Impact of Macro-Economic Variable on Pakistan Stock Exchange KSE-100 Index

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ABSTRACT
The researcher investigates the impact of inflation, exchange rate, and interest rate on Pakistan stock Exchange performance KSE-100 index by using monthly time series data which covers the period of 2013 to 2020. The employed econometrics techniques include ADF test, Ordinary Least squares regression Model, testing for Multi-collinearity, Residual analysis serial correlation, testing for co-integration, Error correction model (ECM), variance decomposition (VAR), and Pairwise Granger causality test. The results indicate a positive impact of the exchange rate on the PSX KSE-100 index, and the effects of inflation and interest rate are adverse. Still, inflation has an insignificant relationship with the PSX KSE-100 index, and the other two variables, interest rate, and exchange rate relationships, are found significant with the PSX KSE-100 index. From the ECM result, it is found that in the short run, 20% of the variation in the dependent variable is due to inflation, exchange rate, and interest rate, and 80% variation is unexplained in the short run. The VAR test results conclude that the exchange rate 1.67, inflation 14.25%, and interest rate 3.90% variation cause in PSX KSE-100 index performance due to these three independent variables.

Keywords: Macro-economic Variable, ECM, VAR, ADF, and PSX

INTRODUCTION
The stock market is the place that shows the real face of the economy of the country. The stock market helps the different investors in the country to predict the economy, security prices, and its return. The stock market drew the interest of economists and financial investors for three reasons. First, the link between macroeconomic factors and the stock market attracted the attention of policymakers and academics. For starters, policymakers would forecast the real impact of existing and future policies and laws. Second, when investors fully grasp this relationship, they may make more educated decisions and reduce their risk exposure. Third, suppose the general public is informed of potential changes in the economy or financial markets. In that case, the shock factor will decrease, and the general public will take preventive measures (Abu-Libdeh & Harasheh, 2011).

The financially strong economy and efficient financial market are because of the best utilization of capital assets and getting a high return from its utilization. If capital is utilized efficiently, it will present a positive picture of the economy to the investors and the people. They have surplus money for the investment. They will invest money in the capital market to get higher returns. Due to these funds, investment is available in different sectors of the economy and these sectors like industries. Agriculture will produce more goods, products, and services, leading to the strength of the economy—the stock market plays a vital role in the country’s economy and its progress towards development. A different factor influences the stock market in the economy. The elements are Interest rate, Exchange rate, Money supply, inflation GDP, GNP, political inability, and many other factors (Khan, Waqas, and Hassan, 2017).

Interest rates and exchange rates are influential variables that affect the performance of the stock market. Liu and Shrestha (2008) examine the impact of the variable macroeconomic effects of Chinese stock market. The research report that inflation, interest rate, and exchange rate are negatively related to stock prices. If the interest rate increase, it will affect the stock market performance negatively. And if the interest rate on deposits decreases, it will positively affect stock market performance, which means the investor will invest more money in the capital markets investment. In contrast, production and money supply are positively related to the stock prices. If production increases, it affects the investor perception towards return and investment positively.
So this study also focuses on different macro-economic variable and their impact on the Pakistan stock exchange 100 indexes.

**Research Objectives**

- To investigate the impact of interest rate on Pakistan stock exchange KSE-100 index.
- To investigate the impact of the exchange rate on the Pakistan stock exchange KSE-100 index.
- To investigate the impact of inflation on the Pakistan stock exchange KSE-100 index.
- To investigate the long-term relationship between the macro-economic variable and Pakistan stock exchange KSE-100 index.
- To investigate the short-term relationship between the macro-economic variable and Pakistan stock exchange KSE-100 index.

**Research Questions**

The study has the following research questions.

- What is the impact of the interest rate on the Pakistan stock exchange KSE-100 index?
- What is the impact of the exchange rate on the Pakistan stock exchange KSE-100 index?
- What is the impact of inflation on the Pakistan stock exchange KSE-100 index?
- Does the long-term relationship exist among the macro-economic variable and Pakistan stock exchange KSE-100 index?
- Does the short-term relationship exist among the macro-economic variable and Pakistan stock exchange KSE-100 index?

**Hypothesis**

H1: There is a significant relationship between interest rate and Pakistan stock exchange KSE-100 index.

H2: There is a significant relationship between the exchange rate and the Pakistan stock exchange KSE-100 index.

H3: There is a significant relationship between inflation and the Pakistan stock exchange KSE-100 index.

