The Impact of Macroeconomic Variables on Stock Prices: An Empirical Analysis of Karachi Stock Exchange

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Abstract The intention of this study was to investigate the causal relationship, both long-run and short-run, between KSE (Karachi Stock Exchange) and some macroeconomic variables in Pakistan. The monthly data of all macroeconomic variables and stock prices was taken from January 2001 to December 2010. In this paper, the variables which have not been previously studied by the researchers in Pakistan were also included. The set of macroeconomic variables used in this study as an independent variables were Exchange Rate (ER), Foreign Exchange Reserves (FER), Industrial Production Index (IPI), Interest Rate (IR), Imports (M), Money Supply (MS), Wholesale Price Index (WPI) and Exports (X). The stock price index of KSE, which is the largest stock exchange of Pakistan, was taken as a dependent variable. The statistical techniques, which were employed in this study, include the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root test, Johansen Co-integration test, Vector Error Correction Model (VECM) and Granger Causality test. The study revealed the presence of long-run association between macroeconomics variables and stock prices. FER, IR, M, MS and WPI showed a positive and significant relationship with stock prices, while ER and X indicated a negative and insignificant impact on stock prices but IPI has a negative but significant relationship with stock prices. The two error correction terms like Vecm1 (-1) and Vecm2 (-1) were resulted from VECM, the first error correction term was significant and indicated short term adjustments towards the equilibrium path. The results of Granger Causality showed that MS and WPI have bi-directional relation while ER, FER and M have uni-directional relationship with the stock prices but IPI, IR and X showed not any casual relationship.

Key words: Exchange Rate (ER), Foreign Exchange Reserve (FER), Industrial Production Index (IPI), Interest Rate (IR), Imports (M), Money supply (MS), Whole Sale Price Index (WPI), Exports (X), Karachi Stock Exchange (KSE).

1. Introduction

The performance of stock exchange is a debatable issue in any country because it plays an important role in global economics and financial markets due to its impact on corporate finance and economic activity. The efficient stock exchange diversifies the domestic funds and activates the productive investment projects, which flourish the economic activities in a country, but this is only possible if the stock market have significant relationship with the macroeconomic variables.

The capital market plays a dominant role in the economic growth and development because it transfers the funds from the savers to the borrowers, but it is only possible if it works efficiently. By investigating the relationship between the stock prices and macroeconomic variables, the investors and the policy makers can make a better investment decisions and can improve the county's overall perception and economic conditions. Stock exchanges enable the firms to attain capital quickly due to the ease with which the securities are traded. (Adjasi and Biekpe, 2006).

The empirical literature consists of substantial number of studies that examine the movements and relationship of stock prices with the macroeconomic variables. Mohammad *et al.* (2009) investigated correlation between macroeconomic variables and stock prices of KSE and found that M2 and IR have negative affect on stock prices. Rizwan and Khan (2007) deduced that MSCI world index, 6-months LIBOR, money supply and CPI showed the stock return volatility in KSE. Nishat and Shaheen (2004) found that the industrial production index was the largest positive determinant of stock prices in Pakistan. While on the other hand, inflation was the largest negative determinant of Pakistan stock prices.

Lijuan and Ye (2010) evaluated the relationship between macroeconomic variables and Shanghai Composite Index of listed companies in China, and they concluded that stock prices were positively related to Exchange Rate, Interest Rate, Macroeconomic Prosperity Index and Consumer Confidence Index, while negatively related with Corporate Goods Price Index. Sharman and Mahendru (2010) found that stock market was highly affected due to changes in macroeconomic variables. Asmy *et al.* (2009) scrutinized the association of stock prices with Inflation (CPI), Money Supply (M2) and Exchange Rate (Ex) in pre-crisis and post-crises, and found a positive relation in pre-crises period and negative association in post-crises period. Humpe and Macmillan (2009) also found a relationship between macroeconomic variables and stock market for USA and Japan stock market.

Qayyum and Anwar (2011) found that a monetary policy has a positive and significant impact on the volatility of stock market. Singh, Mehta and Varsha (2011) examined the casual relationship based on market portfolio rather than single stock. The basic purpose of this study was to verify the assimilation and performance of market in current conditions, and it became significant for the origination of new macroeconomic policies.

This paper provides further empirical evidence regarding the long-run and short-run relationship between the stock prices of Karachi Stock Exchange (KSE) and macroeconomic variables. It is also investigated that either the stock prices act as a leading indicator for macroeconomic variables or vise versa. This paper is structured as follows: the next section provides the objectives of the study. Third section gives the history of KSE. Forth section presents the literature review. Fifth section presents the research methodology and data base. Sixth section discusses the empirical results and analysis and seventh section provides the conclusion and recommendations.

2. Objectives of the Study

The overall purpose of this research paper is to find out that either there exists any causal relationship, both long run, short run, between the stock prices and macroeconomic variables or not. Underlying objectives of this study are the following:

1. To find that either there is any long-run relationship between the macroeconomic variables and stock prices or not.
2. To find the short term adjustments towards the equilibrium path.
3. To unravel the causal relationship between the stock prices and a set of macroeconomic variables and also the direction or nature of this causal relationship.

3. History of KSE

Karachi Stock Exchange is one of the largest and most dynamic stock exchanges in Pakistan. It was established on September 18, 1947 and was incorporated, as a company limited by guarantee, on March 10, 1949. At the time of its formation, it had 90 members, number of active brokers was 5-6, and five companies were initially listed, with a paid up capital of Rs 37 million. Later, the number of companies reached to 15 with the total paid up capital of Rs.117 million.

In 1960, the number of listed companies in KSE rose to 81 companies with a paid up capital of Rs 1.0 billion, and the market capitalization was about 1.9 billion at that time. In 1966, the number of listed companies reached to 200 and KSE stopped to admit new members. It also modernized its operations by establishing Clearing House in 1969. In 1970, listing at KSE had risen to 291 companies and market capitalization had reached to Rs 5.66 billion. Annual share trading turnover, also increased to more than 15.4 million shares traded, which was 3.5 times more than 4.4 millions traded in 1965. In 1980 the number of listed companies reached to 314, market capitalization was Rs 9.77 billion while annual turnover was 25.8 million shares.

In 1990, 33 companies were delisted due to certain reasons and the number of listed companies reached to 487. The market capitalization increased more than 6 times and reached to Rs 61.8 billion due to which the aggregate paid-up capital became twice, and annual turnover was 252.9 million shares (increased almost 10 times as compared to 1980's). In the end of 1991, 6 companies were delisted and remaining number of listed companies reached to 542. Market

capitalization and turnover were doubled. Till the end of 1995, the number of listed companies at KSE reached to 764 (including one merger). The paid up capital was Rs 134,427 million and total turnover was 3051.09 million shares.

In 2002, Pakistan stock market was declared as the "*best performing market*" in the world, while in 2003 and 2006 it was ranked at third. During 2003-04, KSE share index presented an increase of 55.2% and market capitalization was increased by 81.9%.

From 2004 to 2005, KSE 100 index reflected a sharp increase of 47.2% (from 5279 points to 7770.3 points). During the same period the market capitalization presented a growth of 55.8 %. As a result of growth rate, Karachi stock market became one of the five best performing markets in the world. Market capitalization was increased by 35% in 2007 as compared to 2006. In 2007, the KSE 100 index was increased so much and reached to 12961 points.

On 20 April 2008, KSE-100 Index crossed the level of 15,000 points for the first time in its stock exchange history. Moreover, the increase of 7.4 % in 2008 made it the best performer among major emerging markets. In 2009, the numbers of listed companies were 654 at KSE and market capitalization was 8.561 trillion. In 2009, the KSE 100 index and 30 index increased by 20-25%.

On 30 July 2010, the market capitalization of KSE became 2.95 trillion. During the period from 2010-11 (July-March), the capital markets presented rising trend and posted modest gains. Total 638 companies were listed at the Karachi Stock Exchange (KSE) in 2010-11 and the total listed capital during that period was of Rs. 920.1 billion.

