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IMPACT OF MACROECONOMIC VARIABLES ON STOCK PRICES IN PRE AND POST 9/11 ERA A CASE STUDY OF KARACHI STOCK EXCHANGE

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Abstract

This study investigates the impact of various macroeconomic factors on the Karachi Stock Exchange (KSX), focusing particularly on the periods before and after the September 11, 2001, attacks. Time series data analysis techniques are employed, beginning with the Augmented Dickey-Fuller test to assess data stationarity and detect unit roots. The Chow test is utilized to identify structural breaks in the data, revealing significant shifts post-9/11 compared to pre-9/11 periods. Additionally, the Granger Causality test examines causal relationships among the variables. Multiple regression analysis further explores the influence of macroeconomic factors such as crude oil prices, inflation, interest rates, exchange rates, GDP growth, and gold prices on stock prices. Moreover, the results of the study indicate stationary data post-Augmented Dickey-Fuller test, with structural breaks identified by the Chow test aligning with the timing of the 9/11 event. Furthermore, the study finds that macroeconomic variables, including Foreign Direct Investment, price stability, and turnover, added value to the stock market post-9/11. The Granger causality analysis indicates no significant causal relationships between stock prices and the examined variables throughout the study period, affirming data authenticity. The study provides insights valuable to investors and policymakers, emphasizing the impact of crude oil prices and interest rates on stock prices and suggesting strategies for managing market volatility and shaping economic policies in response to geopolitical shocks.

Keywords: Macroeconomic Variables, KSE 100 index, Augmented Dickey Fuller test, Chow test, Granger Causality test and Multiple Regression Analyses.

Introduction

Macroeconomic factors manage Macao's economy in general. The conventionally managed factors are macroeconomic factors. Thus, the founder of macroeconomics is John Maynard Keynes. The macroeconomic variables are very useful instruments in dealing with the economy for its proper direction, increase in growth rates, and in identifying the proper trends of the overall state of the country's economy. Furthermore, the government incorporates macroeconomic factors into its policies to pursue the stability of the economy. The last ones include those concerning the macroeconomic activity level, including inflation rates, money circulation, exchange rates, and economic growth, as well as analyzing trends within the economy and fluctuations on a larger scale. Thus, to explain the causal linkage between the macroeconomic factors and the stock prices, there are many readings. In evaluating an economy, the most volatile element that is used is stock. The economy will be worse off as a result of any turn of events that seek to change the stock prices

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in the market. As a result, the relationship between stock prices and macroeconomic variables has now emerged as a hot issue in finance (Ozbay, 2009). As stated in a couple of works, macroeconomic variables significantly affect or hyperbolize the values of stocks and are crucial for a long-term perspective. The means that are utilized in this study comprise the interest rate, crude oil prices, inflation rate, economic growth rate, exchange rate, and gold prices. The 9/11 attacks marked a pivotal moment in global economics, with Pakistan experiencing significant shifts in foreign aid, trade policies, and capital inflows due to its alliance with the U.S.-led war on terror. This study focuses on Pakistan's unique context, where the post-9/11 period saw increased foreign direct investment (FDI), export quota expansions, and currency stabilization.

The stock market is a very central organ in economic advancement due to its provision of capital for expansion and economic growth. Securities are marketable items through which the users of capital, especially funds and savers, pool their resources in the form of risk sharing and wealth transformation. Spending generates other reserves in the form of productive assets, which leads to economic activities. With the share prices in mind, the investors decide whether to invest in different shares in the market or not. The previous theories indicate that macroeconomic factors have a relationship with the fluctuations in share prices. Three reasons governed the consideration of macroeconomic variables and stock market; i) Current and future policies/regulations into consideration would be reliable, ii) This research works as a tool in decision making and minimizing risk since data is clear and distinguishable, iii) The unpredictable changes in macroeconomic variables are understood and possible measures are taken since the population is always informed Hence, the authors chose the relationship between macroeconomic variables and stock market (Abu-Libdeh & Harasheh, 2011). Macroeconomic variables cannot be ignored when analyzing the economy. They play a vital role in determining the stock market's performance (Mohnot et al., 2024).

Various empirical studies reveal that the stock prices have a strong relation with macroeconomic factors like oil price, inflation rate, exchange rate, interest rate, gold rate, growth rate of gross domestic product, the market capitalization, price-earnings ratio, money supply, employment rate, risk premium etc. The determination of investors over the decision in relation to investment in a particular stock depends on such factors as oscillations, which are either positive or negative, on the market prices of stocks. The risks in the stock market include stock market variables, information regarding the stock market, the stock prices, and the macroeconomic performance of the business venture, which should manage such risks through risk management before they surface. It is necessary to discuss the reduction of risk due to the instability of stock exchange markets among investors and market regulators. Market regulators should ensure that the stock market does not experience any financial corruption. On the other hand, the investor who is acting on the market must use the risk management models in order to protect an open position on the market (Varma, 1999).

