

Macroeconomic variables and Stock Market Returns. Evidence from Developing Economy using GARCH Model

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Abstract

This paper investigates the impact of Exchange rate and rate of interest on stock returns of the Karachi Stock Exchange (KSE) 100 index. The performance of an economy can be judged from the working of its Stock Market. To find out the relationship among variables, econometric tests are run. Weekly closing prices data is collected from Pakistan stock exchange for five-years. Data of “interest rate” and “exchange rate are also gathered. This study uses regression (OLS) and GARCH (1,1) model to check the relation of exchange rate and rate of interest with stock returns in Pakistan. Findings depict interest rate has positive impact on stock returns and rate of exchange exert negative impact on performance of KSE-100 index. By keeping in view, the findings concerned authorities should construct policies that can affect economy in a positive way.

Key words: Exchange Rate; Interest Rate; Stock Return; KSE (100) index

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1. Introduction

Stock exchange is the market where the investors deal in stocks and other securities. They grow their wealth by dealing in securities. The major stock markets of Pakistan were Karachi, Lahore and Islamabad stock exchanges. KSE is the first one and established in September 18, 1947. The indices in KSE have three main categories; KSE100 index, KSE-30 index and All Share Index. During last decades the Stock Exchange of Pakistan remained highly volatile. PSX has faced three serious financial crises in last two decades, the market collapsed in 2005, 2nd quarter of 2006 and during 2008 to 2009. During this period KSE-100 Index is declined by 10,000 points. After this 2013 and 2014 has proved the best years in the history of Stock exchange. In this period, Karachi stock exchange index has witnessed highest increment in the world. The index of Pakistan stock exchange has increased by 37.6% (7907.3 points) from July 01, 2013 to April 30, 2014. Rather the indices of world's major powers such as USA has raised by 17.3%, China 2.4%, India 15.6% and UK 9.1%. Through

market capitalization Karachi stock exchange 100 index tracks major companies' performance from all sectors which are listed in the market. From 2012, the index is freely floating. Since 1991, the base value of KSE-100 has remained at 1000 points. Since formation of Pakistan stock exchange (KSE) there were only 5 listed companies in 1949. Then the number of listed companies have increased gradually over the period and reached to 765 during 1998-99. There were 443 companies listed in Pakistan stock exchange in January 2021.

From Pakistan, CFD¹ trading has tracked the standard index at the start of 2021 and finds KSE-100 index has raised by 2.44% and reached to 1066 points. All the three stock markets KSE, LSE and ISE had distinct management, indices, trading interfaces and had no link to each other. Their structures created conflict of interest among investors. So According to Demutualization Act 2012 all the stock markets are consolidated to make a new mixed stock exchange that is known as Pakistan Stock Exchange Limited (PSX). PSX has initiated work on January 11, 2016. Share price movement in stock exchange shows what is happening in the economy. So, it is very important to know what are the potential factors that can influence stock market performance? There are plenty of variables that impact the stock market performance, for instance, economic factors, Political stability, other external and internal factors. The interest rate, inflation, exchange rate also influences the stock market returns. The investors consider these variables at the time of taking investing decisions.

Exchange rate is "The value of one currency for the purpose of conversion to another". It represents the price of currency of one Nation in term of other nation's currency. Foreign investors turn their returns into their own currency. When foreign currency is strengthened against local currency then foreign investors are affected. Interest is the fee the lender receives from borrower as a return of assets used. It is actually the charge of using money or the price paid for borrowing money. Rate of interest is the percentage of loan that is charged as interest by the lender to the borrower. It is mostly expressed annually. For instance, a person borrower's² . 500 at interest rate of 10% annually, he/she will be liable to pay Rs. 50 to the lender after one year. A general believe is interest rate and stock prices are move in opposite direction. When government adopts expansionary monetary policy, it lowers the interest rate. The cost of borrowing

¹ Contract For Differences (CFD) is the process of earning profit by price fluctuations without the ownership of specific asset)

² Rs means Pakistani rupee

decreases. Good investors will like to invest in efficient market. So, it increases demand of stock which leads share prices up and market will move upward. Alternatively, if interest rate increases it decreases investment in the economy so share prices also go down.