H4: The long-term relationship exists among the macro-economic variable and Pakistan stock exchange KSE-100 index.

H5: The short-term relationship exists among the macro-economic variable and Pakistan stock exchange KSE-100 index.

**LITERATURE REVIEW**

Many of the studies have done on impact of a macroeconomic variable on the Pakistan Stock Exchange. Some of the studies were also carried out in developed countries. Some researchers also carried down research in developing countries, and a few studies are also done in Pakistan which is reviewed below.

Chen et al. (1986) asserted and empirically shown how changes in macroeconomic factors impact future dividends, discount rates, and, consequently, stock prices. Summers (1981) discovered that stock market movement in the United States alters during the economic cycle, declining soon before a recession begins and rising shortly before a recession ends. According to Atje and Jonanovic (1993), stock market development, especially trading volume, is related to economic growth. According to Levine and Zervos (1998); Singh (2011), there is a good link between stock market performance and long-run economic development. Fama (1981); Chen et al. (1986) investigated the long-term connections among stock price fluctuations and macroeconomic factors in the United States. They contended that macroeconomic conditions and the stock market had a long-term link. According to Fama (1981), there is a significant positive connection between expected stock returns and real economic indicators such as capital expenditures, industrial production, real GDP, money supply, delayed inflation, and interest rates. According to Chen et al. (1986), the essential economic variables influencing the stock market include aggregate output, inflation, short-term interest rates, the maturity risk premium, and the default risk premium. Mukherjee and Naka (1995) discovered a link between the exchange rate, money supply, inflation, industrial production, and stock prices.

The study done in one of the developed and developing countries are, Gosnell et al. (2010) researched “Macroeconomic news and risk factor innovations”, the variable which researcher selected for his research are Macroeconomic news, market excess return, book to market, daily time series data from the period 1993 to 2003 were taken for the research the researcher conclude that inflation employment consumption were found to affect levels and volatilities and risk factors, inflation and non-farm payrolls decrease the market risk premium while increase the size premium, GDP influence the level of momentum factor and producer inflation and personal income increase the volatility of the size premium. Joshi and Giri (2015) studied the Macroeconomic indicator impact on stock prices of ISE and concluded that a long-term relationship exists between the stock prices and Macroeconomic variables. And mostly, it is found that stock markets are affected by its shocks. Bahloul, Mroua, and Naifar, (2017) studied the impact of macroeconomic and conventional stock market variables on Islamic index returns under regime-switching. The researcher’s evidence for the period 2002–2014 demonstrates that conventional stock index returns and money supply impact both developed and emerging Islamic stock indices in higher and lower volatility regimes. However, other macroeconomic factors, particularly in the high volatility regime, fail to explain the behavior of Islamic stock indexes.

Celebi, K., & Höning, M. (2019). The impact of macroeconomic factors on the German stock market: Evidence for the crisis, pre-and post-crisis periods. The findings show that a greater variety of variables and macroeconomic variables had a significant influence on stock returns during the crisis-era than during the pre and post-crisis periods and suggest that a macro-driven market predominates in the post-crisis era.

Devkota, and Dhungana, (2019). Impact of macroeconomic variables on stock market in Nepal. The Bound test result indicated that the variables had a long-run connection. The ARDL finding, which aligns empirical evidence, suggests that interest rates are the most critical determinants of Nepal’s stock market index. The Nepalese stock market is susceptible to interest rates, but the gold price has little influence on the stock market. Although the Nepalese economy is referred to as remit anomaly (currency exchange
economic), the actual exchange rate has little impact on the stock market. In a nutshell, macroeconomic factors have a significant influence on the stock market.

Megaravalli, & Sampagnaro (2018) evaluate Macroeconomic indicators and their impact on stock markets in ASIAN 3, including India, China, and Japan. The findings of the pooled estimated results of the three ASIAN nations demonstrate that the exchange rate has a positive and substantial long-run influence on stock markets. Still, inflation has a negative and minor long-run effect. There is no statistically meaningful link between macroeconomic factors and stock markets in the near run. This study focuses on the influence of macroeconomic factors on stock market performance in emerging (India and China) and developed economies (Japan).

