*Full Length Research Paper*

# The relationship between stock market volatility and macroeconomic volatility: Evidence from Pakistan

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This study is based on examining the relationship between stock exchange market volatility and macroeconomic variables volatility with respect to Pakistan. To measure this time series relationship for Pakistan exponential generalized autoregressive conditional heteroskedasticity (EGARCH) and lag-augmented vector autoregression (LA-VAR) models were used. It was found that there is a positive relationship of consumer price index (CPI) and foreign direct investment (FDI) with stock market; however, exchange rate (ER) and T-bill rate (TBR) are inversely related to stock market volatility. On the other hand, we found strong evidence that there is a bilateral relationship of FDI and ER with stock prices, while a unidirectional relationship was found between TBR and stock market prices, with the direction from stock prices to treasury bills interest rate. However, a significant causal relationship not found between CPI and stock prices. The analysis of this study reveals that the stock market of Pakistan is relatively less efficient as compared to US and other developed economies of the world.

**Key words:** Pakistan, macroeconomic volatility, stock market volatility, exponential generalized autoregressive conditional heteroskedasticity (EGARCH), lag-augmented vector autoregression (LA-VAR) model.

## INTRODUCTION

In an economy, stock market plays a vibrant role in assessment of economic position of the country. Increasing trends in stock returns gives an indication of higher profitability of firms and higher profitability of firms leads towards overall economic growth and vice versa. Investors try to discover the variables that may assist to predict the stock prices. By discovering these variables, they can manage their investments and portfolios to invest in those securities or portfolios which provide higher returns with lower risk. Macroeconomic indicators serve them as a reliable predictor of stock market if they use macroeconomic news efficiently and effectively. On the other hand, stock market provides an indication of economic condition and the Government bodies can control the economic condition by paying attention on fluctuations of stock market of an economy. The relationship between stock market and macroeconomic indicators has been a hot issue for economic and academic researchers. Stock market in today's world is

recognized as most important component of economic and political development of a country. The global financial crises affect badly to the world's major stock markets, besides that, these crises also shaken the stock markets of emerging economies. Variation in stock price during a given period is called stock return volatility. This volatility has had great impact on country's economic condition, policy makers, financial managers, firms, investors and on other stakeholders. So it would be worthwhile to understand the causes and determinants of this volatility. Macroeconomic variables considered as the powerful tool to forecast the volatility of stock market all over the globe.

This study is based on most recent data of economic condition of the country and includes the macroeconomic variables like consumer price index (CPI) as economic activity of the country. T-bills interest rates (12-months) [1], foreign direct investment (FDI) [2] and money supply

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[1] Monthly T-bills interest rates are available at SBP economic data (3months 6 months and12-months).
[2] FDI foreign direct investment data also taken from SBP economic data the monthly data is taken for analysis.

(M2)[3] included as a macroeconomic variables.

In Pakistan, macroeconomic news has great impact on stock exchange. The political condition of Pakistan is crippling and unpredictable, the stamp of terrorism also have a significant impact on stock market. It is necessary to discuss some other factors that have impact on stock market, problem of power shortage leads towards deprivation of industrial sector, unemployment increasing day by day and inflation rate is also on its peak levels ever in the history of the country, corruption and rising trends in petroleum prices. Pakistan it has three stock exchanges, "Karachi stock exchange (KSE), Islamabad stock exchange (ISE) and Lahore stock exchange (LSE)". Karachi stock exchange is the largest, oldest and most liquid stock exchange of the country. It was formed in September 18, 1947. Currently it has 651 local and foreign listings of companies as well and 4-indices KSE-all share index, KSE-100, KSE-30 and KMI-30. It has listed capital of US $ 9.65 billion and market capitalization of US $ 26.48 billion[4]. Local companies which are listed on KSE are divided into different sectors to which they relate, and present the representation of almost all sectors of the economy. In 2002 KSE was declared as best performing stock exchange in the world. In the period of 2005 to 2008 KSE showed best performance and KSE-100 index crossed the limit of 14000 which is highest ever in the history of KSE.

