The Dynamics of Macroeconomic Forces and Stock Market Performance – An empirical Analysis

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Abstract

The study focuses developing a multifactor macroeconomic variable model and examine its impact on the performance of Pakistan Stock Market (formerly Karachi Stock Market within an APT framework. Monthly time series data of twenty years i.e. from 1996 to 2015 were used. Co integration and error correction model techniques were used to examine both long and short-term relationship. The study reveals that selected variables like GDP, inflation, labor cost, foreign stock market have positive significant impact where as interest rate and un employment have inverse statistical impact on the performance of Pakistan Stock market. Originality of the study is the selection of variables and examining its impact on stock market performance.

Keywords: Macroeconomic variables, Efficient Market Hypothesis, Portfolio Theory, Capital Asset Pricing model, Arbitrage Price theory, Stock Exchange

Introduction

It is evident from the history that Stock Prices and other financial assets have remain an important part of economic activity and play an essential role in the economy of a country. Therefore economists, financial managers and investors watch closely the behavior of an equity market by making its operation free from risk and uncertainty so as to achieve financial and economic stability

While making investment in a stock market, investor has deal with many challenges in order to draw a good return from it. Risk and uncertainty are involved during process of investment in a stock market. If the investment process does not receive any set back then it accelerates economic growth. Once the risk factor is minimized the production cost becomes low which in results boosts the production of goods and services and the employment level gets better. Therefore an equity

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market with a high return and minimum risk signals of sound financial and political economy.

Different studies about the relationship between macroeconomic variables and developed stock markets with in the framework of APT have been conducted since 1970's. Then the focus has been shifted to emerging markets now. Pakistan stock market being an emerging market faces many problems like political instability, terrorism incidents, sectarian violence, etc. For example it crashed in March 2005, in second quarter of 2006, May 2008 and January2009. Pakistan stock market (PSX) was formed on Jan 11, 2016 by the Government through Corporation Demutualization & integration Act, 2012 as a result of merge of Karachi Stock Exchange, Lahore Stock Exchange and Islamabad Stock Exchange. Before this process Karachi Stock Exchange remains one of the oldest stock exchanges of South Asian region. KSE 100 index was launched in November 1991 which comprises of 100 companies with selection based on sector representation and captures about 90 percent of the total free float capitalization of the companies listed on the stock market.

Knowing the pivotal role of risk free operations of stock market and its contribution to the economy, this research paper analyzes the impact of macroeconomic variables on the performance of Pakistan Stock market for the period of 1996 to 2015 by using monthly data. It develops macroeconomic multifactor models for managing risk in view of Arbitrage Price Theory, Efficient market Hypothesis and Rational Expectation Hypothesis. Being source of systematic risk these macroeconomic factors and their effect on stock market performance can be explained through quantitative techniques. Variables used in this study are Economic growth , nominal GDP, inflation, interest rate, un employment, labour force , exchange rates, the US and Pakistan stock market.

Review of Literature

Eugene Fama presented this hypothesis which states that the effect of changes in information are revealed soon in the stock prices so that no one can take advantage of making abnormal profit due to change in information. EMH exists in three forms

Weak form EMH

In this form the present price of a security completely reveals all the past information related to price and no one can make abnormal profit such information. It includes Random walk, Technical analysis and seasonality of the stocks.

Semi strong form EMH

In Semi strong form the present stock price completely reveals all public information including the past price and the information in the financial statements, acquisition, mergers and expectation related to macro economics factors etc.

Strong Efficiency form

In strong form the present price is completely revealed all prevailing information whether private or public in nature.

When whole information is easily readily obtainable then no one can beat another in earning money in financial markets. It shows information content of EMH. Milgram and Stokey(1982), Bloomfiield (2002) and Samuelson (2004)

Expectation plays a significant function in economic activities. People involve in the stock market business make expectations about the future return in a stock market. The theory of Rational Expectation and EMH advocates that expectations in financial markets are equal to optimal forecast by using all existing Testfatsion (2005). The field of financial economics experienced a tremendous change with the development of portfolio theory by Harry Makowitz (1950) and further contribution by Tobin (1958). This theory takes into account as how assets can be combined for a given rate of expected return and how the systematic and un systematic risk involved can be minimized. Further research efforts in financial theory made ways to new theories and equilibrium models like Capital Asset Pricing Model (CAPM, a single factor model) and Asset Pricing Theory (APT, multi factor model). The above models combine the portfolio theory of risk and its return with macroeconomic variables which are source of systematic risk. Also they decide suitable measure of risk for a single asset or portfolio and the market price for it.

Sharpe (1963), Friend and Blime (1970), Fama and Mac Beth (1973) and Durack *et al* (2004) used CAPM in their studies and its validity was analyzed from time to time. Consequently the APT as an alternative to CAPM was developed by Ross (1976). It is viewed as an alternative approach to CAMP and is in more general form. The APT was used from time to time by Roll and Ross (1980), Chen (1983), Chen et al (1986), Priestly (2002), Claire and Thomas (1994), Cheng (1995), etc. However validity of APT has been questioned in studies of Qi and Maddala (1999) and Nawalkha (2007). So exisiting literature so far couldn't identify important macroeconomic variables that are sorces of risk factor in the teory of APT. So still there is a gap of further research in this area.