An evidence from Indian stock market the findings of the Johansen co-integration test show that the exchange rate, inflation rate, and index of industrial output have a substantial negative link with stock prices. Still, the money supply and yield on treasury bills have a strong positive association with stock prices. The vector error correction model was used in determining the causal link between macroeconomic conditions and stock price in both the short and long run. The findings revealed that short-run causality flows from the exchange rate to the Nifty, the money supply, and the inflation rate. In contrast, long-run causality goes from the Nifty to the short-term interest rate and money supply. (Mangala, 2015; Pal & Mittal 2011)

Fathi, Sameti, Nouri, and Esfahani (2012) examine the effect of selective macroeconomic variables on the stock exchange like National income, investment rate, and intermediary financial development from the period 1998 to 2007. In this research Johansen Co-integration and Vector Error Correction Model was used to investigate the study. Researchers explore a positive relationship between national income and stock prices and a positive for intermediaries’ development. Nurasyikin, Shahnaz and Syamimi (2017) study results indicate that Inflation significantly and strongly negatively affects the stock market return and Money supply is found insignificant.

The Nguyen (2011) worked on “US macroeconomic news spillover effect on Vietnamese stock market” monthly time series data were taken for conducting the research form the period 2000-2009, variables selected for the research were macroeconomic variable and Vietnamese stock index. MA-EGARCH model was used to conclude; after applying the model, the researcher concluded the result is significant, and US macroeconomic news has the most substantial effect on the Vietnam’s stock returns. It means Vietnam’s investor believes on macroeconomic information, and they take decisions based on macroeconomic variables and their fluctuation.

In another study, Yahyazadehfar and Babaie (2012) looked over the relationship between stock prices and macroeconomic variables like interest rate, gold rate, and house prices. The results indicate a positive relationship between stock prices and house prices and a negative relationship between nominal interest rate and gold prices with stock prices.

In an empirical study conducted by Osamwonyi and Evbayiro (2012) the relationship between macroeconomic variables and the Nigerian stock market index. The studies conclude that there is a significant relationship between the macroeconomic variable and stock prices and also found that there is a positive relationship between the consumer price index and stock prices and a positive relationship between gross domestic product and stock prices, the study also concludes that there is a negative relationship between M2 and stock prices.

Naseem, Rizwan, Abbas, Mohsin and Rehman (2019). Impact of Macroeconomic Variables on Pakistan Stock Market The results of multiple regression analysis reveal that money supply & exchange rate has a substantial negative and positive sign, respectively. Still, inflation and interest rate have a positive but small influence on the Pakistan stock market. Furthermore, the correlation matrix, heteroscedasticity, and serial correlation test are used to validate data for suitable conclusions. These study patterns and findings are highly beneficial for investors interested in the Pakistan Stock Exchange and the government in developing regulations for stock market development.

Iqbal, Zia and Kashif (2018); Jawad and Imran (2018) found in Pakistan that These macroeconomic variables have a significant impact on the return of an equity market. Macroeconomic variables such as labor force cost, economic growth, exchange rate, and inflation have been found to have a significant relationship with stock return. In contrast, the rest of the variables such as unemployment rate, equity market, and GDP have been found to have an insignificant relationship. And in the long run there is significant relationship exists between the Macroeconomic variable and stock prices.

Theoretical Support
The relations between the Macroeconomic variable and Pakistan stock exchange are motivated using the Arbitrage Pricing Theory (APT) model developed by Ross (1976). These models provide a basis for the long-run and short-run dynamic interactions between macroeconomic variables and stock prices. The APT is a multifactor asset pricing theory that uses the linear relation between the expected return of an asset and a range of macroeconomic factors that capture a systematic risk to predict an asset’s return. It is a helpful instrument for assessing portfolios from a value investment point of view so that assets can be momentarily mispriced. According to the assumptions, asset returns are based on several macroeconomic factors such as inflation, exchange rates, market indicators, production measurements, market emotions, interest rate variations, curve movements, etc.

RESEARCH METHODS
The researcher has studied the Impact of the Macroeconomic variable on the Pakistan Stock Exchange KSE-100 index. The econometrics techniques which were employed for testing the impact of Macro-economic variables and KSE-100 index and stock market behavior in the short and long run, includes ADF test, Ordinary Least squares
regression Model, testing for Multi-collinearity, Residual analysis serial correlation, testing for co-integration, Error correction model (ECM), variance decomposition (VAR) and Pair wise granger causality test.

**Data Collection**

The data included in this research are monthly time series data consisting of Macroeconomic variables, including interest rate inflation exchange rate and Pakistan stock exchange KSE-100 index from year 2013 to 2020. To measure the stock market performance PSX KSE-100 index was taken, which was first introduced in 1991. Daily 100 index point was taken from the website of Pakistan stock exchange and the data was considered as a Dependent variable.