4. Literature Review

It was found (Ali, 2011) that inflation and foreign remittance had a negative impact while industrial production index, market P/Es and growth rate of market capitalization had a positive impact on stock returns for Dhaka Stock Exchange. Asaolu and Ogunmuyiwa (2011) inspected the impact of macroeconomic variables on Average Share Price (ASP) for Nigeria and found the long run relationship between macroeconomic variables and ASP.

Ashish Kumar (2011) examined the nature of causal relationship between macroeconomic variables and stock market of India, which corresponded with the real and financial sector of the economy. The study adjudicated that Indian financial market not so good because only 2-3% Indians invested in the market. Qayyum and Anwar (2011) checked the association between the monetary policy and the stock market in Pakistan, and found that a monetary policy has a positive and significant impact on the volatility of stock market.

Singh, Mehta and Varsha (2011) observed the casual relationship between Taiwan Stock Return (portfolio) and macroeconomic variables, and the basic purpose of this study was to verify the assimilation and performance of market in current conditions, and it became significant for the origination of new macroeconomic policies. Ali *et al*. (2010) inspected the causal relationship between the macroeconomic indicators and stock prices of KSE and found that there was a co-integration between the industrial production index and stock prices. They also found that there was no causal relationship between the macroeconomic indicators and stock prices in Pakistan.

The study in China found that industrial production, short term interest rate, money supply, and exchange rate had significant positive relation with stock prices. While inflation had negative relation and long term interest rate had no significant relation with stock prices, and it was also deduced that shanghai stock index act as leading indicator of macroeconomic variables in china. (Garcia and Yue, 2010). The relationship between macroeconomic variables and Shanghai Composite Index (Stock Prices) of listed companies in China was also found. The study concluded that the stock prices were positively related with the Exchange Rate, Interest Rate, Macroeconomic Prosperity Index and Consumer Confidence Index and negatively related with Corporate Goods Price Index. (Lijuan and Ye, 2010).

Sharman and Mahendru (2010) confirmed the impact of major macroeconomic variables on stock prices in case of Bombay Stock Exchange (BSE) in India, and the empirical results exhibited that exchange rate and gold prices highly affect the stock prices. Singh (2010) examined a causal relationship between the macroeconomic variables and stock market index i.e. BSE Sensex of Indian economy, and found a bilateral causal relationship between IIP and BSE Sensex and found a unilateral causal relationship between WPI and BSE Sensex.

Asmy *et al.* (2009) scrutinized the association of stock prices with Inflation, Money Supply and Exchange Rate in pre-crises (1987-1995) and in post-crises (1999 - 2007), and found a long run relationship with stock prices in both periods. Inflation rate (CPI) had a positive while money supply had a negative relationship with stock prices. Exchange rate had a positive relation in pre-crises period and negative association in post-crises period. Humpe and Macmillan (2009) studied the influence of various macroeconomic variables and identify distinction and resemblance among USA and Japan stock markets.

Mohammad *et al.* (2009) investigated correlation between macroeconomic variables and stock prices of KSE in Pakistan, and found that the foreign exchange reserves and foreign exchange rate significantly affected the stock prices.

While IPI and GFCF considerably affected the stock prices, and also found that M2 and IR have negative effect on stock prices. Donatas Pilinkus (2009) studied that the macroeconomic variables i.e. M1, M2 and IDCG found a bi-directional causality with stock prices in Lithuania.

Sohail and Hussain (2009) examined the long-run and short-run relationship between macroeconomic variables and Lahore stock exchange LSE25 index, and found that there was a negative impact of CPI on stock returns and IPI, ER and M2 had a significant positive impact on the stock returns but three month treasury bills had an insignificant positive impact on stock prices. Gay, Jr (2008) found that there was a negative relationship between stock prices and oil prices, while the exchange rate had a positive relationship with stock prices in four largest emerging economies such as Brazil, Russia, India, and China.

Hasan and Nasir (2008) found that inflation, industrial production index and oil prices were not significantly related while exchange rate, money supply and short term interest rate were significantly related with the equity prices. Ihsan *et al*. (2007) explored the relationship of economic and financial variables with behavior of stock return and found that the unanticipated realizations of economic and financial variables were found to be a significant determinant of movement in stock returns.

Rizwan and Khan (2007) deduced that MSCI world index, 6-months LIBOR, money supply and CPI showed the stock return volatility in KSE. Gan *et al.* (2006) scrutinized that New Zealand stock index was not a leading indicator of macroeconomic variables. Erdogan and Ozlale (2005) investigated the influence of varying macroeconomic variables on stock return of turkey and found that IPI and ER were positively related with the stock return. On the other hand, Circulation in Money (M1) had no any significant impact on stock return.

Al-Sharkas (2004) found that inflation and interest rate affects negatively on stock prices, while real economic activity and Money supply (M2) affects positively on Amman stock prices in Jordan. Nishat and Shaheen (2004) found that the industrial production index was the largest positive determinant of stock prices while inflation was the largest negative determinant of Pakistan stock prices.

Nath and Samanta (2003) investigated the relationship between Exchange Rate and Stock Prices of India but the result of this study was uncertain because it was against all other previous studies. Chang, Yeung, and Yip (2000) found that Money supply, interest rate, commodity prices and capacity utilization were negatively correlated. While inflation, consumer expectation, manufacturing contracts and orders were positively related with stock prices.

5. Data Description and Research Methodology

5.1. Data description

This study analyzed the long run, short run and causal relationship between macroeconomic variables [Real Exchange Rate (ER), Foreign Exchange Reserve (FER), Industrial Production Index (IPI), Interest Rate of three month treasury bills (IR), Imports (M), Money Supply (MS), Wholesale Price Index as inflation (WPI) and Exports (X)] and stock prices of Karachi stock exchange for the period January 2001 to December 2010 by using monthly observation. Data of these macroeconomic variables were extracted from "International Financial Statistics" (IFS) and "Monthly Bulletins of Statistics" while data of KSE was collected from the Karachi Stock Exchange.

To determine the effect of real economic variables on stock prices, it was preferred to use the data in real terms rather than in nominal terms. When the data was collected, the values of Foreign Exchange Reserve, Interest Rate, Imports, Exports and Money Supply were in nominal form so, they were converted into real terms by using the following formula:

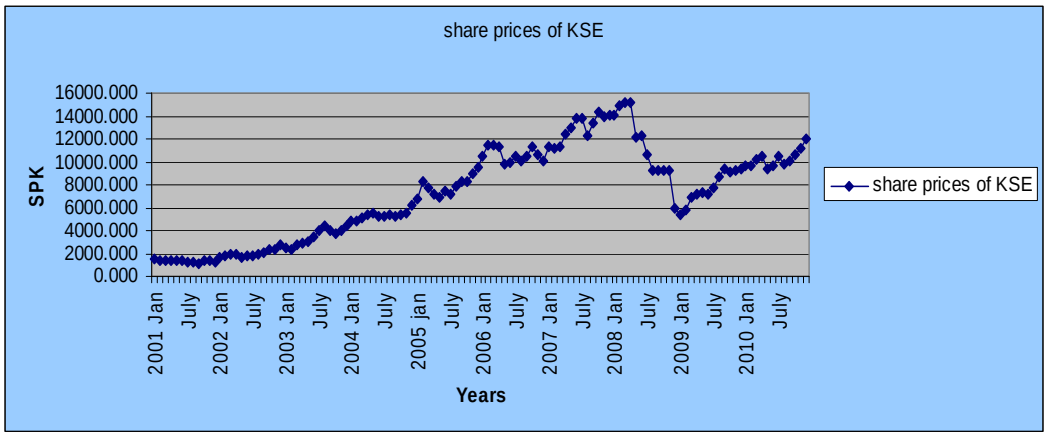
$$\textbf{Real values} = \frac{\textbf{nominal values}}{\textbf{CPI}}$$

The base year of Exchange Rate, Industrial Production Index and Wholesale Price Index from 2001-10 is not same. So, the data of these variables were transformed into a same base year of 2000. The nature of our observable data is secondary.