Macro-economic factors influence the level of stability or otherwise of an economy. Among these, the interest rate plays a central part, given that investment levels are directly conversed with interest rates. Consequently, when the interest rates go down, it becomes easier and easier to attract more and more investors towards

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stocks. Interest rate is related to the pricing of money at a given point in time in relation to the price that it will have at another given point in time in the future of the business. The other factor that distinguishes borrowing money from receiving it to save is the interest rate, which is given as the time value of money. If this is occasioned by inflation, then the rate of return would be high since the prices have gone up. During the times of uncertainty, the demand for interest rates would be higher than the rates of inflation in the worst periods (Reilly & Brown, 2003).

The crude oil prices highly influence the stock prices. Crude oil has played a constructive role in the context of differentiated assets and the development of the oil and gas sector in Pakistan for a relatively long time. This increase in the prices of petroleum products is significant, while keeping inflationary pressure on the economy in mind. The impact of oil price shocks on stock returns of the US economy varies greatly, as it depends on the change in oil prices associated with the supply and demand of the oil market. The variations in stock returns of the US are 22% in the global crude oil market, according to Lutz (2009). Inflation rate also emerged as another determinant of stock market prices, as noted in most previous research. For example, McConnell et al. (2012) categorize an increase in the general price levels as inflation. Due to an increased inflation rate, there are fewer resources to be bought with each unit of earnings because purchasing power decreases. CPI is one of the key indicators of the inflation rate in any country and is calculated on a monthly basis. Macroeconomic policy is a way through which the government implements its policies since it works on the overall economy; it can control the level of inflation through the interest rates or by coming up with ways of eradicating unemployment in the economy. From the work of Talla (2013), it is understood that inflation can be either beneficial or detrimental to the stock markets. There is always a difference in the cost or the prices of products when the supply of products is less than the demand. This is because it can help enhance the sales of the firm and the overall earnings of the concern through the provision of economy bulk products with improved efficiency. Also, they amount to less than the number of people who testify in court to avoid delay because of an increase in the general price level. This will increase the utilisation of its consumption goods and services while decreasing investment. Inflation is also likely to cause an increase in the interest rate, and as a consequence, the stock prices begin to go down. A rise in the rate of inflation also has a bearing on the foreign exchange market, affecting the value of the domestic currency relative to the foreign currency, which is termed the exchange rate.

The country's exchange rate influences the net exports and the stock prices. The same applies to a competitive firm that relies on fluctuations in exchange rates concerning foreign currency prices. Also, the exchange rate affects the firms' profit and consequently affects the changes in the stock prices of the markets. In addition, the prices of the stocks affect the flow of capital through the outflow of capital and the inflow of capital. This means the quantity of capital, both domestic and foreign, will be attracted when there is an increase in the price of stocks, while this will have the effect of reducing the stock of wealth in a country (Vejzagic & Zarafat, 2013).

Rationale of the Study

The Karachi Stock Exchange (KSE) serves as a critical barometer of Pakistan's economic health. Understanding how macroeconomic variables influence

stock prices—especially in the wake of geopolitical shocks like 9/11—is essential for investors, regulators, and policymakers. This study fills a gap by examining structural breaks and long-term relationships in a developing market context.

Problem Statement

Despite extensive research on macroeconomic variables and stock prices, few studies explore the structural breaks caused by geopolitical events in emerging markets. Pakistan's post-9/11 economic landscape, characterized by policy shifts and external shocks, presents a unique case for analysis. This study addresses the lack of empirical evidence on how such events alter the relationship between macroeconomic indicators and stock market performance.

Research Questions

1. What is the long-run relationship between macroeconomic variables (inflation, exchange rates, crude oil prices, gold rates, interest rates, GDP growth) and KSE stock prices?

2. How did the 9/11 event influence this relationship?

3. Is there a structural break in the impact of macroeconomic variables on stock prices pre- and post-9/11?

Research Objectives

- To evaluate long-term associations between macroeconomic variables (inflation, exchange rates, crude oil prices, gold rates, interest rates, GDP growth) and KSE stock prices.

- To assess structural breaks using the Chow test.

- To provide actionable insights for investors and policymakers.

Theoretical Framework

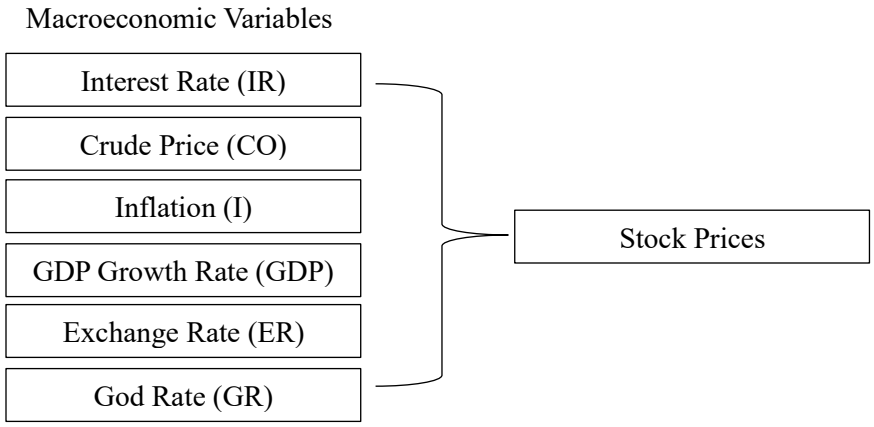
The study is grounded in the Efficient Market Hypothesis (EMH) and Keynesian macroeconomic theory, which posit that stock prices reflect all available information and are influenced by economic policies.