The APT is an alternative approach to the CAPM that has become the major analytic tool for explaining the phenomena observed in capital markets. There are many multifactor assets pricing models used in the literature. According to Sinclair (1984), all of the multifactor asset pricing models used in the literature are considered as special hypothetical forms of the APT. The APT has been examined in various economies of the world. Examples are: Roll and Ross (1980), Chen (1983), Chen et.al (1986), Priestly (2002), Clare and Thomas (1994), Cheng (1995), Cheng (1998), Chen and Jordan (1993), Merville et al. (2001), Chen et al. (1997), Beenstock and Chan (1986), Cho et al. (1984), an Priestley (1996). There are a number of empirical studies of APT such as: Sinclair (1984); Groenewold and Fraser (1997), Faff and Chan (1998).

There are two versions of APT

Factor Loading Model

Rolls and Ross (1980), Cho *et al* (1984), Chen (1980), Sinclair (1984), Shukla and Trzcinka (1990), Merville *et al* (2001) used factor analysis method by using artificial factors to identify the number of factors and their importance in analyzing the sensitivity of individual securities to sources of systematic risk.

Macro Variable Model

Chen *et al* (19860, Beenstock & Chan (1986), *He and Neg* (1994), Merville *et al* (2001), Shanken and Weinstein(2006), Tursoy(2008), *Humpe and Mcmillan* (2009) used observed factors assuming that stock prices react to news about macroeconomic and financial variables. Various research work lead to the idea that stock market return is affected by different macroeconomic factors.

There are plenty of variables in product market and some associated variables related to expect or analyze the behavior in stock market. Important product market variables are GDP and its components and cyclical indicators of the economy. Such factors are keenly observed in the market due to their significant impact on stock prices.

GDP and Stock Market

GDP is an indicator of an economy and its relation with the stock market is very much evident in the literature. Several studies have analyzed the historical relationship of GDP and Stock return. Such studies are Fama (1990) and Schwert (1990). Fama (1990) investigated the relationship between GDP and the stock market return by taking US data between 1953 and 1987.

Consumption

Despite the fact that it is a statistically sub component of GDP, consumption has been studied also in relation with stock market

return.Chen *et al* (1986) stated that their results were relatively below par with reference to asset-pricing theories based on consumption.

Investment

The relationship between investment and the stock market has been studied through Tobin's q-theory .Examples are Barro (1990), Dow and Gorton (1997) and Branston and Groenewold (2004). One of the most cited papers in this association is Barro (1990). He concluded that variations in stock prices have considerable descriptive ability for investment in the US economy.

Inflation and Stock Market

A general belief is that the stock prices and inflation would show a positive association, and that common stocks are a hedge against inflation. The bond between stock prices and inflation has been studied thoroughly in the literature. Examples are Jaffe and Mandelker (1976), Fama and Schwert (1977), Schwert (1981), and Boudoukh and Richardson (1993). These studies revealed presence of anomalies in relationship of stock return and inflation and there was not enough supportive explanation of the negative relationship in the literature. Many hypotheses about the relationship between inflation and stock prices are available in literature. According to Jorgenson and Terra (2003), well-known theories on stock prices and inflation are: Fisher Effect Hypothesis & Proxy Hypothesis. Money market variables and the stock market show significant relation from literature. Important money market variables are interest rate and money supply. Several empirical studies addressed this relationship. Beenstock and Chan (1988) concluded that money supply and interest rates are a risk factor for stock return. Such researches showed that economists and investors take monetary policy as a state variable that causes an impact on any economic activity. The decisions in the money market are managed or linked by interest rate (price). It also impact in other markets of the economy like in product market through the effect on demand for investment. Interest rate exhibits all available information in case of an efficient market. As a result it do creates an impact on stock market performance.

Equilibrium analysis in the money market suggests two macroeconomic variables, the interest rate and the money supply. Interest rate was used in this model, as it shows the price in the money market. Further there exists a strong relationship between money supply and GDP. Variation in the labor cost has shown to be a risk for the profitability of a firm and for the stock market ultimately. Labor is an important factor of production and stands responsible for firms total cost. Means that high labor cost leads to high cost, resulting in low profit.