A. Dependent variable and its trend

Stock Prices of KSE 100 index has been used as a dependent variable. The graph represented the trend from the year 2001 to 2010.

Figure 1: Stock Prices of Karachi Stock Exchange Index (SPK)



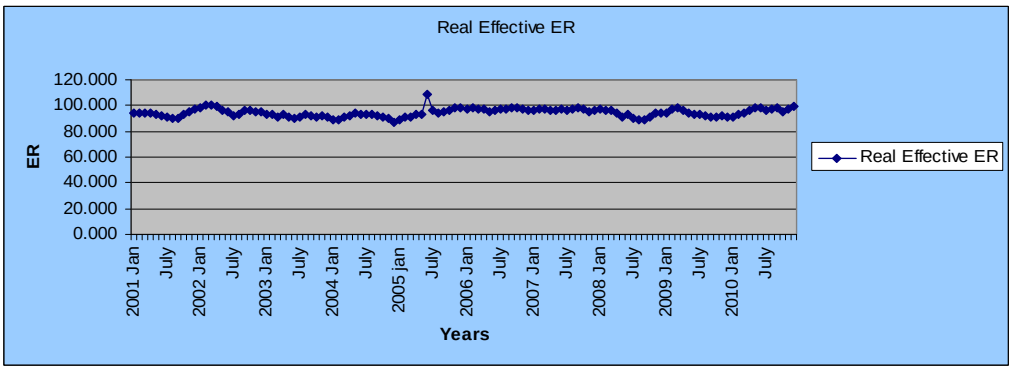
From the graph, it is construable that in first seven years of twenty first century the share index showed upward trend. But in 2008, due to uncertainties it showed a downward trend but after that period, the trend goes upward as shown in the graph.

B. Independent Variables and their trend

i. Exchange Rate (ER)

Exchange rate is a rate at which one currency is converted into another currency. The exchange rate is used in the foreign exchange market, when converting one currency into another currency or when engaging in speculation or trading. The graph represented the trend from the year 2001 to 2010.

Figure 2: Exchange Rate (ER)

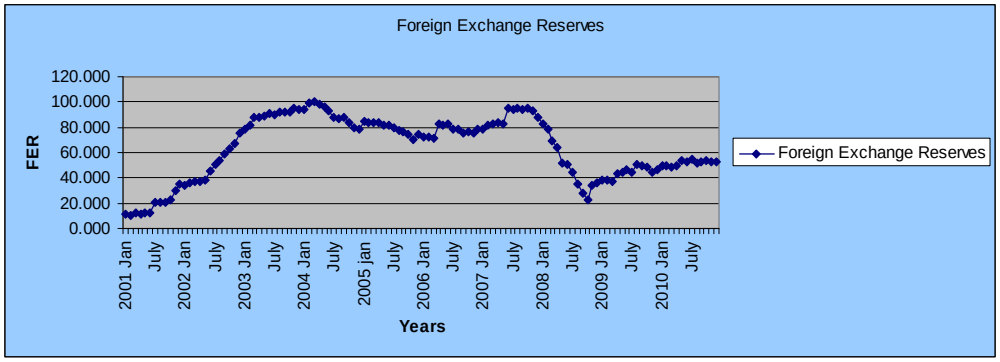


The above graph showed relatively stable Exchange rate from 2001 to 2010.

ii. Foreign Exchange Reserve (FER)

Foreign Exchange Reserves are the foreign currency deposits and bonds which are held by the central banks and monetary authorities. Following graph showed a trend in foreign exchange reserves.

Figure 3: Foreign Exchange Reserve (FER)

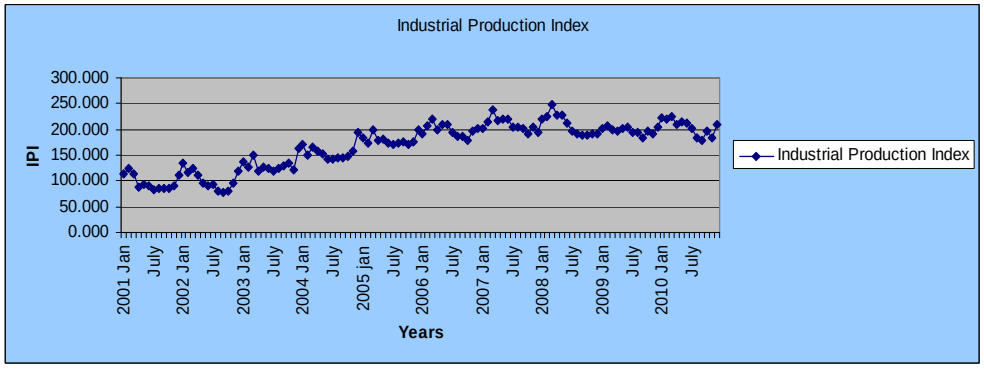


From 2001 to 2008, it showed an upward trend. But after 2008, it showed downward trend and then in 2009 it increases slightly.

iii. Industrial Production Index (IPI)

Industrial production index is a macroeconomic indicator, used to measure the volume of output related with the manufacturing, mining and utilities sectors. The upward movement of industrial production index can be shown by the following graph.

Figure 4: Industrial Production Index (IPI)

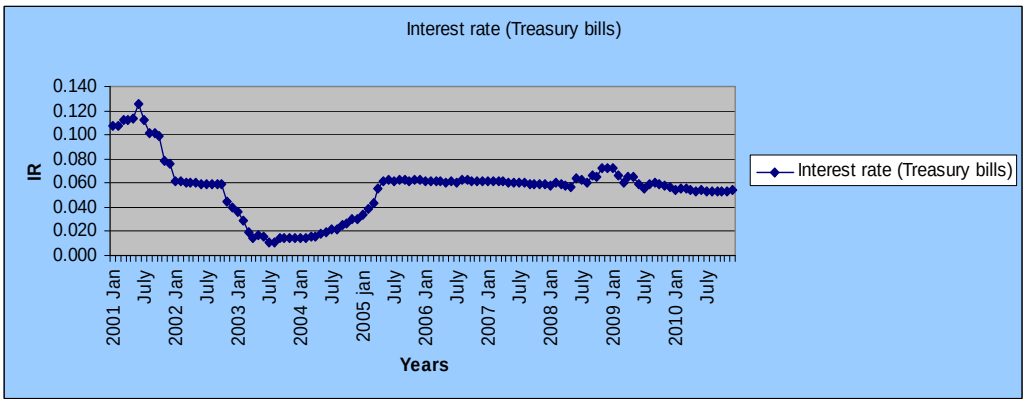


Overall industrial production index graph showed the upward trend.

iv. Interest Rate (IR)

Interest rate is the rate charged by the lender to a borrower, for the use of assets i.e. cash, consumer goods, vehicle or building. The graph represented the trend from the year 2001 to 2010.