Conceptual Framework

In the conceptual framework, the sources of variation have been identified as independent variables such as inflation rate, exchange rate, international oil price, gold prices, interest rate, and gross domestic product growth rate. In contrast, the stock prices are the dependent variables (Figure 1). We do not set any loss function to choose among the said variables from the other macroeconomic variables. The chosen variables influenced the existing stock prices in a major way. This macroeconomic variable is examined jointly as a group of variables on KSE while working on it as a dependent variable. These variables are closely tied to each other as well as the economy.

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The specified variables are of significant interest in the current economy, particularly in the case of Pakistan.



Research Hypotheses

H_1: The 9/11 event caused a structural break in this relationship.

H_{2a}: Inflation significantly influences KSE stock prices.

H_{2b}: Exchange rates significantly influence KSE stock prices.

H_{2c}: Crude oil prices significantly influence KSE stock prices.

H_{2d}: Gold rates significantly influence KSE stock prices.

H_{2e}: Interest rates significantly influence KSE stock prices.

H_{2f}: GDP growth significantly influences KSE stock prices.

H_3: Crude oil prices and interest rates have a stronger impact than GDP growth.

Literature Review

This review is centered on pertinent factors that are relatively rare in the literature. The five are the international prices of gold, crude oil prices, the inflation rate, the interest rate, and the real GDP per capita, respectively. However, these themes are provided in the literature under different frameworks. For this work, emphasis will be placed on the relationship between Macroeconomic variables and Stock Prices.

It is also important to note that there was a change in the volatility behavior after the attacks of 9/11. The nature of volatility behaviour during the pre- and post-9/11 periods shall be examined to understand that the Pakistan government decided to side with the US for a strong coalition in the war on terrorism, which brought some action to the Pakistan economy. The benefits which this country was able to gain due to this alliance include; there was a revival of relationship with this giant over USA, there was a good quantity of increase in the export quotas of textile to USA and the EU, flow of remittance started and has improved formally, the value of the local

currency was on the process of being strengthen, and the burden of debts which has been a major hindrance to this country has reduce (Kausik & Rudra, 2014).

Thus, certain investigations on the different aspects of Pakistani stock markets were conducted in different studies to discover the patterns of their relation to macroeconomic factors. According to his research, Nishat & Shaheen (2004) employed inflation and interest rates in calculating stock prices. On the basis of identified inflation values, the effect of negative inflation on the stock market was established. Since we were aiming to statistically test for causality between the variable of interest (namely, stock prices and macroeconomic factors), the Granger Causality approach was employed in another study, where Naz, Subhani, & Aslam, (2024) adopted the Granger Causality test for exchange rate and established that exchange rate is Granger caused by stock prices. Khan and Qazi (2011) examined the level of linkages between economic growth, commonly measured by gross domestic product (GDP) growth rate, and the stock prices in economies such as Pakistan. They explained that their study focused on assessing the studies that considered the presence of a long-run relationship between the variables of growth rate and stock market. According to these facts and assumptions, the present study was cautious in making efforts to examine the effect of macroeconomic variables on the KSE stock prices (Jamil & Rasheed, 2024).

Multiple investigations in different national economies have researched stock market behavior using macroeconomic factors as analysis variables. The research by Hondroyiannis and Papapetrou (2001) in Greece evaluated how the real oil price and interest rates, along with exchange rates and foreign stock market movements, influence the market. Bhattacharya et al. (2001) analyzed the influence of trade balance alongside foreign exchange reserves as well as the exchange rate on the Indian market. Wongbangpo and Sharma (2002) conducted a research analysis that studied Indonesia, Malaysia, the Philippines, and Singapore through the evaluation of stock price index, GNP, CPI, money supply, interest rate, and exchange rate data. The research on industrial production and money supply with CPI and exchange rates in Malaysia was carried out by Ibrahim and Aziz (2003), and a parallel investigation was carried out by Tsoukalas (2003) in Cyprus.

Maysami et al. (2004) investigated interest rates alongside industrial production, money supply, CPI, and exchange rates in Singapore, while Kurihara (2006) studied Japanese stock prices in his analysis of Japan. The analysis conducted by Coleman and Tettey (2008) evaluated lending rates together with inflation and market performance in Ghana, and Rong-gang et al. (2008) studied oil price shocks in China. The analysis by Attiya and Eatzaz (2008) in Pakistan incorporated market return along with call money rate, term structure, inflation, exchange rates, industrial production, real consumption growth and oil prices. The exploration of CPI alongside industrial production, exchange rate, inflation, and reserves and money supply as variables was conducted in multiple Pakistani studies by Nadeem and Zakir (2009), Mohammad et al. (2009), Sulaiman et al. (2009), and Imran et al. (2010).

