.01904	0.98114
IPI does not Granger Cause TB	118	0.97355	0.38089
TB does not Granger Cause IPI		2.30668	0.10426
RES does not Granger Cause TB	118	3.20586	0.04424
TB does not Granger Cause RES		0.66554	0.516
IPI does not Granger Cause EXR	118	1.92558	0.15054
EXR does not Granger Cause IPI		0.62503	0.53709
RES does not Granger Cause EXR	118	0.80923	0.44776
EXR does not Granger Cause RES		1.3344	0.26743
RES does not Granger Cause IPI	118	0.53005	0.59003
IPI does not Granger Cause RES		1.2679	0.28539

Appendix F. Variance decomposition analysis of economic forces and equity market.

F1:Decomposition OF M2								
Period	**S.E.**	**KSE**	**M2**	**CPI**	**TB**	**EXR**	**IPI**	**RES**
1	0.015	0.085	99.914	0	0	0	0	0
2	0.0163	1.169	97.142	0.020	0.312	1.139	0.027	0.187
3	0.017	4.220	88.055	0.464	2.048	3.386	1.070	0.754
4	0.017	4.141	85.853	0.600	2.147	4.108	1.738	1.409
5	0.01	4.194	84.826	1.602	2.188	4.067	1.728	1.392
6	0.017	4.280	84.634	1.662	2.183	4.086	1.761	1.390
7	0.017	4.278	84.591	1.680	2.186	4.091	1.779	1.391
8	0.017	4.279	84.578	1.692	2.186	4.092	1.778	1.391
9	0.017	4.279	84.575	1.695	2.186	4.091	1.779	1.391
10	0.017	4.280	84.5725	1.695	2.1868	4.093	1.779	1.392
F2: Decomposition OF CPI								
1	0.007	0.569	6.774	92.656	0	0	0	0
2	0.007	0.620	5.829	91.791	1.255	0.318	0.099	0.084
3	0.008	0.555	5.579	85.478	1.142	3.719	0.113	3.412
4	0.008	0.601	5.718	84.786	1.143	3.708	0.319	3.722
5	0.008	0.620	5.601	84.898	1.117	3.695	0.309	3.756
6	0.008	0.635	5.589	84.774	1.106	3.738	0.313	3.841
7	0.008	0.635	5.566	84.743	1.102	3.740	0.328	3.883
8	0.008	0.637	5.548	84.744	1.099	3.737	0.328	3.903
9	0.008	0.636	5.544	84.741	1.097	3.738	0.328	3.912
10	0.008	0.636	5.543	84.735	1.097	3.740	0.328	3.918
F3: Decomposition OF TB								
1	0.090	0.164	0.048	0.095	99.690	0	0	0
2	0.098	0.472	1.763	2.458	90.470	4.260	0.532	0.042
3	0.104	2.144	3.208	4.197	85.318	3.893	0.513	0.723
4	0.107	2.030	3.034	7.208	80.018	4.779	0.553	2.374
5	0.108	2.022	3.123	7.776	79.193	4.816	0.546	2.520
6	0.109	2.020	3.086	8.803	78.085	4.785	0.543	2.674
7	0.109	2.012	3.067	9.374	77.517	4.754	0.539	2.734

Appendix F. Contd.

8	0.109	2.006	3.077	9.614	77.226	4.756	0.537	2.781
9	0.109	2.003	3.076	9.714	77.100	4.758	0.536	2.810
10	0.109	2.002	3.073	9.780	77.031	4.755	0.536	2.818
F4: Decomposition of EXR								
1	0.018	0.3129	2.006	3.762	0.000	93.91	0	0
2	0.019	0.460	5.470	3.510	0.036	87.61	2.338	0.566
3	0.020	0.549	5.057	9.625	0.287	81.39	2.165	0.921
4	0.020	0.787	4.984	10.329	0.282	80.54	2.148	0.926
5	0.020	0.782	4.973	10.759	0.296	80.03	2.182	0.967
6	0.020	0.778	4.967	11.252	0.299	79.50	2.169	1.024
7	0.020	0.776	4.953	11.465	0.298	79.30	2.165	1.033
8	0.020	0.776	4.956	11.553	0.301	79.19	2.162	1.051
9	0.020	0.775	4.953	11.593	0.300	79.15	2.161	1.057
10	0.0208	0.776	4.951	11.625	0.300	79.125	2.161	1.060
F5: Decomposition of IPI								
1	0.099	0.3115	6.558	1.510	5.019	0.250	86.349	0
2	0.105	0.297	7.382	2.358	8.899	0.263	77.546	3.251
3	0.106	0.292	7.286	2.418	9.049	1.467	76.230	3.255
4	0.107	0.484	7.201	2.784	9.214	1.666	75.425	3.222
5	0.107	0.483	7.194	2.777	9.312	1.666	75.238	3.327
6	0.107	0.485	7.209	2.792	9.324	1.666	75.182	3.338
7	0.107	0.490	7.208	2.800	9.325	1.667	75.164	3.342
8	0.107	0.490	7.207	2.803	9.330	1.669	75.156	3.342
9	0.107	0.490	7.209	2.803	9.330	1.669	75.153	3.342
10	0.107	0.490	7.209	2.803	9.330	1.669	75.153	3.343
F6: Decomposition of RES								
1	0.063	0.070	13.479	2.435	0.054	10.33	0.725	72.903
2	0.065	0.233	13.088	5.999	0.269	10.65	1.274	68.479
3	0.070	0.572	15.093	12.525	1.338	9.876	1.772	58.821
4	0.071	0.562	15.462	13.483	1.642	9.656	1.793	57.398
5	0.072	0.715	15.123	14.916	1.612	9.500	1.841	56.289
6	0.072	0.720	15.069	15.224	1.605	9.541	1.850	55.988
7	0.072	0.719	15.047	15.321	1.603	9.536	1.854	55.917
8	0.073	0.721	15.017	15.469	1.600	9.518	1.853	55.819
9	0.073	0.720	15.005	15.528	1.599	9.512	1.851	55.780
10	0.073	0.720	15.003	15.546	1.598	9.512	1.851	55.767