Figure 5: Interest Rate (IR)

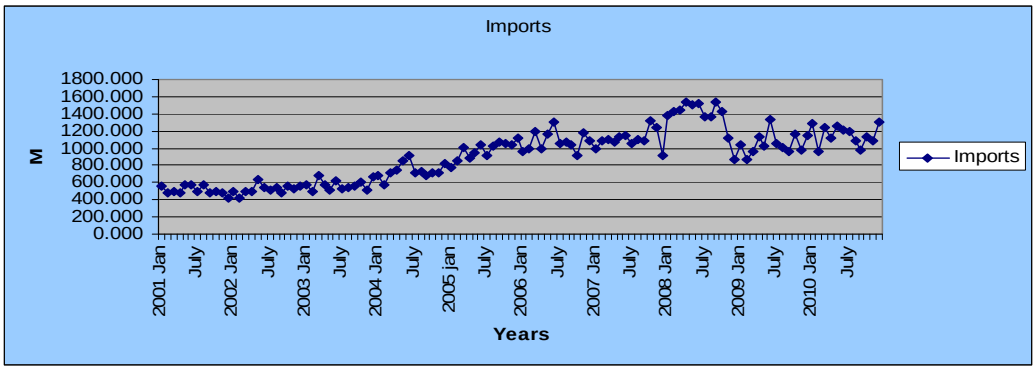


After 2003, IR represented the gradual upward trend as shown in the graph.

v. Imports (M)

Imports cover the goods and services which are brought into a country from another country. These goods and services are produced by the foreign sectors and brought by the domestic country. Following graph showed a trend in imports.

Figure 6: Imports (M)

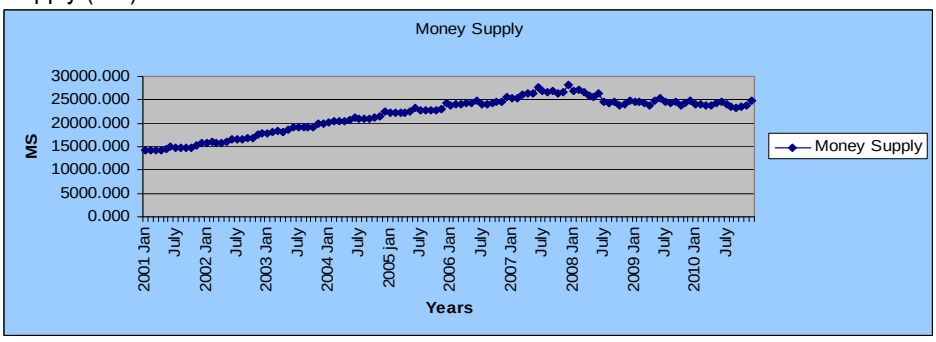


From this graph, it is concluded that Pakistani imports boomed over this period.

vi. Money Supply (MS)

It includes different types of monetary aggregates M_0, M_1 and M_2. Where M_0, M_1 are the narrow measures while M_2 is a broader aggregate. M_2 is composed of currency in circulation, demand deposits, other deposits with SBP, time deposits and Resident Foreign Currency Deposits (RFCDs) of the scheduled banks. The graph represented the trend from the year 2001 to 2010.

Figure 7: Money Supply (MS)

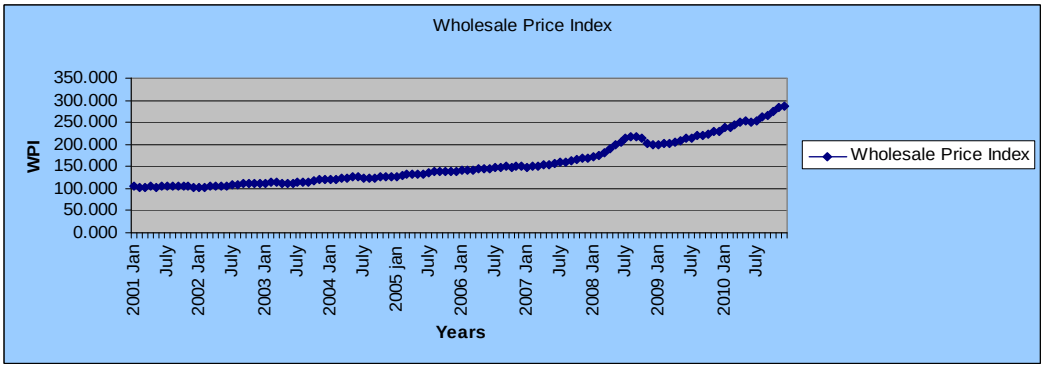


From above, it is infer that money supply sharply increased in Pakistan in last few years.

vii. Wholesale Price Index (WPI)

WPI reflects a raise in the general price level of goods and services. It can be used as an indicator of inflation. Following graph showed a trend in wholesale price index.

Figure 8: Wholesale Price Index

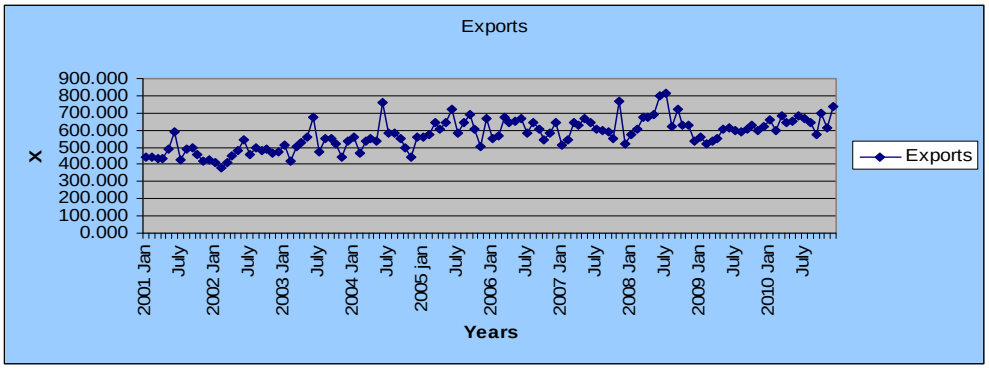


The inflation reflected an upward trend in Pakistan from 2001 to 2010 but in the last five years, high inflation was witnessed.

viii. Exports (X)

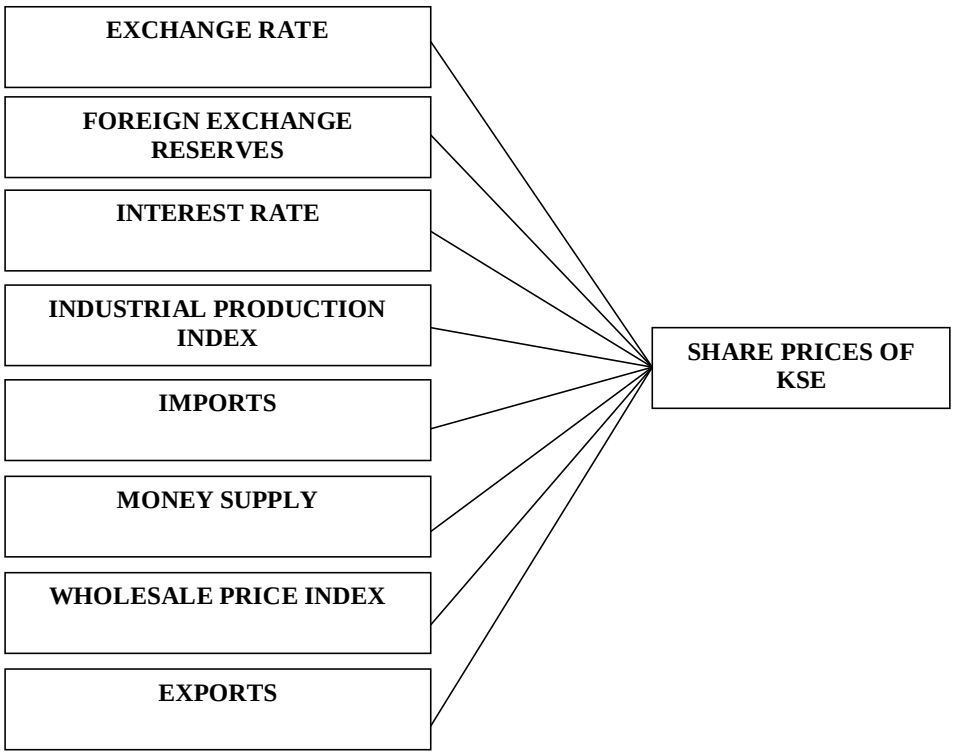
Exports are the goods and services which are produced domestically and sold to the foreign countries, in terms of foreign currency. Export is the oldest form of economic transfer which occurs on a larger scale with a few restrictions on trade such as tariff and subsidies. The graph represented the trend from the year 2001 to 2010.