In Turkey, Buyuksalvarci (2010) conducted research along with George (2010) in Greece, who focused on variables including oil prices, production indices, and inflation rates. The study conducted by Singh et al. (2011) in Taiwan used GDP along with employment, inflation, and exchange rates. Additionally, in 2011, India

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also analyzed these same variables. The impact of factors like crude oil and gold prices was further examined in studies conducted in Thailand by Nopphon (2012), India by Chandni et al. (2012), and Pakistan by Mehr and Mohammad (2012). In Pakistan, Khalid et al. (2013) and Muhammad and Humera (2013) carried on this emphasis, while Mohi-u-din and Mohammad (2013) in India examined a variety of factors, such as the money supply and gold prices.

Muau and Alhassan (2014) in Ghana and Ita and Joe (2013) in Nigeria studied national savings, inflation, and exchange rates in Africa. While Wang et al. (2014) in Japan concentrated on oil prices, Ullah et al. (2014) and Umar et al. (2014) in Pakistan examined GDP, money supply, and interest rates. Barakat et al. (2016) investigated the money supply, interest rates, exchange rates, and consumer price index in Egypt and Tunisia. When taken as a whole, these studies offer a thorough understanding of how macroeconomic factors affect stock market behavior in a range of industrialized and emerging economies.

The correlation between the stock activity and the fluctuations of the oil price. Two groups have been distinguished in the earlier literature between the stock markets and the crude oil prices at the industry level and the market level as well (Lee et al., 2012). Fluctuations in the financial market lead to shocks, and the macroeconomic effect of changes in the international price of oil is examined. It is argued that any adjustment shock on oil prices and its macroeconomic relation requires the consideration of other shocks. Policy makers should also take into consideration changes in financial markets that may arise when analysing shocks to oil, as stated above. And then, on the basis of those analyses, it should formulate the right policy for stabilization in order to counter the shocks in that economy, as shocks may have different effects on an economy at different times (Jagirdar & Gupta, 2024). Out of all the macroeconomic factors, the interest rate has a great impact on the expected stock prices in the future.

Another study found that more emphasis was placed on analyzing the relationship between macroeconomic variables and the yields of shares in the market after the year 1986. The macroeconomic factors exist in the form of interest rates, inflation, GDP, and the money supply, also known as stock (Kandir, 2008).

The channels and the mechanisms through which the macroeconomic variables affect stock prices are given below:

a. IR↑ → Bond demand↑ → Stocks demand↓ → Stock prices↓

b. CO↑ → Profitability of energy firms↑ → Stock prices of energy firms↑

c. Cost of production↑ → Profitability of other firms↑ → Stock prices↓

d. I↑ → Firm's profit↑ → Share value↑ → Stock prices↑

e. GDP↑ → Demand↑ → boom → investor's sentiment↑ → Earnings per share↑ → Stock prices↑

f. ER↑ → ER(Exp)↑ → Capital outflow → Stock prices↓

g. GR↑ → Expectation of further increase in GR → Portfolio of investment changes → Stock prices↓

Research Methodology

Time series data are employed in this investigation. Stationarity is the most important prerequisite for time series regression to be valid. Stationarity is a transition from one time to another. When a time series' statistical characteristics, including its mean, variance, and others, remain constant across time, it is said to be stationary. If a time series's probability distribution does not change over time, it is considered stationary. It is argued that Yt is non-stationary if it varies over time. In a probabilistic sense, stationarity is necessary if the future is expected to be similar to the past. If the data is stationary, it behaves well in technical terms. However, if the data deviates from stationarity, it is said to be non-stationary. Next, we must address the non-stationarity problem. Trend and structural break are the two primary categories of non-stationarity. The structural break takes into account the possibility that the model's coefficients may not remain constant across the whole sample. Forecasting is hampered if the historical data deviates from the current model. Tests for a break are mentioned below in a variety of ways to address the issue of changes in coefficients. Logarithms, first differences, second differences, and lags would all be used to alter the time series variables. In a time series Yt, the first lag is Yt-1, and the jth lag is Yt-

The change between periods t and t-1, or ΔYt, is the initial difference in a time series. This shows that ΔYt= Yt – Yt-1. The first difference, Δln(Yt) = ln(Yt) – ln(Yt1), is the logarithm of Yt.

To ascertain if time series variables are static or not, Dickey and Fuller developed the Augmented Dickey-Fuller test in 1981. The stationarity of the time series data is checked using the Augmented Dickey-Fuller test (ADF), a unit root test that is essential for identifying long-term associations. This test's objective is to determine if a time series sample contains a unit root. The ADF is used in this work to observe and verify the non-stationarity issue. Many researchers use this model to check for stationarity in their studies, such as (Irfan & Luqman, 2013; Hina & Naveed, 2013; Salma et al., 2014; Suleman et al., 2009; Sangmi & Hussain, 2013; Tripathy, 2011; Nadeem & Zahir, 2009; Imran et al., 2010; and Barakat et al., 2016). This test is used in our study.

An expanded version of the Dicky-Fuller test is called the Augmented Dickey-Fuller (ADF). The ADF test equation is provided below to verify the stationarity of time series data:

$$\Delta Yt = \propto + \beta T + pYt - 1 + \sum^{k}_{i=1} \quad \gamma i \Delta Yt - 1 + et \qquad (1)$$

Similar to how this test is used in our study, numerous researchers' studies (Irfan & Luqman, 2013; Hina & Naveed, 2013; Salma et al., 2014; Suleman et al., 2009; Sangmi & Hussain, 2013; Tripathy, 2011; Nadeem & Zahir, 2009; Imran et al., 2010; and Barakat et al., 2016) use this model to check for stationarity.