Stocks listed in the Pakistan Stock Exchange are a good sample of the productive capacity of the Pakistan's economy. Important variables of labor market are employment, unemployment rate, participation rate, average hourly earnings, average weekly earnings, job advertisements, labor cost, and wage rate. Cheng (1995) proved that the security returns are positively related to the unemployment rate. Park (1997) concluded that employment growth shows the strongest negative effects on stock returns. The firm value is related to economy variables of Pakistan being an open economy. Common open economy variables can be exchange rate, balance of trade, balance of payments etc. Exchange rate means the price of one currency in terms of another one. In terms of EMH exchange rate exhibits all information related to impact on Pakistan's economy from abroad. Or we can say that the status of Pakistani Ruppee shows the economic fundamentals. Jackson and Mclver found that Preferences; GDP differentials; Inflation differentials; Interest rate differentials and; Speculation are important determinants responsible for the demand and supply change in currency. Exchange rate is also affected by change in the preferences of consumers for the product of a country causing change in demand and supply functions of the currency. A sound economy with rising interest rates leads to high exchange rate as they make our stock market attractive for investors. Speculation is another determinant of the exchange rate. The exchange rate (price of the currency) carries the impact of several macroeconomic factors of the local economy and the other economies. Any effect on the supply and the demand side is shown in the price of the currency. Donelly and Sheehy (1996) found that by regressing returns with exchange rates using a randomly selected cross-section of firms unlikely to yield an overall significant exposure coefficient. Grubel's (1968) brought the concept of getting benefit from international diversification. He showed that international diversifications are mathematically correct. Later some other researches contributed to this work by analyzing the stock markets worldwide like Agmon (1972), Agmon (1973), Webb et al. (1995) and Kazi (2009).

Methodology

This research involves conceptual analysis and statistical analysis. For checking weak form efficiency of the stock market autocorrelation function has been performed in a software microfit 4 versions. The sequential properties of all variables have been analyzed through descriptive statistics. To show relationship among variables correlation matrix has been used. Stationarity of the data has been analyzed by Augmented Dickey Fuller test. Johensen & Juselius co integration and vector error correction (VEC) has been used to examine the long and short term relationship. Lastly Granger Causality test has

been used for cause and effect purpose. These tests have been performed with the help of software STATA 12.

Pakistan stock market is the biggest and most liquid market of the country. The KSE-100 is a capital weighted index and consists of 100 companies representing about 90 percent of market capitalization of the Exchange. Monthly data of KSE 100 index for a period 20 years would be taken as a sample. Similarly monthly data of the macro economic variables economic growth, GDP, inflation, interest rates, Labor market, exchange rates and the US stock market like will be used for same time period.

Time series data on most of the economic variables are available in the Database of International Financial Statistics and World Development Indicators. In addition to this, the Bureau of Statistics and State Bank of Pakistan statistics data bases will be used. A few databases of stock prices are also available from the website of Pakistan Business Recorder & Yahoo finance. The choice of the period is based on the availability of the data on the economic and financial variables.

Statistical Analysis

The presence of autocorrelation has an important connotation in terms of the EMH. If the successive changes are correlated then we can say the market is showing weak form inefficient behavior. The KSE 100 index is used in the model to check for the presence or absence of serial correlation. There is overwhelming support for the theories that the stock market is weak form efficient (Fama 1970). However, there are inconsistencies with the EMH.

The following hypothesis is tested using Microfit 4

Null Hypothesis: H_o*:* KSE 100 index returns are not independent – (i.e. autocorrelation)

Alternative Hypothesis: H_1: KSE 100 index returns are independent (i.e.no autocorrelation) the Autocorrelation coefficients of the KSE 100 index was estimated up to order 15. According to Pesaran and Pesaran (1997), the autocorrelation coefficients, the Box-Pierce and Ljung-Box Q statistics can be used to investigate whether there is autocorrelation or not. The Ljung-Box Q statistics is more reliable for small samples. The figures in parenthesis are the probabilities of committing type 1 error i.e. wrongly rejecting the null hypothesis of no serial correlation. A high *p*-value indicates that there is no serial correlation, while, a small *p*-value provides evidence that KSE 100 index return is serially correlated. It is very clear from the table provided below that the *p*-values are quite high indicating an absence of serial correlation. The autocorrelation coefficients from 1 to 15 orders are not large relative to their standard errors. Therefore we reject the null hypothesis and conclude that KSE

100 index returns are independent. The existence of autocorrelation indicates the inefficiency of the market in term of the EMH. Since there is no autocorrelation of the consecutive return of time series data, we can conclude that the Pakistani stock market showing weak form efficient.

Table 1- Autocorrelation Function

Sample period: 1996 to 2015
Variable(s): KSE 100 index
Maximum: .36153
Minimum: -.43090
Mean: .023425
Std. Deviation: .085325
Skewness: -1.2373
Kurtosis - 3: 4.8145
Coef of Variation: 5.4728
Variable KSE 100 index Sample from 1996 to 2015

Order	Autocorre Coeff	Std Error	Box-Pierce	Ljung-Box
1	.031090	.041613	.060683[.840]	.088024[.857]
2	.02356	.051642	.13268[.952]	.12467[.960]
3	.21410	.071656	4.6208[.335]	5.7053[.303]
4	.03956	.072933	4.8013[.544]	3.9001[.530]
5	.20636	.072994	5.0082[.326]	7.1873[.308]
6	.35317	.073785	7.2504[.406]	7.4408[.386]
7	-.16361	.073871	13.4703[.479]	14.9106[.504]
8	.04185	.075707	17.8020[.500]	18.0705[.540]
9	.01120	.075825	18.8365[.223]	19.2965[.197]
10	-.09469	.075834	13.584[.193]	15.1684[.186]
11	-.03050	.076438	13.7663[.246]	14.3525[.414]
12	.031044	.076500	13.9542[.304]	18.5548[.567]
13	-.11062	.076565	16.3425[.531]	17.2399[.593]
14	.05800	.077381	26.9786[.456]	19.8440[.414]
15	.05790	.88356	29.3450[.497]	28.3450[.456]

Descriptive Statistics

The below table shows a summary of some basic statistical measures of data obtained after performing the summarize test. The first column on the left most side of the table show the variables used in this study. It is clear from the table that there are total nine variables used in this study. The second column of the table shows that there are total 240 observations included in this study. Third column shows the mean values calculated from sample for each and every variable. Then we have the standard deviation for each variable and minimum and maximum values in each observation.