The government of Pakistan has taken various initiatives to strengthen the financial sector of the country to stable and improve the economic situation. This study is based on examining the relationship of KSE-100 index with macroeconomic variables. Nishat and Shaheen (2004) tried to explore the relationship between equity market returns volatility and change in macroeconomic indicators and concluded that in Pakistan the industrial production is found to be one of the most important forecaster of equity prices, further, they also concluded that inflation has a negative impact and macroeconomic variables in Pakistan has an significant impact on stock market. Mookerjee and Yu (1997) reported that in Singapore there is a significant relationship between M2 and foreign exchange reserve and stock prices. Maysami and Koh (2000) also observed that the interest rate and exchange rate have a significant impact on stock market of Singapore in the long-run. Kwon et al. (1997) studied the relationship between stock market volatility and the volatility in macroeconomic variables in Korea, money supply, exchange rate, oil prices, and dividend yield are considered the most important predictor of stock market variation on behalf of macroeconomic variables. Agrawalla (2006) documented that better performing stock market is very beneficial for economic activity, it attract the FDI (foreign portfolio investment) and FPI,

(foreign portfolio investment), and provide confidence to investors and portfolio managers to invest in diversified portfolios and securities from where they can get maximum profit with minimum risk.

## LITERATURE REVIEW

Macroeconomic volatility and its effects on stock market is a very well-off topic and enormous studies have been done to measure the relationship between stock market variability and macroeconomic variability in the past era because of the rapid instability in the global stock markets, but in context of Pakistan we are unable to trace back too much studies on this topic and still it is very demanding to find out the factors causing the instability of stock market in Pakistan[5].

Xufang (2010) examined the association between China stock market and macroeconomic indicators like interest rate, GDP and inflation. The methodology of this study was based on two steps; in first step for estimation of volatility (EGARCH) model is used for each variable. And the second step was performed using LA-VAR model for examining the causal relationship between the volatility of stock market returns and macroeconomic variables. In the first instance, researcher examined no causal relationship between the volatility in GDP and in the volatility of stock market. Secondly it was interpreted that there was a two-sided causal relationship between equity market volatility and inflation volatility. Thirdly, the researcher showed the findings of causality test that there is a unidirectional causality relationship between interest rate volatility with the direction from stock prices to interest rate. In addition to these findings, the researcher also explored that the Chinese market does not replicate the changes of macroeconomic variables like the interest rate and GDP but except for inflation rate.

Zafar et al. (2008) investigated the influence of interest rate variations on volatility in KSE for the period of January 2002 to June 2006. They have also used two glossary autoregressive conditional heteroskedasticity (GARCH) models to find out the results. In model 1, the researchers estimate excludes interest rate changes and similarly in model 2 they estimated mean and variance by including the interest rate. The study exhibited that variance parameter and market returns are behaving in similar manners in both models under contemplation. They explained their study based on US and Korean equity markets and found that conditional equity market returns have significant but negatively co-related with the interest rate. Finally, the researchers concluded their study in the way that the stock market in Pakistan can be easily predicted by carefully analyzing trends in interest rate. In the same period, Adjasi et al. (2008) found a

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[3] M2 the monthly data about M2 is also taken from SBP economic data for our analysis.
[4] This information about facts and figures is taken from the Karachi stock exchange official web site.

[5] Studies are done to investigate the relationship between macroeconomic indicators and stock market in Pakistan but in this we use the economic indicators which were rarely used previously.

positive and significant relationship between macroeconomic indicators volatility and equity market volatility in Ghana. They further explained a bilateral relationship between stock market volatility and consumer price index. They had also found a negative and statistically significant relationship between volatility in stock market and treasury bills.

Adjasi and Biekpe (2005) carried out an empirical research through collecting the data from seven African countries and tried to explore the relation between equity market returns and exchange rate movements and concluded with encouraging results. The researcher elaborated the co-integration test and which showed different results in for different countries, test results showed that in short run appreciation of local currency reduced the market returns contrarily they also found that exchange rate diminution in the long run caused upturns in stock market prices in some parts of Africa.

Mishra (2004) investigated the causal relationship between exchange rate and stock market returns and found no evidence of Granger causality between exchange rates and the stock returns. Further he explained that exchange rate, stock returns, interest rate and demand for money are associated to each other; however, there is no constant relationship among them.

Foreign direct investment and worker's remittances are also important variables which may cause the stock market returns in developing countries. Wang (2010) concluded that, in developing countries, it is important to explore the impact of foreign direct investment on exchange rate and stock returns. To measure this relationship they use three stage foreign direct investment, exchange rate and stock returns of Taiwan's context. The main tests they use to measure the impact of direct investment are Granger causality, ordinary least squares (OLS) and GARCH models and present the results that the foreign portfolio investment has positive relationship with stock market return of Taiwan. In addition to this, they also concluded that foreign direct investment also has positive relationship with exchange rate of the country.