The other three variables include the interest rate inflation and exchange rate. Interest rate data was taken from the website of Stat bank of Pakistan from 2013 to 2020. The second independent variable is inflation. The CPI (Consumer Price Index) was taken as a proxy of Inflation.

**RESULTS AND DISCUSSION**

| Variable | Coefficient | Std. Coefficient | t-Statistic | Prob. |
|----------|--------------|------------------|-------------|-------|
| EXCHNG   | 22.18144     | .189             | 3.216591    | 0.0015|
| INFLATION| -185.5986    | -0.67            | -0.653957   | 0.5139|
| INTEREST | -2569.760    | -0.494           | -4.810502   | 0.0000|
| C        | 4226.128     | 12.24414        |            |       |
| R-squared| 0.344873     | F-statistic      | 33.34005    |       |
| Adjusted R-squared | 0.334529 | Prob (F-statistic) | 0.000000 |       |

The t value of inflation is -.067, and the p-value of inflation is .5139, which means there is an insignificant relationship between inflation and the PSX 100 index.

| Variable | ADF Test | Confidence interval (5%) |
|----------|----------|--------------------------|
| PSX 100 index | -5.68   | -2.8768                  |
| Inflation   | -4.91    | -2.8769                  |
| US $ (1st diff) | -9.10  | -2.8766                  |
| Interest rate | -3.966  | -2.8768                  |

| Table 3. Ordinary Least Squares Regression Model |
|-----------------------------------------------|

As per table 2 finding reveal that if R square > D-W statistic indicates a sign of spurious regression and then research cannot be further proceeds the D-W Value in table 2 is 0.122, which is less than R square. Still, if the Residual analysis is found stationary at the level than research can further proceed for analysis. Hence, Table 3 of the Residual analysis ADF test value is 7.38 which is more than its critical value at 1% and 5% it means there is no unit root problem.

| Table 4. Residual analysis |
|-----------------------------|
| ADF Statistic | -7.387148 | 1% Critical Value* | -3.4633 |
| 5% Critical Value | -2.8769 |
| 10% Critical Value | -2.5749 |

Serial correlation is a standard part of time series data. To find a serial correlation the Breusch-Godfrey Serial Correlation LM test is conducted. The result in the above
Testing of co-integration is an essential step in the analysis of time series data where for Johnson co-integration test is applied to estimate the co-integration among the variables. Johnson co-integration uses two major statistics like trace statistics and Eigen value. Findings of both statistic is mentioned in table no 6 and 7.

The results show in trace test that the value of trace statistics is less than the critical value at 5%, which means there is no co-integration. Similarly, the value of Eigenvalue is also less than its critical value at 5%, so there is also no co-integration found in the Johnson co-integration test.

Table 6. Unrestricted Co-integration Rank Test (Trace)

| Hypothesized | Trace | 0.05 |
|--------------|-------|------|
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None         | 0.260155 | 47.4746 | 47.85613 | 0.0543 |
| At most 1    | 0.131859 | 1      | 29.79707 | 0.3268 |
| At most 2    | 0.119354 | 2.29424 | 15.49471 | 0.2558 |
| At most 3    | 0.003718 | 0      | 3.841466 | 0.5875 |

Trace test indicates no co-integration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

| Hypothesized | Max-Eigen | 0.05 |
|--------------|-----------|------|
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None         | 0.280155  | 25.9688 | 27.58434 | 0.0793 |
| At most 1    | 0.131859  | 9      | 21.13162 | 0.6302 |
| At most 2    | 0.119354  | 8      | 14.26460 | 0.2093 |
| At most 3    | 0.003718  | 0      | 3.841466 | 0.5875 |

Table 7. Normalize co-integration test

| PSX index | Exchange rate | Inflation | Interest |
|-----------|---------------|-----------|----------|
| 427.78    | -72.73        | -355.8    |          |
| S.E       | 369.894       | 367.752   | 1575.32  |
| t-statistics | 2.34    | -1.10     | -2.22    |
| p-value   | 0.035         | 0.339     | 0.001    |

The normal co-integration equation is as follow

\[
PSX\ Index = 427.78exc+infl\ (-72.73) +\ Interest\ (-355.8)
\]

The above model shows the long-term relationship between the dependent and independent variables. Beta of Exchange rate shows that if there is a 1-unit increase in the exchange rate, the PSX 100 index will increase 427.78 units. And the beta of inflation shows that there is a negative relationship between inflation and 100 indexes. According to the results,
To investigate the short-term dynamic aspects of stock market performance (PSX 100 index). It designates the amount of information each variable contributes to the other variable in the VAR model. It establishes how much of the forecast error variance of each variable can be explained by exogenous shocks to the other variables.