Table 2 - Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
kse100index	240	6589.297	4923.715	841.7	15378.89
gdp	240	6.937208	2.76853	1.01	15.4
ecogrowth	240	.49395	.3811063	.038	1.78
exchrate	240	4.157917	2.739765	.12	22.34
sp500	240	1241.984	348.3221	500.71	2067.56
interestrate	240	.0244542	.0027953	.02	.029
unemployme~e	240	1.690792	1.092657	.19	4.33
laborforce	240	3.595833	1.706247	1	8
inflation	240	7.956917	3.407641	1.01	20.3

Correlation Matrix

The following is an output table presented by STATA 12 for the analysis of correlation between variables under study. This table depict that the relation is symmetric between variables.. It means that the range of correlation coefficient lies within -1 to +1. It is very obvious from the table results that except economic growth and interest rate, all other variables are positively correlated with KSE 100 index. On the other hand GDP, Exchange rate, SP 500, unemployment ratio labor force and inflation have direct relationship with KSE 100 index. Similarly this table shows the correlation between other pairs of variables as well. The second column shows the relationships between gdp and economic growth along with other variables. The GDP and exchange rate are directly related with each other such that 8% change in GDP will change the he exchange rate by 7.6% i.e. if there is an increase of 8% in GDP, the GDP and SP 500 index are also directly related. IF GDP increase by 20% the SP 500 index will change by 8.4%. Interest rate and GDP are negatively related i.e. an increase in Interest rate will cause a decrease in GDP and vice versa. GDP and labor force are also directly related such that a change 22% in GDP will change the Labor force by 21%. The table shows that inflation increases the GDP in a way that an increase of 32% in inflation will increase GDP by 0.08%.Economic growth and exchange rates are directly related such that an increase of 13% in economic growth will increase the exchange rate by 7%. SP 500 index is inversely related with economic growth. The table shows that interest rate, unemployment ratio and inflation negatively affect the economic growth of a country. Note that their signs are negative shows that as interest rate increases the ratio of unemployment tend to decrease in a country as suggested by the negative sign for this pair of variables. On

the other hand an increase in interest rate leads to increase in inflation and vice versa. Correlation table is given at Annexure A

Test of Stationary

A time series data must have to be checked for the presence or absence of unit root. In simple words we must look in for the stationary of a time series data. For this purpose widely used analysis applied to most of the sample studies is the Augmented Dickey Fuller unit root test. This test holds the null hypothesis that there present a unit root in the sample data. While the alternate hypothesis is that the data is stationary and there is no unit root problem. An ADF value is always expressed in negative terms. The closer the value to negativity increases the probability of rejecting the null hypothesis. The following ADF equation has been subjected for the test

$$\Delta yt = \gamma + \delta\, xt + \alpha yt\text{-}1 + \beta 1\, \Delta yt\text{-}1 + \beta 2\, \Delta yt\text{-}2 + \ldots\ldots + \beta p \Delta yt\text{-}p + vt,$$

Where, γ denotes constant α, β and δ denotes the coefficients or parameters, p denotes the lag order while v denotes error term. The results of an ADF test have been shown in Table 5.4. The lag order used here is 1.The ADF test statistics value for each variable has been shown and compare with the critical value at 5% level of significance. Here the critical value is -2.88. All variables are having fewer values i.e. more negative values than the critical value at the order of 1. So we reject the null hypothesis stated earlier that there present unit root in data and concluded that the data is free from unit root at the order of 1.

Table 4 - Results from the ADF test

Variable name	Test statistics value	Critical value
KSE 100 index	-16.927	-2.881
GDP	-17.943	-2.881
Economic growth	-22.943	-2.881
Exchange rate	-23.586	-2.881
S&P 500 index	-14.889	-2.881
Interest rate	-31.474	-2.881
Un employment	-20.468	-2.881
Labour Force cost	-21.249	-2.881
Inflation	-19.533	-2.881

Level of significance 5% for critical value

The ADF test has been performed in order to check the for the unit roots in data. It is shown in the above table that KSE 100 index was not stationary at level. By taking the first difference of KSE 100 index, it becomes stationary. The critical value is -2.881 at 5% level of significance. The test statistics value should be greater than critical value decided. We can see from the above table that the test statistics value is 16.972. Secondly the Mackinnon p value is less than 0.05. In this way

we can say that KSE 100 index is integrated of order 1 or *I (1).* The test statistics value is -17.943 compare to its critical value -2.881. The p value is 0.000 i.e. less than 0.05. So we conclude that gdp is also integrated of *I (1).* The ADF test of economic growth shown in the above table has also been performed in the similar way. It can be seen from test statistics and p values that economic growth also follow the same order i.e. I (1) for its stationary. Exchange rate also follows the same pattern as other variable did in this data. Test statistics is -23.586 which is much larger than the critical value at 5% level of significance. The p value confirms that the exchange rate is integrated of order 1. A similar result can be observed in the table below for SP 500 index. Its test statistics value -14.889 and p value is 0.0000. The interest rate also shows the same pattern i.e. it is integrated of order 1. The first difference of interest rate gives -31.474 test statistics value and a p value of 0.0000.