Al-Nasser and Gomez (2009) declare foreign direct investment as an important element of globalization. They further concluded that foreign direct investment can leads toward a number of macroeconomic changes in the host country. To assess this relationship, the author takes 15 Latin American countries as a sample and used a pooled data from 1978 to 2003. The main findings of this paper were FDI is positively correlated with stock market development and with the level of private credit which are offered by banks.

Fritz et al. (2005) use regression analysis to measure the relation of levels of domestic capital formation and outbound FDI of comparatively larger sample of countries for the period of 1980s to 1990s. In their findings they stated that, it might be a natural assumption that the FDI in the country came at the cost of domestic investment.

Errunza (1983) tried to explore the long run impact of foreign capital inflows and on stock market development and concluded the study with positive results. Boubakari and Jin (2010) studied the five Euronext countries and used the data of macroeconomic indicators and stock market for the period of 1994 to 2008. This study uses Granger-causality test and results of the study shows that the stock market growth and economic growth have long-run relationship.

Interest rate is also considered to have relation with stock market return the researchers have the view that the change in interest rate has an impact on value of the share of company and return. Many researchers found the positive correlation between interest rates and stock market returns. Modigliani and Chon (1978) considered interest rate as one of the most significant determinants of the stock prices, but they did not concluded it with confidence and suggest that interest rate changes will directly and significantly affect the stock market. And some of the researchers of this matter reports negative correlation between stock market returns and interest rates. Ndri (2008) concluded that volatility in interest rates and equity market returns are significantly and negatively correlated.

Exchange rate is also attracted the concentration of researchers and academics as an important predictor of stock market returns. In this age of globalization developing countries faces the dramatic ups and down in their exchange rate and this variation has significant relationship with the stock market returns. One of the most common and early quoted study on relationship between exchange rate and stock return was conducted by Frank and Young (1972) and found no significant relationship between exchange rates and equity market prices. On the other hand Soenen and Hennigan (1988) present totally opposite results and exhibited significant negative relationship between exchange rate and stock market returns. Jorion (1990) somehow reported the moderate kind of positive relationship between these two variables. Ghartry (1998) explore the relationship between exchange rate and stock market returns and find out statistically significant relationship between exchange rate and equity market prices. In recent studies, the researchers are unable to obtain any short run relationship between exchange rate and stock returns but they found significant relationship in the long run. Kutty (2010) conducted a research to measure the relationship between these two variables and Granger causality test was used for this purpose. The author shows that stock prices lead exchange rates in the short run, and found no evidence in support of long run relationship between these two variables. Bahmani-Oskooee and Sohrabian (1992) also reported that in the US, there is no long term relation between stock market prices and exchange rates. However, they reported a short term relationship between these two variables using Granger causality tests.

Wongbangpo and Sharma (2002) examined the association between five indicators of macroeconomic and stock returns for Asian countries and elaborated that in long-run term five sock price indexes significantly and positively related to growth in output and negatively to sum of price level.

Park and Ratti (2000) used VAR model and found there is a vibrant interdependence among inflation, monetary policy, stock returns and real economic activity. In this research, the data used was from 1955 to 1998, and it results revealed that, monetary contraction produced important progress in expected real stock returns, inflation and these movements were also found in positive directions.

Aylward and Glen (2000) analyzed degree to which stock market prices forecasted future economic development by using annual data of 23 countries in which 15 were developing and others were developed countries, data used was between 1951 to 1993. The results indicated that stock prices usually have some forecasting control extent to which may diverge sustainability crosswise countries, and significant results for G-7 countries as compare to the emerging markets.

Another study conducted by Kwon et al. (1997) in South Korea found the association between several macroeconomic indicators and stock market by utilizing the monthly data covering the period of twelve years 1980 to 1992. The results exhibited that Korean stock market found very receptive from international trading and economic behavior as compare to the Japanese stock indexes and US stock market. Donnelly and Sheeby (1996) also conducted a research and found a statistically significant relationship between market value of large business exporters and foreign exchange rate. Dropsy and Nazarian (1994) found the effect of macroeconomic policies on stock returns by analyzing the monthly data of 11 industrialized countries for the period of 1970 to 1990 and articulated the results that estimated macroeconomic policies did not support forecasting the stock returns.