This paper examines the effect of rate of interest and rate exchange on returns from KSE-100 index of PSX. For this purpose, PSX of Pakistan is selected because it is most important and old market of Pakistan. The research is based on the following main objectives,

- a) To investigate the effect of interest rate on returns from KSE-100 index.
- b) To investigate the effect of exchange rate on returns from KSE-100 index.

The area of investigation in this study is relevant to Pakistani stock exchange. Due to short time and limited availability of resources, data is collected from only one country. However, this paper provides sufficient knowledge and guidance to early researchers in this area as well as provides guidance to financial operators for investing in stock market. Many studies are available which determine the link between macro-economic variables and working of stock markets. Majority of those are conducted in foreign equity Market. This paper targets the Stock exchange of Pakistan. This study identifies the Impact of KIBOR and Exchange rate on KSE100 index. Time frame is supposed to be the major research gap. No published Article is available which shows the Impact of KIBOR and Exchange rate on KSE100 index during 2010 to 2015.

2. Literature Review

Stock market of a country is vital for its economic development. Working of Stock Market is affected by lot of factors. These factors may enhance or negatively affect the performance of stock market. Many Research articles are available which show the connection between macroeconomic indicators and stock market. In recent era, many researchers focus on the inverse relation of interest rate and exchange rate with equity markets.

Kaul (1987) find negative relationship between equity returns and anticipated inflation and positive relationship between stock returns and Interest rate. Mukherjee and Naka (1995) describe the relationship between variables of macroeconomic and equity prices in Tokyo stock market. The researcher applies Vector Error Correlation Model. It shows significant positive relationship in

supply of money and share prices, Stock prices and industrial production, exchange rate and equity prices.

Hasan and Javed (2009) explain the link between stock prices with the money supply in Pakistan: T Bill rate, CPI and Foreign exchange rate. The researchers apply Cointegration test, Impulse response Analysis and Granger Causality. They conclude that relation of exchange rate and rate of interest with equity market return is negative. Agrawal et al. (2010) investigate the impact of the exchange rate of Indian Rs – US \$ on Nifty index. For the analysis, the data has been extracted from October 2007 to March 2009. With their study, it has been established that Nifty returns in addition to rate of exchange is not-normally dispersed. Through analysis, it has also been proved that both rate of exchange and NIFTY returns are stationary at the level. Correlation concerning Nifty dividends and Alternate Rates have been found to become negative. Their coefficient regarding correlation relating to the two variables are calculated, which advised slight unfavorable correlation between them.

The study of (Bilal et al.,2012) identifies co-integration between the macro indicators and returns of PSX which usually demonstrate that Pakistan's biggest stock market index KSE-100 has negative relationship with the terrorism, that have ordinary relation with rate of interest. Khan (2014) finds that exchange rate, inflation and Gross domestic product (GDP) progress rate have positive relation with stock price of (KSE-100 index), and there is negative impact of prices of stock exchange KSE-100 index with the rate of interest. He further claims that the relationship of interest rate with prices of stock exchange is moderate and negative, it shows whenever the interest rate is increased the prices of stock exchange will be reduced. The Karachi stock market was the first and the largest market in Pakistan, which being single constituted (74%) of capital market. It plays crucial role in prosperity of Pakistani economic climate. After 1997 financial slum in Asia, exchange rate and equity return relationship have become very crucial. At that time, in Asian stock markets, both equity prices and rate of exchange reduced massively. Many researchers say that we can link expected return on shares with the variation in exchange rate. Shahid and Mehmood (2015) examine calendar anomalies at KSE-100 index and find remarkable variations among the returns of week days, with largest average returns on Friday that acknowledges the existence of weekend effect at PSX.