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The Dicky-Fuller test has been expanded into the Augmented Dickey-Fuller (ADF) test. The ADF test equation is provided below to determine whether the time series data is stationary.

The Chow stability test is employed to ascertain whether parameters remain constant throughout the estimating period. A major shock to the economy or a change in policy can frequently cause a structural break in a set of data. The Chow stability test examines a structural breach or the aftermath of an abrupt shock or policy change.

Working on the Chow test involves the following steps:

1. First, the regression is performed using all of the data. RSSc is gathered both before and after the structural break.

2. In the second step, two distinct regressions are performed on the data: one prior to and one subsequent to the structural break. RSS is gathered in both situations, producing RSS1 and RSS2.

3. To determine the test statistic, use the formula below with the three numbers mentioned above:

$$F = \frac{\frac{RSS_C - (RSS_1 + RSS_2)}{k}}{\frac{RSS_1 + RSS_2}{n-2k}} \quad \text{eq (1)}$$

4. The F-test tables' essential values are identified. In this instance, the degrees of freedom are F (k, sn-2k).

The absence of a structural break is the null hypothesis.

The Granger Causality test is employed to ascertain whether macroeconomic variables and the stock market are causally related. The Granger Causality test can be used to predict one variable based on another. Given that this link is reciprocal, Y is likewise expected to Granger-cause X. Additionally, the chosen macroeconomic factors can predict changes in the stock market (Stern, 2011). The Granger causality technique is used to determine whether or not one variable is Granger-causing another.

The explanation concludes by stating that if lagged values of Xt can predict Yt and vice versa, then Xt is said to Granger-cause another variable (Yt). The test's foundation is the regression line that follows:

$$Yt=\beta^{\circ}+\sum^{M}_{k=1}\beta k Y_{t-k}+\sum^{N}_{l=1}\alpha X_{t-l}+Ut \quad (3)$$

$$Xt=\gamma^{\circ}+\sum^{M}_{k=1}\gamma k X_{t-k}+\sum^{N}_{l=1}\delta l Y_{t-l}+Vt \quad (4)$$

Where the variables to be studied are Yt and Xt, the period is represented by t, the number of lags is "k" and "1," and the mutually uncorrelated errors are ut and vt.

Multiple regression analysis is a statistical method used to estimate the relationship between variables. Regression analysis in multiple Analyses forecasts how two or more independent variables will relate to a dependent variable. They can also aid in assessing the model's overall fit.

The following is the stated ordinary Least Squares equation:

$$(KSE)t=\alpha+\beta_1(CO)t+\beta_2(CPI)t+\beta_3(ER)t+\beta_4(IR)t+\beta_5(GDP)t+\beta_6(GR)t+\varepsilon_t$$

Where t is the period, α is the intercept term, and KSE is the Karachi Stock Exchange. Regression coefficients, or βs, indicate how important independent variables are. The index of the KSE 100 is the dependent variable. (5)

Analyses and Interpretations

Table 01: Augmented Dickey Fuller Test (ADF) for data Stationarity

Variables	Test of Stationarity	t- Statistics	Probability Value	Decision
CO	At first difference	-5.6730	0.0002	Stationary
I	At first difference	2.4528	0.0253	Stationary
ER	At first difference	-4.5926	0.0008	Stationary
GDP	At second difference	-5.2967	0.0005	Stationary
GR	At second difference	-6.9820	0.0000	Stationary
IR	At first difference	-4.4756	0.0112	Stationary

The result of the Augmented Dickey-Fuller Test is presented in Table 1 to determine the stationarity of the data. As the absolute value t > Dickey-Fuller critical value, it means that we can reject the null hypothesis of non-stationarity for the mentioned data set according to the result of the unit root test on the first difference in Table 1. The P-value also gives more evidence as to why it is correct to conclude that the crude oil time series has become stationary at the first difference.

The analysis of the inflation differenced data obtained from the e-views necessarily underpinning the augmented Dickey-Fuller unit root test asserted that the critical value of Dickey-Fuller is less than the t-statistic in an absolute regard, hence enabling the rejection of the null hypothesis. Since, therefore, the value p is less than 0.05, we conclude that the variable under study—inflation—is stationary at the first difference.

The above table shows that, given that the unit root test-based series is differentiable, the t value in its absolute form appears to be higher than the Dickey-Fuller critical value. By virtue of its p-value, the analysis infers that the exchange rate time series is stationary at first difference.

We may reject the null hypothesis of non-stationarity as the unit root test on a differenced series of the following table shows that the t value, now taken in the absolute sense, is higher than the Dickey-Fuller value. Therefore, we can conclude

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that you can find non-stationarity in the first difference, but the second difference result shows that there is a statistically significant outcome.

In cases as shown in the above table that depicts the findings of gold rate, the unit root test differenced series is proposing that since the Dickey-Fuller value is less than the "t" value when taken in its absolute sense, then the null hypothesis, which posits non-stationarity, should be rejected. Hence, we can conclude that the gold rate for the time series analysis is stationary at the second difference. The p-value that we have here is very low and also has a significant value to support this conclusion.