In these sequential studies, Schwert (1990) also added his findings that stock return volatility associated with the stock market crashes because the researcher empirically examined that stock market volatility abruptly shoot up in the era of crashes and it was seen quick decline when crashes were low, so the stock market volatility and stock returns volatility inversely proportional to each other. The researcher also analyzed the association of financial asset volatility and macroeconomic volatility using monthly data of US for the period of 1857 to 1887; the findings were articulated that financial asset volatility has strong effect on macroeconomic volatility and it also can be helpful to predict future macroeconomic volatility.

Officer (1973) exhibited that during the era of depression, the sum of volatility of money growth, stock volatility and industrial production were grown up.

Although, the researcher found that there was no change in position of stock volatility after and before depression. The statement of officer contradict the many other researchers mainly Black (1976) and Christie (1982) by explaining that volatility in stock market can be nominally be elucidated by financial influences. French et al. (1987) revealed that with the changing over time market volatility also changes. According to these researchers' point of view, the worth of business equity normally depends on strength of economy; consequently, the variation in uncertainty concerning future macroeconomic situations would be due to variation in return volatility.

## DATA AND METHODOLOGY

The data was mainly obtained from secondary sources like "KSE-100, State Bank of Pakistan (SBP) and Federal Bureau of Statistics (FBS) Pakistan". Hodrick-Prescott filter first proposed by Whittaker (1923) was used on time series data to separate the cyclical trends from the data. In the first step of the analysis descriptive statistics is used to find out the mean, median, standard deviation, skewness, kurtosis and other statistics. The data was tested for stationary in order to eliminate spurious regression results. Augmented Dickey Fuller (ADF) method was used to test the stationarity of the data developed by dickey and fuller in 1979. After testing the data series for stationarity in the next step of data analysis, we use the Exponential Generalized Autoregressive Conditional Heteroskedascity model (EGARCH) because (EGARCH) is particularly intended to predict conditional variance of financial assets. The mean and variance equations are modelled as.

$$Y_t = \beta_0 + \beta_1 \Delta ER_t + \beta_2 MS_t + \beta_3 CPI_t + \beta_4 TBR_t + \beta_5 GDP_t + \beta_6 FDI_t + \varepsilon_t \ldots\ldots(1)$$

$$\log (\sigma^2_t) = \varpi + \beta \log (\sigma^2_{t-1}) + \alpha | \varepsilon_{t-1}/\sigma^2_{t-1}| + \gamma | \varepsilon_{t-1}/\sigma^2_{t-1}| + \delta_t \ldots\ldots\ldots(2)$$

Where

$Y_t$ = stock market returns
$S_t$ = changes in exchange rate at time
$MS_t$ = Money Supply M2
$CPI_t$ = Consumer Price Index
$FDI_t$ = Foreign Direct Investment
TBR = T-Bills Rate
$\log (\sigma^2_t)$ = log of conditional variance of the stock market returns is taken
$\varepsilon t$ = error term
$\beta$ = vector of coefficient
$\delta_t$ = volatility

After review of literature about stock exchange volatility and macroeconomic volatility now we are able to identify our variables of concern for this study. Literature about this topic suggests us different kind of microeconomic indicators of the economy these are explained and discussed as follow.

### Stock price (SP)

Data about stock price movement is collected from monthly stock index data of KSE 100-index for the period of 2000 to 2010.

### Exchange rate ($S_t$)

Stands for spot exchange rate of Pakistan Rupee versus US  Dollar

PKR/USD. The monthly data about exchange rate is congregated from State Bank of Pakistan's official web site. We use the trade weighted index (TWI) to determine the spot exchange rate as suggested by White (1997). It is an index which measures the value of the PKR relative to the currencies of Pakistan's major trading partners; it is also known as effective exchange rate, same is calculated by the State Bank of Pakistan as real effective exchange rate (REER). The trade weighted index is also known as effective exchange rate and is updated annually Foreign Direct Investment (FDI). The data about foreign direct investment and foreign portfolio investment is collected from SBP quarterly reports for the period of 2000 to 2010.

### Consumer price index (CPI)

CPI is an index in which changes in the price level of consumer goods and services purchased by households are measured. We use CPI as proxy for inflation in the country.