Khalid and Kawai (2003) also find relationship among three variables that are interest rate, exchange rate and stock prices. They have done research in nine

East Asian countries by using VAR model. Further, the predictability of returns and its time varying property exists in cryptocurrency markets as Shahid et al. (2018a) first document the time varying predictability of bitcoin and in commodities market (Shahid et al., 2020)

Recent trend has shifted from estimating stock market returns from efficient market hypothesis to adaptive market hypothesis view point as (Shahid & Sattar, 2017; Shahid et al., 2018b; Shahid et al., 2019; Shahid et al., 2021) find that returns from PSX varies over time. The study of (Shahid & Sattar, 2017) is the first study which explores the PSX using AMH through month of the Ramadan effect along with other popular anomalies over the period from 1992 to 2015. They reveal that performance of calendar anomalies has changed over time and this variation in their behavior from time to time is in line with Adaptive Market Hypothesis

3. Research Methodology

This paper takes data of KSE-100 index of Pakistan stock exchange, which is the largest market in terms of capitalization of the market which is founded on January 18th 1947. In the year of 2002 stock exchange of Pakistan is declared by the market as one of the efficient performing markets in term of stock in the world. On December 8th 2008 around 654 companies are listed in the stock exchange with the market capitalization around Rs. 8.6 trillion. While on July 30th 2011 the capitalization of market is reached to about Rs. 2.9 trillion and on May 28th 2013, it is reached to Rs. 5.22 trillion. This research explores the link between market index with rate of interest and Exchange rate. We have taken six years weekly data from 2009 to 2014. Data is collected on weekly basis and it is taken by every closing day of week for five years. The weekly closing index of KSE 100 is taken for five years. The 1 week of KIBOR offer rate is taken of each closing day of week for more than half a decade. And Direct rate of US \$ is also taken for six years on each closing day of week. Then we make 262 observations for a single variable. Data has been gathered from the state bank of Pakistan's official website. This paper instigates effect of rate of interest and exchange rate on equity returns of KSE-100 index of PSX. The variables involve in this research are rate of interest, Exchange rate and stock returns of KSE-100 index. Interest rate and Exchange rate are independent variables. Return KSE-100 index is taken as dependent variable



Figure 1: Relationship between Independent and Dependent Variables.

Based on the relationship between variable the study uses the following regression equation

$$R_t = c + \beta ER_t + \beta IR_t + \varepsilon_t, \quad t = 1, \dots, T$$

Where R_t is the return from KSE-100 index of PSX, while ER and IR represents the exchange rate and interest rate respectively. To find the interest and exchange rate impacts on Stock exchange of Pakistan we have applied GARCH (p,q) model. According to Engle (2001) where volatility of series involves, a GARCH (1,1) model is considered on first priority to apply because of its robustness, simplicity and wide applicability. Therefore, along with simple OLS regression, the current study also uses GARCH (1, 1) model. GARCH (1, 1) model “allow researchers to model variance as conditional on the past variance and error, rather than fixed through the series (Urquhart & McGroarty, 2014)”. GARCH (1,1) model is best fitted model to grab the desirable characteristics of Stock market return. Eviews software is used in this paper to run the said econometric model tests. The empirical tests are applied on weekly stock returns of KSE 100 Index during period of 2009 to 2014. we have used the below equation to calculate returns.

$$rt = [l(Pt) - ln(Pt-1)] \times 100$$

The above equation $l(Pt)$ shows the natural log of index during time t, while $ln(Pt-1)$ represents natural log at time t-1, while rt is the return of KSE-100 index in table 1 descriptive summary statistics shows weekly returns are often positive. The existence of excessive kurtosis is the evidence of leptokurtic series.