The t value is greater than the ADF value, as pointed out by the result of the unit root test for the differenced series shown in the table above. Therefore, it allows us to reject the non-stationarity null hypothesis. Therefore, we shall be inclined to approximate that the variable interest rate on time series satisfies the assumption of being stationary first differenced, as supported by the P-value of 0.0112.

Chow Test

The Chow test is applied to determine whether the data contains a structural break. Would the data provide a breakeven point in the discussion?

Table 02: Chow Test for the Pre 9/11 era for structural break (1992-2000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCO	-0.321	0.164	-1.953	0.308
DI2	6.865	1.153	5.954	0.162
DER	-0.413	0.708	-0.583	0.778
DGDP2	2.457	0.750	3.276	0.173
DGR2	0.009	0.029	0.306	0.901
DIR	-0.093	0.347	-0.267	0.899

According to the pre-event Chow Test results (Table 02), GDP, CO, and CPI have a considerable impact on the stock index. However, the pre-stages' total result is inconsequential because the remaining factors are negligible.

Table 03: Chow Test for the Post 9/11 era for structural break (2001-2011)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCO	0.442	0.096	4.628	0.061
DI2	-5.311	0.614	-8.657	0.005
DER	-6.311	0.528	-11.949	0.001
DGDP2	2.702	1.621	1.667	0.355
DGR2	-0.073	0.029	-2.475	0.224
DIR	17.489	1.049	16.664	0.001

According to the E-views, with the exception of GDP, which is important at the 10% level of significance, all macroeconomic indicators are notable at the 5% level of significance in the post-event period of 9/11 (Table 5.3). The post-period analysis's overall outcome is noteworthy.

Table 04: Chow Test for both the Pre & Post 9/11 era for structural break (1992-2011)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCO	0.952	0.468	2.034	0.227
DI2	1.573	3.018	0.521	0.726
DER	-3.440	2.544	-1.352	0.240
DGDP2	-3.313	6.136	-0.540	0.662
DGR2	0.188	0.137	1.374	0.362
DIRD	0.110	3.340	0.033	0.976

Table 4 analyzes the full research period using the Chow test, and the overall result is negligible, indicating that some macroeconomic factors did not influence the stock index prior to September 11th.

Table 05: Chow Test for the Breakeven Point (2001)			
F-statistic	9.292	Prob. F(6,10)	0.001
Log likelihood ratio	41.433	Prob. Chi-Square (6)	0.000
Wald Statistic	55.753	Prob. Chi-Square (6)	0.000

F-statistic = 9.29 with crucial F value (6, 10) indicates that F = 9.29 > F (6, 10) = 5.39 and 3.22 at the 1% and 5% level of significance, according to the results from E-Views shown in Table 05. Additionally, the p-value is below the significance level (p-value <0.05). As a result, we conclude that our model has changed structurally for Pakistan between 1990 and 2012 and reject the null hypothesis that there was no structural break at the designated breakpoint (i.e., 2001). The findings also imply that the macroeconomic indicators of Pakistan from 1990 to 2012 show the breaking point of the 9/11 incident in 2001.

The Chow Test results indicate that the variables in the Pakistani stock market contributed to the market after 9/11, as indicated in Table 3. However, the variables prior to 9/11 had no contribution because the results were negligible, as indicated in Table 2. The Chow test's total result likewise becomes unimportant due to the pre-era findings, indicating that the macroeconomic factors have no bearing on the stock index. Given the importance of the F-test and chi-square test, the Chow test suggests that there is a break point with a probability of around zero.

Granger Causality Test

The Granger Causality Test was employed to analyze the impact of the above-said macroeconomic factors on the values of Pakistan’s stock exchange from the year 1990 to 2012. Compared to the alternative hypothesis claiming that pair wise Granger causality existed between some selected macroeconomic variables, namely the crude oil prices, the rate of inflation, the GDP growth rate, the rate of gold, the exchange rate and the rate of interest and the null hypothesis of the Granger

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Causality Test stated that there was no causal relationship between the selected maco economic variables.

Table 06: VAR Granger Causality Test among macroeconomic variables

	ΔKSE	ΔCO	ΔI	ΔGNI	ΔGR	ΔER	ΔIR
ΔKSE		0.180	0.077	1.420	1.589	1.438	1.398
ΔCO	5.740*	-	0.010	0.006	6.546*	0.000	0.618
ΔI	0.082	0.547	-	0.610	0.577	5.043*	0.372
ΔGNI	0.137	0.019	7.560*	-	6.527*	0.027	0.716
ΔGR	0.708	0.098	0.021	1.783	-	0.008	2.103
ΔER	3.684**	2.918**	0.358	1.161	0.145	-	1.578
ΔIR	0.025	2.189	0.778	1.091	0.425	8.936*	-

Note: * and ** show significance at 5% and 10 % level of significance.