### Money supply (MS)

Money supply is the total amount of money available in an economy at a given point of time. Money supply is categorized as Mo, M1, M2 and M3 according to the size and account in which it is kept. Generally researchers and economists use the M2 for measuring the quantity of amount of money in circulation to explore the economy's monitory position. In the analysis M2 was not included because of its positive correlation with TBR. We can trace back the literature about the relationship of money supply and stock market returns as Friedman and Schwartz (1963) tried to explore the relationship between these two variables and conclude that the rise in money supply can affect the aggregate economy and it can also influence expected stock returns.

### T-bills rate

The monthly T-bills rates are collected from the State Bank of Pakistan. 12-months T-bills rates are used in this study to measure the relationship between T-bills rate and stock market volatility. Various researchers tried to measure the impact of interest rates on stock market and presents diversified findings. Campbell (1987) reported a positive relationship between these two variables and negative correlation of interest rate with future stock returns. Whitelaw (1994) noted the positive relationship between one-month T-bills yield and stock market volatility.

## RESULTS AND DISCUSSION

Here results derive from the previously mention methodology and equations are posed and discussed. Tables 1 depicts the descriptive statistics as it is self-explanatory, the mean and standard deviation of stock return volatility is high as compared to other variables that is (0.014741) and (0.451536) respectively, with also high values for Jerque-bera; furthermore, the table also reported the positive skewness except (CPI) Consumer price index and (FDI) foreign direct investment, also higher and acceptable values of kurtosis in all cases. In addition to these statistics, if we move further, the jerque-bera and p-values also signifies that the null hypothesis of normal distribution is rejected at 1% level of

significance excluding money supply and foreign direct investment. These statistics supporting the argument that the stock exchanges market of Pakistan are more volatile than the volatility of macroeconomic indicators. Although, the data of some macroeconomic variables is normally distributed but most of the economic indicators are not normally distributed but shows lower volatility relative to stock prices. This is the same as described by the Ali et al. (2009).

ADF test was applied to test the data for stationarity. At the level were the variables were found not stationary as the t-value was greater than the critical value. However, the variables found to be stationary at first difference and 1% level of significance except M2. It was not stationary at first difference however this variable attained the stationary at second difference. Table 2 named as ADF test depicts the information of unit root. ADF test statistics of ER has the t-value (-3.721254) which is found to be a stationary variable at first difference and at 1% significant level as the critical value (-3.484653). ADF test statistics of CPI was also found stationary at first difference with t-value of (-4.089093) and critical value (-3.484653). FDI and TBR T-bills rate were also stationary at first difference and at 1% significant levels. However, M2 was found non-stationary at level and first difference but it was stationary at second difference and at 10% level of significance. The results of EGARCH model are exposed in Table 3. The first part of the table presents the results of Equation 1 and the second part comprised of the results of Equation 2, which is the variance equation based on residuals and GARCH series. The first variable of the equation was CPI the results shows that there is a positive and statistically significant relationship between consumer price index and stock market volatility. It has positive (0.383588) value and is significant at 1% also have positive z-statistics. It meansthat a rise in consumer price index will lead towards increase in stock market volatility. Adjasi (2008) also reported similar results of the stock market and macroeconomic relationship from China. Also, Skousen (2006) revealed that stock market performed better in the period of strong economic growth with relatively in the conditions of stable price levels. While moving towards our second independent macroeconomic indicators, the results suggest that the exchange rate has the negative coefficient (-1.885229) at p-value of (0.000). It means that a negative and statistically significant relationship existed between exchange rate and equity market in Pakistan. Higher volatility in exchange rate will dampen the equity market volatility. T-bills rate also have the inverse and statistically significant relationship with stock market, it means that rise in the volatility of TBR will leads towards decrease in stock market volatility in Pakistan. More specifically, we can say that our results suggest that a rise in TBR will dampen the stock market activities. The analysis shows that, if there is an increase in treasury bills rates, the investors would like to invest in treasury