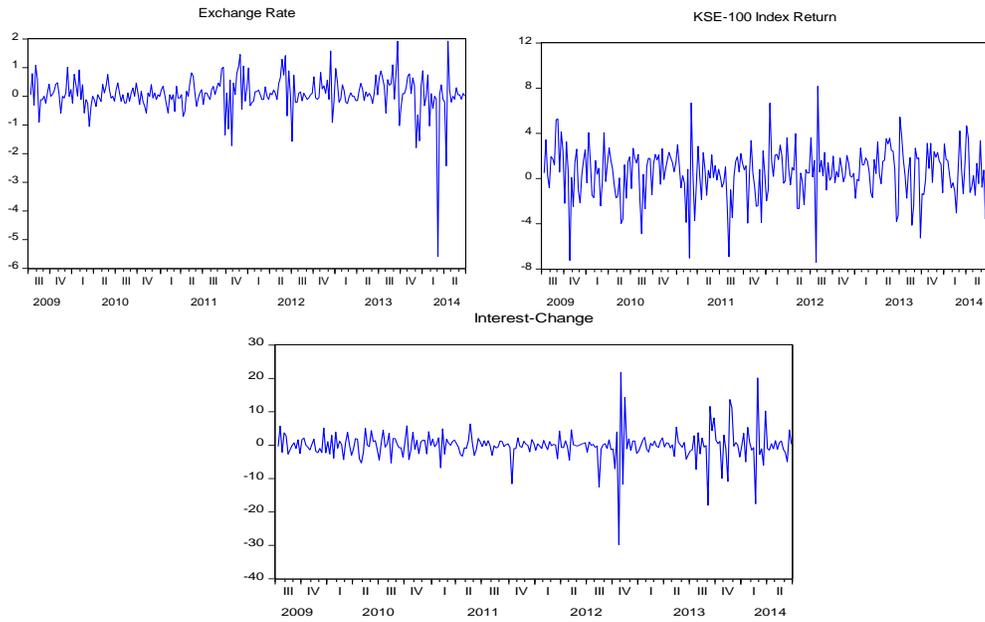


Figure 2: Log Returns for Exchange rate and KSE-100 index along with changes in Interest rate over time.

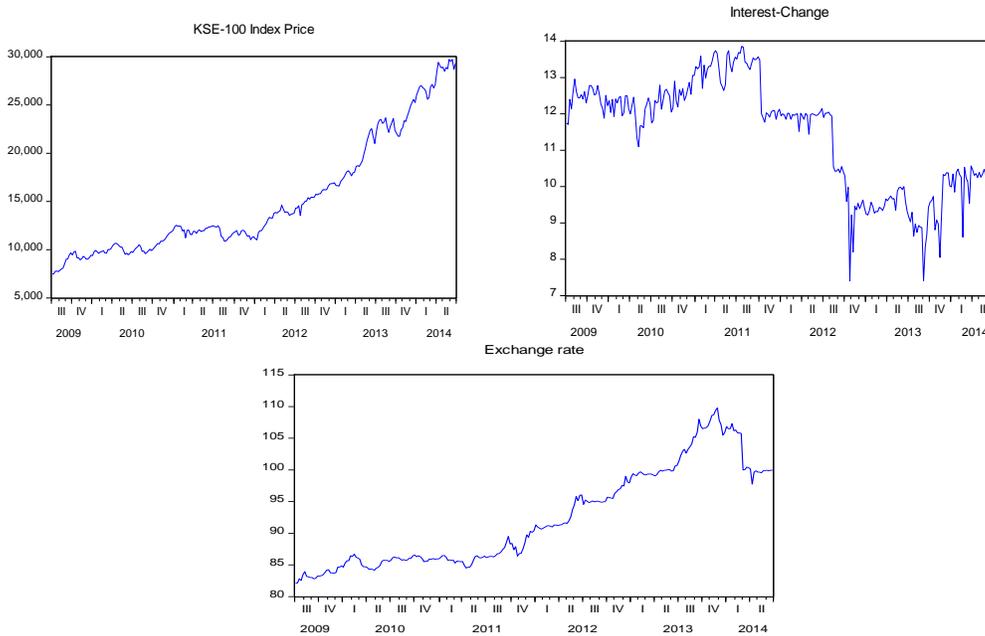


Figure 3: Prices of KSE-100 index over the time along with Exchange rate and Interest rate.