Source: International Financial Statistics

As shown in Table 6, the VAR Granger Causality test result of the chi-square statistic shows that in relation to all the variables for both the 5% and 10% levels of significance, the null hypothesis could not be rejected. This also means that there is no Granger Causality connection between the KSE and any of the lagged coefficients of currency rate, interest rate, gold rate, inflation rate (CPI), gross national income, or crude oil from 1990 to 2011.

CPI and GR, therefore, cause GNI in the course of the research, and the chi-square values that are 7.5590 for CPI and 6.5274 for GR in the regression equation of GNI reject the null hypothesis at the 5% level of significance. On the other hand, the GR equation does not Granger-cause the gold rate because all the coefficients of variables lagged are significant at the 5 percent level. Based on the exchange rate equation, we fail to retain the null hypothesis at the 10 % level of significance, where the chi-square value is determined as 3.6843 and 2.9183 for an index of KSE and CO, respectively. The results show that the exchange rate has Granger causality in both KSE and CO. At 5% and 10% levels of significance, the remaining variables, CPL, GNI, GR, ER and IR, do not, however, show significance level. Finally, in the equation IR, the null hypothesis of the exchange rate is again rejected at a 5 percent significance level. In contrast, the null hypotheses for the lagged coefficients of the other selected variables could not be rejected. Hence, at a 5% level of significance, the Granger exchange rate leads to IR.

Multiple Regression Results

The reported equation is given as:

$$(KSE)t=\alpha+\beta_1(CO)t+\beta_2(CPI)t+\beta_3(ER)t+\beta_4(IR)t+\beta_5(GDP)t+\beta_6(GR)t+\varepsilon_t$$

Where α is the intercept term, t is the period, and KSE is the Karachi Stock Exchange. Regression coefficients that indicate the importance of independent variables are called βs. The first step was to convert each independent variable into a stationary series. The reason for this is that every time series variable has a unit root.

The following are stationary at the second difference: CO stands for crude oil prices; CPI for consumer price index; ER for exchange rate; IR for interest rate; GDP for gross domestic product; and GR for gold rate. The error term is ε.

Table 07: Regression Model for the effect of macroeconomic variables on stock prices

Variables	Coefficient	Std. Error	t-Statistic	Prob.
DCO	0.596	0.207	2.886	0.013
DI	-0.996	0.421	-2.367	0.027
DER	-2.673	1.212	-2.204	0.046
DGDP2	0.255	1.892	0.135	0.895
DGR2	0.078	0.045	1.706	0.112
DIR	-0.367	0.147	-2.499	0.039
R-squared	0.744			
F-statistic	6.296			
Prob. (F-stat)	0.0027			

The findings show that the dependent variable, the KSE-100 index, is significantly impacted by crude oil, inflation, interest rates, and currency rates. Since the p-value is less than 0.05, the result shown in Table 07 shows a significant negative link between the stock price index and inflation (DCPI). The negative sign of the regression coefficients indicates that the stock price declines as the degree of inflation rises over time. For instance, the KSE index falls by 0.99% for every 1% drop in the inflation rate. In contrast, there was a substantial negative correlation (p-value < 0.05) between stock prices and currency rates. This demonstrates that currency depreciation typically results in a decline in stock price, which validates previous research (Doong et al., 2005). However, when it comes to crude oil prices, the outcome is noteworthy, as it was found that there is a strong positive correlation between crude oil prices and KSE-100 stock prices. The findings are also supported by earlier research (Miller & Ratti, 2009; Bhar & Nikolova, 2009). Since the p-value is less than 0.05, the interest rate coefficient shows a significant negative relationship with stock prices over time. The interest rate coefficient's negative sign signifies that as interest rates rise, stock prices decline. The other macroeconomic factors, however, were shown to be negligible.

The value of R-squared, which measures the degree of fit of the regression model, is 0.744, which means that up to 74 % of the total variations in stock prices can be explained by all the factors used in the model. The value of the F-statistic equals 6.29 and has a small p-value less than 0.05; therefore, it can be concluded that the independent variables impact the stock price to a considerable extent and the model provides a good fit to the analysed data in general.

Furthermore, when the regression equation output was run, it was observed that the value of the coefficients was negative, which is in concordance with the existing literature. For example, the negative sign of the interest rate variable is supported by Mahmudul & Gazi (2009), who investigated the link between stock index and interest rate in the developed and developing countries. This implied that it was the general tendency in most of the countries under consideration that there was a direct inverse relationship between interest rates and stock prices.

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Discussion

Research outcomes have a significant influence on Pakistan's economic governance and policy-making processes. Following its alignment with the United States in the War on Terror post-9/11, Pakistan experienced a marked increase in foreign direct investment and expanded export quotas, particularly in the textile sector. This geopolitical alignment introduced a structural break in the country's economic trajectory (Attiya & Eatzaz, 2008). As a result, the stock market exhibited heightened responsiveness to macroeconomic indicators, notably crude oil prices and interest rates, both of which retained their statistical significance. The positive relationship between fluctuations in oil prices and stock market performance underscores how profits within the energy sector have helped offset some of the economic costs incurred during this period (Buyuksalvarci, 2010; Wang et al., 2014). Consequently, policymakers are urged to maintain stable energy supplies and effectively manage interest rate strategies, given their demonstrable impact on market dynamics.