Figure 9: Exports (X)



Pakistani exports showed an upward trend during 2001-2010, although it has been facing a lot of fluctuations over the period but the overall trend was upward.

2. Theoretical Framework



3. Research Methodology

Firstly, descriptive statistics were applied to find out the Mean, Median, Mode, Standard deviation, Skewness, Kurtosis, Jarque-Bera Test and Probability. Unit root test was employed to check the stationarity of variables. Johansen Cointegration technique and Vector Error Correction model were applied to investigate the long-run and short-run

relationship. Lastly, Granger Causality Technique was conducted to find out the causal relationship between the macroeconomic variables and stock prices.

Unit Root Test

Unit root test was used to determine the stationarity of data. Stationarity of data was very important aspect for empirical analysis. In this paper, stationarity is checked by two unit root tests: (i) Augmented Dickey-Fuller (ADF) Test; and (ii) Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test. The ADF test was well known and probably the most applied test in the unit root framework.

It can be shown as:

$$\Delta y_t = \beta_1 + \delta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-i} + \varepsilon_t$$

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-i} + \varepsilon_t$$

The test about the stationarity of time series always depends upon the coefficient δ of the regressor y_{t-1}. $\delta = \rho - 1$ but if $\rho = 1$ then $\delta = 0$, then as a result the null hypothesis $\delta = 0$ is not rejected, because computed absolute value of τ statistics is lesser than the critical values of Dickey Fuller (DF) asymptotic distribution. If δ is negative or less than one, then the null hypothesis $\delta = 0$ is rejected because the computed absolute value of τ statistics is greater than the critical values of Dickey Fuller (DF) asymptotic distribution.

Kwiatkowski–Phillips–Schmidt–Shin (KPSS) is another test, which was used to test the stationarity in this research paper. Basically in this technique, a null hypothesis reflects that an observable time series is stationary. Its null hypothesis is opposite to ADF test.

Johansen Co-integration Test

The Johansen co-integration test, named after Soren Johansen, is a procedure for testing co-integration of time series data in same integrated order. Johansen's methodology takes its starting point from vector auto-regression (VAR). The Johansen Co-integration technique can be expressed as:

$$x_t = A_0 + A_1 \Delta x_{t-1} + A_2 \Delta x_{t-2} + \ldots\ldots\ldots + A_{k-1} \Delta x_{t-k} + \Pi x_{t-k} + \varepsilon_t$$

The first step is to test the order of integration of the variables. The second step is to select the appropriate lag length. The Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) are used to select the optimum lag length. Co-integrating vectors are determined in third step. For this purpose the Johansen Co-integration technique describes two likelihood ratio tests, one is the "trace test" and the second one is the "maximum Eigen value test".

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i)$$

The null hypothesis is that the number of the co-integrating vector is less than or equal to r against the alternative hypothesis that there is one or more co-integrating vectors which shows that $\mathbf{r > 0}$.

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \lambda_{r+1})$$

The null hypothesis is that the Π(rank) = **r** against the alternative hypothesis that the Π = r+1. The null hypothesis suggests that there is Co-integration relationship equal to **r** against the alternative hypothesis, that there is one or more than **r** Co-integration relationship (i.e. r+1).

Vector Error Correction Model (VECM)

Error correction model is a procedure having such characteristics that if the current state deviate from its long-run relationship than such deviation will be fed into its short-run dynamics. To find out the short run dynamics in the model the vector error correction model was applied. For this, the following VAR equation is considered:

$$x_t = A_1 x_{t-1} + A_2 x_{t-2} + \ldots\ldots\ldots\ldots + A_k x_{t-k} + \varepsilon_t$$

This can be rewrite in a vector error correction model (VECM) as follow:

$$\Delta x_t = \Gamma_1 \Delta x_{t-1} + \Gamma_2 \Delta x_{t-2} + \ldots\ldots\ldots + \Gamma_{k-1} \Delta x_{t-k-1} + \Pi x_{t-1} + \varepsilon_t$$

Where Π = Matrics of parameters, which indicates the long-run relationship in the model. However, $\Pi = \alpha\beta'$ where α is the speed of adjustment towards the equilibrium parameters and β' is the matrics of parameters and tells us about the long-run relationship.

Granger Causality Test Analysis

Granger causality technique investigates the causality from independent to dependent variable and also from dependent to independent variable. It is expressed as:

$$\textit{Dependent Variable} \xrightarrow{\text{causality}} \textit{Independent Variable}$$

$$\textit{Dependent Variable} \xleftarrow{\text{causality}} \textit{Independent Variable}$$

6. Analysis and Results

6.1. Descriptive Statistics

The Mean, Median, Standard deviation, Skewness, Kurtosis, Jarque-Bera Test and Probability of all variables can be determined by the descriptive statistics. The summary statistics of all variables is shown below in Table 1.

Table 1. Descriptive Statistics of KSE

	SPK	ER	FER	IPI	IR	M	MS	WPI	X
Mean	7290.481	94.48107	63.93853	168.4012	0.055592	909.3435	21861.55	156.3021	574.1267
Median	7585.525	94.45200	72.32850	183.0000	0.060000	964.3150	23397.14	140.8000	579.2755
Maximum	15125.89	108.2200	99.87700	247.1700	0.126000	1543.403	28140.77	287.6350	818.2820
Minimum	1133.430	87.24000	10.46700	76.33700	0.011000	411.9840	14173.13	102.9100	378.5370
Std. Dev.	4072.490	3.136398	24.87112	44.44625	0.023734	306.1945	3850.954	49.81788	90.10244
Skewness	0.009053	0.478185	-0.469782	-0.563516	0.255401	0.080217	-0.605252	0.898271	0.110525
Kurtosis	1.856815	4.634988	2.082000	2.118009	3.811923	1.933788	2.151037	2.693190	2.668287
Jarque-Bera	6.535995	17.93915	8.627529	10.24056	4.600692	5.812736	10.93029	16.60847	0.794482
Probability	0.038083	0.000127	0.013383	0.005974	0.100224	0.054674	0.004232	0.000247	0.672172
Sum	874857.7	11337.73	7672.623	20208.14	6.671000	109121.2	2623386.	18756.25	68895.20
Sum Sq. Dev.	1.97E+09	1170.602	73610.17	235080.8	0.067035	11156851	1.76E+09	295336.7	966095.6
Observations	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**

Table 1 shows that the average value of SPK is 7290.481 and its Standard Deviation is 4072.490 which is relatively very high as compare to other variables. It shows that there was significant variability or high volatility (Risk) in the stock prices during 2001-10. High volatility indicated that there was a higher risk in stock prices. While the standard deviation of IR is relatively very low as compare to other variables and its value is 0.023734, and its average value is 0.055592. MS has highest range as compare to other variables which is from 14173.13 to 28140.77. From skewness, we observed that ER, IR, M, WPI and X are positively skewed while FER, IPI and MS are negatively skewed which clarified that the variables are asymmetrical. Skewness value of SPK is very near to zero so it is relatively symmetrical. Kurtosis values indicated that SPK, FER, IPI, M, MS, WPI and X have platy-kurtic distribution while ER and IR have lepto-kurtic distribution, and it is concluded that variables are not normally distributed. By analyzing Jarque-Bera test, it is found that no variable is normally distributed because it is based on skewness or kurtosis. P value of SPK, ER, FER, IPI, IR, M, MS and WPI are less than or equal to 10%.