Lag selection

The varsoc command is used for the selection of lag level. It is used to identify the optimal lag level to be used in the co integration test. The below table shows an output result for the varsoc test. Total no of observation used 236. The AIC, HQIC, SBIC criteria shows that the maximum lag selection for the co integration test is 1 lag. Results from VARSOC table is given at Annexure B

Co integration

Once it has been determined that the time series data is of first order integration the next step is to perform the test for co integration and identify which equation(s) are co integrated and then to estimate the suitable co integrating vectors for our selected equation. If co integration relationship exists then the variables are at equilibrium in the long run. Also they are each $I(1)$ then there is a possible linear combination of them at $I(0)$. Johansen and Juselius (1990) approach has been used for this purpose. This method makes the use of maximum Eigen and trace value test statistics to verify how many co integrating vectors are present there.

The equation below was tested using J& J (1990) approach.

$$logKSE\ 100 = \alpha + \beta 1\ logGDP + \beta 2\ logE\ growth + \beta 3\ log\ exch\ rate + \beta 4 log\ S\&P + \beta 5\ log\ Interest\ rate + \beta 6 logUnemployement + \beta 7 log\ labor + \beta 8\ log\ Inflation + \epsilon$$

The table below is an output table for integration. The first line in the top shows the command used for performing the test. Total number of observations are 239 i.e. 1 lag is used. There are two parts of the table. The first part shows the test statistics compared to the critical values at

5% level of significance. For the maximum ranks 0 the trace statistics is 8.22.50 i.e. greater than the critical value of 192.89. For maximum rank 1 the trace statistics is 5.7819 is also greater than 156.00. The rank of the test is where the trace statistics is less than the critical value provided in the table. It can be observed that the rank of our co integration test is 7; where trace statistics is 11.23 as compare to 15.41. Referring to the below output table, based on Trace statistics i.e. first section of the table, we can say that there are seven co integrating equations. The second part is the maximum Eigen values criteria which also serve the same purpose. It also uses the rank for the identification of co integration equations. The maximum Eigen value also confirms the same results. In this way we have seven co integrating vectors present in our model. So we can say that these variables have long run relationship with each other. *Table 6 - Results from co integration test given at Annexure C*

Vector Error Correction Model

At time when co integration equation is identified by Johnson co integration test, we can move further to perform VECM. Had there been no co integration, we use VAR test. Before performing the VECM, it is necessary that we identify the optimum lag level. For this purpose the 'varsoc' test has been performed. The varsoc test shows that the four important criterion i.e. FPE, AIC, HQIC, SBIC suggest that we should take only one lag. Therefore we will select one lag while performing the test of VECM. VECM is used for the deviation present between the variables in the long run. The co integration equations identified, confirmed that though there is an arbitrary movement between variables in the short run, yet they will return to equilibrium in the long run. So a long run relationship exists between the variables. What will be the speed to attain the equilibrium if the two variables move far from each other? This speed will be decided by the VECM model. In fact VECM is used to rectify the short term deviation between variables over the long term relationship with the help of co integration. *Table. 7 - Results from VECM test given at annexure D*

The table has been divided into three parts. The first part is shown in the above table. The top first part of the table shows the command used for VECM test. There are 239 observations used for the table i.e. confirming the one lag value. The AIC value is 40.26, while HQIC shows a value of 40.41 and SBIC shows 40.64.