Notably, stock market prices in Pakistan exhibit weak sensitivity to GDP growth figures, primarily due to structural inefficiencies within the national economy. A substantial portion of Pakistan's economic activity remains undocumented, complicating accurate measurement through conventional GDP estimates (Umar et al., 2014). The stock market, influenced by a limited industrial base and the dominance of a few large firms, fails to adequately capture broader economic performance. As such, there is a critical need for improved GDP measurement methodologies and industry diversification within the stock market to foster more reliable indicators of economic health. For investors, it is essential to recognize that GDP trends, on their own, may not sufficiently predict stock market movements in Pakistan due to the prevailing structural constraints (Pal & Mittal, 2011).

Crude oil prices and interest rates continue to serve as key explanatory variables in Pakistan's economic environment. Given Pakistan's status as an energy-importing country, fluctuations in oil prices directly influence corporate profitability across numerous sectors. In line with traditional financial theory, higher interest rates increase borrowing costs and reduce corporate investment, ultimately diminishing stock market valuations (Khalid et al., 2013; George, 2010).

Additionally, exchange rate dynamics impact markets through mechanisms such as enhanced export competitiveness, elevated import expenses, and capital flight. These factors collectively account for the moderate yet significant relationship between exchange rates and market performance (Sulaiman et al., 2009). During periods of economic uncertainty, gold prices serve a protective function, acting as a hedge against inflation and preserving value, a trend particularly relevant in the Pakistani context due to gold's cultural and financial importance (Hina & Muhammad, 2012).

The GDP growth rate warrants critical attention due to its minimal influence on market behavior. Official statistics often fail to reflect the realities of Pakistan's informal economy, which constitutes an estimated 35–50% of GDP (Ita & Joe, 2013). Moreover, the market's concentration in a few sectors, such as finance and energy, limits its ability to represent broader economic trends. Long-term reforms aimed at

formalizing the economy and diversifying industrial representation within the market are essential for enhancing the relationship between GDP growth and macroeconomic indicators such as inflation.

Conclusion

The purpose of the present study was to analyse the effects of selected macroeconomic variables on stock prices in the Karachi Stock Exchange before and after the 9/11 tragedy. An ADF test was performed to test the integration of the macroeconomic variables and the KSE-100 index. In contrast, the Chow and Granger causality test was applied to determine the causality relationship between the macroeconomic variables and the KSE-100 index, and multiple regression analyses were used to examine the extent to which the macroeconomic variables affect the KSE-100 index. In its turn, it is a time series analysis, and the sample data from the years 1990-2011 were considered. Therefore, the above findings show that the time series values are stationary when the Augmented Dickey-Fuller test is conducted. Therefore, utilizing the Chow Test to determine the structural break, it represents the stage before 9/11 as being insignificant and the stage after 9/11 as being significant. However, this is so because of the pre-insignificant period, where the overall impact of the structural change also becomes insignificant. Moreover, the Chow Test presents the breakdown of macroeconomic variables in the stock market after the September 11 attacks.

By subjecting the analyses to the Granger Causality analysis, it was realised that there is no Granger Causality for some macroeconomic variables. Thus, in the context of the Multiple Regression analysis, the relationships between Macroeconomic factors and KSE were observed from 1992 to 2011. The study also established that all the independent variables featured in this study affect KSE in different ways. However, GDP was not found to have a non-significant relationship with KSE. Therefore, from the analysis of the entire regression model, it can be realised that nearly all the independent variables have a positive impact on the stock prices. The current trend is that many investors tend to think that gold is a very accurate barometer of the stock market performance in the long term and, as such, is a good investment asset, which this research has corroborated.

Recommendations

For investors, portfolio diversification into gold and foreign equities can hedge against macroeconomic volatility, as shown by gold's negative correlation with KSE returns. Policymakers should stabilize exchange rates and subsidize energy costs to mitigate oil price shocks, while improving GDP measurement to include informal sectors. Future research should extend beyond 2011, incorporate political risk factors, and conduct sector-specific analyses for more targeted insights.

Limitations of the Study

The study offers valuable insights, but certain limitations must be acknowledged. First, the timeframe (1990–2011) excludes recent economic developments, such as post-2011 policy changes or global financial crises, which may alter the relationships observed. Second, the focus on quantitative

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macroeconomic variables overlooks qualitative factors like political instability, regulatory changes, or investor sentiment, which could further explain stock price fluctuations. Third, the exclusion of sectoral analyses limits the granularity of findings, as different industries (e.g., energy vs. textiles) may respond uniquely to macroeconomic shocks. These gaps highlight opportunities for future research.

Significance of the Study

This study is of critical importance to multiple stakeholders, including investors, policymakers, and academics. For investors, the findings provide actionable insights into how macroeconomic variables like crude oil prices and interest rates influence stock prices, enabling better risk management and portfolio diversification strategies, particularly during geopolitical shocks. Policymakers can leverage the identified structural breaks post-9/11 to design stabilization measures, such as interest rate adjustments or export incentives, to mitigate market volatility. Academically, the study contributes to the limited literature on emerging markets like Pakistan, validating theoretical frameworks (e.g., structural break models) in a real-world context marked by sudden geopolitical and economic shifts.

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