**Table 1.** Summary statistics.

| Variable | SP | CPI | M2 | TBR | ER | FDI |
|---|---|---|---|---|---|---|
| Mean | 0.014741 | 0.000282 | 0.000806 | 0.004117 | 0.001128 | 0.008956 |
| Std. Dev. | 0.451536 | 0.075131 | 0.001101 | 0.094396 | 0.016631 | 0.626816 |
| Skewness | 0.003010 | -10.90185 | 0.260755 | -1.454685 | 0.090508 | 0.162450 |
| Kurtosis | 21.65832 | 121.2560 | 3.105814 | 11.78013 | 4.388639 | 3.603569 |
| Jarque-Bera | 1827.698 | 75914.40 | 1.486640 | 449.1641 | 10.29570 | 2.466745 |
| p-value | 0.000000 | 0.000000 | 0.475533 | 0.000000 | 0.005812 | 0.291308 |

**Table 2.** ADF test.

| Variables | t-statistics | Level of significance | Critical value |
|---|---|---|---|
| | | 1% Critical Value** | -3.484653 |
| ADF test statistic-ER | -3.721254 | 5% Critical Value | -2.885249 |
| | | 10% Critical Value | -2.579491 |
| | | 1% Critical Value** | -3.484653 |
| ADF test statistic-CPI | -4.089093 | 5% Critical Value | -2.885249 |
| | | 10% Critical Value | -2.579491 |
| | | 1% Critical Value** | -3.484198 |
| ADF test statistic-FDI | -5.791279 | 5% Critical Value | -2.885051 |
| | | 10% Critical Value | -2.579386 |
| | | 1% Critical Value** | -3.484653 |
| ADF test statistic-TBR | -3.798298 | 5% Critical Value | -2.885249 |
| | | 10% Critical Value | -2.579491 |
| | | 1% Critical Value | -3.490210 |
| ADF test statistic-M2 | -2.745344 | 5% Critical Value | -2.887665 |
| | | 10%Critical Value*** | -2.580778 |

*, Not stationary; **, stationary at 1 and 5% significant level and at first difference; ***, stationary at 10% level and at second difference.

**Table 3.** Empirical results of EGARCH model.

| Dependent variable: SP | | | | |
|---|---|---|---|---|
| Method: ML – ARCH | Coefficient | Std. Error | z-Statistic | Prob. |
| C | 0.000872 | 0.000236 | 3.694895 | 0.0002 |
| CPI | 0.383588 | 0.027955 | 13.72165 | 0.0000 |
| ER | -1.885229 | 0.278082 | -6.779399 | 0.0000 |
| TBR | -0.657861 | 0.038419 | -17.12325 | 0.0000 |
| FDI | 0.358961 | 0.017614 | 20.37981 | 0.0000 |
| SP(-1) | 0.981723 | 0.009453 | 103.8484 | 0.0000 |
| CPI(-1) | -0.345862 | 0.026971 | -12.82329 | 0.0000 |
| TBR(-1) | 0.667895 | 0.039673 | 16.83480 | 0.0000 |
| ER(-1) | 0.208081 | 0.280128 | 0.742805 | 0.4576 |
| FDI(-1) | -0.352900 | 0.019059 | -18.51581 | 0.0000 |

**Table 3**. Continued.

| | Variance Equation | | | |
|---|---|---|---|---|
| CPI | -5.786756 | 1.967655 | -2.940940 | 0.0033 |
| ER | 3.149715 | 0.603634 | 5.217926 | 0.0000 |
| TBR | -0.176890 | 0.380585 | -0.464784 | 0.6421 |
| FDI | 0.719112 | 0.194775 | 3.692009 | 0.0002 |
| CPI(-1) | 1.407500 | 7.035733 | 0.200050 | 0.8414 |
| TBR(-1) | -0.798354 | 7.072797 | -0.112877 | 0.9101 |
| ER(-1) | -0.905533 | 0.678740 | -1.334138 | 0.1822 |
| FDI(-1) | 0.380346 | 0.733402 | 0.518605 | 0.6040 |
| | | | | |
| R-squared | 0.967304 | Mean dependent var | | 0.015370 |
| Adjusted R-squared | 0.962109 | S.D. dependent var | | 0.039060 |
| S.E. of regression | 0.007603 | Akaike info criterion | | -7.586192 |
| Sum squared resid | 0.006186 | Schwarz criterion | | -7.178915 |
| Log likelihood | 492.1370 | F-statistic | | 186.2078 |
| Durbin-Watson stat | 0.263797 | Prob(F-statistic) | | 0.000000 |

bills because there will be more certain future cash flows than from the stock market returns. As a result of this activity stock market will fall. Another macroeconomic indicator FDI it is also a very important element of economic growth of the country "it provides an inflow of foreign capital and funds in addition to an increase in the transfer of skills, technology and job opportunities" the foreign direct investment shows the positive and statistically significant relationship with stock market as this indicator has the coefficient of (0.358961). Hence, on the basis of our empirical analysis we can say with context to Pakistan that the positive relationship existed between foreign direct investment and equity market returns. Moreover, it could be concluded that rise in the level of FDI will lead to increase in stock market volatility, and if there is more FDI in the country there will be more economic growth, more employment opportunities and increase in foreign exchange reserves.