Second part of VECM

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_kse100index						
_ce1						
L1.	.0000803	.0002763	0.29	0.771	-.0004612	.0006217
_cons	2.520345	195.7063	0.01	0.990	-381.0569	386.0976
D_gdp						
_ce1						
L1.	-7.11e-07	7.43e-07	-0.96	0.338	-2.17e-06	7.45e-07
_cons	.489232	.5263908	0.93	0.353	-.5424749	1.520939
D_ecogrowth						
_ce1						
L1.	-3.32e-07	1.45e-07	-2.29	0.022	-6.16e-07	-4.75e-08
_cons	.2254028	.1027034	2.19	0.028	.0241078	.4266979
D_exchrate						
_ce1						
L1.	-4.31e-07	1.08e-06	-0.40	0.690	-2.55e-06	1.69e-06
_cons	.2891694	.765622	0.38	0.706	-1.211422	1.789761
D_sp500						
_ce1						
L1.	-.0000137	.0000129	-1.07	0.286	-.0000389	.0000115
_cons	14.65738	9.108152	1.61	0.108	-3.194271	32.50903
D_interestrate						
_ce1						
L1.	1.63e-08	8.39e-10	19.45	0.000	1.47e-08	1.80e-08
_cons	-.011068	.0005946	-18.61	0.000	-.0122334	-.0099027
D_unemploymentrate						
_ce1						
L1.	-4.56e-07	3.32e-07	-1.37	0.169	-1.11e-06	1.95e-07
_cons	.3141531	.2353104	1.34	0.182	-.1470469	.7753531
D_laborforce						
_ce1						
L1.	-1.23e-07	5.86e-07	-0.21	0.833	-1.27e-06	1.03e-06
_cons	.0877069	.415483	0.21	0.833	-.7266249	.9020386
D_inflation						
_ce1						
L1.	-7.62e-07	7.53e-07	-1.01	0.312	-2.24e-06	7.14e-07
_cons	.5441261	.5333123	1.02	0.308	-.5011469	1.589399

Third Part of VECM

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	8	421.7951	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
kse100index	1	.	.	.	.	.
gdp	-3758.356	3854.094	-0.98	0.329	-11312.24	3795.529
ecogrowth	114342.3	27466.82	4.16	0.000	60508.31	168176.3
exchrate	-13428.42	3850.332	-3.49	0.000	-20974.94	-5881.913
sp500	-33.93132	36.73202	-0.92	0.356	-105.9248	38.06211
interestrate	-7.50e+07	3723986	-20.14	0.000	-8.23e+07	-6.77e+07
unemploymentrate	-13286.96	9572.423	-1.39	0.165	-32048.56	5474.648
laborforce	-17147.12	6240.266	-2.75	0.006	-29377.82	-4916.422
inflation	7604.89	3607.773	2.11	0.035	533.7848	14676
_cons	2596720	.	.	.	.	.

The above table is the 3rd part of the VECM table and most important part of the VECM table. Please note that for every variable we have a ce1 value. Basically these are the error correction terms or one can called these the speed of adjustment towards equilibrium. For gdp the coefficients value is -3758.35 which shows the degree of correction towards the equilibrium point. Similarly Economic growth, exchange rate, SP 500 index, interest rate, unemployment rate, labor force and inflation have coefficient values of 11432,13428,-33.93,-7.50e07,-13286,-17147,7604 respectively, which show their respective speed of attaining the equilibrium. From the table the t values have been observed. The individual significance of an independent variable can be represented by its T statistics. From significance we mean that a particular independent variable is having a major and meaningful impact on dependent variable. To show such relationship, the null hypothesis is that the independent variable has no significant impact on dependent variable with an alternative that there exists a significant impact. This statement can be represented as follow.

$$\beta = 0, H_0$$

$$\beta \neq 0, H_1$$

If the T calculated value of an independent variable is greater than its standard T distribution or T tabulated value then such an independent variable is said to be having significance impact on dependent variable and vice versa. Looking at the T values in the table one can safely

conclude that economic growth, exchange rate, interest rate, inflation, labor force have individual significance relationship with KSE 100 index as confirmed by their respective T values. In this case we will reject the null hypothesis stated above for these variables and concluded that these independent variables significantly affect the KSE 100 index

We can also test the individual significance of an independent variable by its p value, which shows the exact probability of committing type 1 error. In fact p value rule is more reliable and followed by researchers when presenting their regression results. Interpretation of P values depends on the level of significance settled by the researcher prior to perform regression analysis. The most widely followed level of significance is 1%, 5% and 10%. Here again the null hypothesis stated that there is no significant impact of independent variable on dependent variable. Closely observing the p values of independent variables present in Table 5.6, it can be opined that economic growth, exchange rate, interest rate, inflation, labor force are significant at 5% level of significance.

VAR and Granger Causality

In order to look for the causality between variables, the Granger approach has been followed. This approach identify that is there a causal relationship between the variables under study? The procedure of this approach is that first we have to run the VAR test and after obtaining the VAR results, then the Granger test has been applied. *Table 8. VAR test results given at Annexure E*

Table shows output result of VAR test. It shows that there are two lags values used along with every individual variable. In the table the LI and L2 lag values of KSE 100 index are positive and significant with KSE 100 index. Similarly S&P 500 with two lags i.e. L1 and L2 are significant with KSE 100 index. Note that S&P 500 index L1 coefficient is positive while L2 coefficient is negative.

The table below shows the condensed results of the Granger Causality test. (Detail results are provided in the appendices). Here the test has been performed to check the null hypothesis that there is no causal relationship between KSE 100 index and the rest of the explanatory variables or in simple words GDP, Eco growth, Exchange rate, SP 500, interest rate, unemployment rate, labor force and inflation do not have causality with KSE 100 index. The results of chi^2 probability show that we do not reject our null hypothesis.