Table 1: Descriptive statistics of the variable under study

	INDEX_RETURN	EXCHANGE-RATE	INTEREST-CHANGE
Mean	0.526441	0.075658	-0.057819
Median	0.720837	0.058241	0.000000
Maximum	8.159873	1.925085	21.85446
Minimum	-7.394162	-5.590763	-29.77527
Std. Dev.	2.263905	0.644915	4.487128
Skewness	-0.488346	-2.801838	-0.672401
Kurtosis	4.671726	26.29487	15.41615

4. Empirical Results

First of all, we run simple OLS regression to find the relationship of dependent variable with independent variables. There is negative (-0.622153) and significant (p-value 0.0044) relationship exists between stock market return and exchange rate. Therefore, H01 is rejected. On the other hand, there exists positive (0.034977) but insignificant (p-value 0.034977) relationship between stock market return and interest rate. So, we cannot reject H02 (see table 3). Based on the volatility depicted in Picture 2, we have also applied GARCH (1,1) model which depicts the same results as OLS delivers. As the Durbin Watson Statistics is approaches to 2 so, autocorrelation problem does not exist in our Model. As the F-Stat is greater than 4, this shows the model is statistically fit.

Table 2: Results of GARCH (1,1) Model applied on the data

OLS RESULTS				
Variable	Coefficient	Std. Error	t-Statistic	Prob
C	0.575534	0.139573	4.123524	0.0001
EXCHANGE-RATE	-0.622153	0.216689	-2.871186	0.0044
INTEREST- CHANGE	0.034977	0.031144	1.123081	0.2625
S.E. of regression	2.234395			
Adjusted R-squared	0.025900			
Durbin-Watson stat	1.935380			
F-statistic	4.443194			
GARCH RESULTS				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.597442	0.147623	4.047076	0.0001
EXCHANGE-RATE	-0.671213	0.289389	-2.319418	0.0204
INTEREST- CHANGE	0.040490	0.034489	1.174021	0.2404
Variance Equation				
C	2.275807	1.190428	1.911756	0.0559
RESID(-1)^2	0.130671	0.064770	2.017463	0.0436
GARCH(-1)	0.408999	0.271449	1.506724	0.1319
Adjusted R-squared	0.025554			
S.E. of regression	2.234791			
Durbin-Watson stat	1.938815			

Table 3: Hypotheses acceptance and rejection based on OLS and GARCH (1, 1)

Ho1: There is no significant link between Exchange rate and KSE (100) index	Rejected
H1: A significant relationship between Exchange rate and KSE (100) index exists	Accepted
Ho2: There is no meaningful link betwixt interest rate and KSE (100) index	Accepted
H2: A meaningful link between interest rate and KSE (100) index exists	Rejected

5. Conclusion

Our findings are in-line with previous literature and strengthen it. If we see the impact of exchange rate on equity market index, there exists the empirical evidences of both positive and negative impacts. This study witness's exchange rate has negative effect on stock market performance. It means higher the exchange rate lowers the effectiveness of stock market. From our results, it is clear that interest rate has no significant but positive effect on returns of stock market, when interest rate increases effectiveness of stock market also increases. The reason is cost of borrowing becomes high at high interest rate so investors try to shift from financial institutions to stock market, which increases demand of shares. High demand for shares ultimately creates high returns.

Due to the time constraints, the current study selects a sample period from 2009 to 2014. Moreover, the study incorporates few popular macroeconomic variables. Therefore, we recommend that future studies should use more recent and a longer time period data to study the impact of macroeconomic variables on stock market returns. The future studies may use the current approach to investigate the similar model in other countries. The future studies may investigate the impact of macroeconomic variables on returns from bonds market, commodities market and real estate investment. Individual investors and financial managers can use the results of this study to construct profitable portfolios while the academicians and researchers can use the results of this study for theoretical justification and for policymaking.

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