6.2. Unit Root Test

In this paper, **ADF** and **KPSS** unit root test was applied to check the stationarity of data. To apply Johansen Co-integration technique, it is compulsory that our variables should be at same integrated order. The results of Augmented Dickey Fuller (ADF) test at 'intercept" & at "trend and intercept" are given in the following table:

Table 2. ADF Unit Root Test

Variables	Level/First Difference/Second Difference	Augmented Dickey-Fuller (ADF) test statistics		Decision
		With Intercept	With Intercept & Trend	
ER	Level	-4.171803*** (0.0011)	-4.267396*** (0.0049)	I(1)
	First Difference	-13.31117*** (0.0000)	-13.26280*** (0.0000)	
FER	Level	-2.250514 (0.1899)	-2.299465 (0.4306)	I(1)
	First Difference	-4.810189*** (0.0001)	-5.066457*** (0.0003)	
IPI	Level	-1.522998 (0.5183)	-0.608975 (0.9763)	I(1)
	First Difference	-2.814369* (0.0596)	-3.152211* (0.0999)	
IR	Level	-2.267029 (0.1844)	-2.255293 (0.4545)	I(1)
	First Difference	-8.826909*** (0.0000)	-9.015341*** (0.0000)	
M	Level	-1.402765 (0.5788)	-3.132617 (0.1037)	I(1)
	First Difference	-11.51574* (0.0000)	-11.46948*** (0.0000)	
MS	Level	-2.114513 (0.2395)	-1.414031 (0.8518)	I(2)*****
	First Difference	-2.301657 (0.1733)	-2.817001 (0.1944)	
	Second Difference	-16.38277*** (0.0000)	-16.29387*** (0.0000)	
WPI	Level	2.373712 (1.0000)	-0.207759 (0.9922)	I(1)
	First Difference	-5.714517*** (0.0000)	-6.426679*** (0.0000)	
X	Level	-2.463899 (0.1270)	-4.848872*** (0.0007)	I(1)
	First Difference	-4.634876*** (0.0002)	-4.651032*** (0.0014)	
SPK	Level	-1.109682 (0.7105)	-1.495223 (0.8261)	I(1)
	First Difference	-9.463223*** (0.0000)	-9.426622*** (0.0000)	
Critical values:				
1% level of significance		-3.48	-4.03	
5% level of significance		-2.88	-3.44	
10% level of significance		-2.57	-3.14	

Note:

*Significant at 10% level of significance.

**Significant at 5% and 10% level of significance.

*** Significant at 1%, 5% and 10% level of significance.

( ) shows p-value.

***** all variables are integrated of order 1, i.e. I(1) except money supply (MS) and it is known that long- run relationship can't be find until the order of integration is same of all variables. So, to get the more authentic results, KPSS test is also applied.

Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is another test to analyze the stationarity of data. The results of KPSS unit root test are more authentic and it is more preferable than ADF test. The results of KPSS test is shown in table 3:

Table 3. KPSS Unit Root Test

Variables	Level/First Difference/Second Difference	Augmented Dickey-Fuller (ADF) test statistics		Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test statistics		Conclusion
		With Intercept	With Intercept & Trend	With Intercept	With Intercept & Trend	
ER	Level	-4.171803 (0.0011)	-4.267396 (0.0049)	0.176454**	0.083214**	I(1)
	First Difference	-13.31117 (0.0000)	-13.26280 (0.0000)	0.070609**	0.054745**	
FER	Level	-2.250514 (0.1899)	-2.299465 (0.4306)	0.242896**	0.245446	I(1)
	First Difference	-4.810189 (0.0001)	-5.066457 (0.0003)	0.328318**	0.091880**	
IPI	Level	-1.522998 (0.5183)	-0.608975 (0.9763)	1.108022	0.300824	I(1)
	First Difference	-2.814369 (0.0596)	-3.152211 (0.0999)	0.044157**	0.035327**	
IR	Level	-2.267029 (0.1844)	-2.255293 (0.4545)	0.159885**	0.167092*	I(1)
	First Difference	-8.826909 (0.0000)	-9.015341 (0.0000)	0.271661**	0.146877*	
M	Level	-1.402765 (0.5788)	-3.132617 (0.1037)	1.107392	0.199065*	I(1)
	First Difference	-11.51574 (0.0000)	-11.46948 (0.0000)	0.500000*	0.500000	
MS	Level	-2.114513 (0.2395)	-1.414031 (0.8518)	1.081593	0.298409	I(1)
	First Difference	-2.301657 (0.1733)	-2.817001 (0.1944)	0.407360**	0.092226**	
	Second Difference	-16.38277 (0.0000)	-16.29387 (0.0000)	–	–	
WPI	Level	2.373712 (1.0000)	-0.207759 (0.9922)	1.212505	0.309180	I(1)
	First Difference	-5.714517 (0.0000)	-6.426679 (0.0000)	0.750177	0.061130**	
	Second Difference	-	-	0.136425**	-	
X	Level	-2.463899 (0.1270)	-4.848872 (0.0007)	1.122280	0.190266*	I(1)
	First Difference	-4.634876 (0.0002)	-4.651032 (0.0014)	0.064431**	0.065387**	
SPK	Level	-1.109682 (0.7105)	-1.495223 (0.8261)	0.965176	0.211457	I(1)
	First Difference	-9.463223 (0.0000)	-9.426622 (0.0000)	0.095721**	0.084065**	
Critical values:						
1% level of significance		-3.48	-4.03	0.73	0.21	
5% level of significance		-2.88	-3.44	0.46	0.14	
10% level of significance		-2.57	-3.14	0.34	0.11	

Note:

* Significant at 1% level of significance.

** Significant at 1%, 5% and 10% level of significance.

( ) shows p values.

Finally we can say that all variables are integrated at first order. Table 4 shows the final decision about the stationarity as shown below:

Table 4. Final Decision

Variables	ADF Test		KPSS Test		Decision
	With intercept	*With intercept and trend*	*With intercept*	*With intercept and trend*	
Exchange Rate (ER)	1st	1st	1st	1st	1st
Foreign Exchange Rate (FER)	1st	1st	1st	1st	1st
Industrial Production Index (IPI)	1st	1st	1st	1st	1st
Interest Rate (IR)	1st	1st	1st	1st	1st
Imports (M)*	1st	1st	1st	level	1st
Money Supply (MS)**	2nd	2nd	1st	1st	1st
Whole Sale Price Index (WPI)***	1st	1st	2nd	1st	1st
Exports (X)	1st	1st	1st	1st	1st
Karachi Stock Price Index (SPK)	1st	1st	1st	1st	1st

Note:

*Imports (M) is stationary at first difference according to the ADF test, and in KPSS it is also stationary at first difference (at intercept). Therefore, we take it at first difference because most of the results support the I (1) order of integration.

**Money supply (MS) is stationary at 2nd difference according to the ADF test, but KPSS test reflected that money supply is stationary at first difference. So, results of KPSS test are more preferred. Therefore ,level of integration of money supply is 1.

***Wholesale Price Index (WPI) is significant at first difference, only KPSS (at intercept and trend) results showed second order of integration, that's why we can say that level of integration of WPI is 1.