Table 9 - Granger Causality Test
Results

Equation	Excluded	chi2	df	Prob > chi2
KSE100index	GDP	2.35	2	0.309
KSE100index	EcoGrowth	1.4463	2	0.485
KSE100index	Exchrate	.0493	2	0.976
KSE100index	SP500	9.9297	2	0.007
KSE100index	InterestRate	.0417	2	0.979
KSE100index	Unemploymentrate	2.3385	2	0.311
KSE100index	Laborforce	4.1703	2	0.124
KSE100index	Inflation	2.4869	2	0.288
KSE100index	ALL	30.426	16	0.016

Conclusion

The main purpose of this paper was to examine and investigate in which way and to what degree the chosen macroeconomic variables influence the stock market return in Pakistan? For this purpose, different tests have been conducted. Though, there are many events which can affect stock market return, based on our proposed model, the key determinants of the stock market return are found to be the macroeconomic variables.

The very first question of this paper was to analyze whether cumulative stock return is affected by the deviation in: GDP, Economic growth, Exchange rate, interest rate, S&P 500 index, Labor cost, CPI, and unemployment rate. This objective has been achieved. These variables do have an important relationship with stock market return. Among these variables, economic growth, exchange rate, labor force cost,and inflation are found to be statistically significant, the rest of variables are found to be statistically insignificant. The second question addressed in this thesis is whether the Pakistani stock market shows weak form efficiency. For this purpose the KSE 100 index has been chosen as dependent variable in the equation. The Box-Pierce and Ljung-Box Q statistics techniques have been studied. The results found no as such evidence of autocorrelation. Since there is no autocorrelation of the consecutive return of time series data, hence it can safely be concluded on the basis of these results that Pakistani stock market shows weak form of efficiency. Thirdly this research paper contributed to the literature in the following areas:

- A broad qualitative analysis of interaction between stock market return and the selected macroeconomic variable.
- A special set of macroeconomic factors are selected by carefully interpretable relationship rather than randomly selected variables.
- A comprehensive quantitative analysis has been applied to test the effects of macroeconomic factors on the stock market return. The applied quantitative model has considered the past relationship between stock market returns and macroeconomic factors.

Some missing figures have been found for different variables in the available data set. This problem has been overcome by taking the mean value of the previous and succeeding period values. As mentioned, KSE 100 index has been used as a bench mark for the representation of stock market, but we all know that KSE 100 index does not include all companies of Pakistan Stock market.

As discussed earlier, the current study implies KSE 100 index as a measure of stock market, other studies can consider some indices of the stock market etc. This study analyses the relationship with the framework of the EMH and the Rational Expectations Hypothesis; however it can be extended into the context of other theories in economics such an option framework, life cycle hypothesis: international arbitrage theory. Moreover, putting this relationship over the much longer time period could yield a significant result. The current study implies a set of some very important variables; however there may be some other important variables like using other money market instrument in place of ten years bond which can be considered for future studies

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Annexure A

Table 3 - Correlation

```
. correlate kse100index gdp ecogrowth exchrate sp500 interestrate unemploymentrate laborfo
> rce inflation
(obs=240)
```

	kse100~x	gdp	ecogro~h	exchrate	sp500	intere~e	unempl~e	laborf~e
kse100index	1.0000							
gdp	0.2876	1.0000						
ecogrowth	-0.0799	0.0648	1.0000					
exchrate	0.0762	0.0867	0.1369	1.0000				
sp500	0.8437	0.2099	-0.0663	0.1614	1.0000			
interestrate	-0.0870	-0.1209	0.0137	-0.0873	-0.0730	1.0000		
unemployme~e	0.1442	0.0436	-0.0350	-0.0536	0.1118	-0.1264	1.0000	
laborforce	0.2118	0.2204	0.1290	0.0004	0.1710	-0.0631	-0.0329	1.0000
inflation	0.3213	0.0888	-0.0211	0.1281	0.5438	0.0194	-0.0714	0.1240

	inflat~n
inflation	1.0000

Annexure B

Table 5 - Results from VARSOC

```
. varsoc kse100index gdp ecogrowth exchrate sp500 interestrate unemploymentrate laborforce
>  inflation

   Selection-order criteria
   Sample:  5 - 240                              Number of obs      =       236
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-5450.78				1.0e+09	46.2693	46.3226	46.4014
1	-4446.28	2009	81	0.000	401353*	38.443*	38.9755*	39.764*
2	-4382.86	126.84	81	0.001	467081	38.592	39.6037	41.1018
3	-4332.08	101.56	81	0.061	607625	38.8481	40.3391	42.5468
4	-4278.53	107.09*	81	0.028	777112	39.0808	41.051	43.9683

```
   Endogenous:  kse100index gdp ecogrowth exchrate sp500 interestrate
                unemploymentrate laborforce inflation
    Exogenous:  _cons