The results indicate that the dynamic behavior in aggregate stock market performance narrates 100% variation of the fluctuation in the first year. In the short run, period 3, the shock to market performance 95.99 variations in stock market performance (PSX 100 index) is its own shock. At the same time, an impulse to exchange inflation and interest rate is 3.3%, .57%, and 0.12% fluctuation in stock market performance, and as a whole total instability is 100%.

While in the long run, that is period ten, the shock to the stock market performance PSX 100 index can contribute 79.89% of stock market performance. However, the shock to the exchange rate, inflation, and interest rate can cause 1.67%, 14.25%, and 3.90% of the variance of stock market performance (PSX 100 index). So from the analysis, it is concluded that in the short run, stock market performance contributes more, but in the long run, contribution to the stock market performance becomes low, and the same is the case with the exchange rate. But in the case of interest rate and inflation, it is contributing less in the short term, and in a long time, it is contributing more opposite to PSX 100 index and exchange rate.

Granger causality test it to investigate the causal relationship between stock market performance (PSX 100 index) and its determinants (exchange rate, interest rate and inflation) in the long run. So the Granger Causality test findings indicate that there is no causal relationship between PSX 100 index and exchange rate, interest rate and inflation. So we accept Null hypothesis and reject the alternative hypothesis.

CONCLUSION

The researcher has conducted a study on Impact of Macroeconomic variables on the Pakistan stock exchange KSE-100 index. The primary independent variables studied were Exchange rate, interest rate, and inflation while the dependent variable was the Pakistan stock exchange KSE-100 index.

So from the results, it is concluded that there is a positive and significant relationship between the exchange rate US dollar and 100 indexs. In contrast, the relationship between inflation and KSE-PSX 100 is found insignificant, but on the other side, interest rates have a negative and significant relationship with the KSE-PSX 100 index.

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The long-term and short-term relations are also studied between the Macroeconomic variable and Pakistan stock exchange 100 index. So from the results, it is also concluded that the short-term exchange rate is contributing more. In the long run, it contributes less to the performance of the PSX KSE-100 index while seeing the results of the other two variables, interest rate, and inflation. Hence, its contribution is more in the long term and less in the short term in the performance of PSX KSE-100 index. At the end of the causality test, there is no causal relationship among the inflation, interest rate, exchanger rate, and Pakistan stock exchange KSE-100 index.
This study's results, therefore, have significant implications for scholars and practitioners alike. From a research standpoint, there is an emphasis on the need, particularly for rising economies like Pakistan, Bangladesh and other Asian nations, to build a model that can address progressive integration into global financial markets. From a practical perspective, the revelation of the link between macroeconomic variables and stock returns may allow investors in Pakistan, by taking into account external shocks and local factors, to adopt better strategies for diversification and risk-return trade. Therefore, policymakers and regulators of Pakistan must closely monitor the distribution of information and time-changing risk exposures resulting from changes in macroeconomic conditions in the country.

It is also recommended that Pakistan Economic policy makers should take positive steps toward the control of inflation, exchange rate and interest rate and stable the exchange rate which will stimulate the investors to invest and also reduce the interest rate to increase the investment towards the stock markets which will strengthen the economy and attract more investors local and international.

Limitation and Future Research Directions

However, the consequences of this study do not extend since there are also certain flaws in this study. The first thing to do is choose macroeconomic variables in this study arbitrarily and not exhaustively set them.

A better understanding of the conclusions of this research could also be offered by the use of certain other national and global macroeconomic variables. In addition, the research methods utilized in this study are sensitive to variable choice, and thus the results might be somewhat incompatible with past empirical evidence. Finally, the failure to provide data and time restrictions has discouraged the use of lengthy periods of data in this study and a varied frequency of data for the set of variables such as weekly or daily series. To investigate the effect of stock earnings of Pakistan's stock bonds, future research directives can be linked to a wide range of worldwide macroeconomic parameters such as international interest rates, global inflation, and world oil prices or the researcher may take some other variable like GDP, economic growth, employment and unemployment.

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