## Causal relationship between macroeconomic and stock market volatility

Here we tried to explore the causal relationship between macroeconomic indicators and stock market volatility with the help of LA-VAR model proposed and developed by well-known researchers Toda and Yamamoto (1995). The most important benefit of using this technique is to avoid the biases of neglecting and giving less importance to integration and co-integration properties of the process of data generation. There are some coefficient restrictions and other test of coefficients restrictions which can be eliminated using LA-VAR and is applicable to Granger causality test within the framework of VAR. Granger causality test is useful when one time series is forecasting the other one, it used in the pairs of two

variables. This test is used to find out the causality between economic indicators and to measure the prediction power of the indicators. We can estimate it using equations depicted as follows:

$$y_t = g_0 + g_1 t + J_1 y_{t-1} + J_2 y_{t-2} + ... J_k y_{t-k} + \varepsilon_t \text{................................(4)}$$

Where $g_0$, $g_1$ $J_1$ and $J_k$ are the matrices of coefficients, t representing the time trend and k is defining the length of a lag. Since we make our hypothesis of causality first we can say that our null hypothesis states that the $j$th variable does not have any kind of Granger-cause with $i$th indicator, this can be presented in the form of equation as follows:

$$H_0: J_{ij}(1) = J_{ij}(2) = \text{...........................} J_{ij}(k) = 0 \text{........................} (5)$$

Our null hypothesis stat that Jij (1) variable is equal to Jij (2) and this process is continuous until it equals to zero matrix. To test the previously stated hypothesis, we use the VAR formulated by OLS.

$$y_t = \hat{Y}_0 + \hat{Y}_t t + \hat{J_1} y_{t-1} + ...... \hat{J_n} y_{t-n} + \hat{e} \text{...................................}(6)$$

Where $n = k + d_{max}$ present the notion of true lag length and $\hat{Y}_0 + \hat{Y}_t t$........ $\hat{J_1}$,......$\hat{J_n}$ are the matrices (vectors) of estimation parameters. In this equation, the values of $d_{max}$ which are considered as zero are not included in Equation 5 restriction. The previously explained modelwas executed using Granger causality test to measure the interrelationship between our variables of concerns. We determine the lag length first and use the analysis on the basis of lag length of 1. The results of the analysis are depicted in Table 4. These results are

**Table 4.** Causality results of LA-VAR model.

| Null hypothesis: | F-Statistic | p-value |
| --- | --- | --- |
| CPI does not Granger Cause Stock market volatility | 0.04789 | 0.82715 |
| Stock market volatility does not Granger Cause CPI | 1.32902 | 0.25123 |
| FDI does not Granger Cause Stock market volatility | 4.12998** | 0.04430 |
| Stock market volatility does not Granger Cause FDI | 19.9147* | 0.00050 |
| ER does not Granger Cause Stock market volatility | 70.8087* | 0.00000 |
| Stock market volatility does not Granger Cause ER | 7.30333* | 0.00786 |
| TBR does not Granger Cause Stock market volatility | 0.24292 | 0.62299 |
| SP does not Granger Cause T-Bills Rate | 8.37637** | 0.00450 |

*, significant at 1%; **, significant at 5%.