.
```

Annexure C

Table 6 - Results from co integration test

Johansen tests for cointegration

Trend: constant — Number of obs = 239
Sample: 2 - 240 — Lags = 1

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	9	-4907.5208	.	822.5095	192.89
1	26	-4785.3654	0.64020	578.1987	156.00
2	41	-4712.1257	0.45821	431.7193	124.24
3	54	-4647.6774	0.41685	302.8227	94.15
4	65	-4596.9269	0.34603	201.3216	68.52
5	74	-4560.1498	0.26491	127.7675	47.21
6	81	-4527.5323	0.23887	62.5324	29.68
7	86	-4501.8846	0.19316	11.2371*	15.41
8	89	-4497.6956	0.03445	2.8591	3.76
9	90	-4496.2661	0.01189		

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	9	-4907.5208	.	244.3107	57.12
1	26	-4785.3654	0.64020	146.4794	51.42
2	41	-4712.1257	0.45821	128.8966	45.28
3	54	-4647.6774	0.41685	101.5011	39.37
4	65	-4596.9269	0.34603	73.5542	33.46
5	74	-4560.1498	0.26491	65.2351	27.07
6	81	-4527.5323	0.23887	51.2953	20.97
7	86	-4501.8846	0.19316	8.3780	14.07
8	89	-4497.6956	0.03445	2.8591	3.76
9	90	-4496.2661	0.01189		

Annexure D

Table. 7 - Results from VECM test

```
. vec kse100index gdp ecogrowth exchrate sp500 interestrate unemploymentrate laborforce in
> flation, lag (1)

Vector error-correction model

Sample:  2 - 240                                        No. of obs      =       239
                                                        AIC             =  40.26247
Log likelihood = -4785.365                              HQIC            =  40.41487
Det(Sigma_ml)  =   1990717                              SBIC            =  40.64066

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_kse100index          2     890.384   0.0045    1.05944   0.5888
D_gdp                  2     2.39486   0.0039   .9191744   0.6315
D_ecogrowth            2     .467259   0.0216   5.235084   0.0730
D_exchrate             2     3.48327   0.0007   .1588761   0.9236
D_sp500                2     41.4384   0.0212    5.14389   0.0764
D_interestrate         2     .002705   0.6148   346.5128   0.0000
D_unemployment~e       2     1.07057   0.0079   1.893915   0.3879
D_laborforce           2     1.89028   0.0002    .045414   0.9775
D_inflation            2     2.42635   0.0044     1.0566   0.5896
------------------------------------------------------------------
```

Annexure E

Table 8. VAR test results

```
. var KSE100index GDP EcoGrowth Exchrate SP500 InterestRate Unemploymentrate Laborforce In
> flation

Vector autoregression

Sample:  3 - 240                                        No. of obs      =       238
Log likelihood = -4412.457                              AIC             =  38.51644
FPE            =  433052.8                              HQIC            =  39.52189
Det(Sigma_ml)  =  102598.2                              SBIC            =  41.01123

Equation             Parms      RMSE     R-sq      chi2      P>chi2
------------------------------------------------------------------
KSE100index             19       866.6   0.9714   8080.338   0.0000
GDP                     19     2.18323   0.4299   179.4913   0.0000
EcoGrowth               19      .361336   0.1508   42.27312   0.0010
Exchrate                19       2.6498   0.1383   38.21234   0.0036
SP500                   19     40.3282   0.9872   18411.79   0.0000
InterestRate            19      .002637   0.1750   50.47801   0.0001
Unemploymentrate        19       .93088   0.3336   119.1684   0.0000
Laborforce              19     1.55261   0.2381   74.36317   0.0000
Inflation               19       2.192   0.6153   380.6817   0.0000
------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
KSE100index  |
  KSE100index|
         L1. |   .7403344   .0743674     9.96   0.000      .594577    .8860917
         L2. |   .2312006   .0753155     3.07   0.002     .0835849    .3788163
             |
         GDP |
         L1. |   34.62511     26.266     1.32   0.187    -16.8553    86.10552
         L2. |  -36.8654    26.27483    -1.40   0.161   -88.36312    14.63231
```

EcoGrowth						
L1.	99.43226	153.4879	0.65	0.517	-201.3985	400.263
L2.	-170.6852	152.2794	-1.12	0.262	-469.1474	127.777
Exchrate						
L1.	-1.029097	21.01158	-0.05	0.961	-42.21105	40.15285
L2.	-4.393656	21.29626	-0.21	0.837	-46.13357	37.34625
SP500						
L1.	4.90168	1.617256	3.03	0.002	1.731918	8.071443
L2.	-4.504922	1.632332	-2.76	0.006	-7.704235	-1.30561
InterestRate						
L1.	-3767.879	20788.46	-0.18	0.856	-44512.5	36976.74
L2.	951.3713	20630.22	0.05	0.963	-39483.11	41385.85
Unemploymentrate						
L1.	35.87849	60.0357	0.60	0.550	-81.78932	153.5463
L2.	-91.444	60.33364	-1.52	0.130	-209.6958	26.80776
Laborforce						
L1.	-40.3239	36.70068	-1.10	0.272	-112.2559	31.60812
L2.	-46.08128	35.92883	-1.28	0.200	-116.5005	24.33793
Inflation						
L1.	37.50651	26.02979	1.44	0.150	-13.51094	88.52396
L2.	-10.18564	26.12099	-0.39	0.697	-61.38185	41.01056
_cons	65.50979	914.5819	0.07	0.943	-1727.038	1858.057