6.3. Johansen Co-Integration Technique

Once the stationarity is checked, the Johansen Co-integration technique can be applied. The trace statistics λ_{trace} and maximum Eigen value λ_{max} statistics results for KSE are shown in the following table:

Table 5 Results of Johansen Co-integration for KSE

Null Hypothesis	Alternative Hypothesis		5% Critical Value	P value
λ_{trace} tests		**λ_{trace} value**		
r = 0	r > 0	678.3544	208.4374	0.0000
r ≤ 1	r > 1	498.6227	169.5991	0.0000
r ≤ 2	r > 2	362.2602	134.6780	0.0000
r ≤ 3	r > 3	258.5987	103.8473	0.0000
r ≤ 4	r > 4	167.7262	76.97277	0.0000
r ≤ 5	r > 5	116.6732	54.07904	0.0000
r ≤ 6	r > 6	73.63836	35.19275	0.0000
r ≤ 7	r > 7	37.75584	20.26184	0.0001
r ≤ 8	r > 8	10.87958	9.164546	0.0234
λ_{max} tests		**λ_{max} value**		
r = 0	r = 1	179.7317	59.24000	0.0000
r = 1	r = 2	136.3625	53.18784	0.0000

r = 2	r = 3	103.6615	47.07897	0.0000
r = 3	r = 4	90.87253	40.95680	0.0000
r = 4	r = 5	51.05296	34.80587	0.0003
r = 5	r = 6	43.03485	28.58808	0.0004
r = 6	r = 7	35.88252	22.29962	0.0004
r = 7	r = 8	26.87626	15.89210	0.0007
r = 8	r = 9	10.87958	9.164546	0.0234

Johansen Co-integration results showed that there are 9 co-integrating vectors in the trace statistics and 9 co-integrating vectors in the maximum .Eigen value statistics in KSE. So, we can say that there is a long-run relationship between the macroeconomics variables (ER, FER, IPI, IR, M MS, WPI, X) and stock prices of Karachi Stock Exchange.
From the normalized co-integrating equation, it can be checked that either there is a positive or a negative relationship between macroeconomics variables and stock prices. The normalized co-integrating coefficients of first co-integrating equation are estimated as shown in the table below:

Table 6 Normalized Co-integrating Equation for KSE

SPK	ER	FER	IPI	IR	M	MS	WPI	X
1.000000	84.05592*	-85.59601*	24.17215*	-71700.44*	-7.820086*	-0.479840*	-33.65123*	1.666985*
S.E.	-69.6632	-15.9321	-9.35437	-9785.08	-3.18955	-0.16525	-6.37116	-4.75529
t-value	-1.20660	5.37255	-2.58405	7.32753	2.45178	2.90372	5.28181	-0.35055

* shows the value of coefficients

The first normalized equation can be written as:

$$SPK = \beta_0 - \beta_1 ER + \beta_2 FER - \beta_3 IPI + \beta_4 IR + \beta_5 M + \beta_6 MS + \beta_7 WPI - \beta_8 X$$

By putting the values of coefficients in the above equation, the above equation cab be written as:

$$SPK = 12749.04 - 84.05592\,ER + 85.59601\,FER - 24.17215\,IPI + 71700.44\,IR$$
$$+ 7.820086\,M + 0.479840\,MS + 33.65123\,WPI - 1.666985\,X$$

According to the normalized co-integrating equation, there is a negative and insignificant relationship between stock prices and real exchange rate (ER). With costly dollar; the energy cost, imported input cost and debt servicing cost are sure to go up and may negatively affect the balance sheets of companies and would have adverse effect on the profitability of the companies. This result is *consistent* with the Soenen and Hennigar (1988), Kwon and Shin (1999) in case of Korea, Ibrahim and Yusoff (2001), Karamustafa and Kucukkale (2003), Ibrahim and Aziz (2003). In case of Malaysian equity market, Yildirtan (2007), Ozturk (2008) and Abugri (2008) for Argentina and Chile because they all found a negative relationship between the exchange rate and stock prices. Abugri (2008) found that there is negative but significant relationship between the exchange rate and stock prices for the Brazilian and Mexican stock returns. Adam and Tweneboah (2008) found a negative relationship between the exchange rate and Ghana stock market. While this result is *inconsistent* with Mukherjee and Naka (1995), Aggarwal (1981), Maysami and Koh (2000),Yusoff (2003) for Malaysian stock market, Maysami *et al.*(2004) for Singapore stock market, Ratanapakorn and Sharma (2007) and Sohail and Hussain (2009), who found that there is a positive relationship between exchange rate and stock market.

FER showed a positive and significant relationship with stock prices.due to increase in FER the country can fulfil foreign exchange obligations (import bills etc). The result is *consistent* with the Maghayereh (2003) and Mohammad *et al.* (2009) who found the positive relationship between FER and share prices.

IR showed a positive and significant relationship with stock prices. The result is *consistent* with Mukherjee and Naka (1995), who found positive relationship between stock prices and the short-term interest rate. Similarly, Maysami *et al.* (2004) found a positive and significant relationship between the interest rate and stock prices in case of Singapore stock market. Ratanapakorn and Sharma (2007) in case of US stock market and Sohail and Hussain (2009) in case of Lahore

stock exchange found a positive relationship between the three months treasury bills and Stock prices. While the result is in*consistent* with Chen *et al.* (1986), Choi and Jen (1991), Grerde and Saetterm (1999), Maghayereh (2003), Al-Sharkas (2004) in case of Jordanian stock market, Yildirtan (2007), Kandir (2008), Adam and Tweneboah (2008) in case of Ghana stock market, Abugri (2008), Humpe and Macmillan (2009), for Brazil, Argentina and Chile, who found a negative relationship between interest rate and stock prices.

M showed a positive and significant relationship with stock prices. Usually imports included the imports of plants, machinery and other industrial inputs, generally used for value addition. In Pakistan, every year about 92 products of machines and about 35 products of textile and leathers segments are imported, for the purposes of manufacturing. This helps to brighten the perception that production capacity is being built up, which will create value and add to the profits of the companies. Hence, it affects the companies' stock prices and EPS, positively and ultimately increase stock prices.

MS showed a positive and significant relationship with stock prices. We can justify this relationship in this way that with improved money supply the cash liquidity improves with investors, institutions, market participants, fund providers and fund seekers, and thus helps to reduce the markup rate and borrowing cost. Lesser borrowing cost may add to the corporate profitability so, impact the earnings per share of companies positively and thus has a positive impact on stock prices. The result is *consistent* with the Friedman and Schwartz (1963), Bulmash and Trivoli (1991) and Maysami and Koh (2000) which indicated the positive relation between money supply and stock prices. Similarly, Al-Sharkas (2004) in case of ASE, Maysami et al. (2004) in case of Singapore stock market, Ratanapakorn and Sharma (2007),Yildirtan (2007) Hasan and Nasir (2008), Sohail and Hussain (2009)and Humpe and Macmillan (2009) in case of USA, found the same results. Our result is in*consistent* with the study of Fama (1981), Geske and Roll (1983), Maghayereh (2003) which indicated the negative relationship between money supply and stock prices in case of Amman stock exchange. Abugri (2008) found negative and significant relationship between money supply and stock prices in case of Brazil and Argentina but in case of Mexico and Chile found an insignificant relationship. Humpe and Macmillan (2009) found a negative relationship between money supply and stock prices in case of Japan.

WPI showed a positive and significant relationship with stock prices. When WPI increases, most of the companies are positioned to pass over the increase in prices to consumers at much higher rates and further enhance their profit spreads. This increase in profits of companies may have a positive impact on their balance sheet and stock prices. Companies generally keep good inventory levels. With increased prices, they are sure to be good beneficiaries of inventory profits, thus it ultimately has a positive impact on stock prices. Our result is *consistent* with the Firth (1979) in case of UK, Abdullah and Hayworth (1993), Ibrahim and Yusoff (2001), Abd. Majid *et al.*(2001), Ibrahim and Aziz (2003), Islam (2003), Ratanapakorn and Sharma (2007), Adam and Tweneboah (2008) in case of Ghana stock market and Asmy *et al.*(2009), because they all found a positive relationship between inflation and stock prices. Our result is *inconsistent* with the results of Nelson (1976), Jaffe and Mandelker (1976), Fama and Schwert (1977) in case of USA, Saunders and Tress (1981) in case of Australia, Fama (1981), Geske and Roll (1983), Chen, Roll and Ross (1986), Mukherjee and Naka (1995), Naka, Mukherjee and Tufte (1998) in case of India, Maghayereh (2003), Al-Sharkas (2004), Nishat and Shaheen (2004) in case of Pakistan, Humpe and Macmillan (2009) in case of both USA & Japan and Sohail & Hussain (2009), because they all found a negative relationship between inflation and stock prices.