discussed one by one and can be used to predict each other. The first section is about causal relationship between CPI and stock market volatility, the null hypothesis that the CPI does not Granger cause stock market volatility cannot be rejected that it has the p-value of (0.82715). Hence it is possible to say that in Pakistan CPI volatility does not cause stock market volatility the argument behind this would be that the higher level of inflation in Pakistan increase the cost of living in the country and for basic necessities day by day rising prices shift the consumer's resources from investing activities to consumption. If we move further, and see that the stock market volatility does not granger cause CPI this hypothesis also cannot be rejected as it has the p-value (0.25123). These results indicate that there is no causal relationship between CPI volatility and stock market volatility in Pakistan. We can say that the stock market of Pakistan is not primarily having association with the economic growth of the country. The second causal relationship is about the FDI and stock market the null hypothesis that FDI does not Granger Cause stock market volatility is rejected at the 5% significance level. Inversely the stock market volatility does not Granger cause FDI is also rejected at the 1% level of significance. Hence, we might be able to say that the FDI and Stock market volatility are the better predictor of each other and can be used to predict the future volatility. Stock market volatility and real effective exchange rate of Pakistan has the bilateral relation with each otherboth at 1% significant level. There is strong causal relationship between exchange rate volatility and stock market in Pakistan. It is possible to say that the exchange rate volatility can be used to predict the volatility of stock market in Pakistan and vice versa. Volatility in exchange rate can create so many managerial and strategic issues because it leads towards possible gains or possible losses because of risk inherited in it for future transactions. Finally, the Granger Causality results suggest that there is unidirectional relationship between treasury bills interest rates and stock market volatility. These results have the direction from stock market to the treasury bills interest rates. The

table depicts that the stock market volatility tends to Granger Cause T-Bills interest rates volatility at the 1% significance level, and has the p-value of (0.00450). Hence, it is possible to say that the stock markets of Pakistan are not efficient in the sense that these do not respond quickly to the change in the treasury bills interest rate. Nishat and Shaheen (2004) also reported same kind of results and found strong and positive causal relationship between stock market and macroeconomic indicators in Pakistan.

Granger causality test demonstrates that in Pakistan the investors who want to invest in stock market may use the macroeconomic indicators to predict the stock market volatility. Academic researcher may also use the macroeconomic data to find out the relationship between stock market and macroeconomic conditions of the country and used the data to study the equilibrium relation between stock market volatility and macroeconomic indicators. Macroeconomic indicators may serves as proxy and guide in predicting future stock market volatility. For better performance of stock markets the policymakers should focus on to improve the economic condition of the country. And to stable the macroeconomic indicators of the economy as a result the stock market will tends to rise.

Various researchers from all over the globe tried to explore the relationship between stock market volatility and macroeconomic indicators and used different statistical and econometrics tools and techniques in some countries the relationship is found strong positive and statistically significant and in some economies the researchers were unable to estimate the relationship. In this study the variables which were used are those that are not extensively studied with respect to Pakistan, this is based on the data set of 2000:06 to 2010:06, the period of ten years was selected for this study.

**CONCLUSION AND RECOMMENDATIONS**

The main objective of the study is to investigate the

relationship between the stock market volatility and macroeconomic volatility with respect to Pakistan. Different types of macroeconomic variables were used to find out the causal relationship with stock market volatility. The data about different macroeconomic variables and stock market index was collected for the period of June 2000 to June 2010. EGARCH model was applied to measure the impact of macroeconomic indicators on stock market returns and Granger Causality test was used to determine the causal relationship between stock market volatility and macroeconomic indicators. The study revealed that the most of macroeconomic variables like CPI and FDI demonstrates the strong statistically significant relationship with stock market volatility while T-bills rate and exchange rate are negatively associated with stock market volatility in Pakistan. The findings also revealed and signify a causal relationship of stock market volatility and foreign direct investment and stock market and stock market volatility also have causal relationship with FDI. However, no causal relationship found between CPI and stock market of both the direction. On the other hand, the bilateral causal relation was found between real effective exchange rate of the country and equity market volatility. Further a uni-directional relationship between T-bills rate and stock market was also found the direction of the relation is stock market to T-Bills rate. After statistical and econometrics analysis it might be possible to conclude that this study provide encouraging empirical evidence in support of the argument that the macroeconomic indicators can be used and be analyzed to forecast the stock market in Pakistan and in other emerging markets because of same macroeconomic characteristics. The stock market of Pakistan volatile the economic conditions of the country are also dynamic and the financial system of the country is also weak relative to developed economies of the world. The index of stock market would not be a leading indicator of economic activity with respect to Pakistan. Generally it is considered that the stock market index is expected to provide the future corporate performance and corporate profits more specifically dividends and more returns. And also reflect the level of economic activity in the country. If the stock market in a country reflects the accurate stock prices than the stock market prices could be used as a leading indicator of economic activity. It is suggested and recommended that the Government of Pakistan need to improve the stock market efficiency and to implement the reforms in the financial system.

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