IPI represented the negative and significant relationship with stock prices because many factors of listed industrial sector, like prolong power outages, higher energy cost, strikes, securities concerns, political instability, policy risk, liquidity constraints, higher interest rate, higher inflation levels, higher cost of doing business, markets multiples and other financials of the country reduced the competitiveness of the companies and also its production levels, which in turn impact the stock prices adversely.

An export (X) has a negative but insignificant relationship with stock prices. When an exports decreases, profitability of export oriented companies also decreases. This resulted in decreased revenue streams and decreased profitability of the companies with poor dividend payout prospects and will have a negative impact on stock prices.

4. Vector Error Correction Model (VECM)

As co-integrating vectors confirmed the presence of long-run equilibrium, so now the short-run dynamics can also be analyzed. Two error correction co-integrating equations are observed to check the short-run dynamics, which is shown in the table below:

Table 7 Vector Error Correction Estimates for KSE

Error Correction:	D(SPK)	D(ER)	D(FER)	D(IPI)	D(IR)	D(M)	D(MS)	D(WPI)	D(X)
Vecm1 (-1)	-0.499703* [-2.58644]	0.002191 [3.31138]	0.001429 [1.47746]	-0.003377 [-1.02994]	3.28E-07 [0.27267]	0.049824 [1.74169]	-0.075569 [-0.73622]	0.000251 [0.34049]	-1.65E-05 [-0.00102]
Vecm2 (-1)	328.6545* [2.41220]	-0.853075 [-1.82798]	1.257671 [1.84348]	4.053153 [1.75314]	-0.000647 [-0.76340]	34.84349 [1.72717]	20.65208 [0.28530]	1.251104 [2.40534]	7.941633 [0.69562]

Note:
** shows the value of error correction terms*
[ ] shows the "t-values"

The adjustment coefficients Vecm1 (-1) and Vecm2 (-1) showed the speed of adjustment towards the equilibrium path. According to the above table, the adjustment in SPK is due to the first error correction term (Vecm1) because its coefficient is less than one with a negative sign and its t-value is greater than two which shows that it is significant. The second error correction term (Vecm2) is greater than one with the positive sign which indicated the absence of short-run relationship. So, according to the first error correction term, the SPK is adjusted by 49.9703 percent which is quiet rapid. This shows that it takes "2 months" (1/0.499703 = 2.00) to eliminate the disequilibrium and achieve the long-run equilibrium path.

The error correction equation is estimated by using the differences of variables and the lagged values of long-run relationship. The error correction equation for KSE is given below:

$$DSPK = 145.1168 + \sum_{i=1}^{8} DSPK_{t-i} + \sum_{i=1}^{8} DER_{t-i} + \sum_{i=1}^{8} DFER_{t-i} + \sum_{i=1}^{8} DIPI_{t-i} + \sum_{i=1}^{8} DIR_{t-i}$$

$$+ \sum_{i=1}^{8} DM_{t-i} + \sum_{i=1}^{8} DMS_{t-i} + \sum_{i=1}^{8} DWPI_{t-i} + \sum_{i=1}^{8} DX_{t-i} - 0.499703\ Vecm1(-1) + 328.6545\ Vecm2(-1)$$

5. Granger Causality Test Analysis

Granger Causality Technique is employed to investigate the causal relationship between macroeconomic variables and stock prices. For causality, p-value is analyzed at 1%, 5% and 10% level of significance. In such case, if the calculated p-value is greater than 10% than we can't reject Ho and we can say that variable does not affect or cause each other. We can confirm this by seeing table 8

Table 8 Granger Causality Results for KSE

Variables	Alternative Hypothesis	P-value	Results	
ER	ER →SPK	0.0143**	↑	Uni-directional
	ER ←SPK	0.6836		
FER	FER→SPK	0.0030*	↑	Uni-directional
	FER ←SPK	0.6963		
IPI	IPI → SPK	0.3589	≠	Independent
	IPI ← SPK	0.8642		
IR	IR →SPK	0.1232	≠	Independent
	IR ← SPK	0.6455		
M	M →SPK	0.0163**	↑	Uni-directional
	M ←SPK	0.2896		
MS	MS →SPK	0.0093*	↕	Bi-directional

	MS ←SPK	0.0029*		
WPI	WPI→ SPK	0.0207**	↕	Bi-directional
	WPI←SPK	0.0628***		
X	X →SPK	0.1743	≠	Independent
	X ←SPK	0.7020		

*Significant at 1% level of significant.
**Significant at 5% level of significant.
***Significant at10% level of significant.

The detailed analysis of Granger Causality Test for KSE revealed that ER causes SPK. This result is *consistent* with Dharmendra Singh (2010), Ozturk (2008), Basabi (2006), Abdalla & Murinde (1996, 1997) and Abdalla (1996), who found that stock prices are caused by exchange rate. This result is *inconsisten*t with Ali *et al*. (2010), Singh (2010), Pilinkus (2009), Gan*et al*.(2006), Mishara (2004), Karamustafa and Kucukkale (2003), Muhammad and Rasheed (2002), Bhattacharya and Mukherjee (2001), Bartov and Bodnar (1994), Bodnar and Gentry (1993), Jorion (1990,1991), Franck and Young (1972), they all found that exchange rate and stock prices do not cause each other.

In FER and M, a uni-directional causal relationship from FER to SPK and from M to SPK was found.
Bi-directional causality only found in MS and WPI which reflects that only MS and WPI may predict the movements in stock prices and vice versa. This result is in line with Dharmendra Singh (2010) that exhibited the bi-directional causal relationship. The result of money supply is *inconsistent* with Toda and Yamamoto (1995) and Ali *et al.* (2010), who found no causal relationship between money supply and stock prices. Similarly, our result of WPI is *inconsistent* with Ashish Kumar (2011) and Ali *et al.* (2010).

No causal relationship was found between the IPI, IR, X and SPK. These results are *consistent* with Ali *et al*. (2010) for IPI and Toda & Yamamoto, (1995) for IR. But these results are *inconsistent* with Dharmendra Singh (2010), Agrawalla and Tuteja (2008), Chakra arty (2005), Nishat and Shaheen (2004), Pethe (2000) and Toda and Yamamoto (1995) that showed a causal relationship between industrial production index and stock prices.
The overall results of KSE indicated that through macroeconomics variables, the policy maker may control the stock prices because they act as a leading indicator on stock prices.

7. Conclusion and recommendations

In this paper, the empirical impact of selected macroeconomic variables on stock prices in Karachi Stock Exchange was investigated. For this purpose, the long-run, short-run and causal relationships among the variables were found from January 2001 to December 2010. All data set used in this study was non-stationary at level but stationary at first difference. Nine long-run relationships were found between macroeconomic variables and KSE100 Index. In long-run ER, IPI and X had a negative effect on stock prices while FER, IR, M, MS and WPI had a positive impact on stock prices. The analysis of VECM described the two error correction terms, *Vecm1 (-1)* and *Vecm2 (-1).* Only first error correction term showed the speed of adjustment towards the equilibrium path. From the results of Granger Causality Test, it was analyzed that ER, FER, M showed unidirectional causality, MS and WPI showed Bidirectional causality while IPI, IR and X not showed any causality.

From the above findings, it can be scrutinize that the government should adopt suitable policies to monitor the economic activities and capital market of Pakistan. It is a matter of facts that these variables have discussed in isolation. The real market works on the basis of all these variables . Combined together, there may be a situation, where one variable is neutralizing the impact of any other. This leads us to conclude that stock market's behavior especially in shorter span of time may not follow the academic path, as provided in text-books.
As a result, it was recommended that monetary managers should adopt suitable monetary measure to control the inflation, so that the volatility of the stock market can be reduced. The increase in Industrial production can play significant positive role in development of the capital market of Pakistan. Thus, it is recommended that authorities should formulate such a policy which promotes industrial production and then stock prices will increase, automatically. SECP should keep a closer eye on the functioning of stock markets and bring more reform to boost up the investor's confidence and availability of new products in the stock market.

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