

Dynamic Linkages among Exchange Rate, Gold Prices, Oil Prices, and Stock Market in Pakistan: Evidence from a Novel Dynamic Simulation Approach

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ABSTRACT

The performance of a stock market is closely linked to a country's overall financial and economic conditions. Stock prices serve as key indicators that reflect the financial health and broader economic situation of a nation, providing valuable insights into real financial activity. This study examines the impact of several macroeconomic factors on stock market performance in Pakistan by utilizing monthly time-series data. The key macroeconomic factors considered include the exchange rate (EXR), oil prices (OP), gold prices (GP), interest rates (IR), the consumer price index (CPI), and the industrial production index (IPI). The analysis employs a novel dynamic simulated Auto-Regressive Distributed Lag (DARDL) approach, along with the bounds cointegration test, to explore the connection between variables. The cointegration results validate the presence of a long-term relationship amongst the chosen variables. Furthermore, the novel DARDL findings reveal that EXR, GP, OP, CPI, and IR exert a significant negative influence on the stock market, highlighting their adverse influence on market performance. In contrast, IPI exhibits a significant positive association, emphasizing its role in driving stock market growth. These results provide valuable insights into the relation between macroeconomic factors and stock market dynamics, offering important implications for policymakers and investors in Pakistan.



Introduction

The connection between macroeconomic variables and stock prices has been a significant focus in both economic theory and empirical research. Numerous studies have highlighted the role of stock prices and market indices as important indicators for understanding economic conditions and trends (Abbass et al., 2022). During the last few decades, the liberalization of financial markets

and rapid advancements in technology have deepened the interconnection between macroeconomic variables and stock markets. As a result, stock indices are now more sensitive and respond quickly to changes in the fundamentals of the economy. The connection between important economic factors and stock markets has been well studied in academic literature, IPI, OP, CPI, GP, IT, and EXR. These linkages have been explored in both developed economies (Humpe and Macmillan, 2009; Gan et al., 2006) and developing nations (Kandir, 2008; Hosseini and Ahmad, 2011), highlighting the significant impact of macroeconomic variables on stock market dynamics.

Research, both theoretical and empirical has demonstrated that changes in macroeconomic variables can have a major effect on future dividend rates, discount rates, and, as a result, stock prices (Chen et al., 1986). Furthermore, empirical data supports the idea that economic variables have an impact on price fluctuations in capital markets. This establishes a clear connection between stock markets advances in economic parameters (Hong et al., 2021; Goswami and Jung, 1997). The connection between stock market and the macroeconomic variables that are sampled is very important to a number of different economic actors. For instance, stock market participants are curious about how changes in corporate profitability may be signalled by macroeconomic trends, which in turn impact stock prices. On the other hand, financial authorities are worried about how monetary policy initiatives may affect the pricing of assets. There are many reasons why someone would think that there will be spillover effects between the selected macroeconomic factors and stock markets.

For example, the stock market is affected by EXR volatility because it influences the competitiveness of exports, the cost of imports, and the flow of foreign investment. The International Fisher Effect and the Purchasing Power Parity (PPP) theory suggest that currency depreciation can increase the revenues of export-driven companies, which could lead to a rise in stock values. However, the periodic depreciation of the currency of Pakistan often creates uncertainty, which discourages foreign portfolio investment. Furthermore, interest rates and stock prices are theoretically related in a number of ways. Changes in IR, for example, have an impact on stock prices and the present value of dividends (Chen et al., 1986). Additionally, the cost of finance is influenced by IR, which in turn affect stock prices and the opportunity cost of borrowing (Mok, 1993). Another potential justification for the inverse correlation between stock prices and IR is that investors may substitute bonds for equities as interest rate increase (Uddin and Alam, 2017). Furthermore, IR is a fundamental part of monetary policy, and stock prices not only react to decisions made about monetary policy, but they also give central banks information about what the private sector thinks will happen with macroeconomic variables in the future (Bjørnland and Leitemo, 2009; Bernanke and Gertler, 2000).

The stock market is also influenced by inflation, which is not merely a monetary phenomenon that reflects the amount of money. Consequently, inflation plays a significant role in the stock market and monetary policy nexus (Suhaibu et al., 2017). A comprehensive strand of literature supports this assertion. There are several theoretical ideas that try to explain how the stock market and inflation might be related. The nation's economic prosperity and stock market performance are both impacted by inflation. The Gordon (1962) model, for instance, suggests that dividend expectations influence stock prices to some extent. In this manner, a rise in the money supply may result in inflation and simultaneously increase stock prices by stimulating economic activity expectations. Inflation can negatively impact stock prices. For instance, the adoption of an expansionary monetary policy may raise inflation, which raises long-term interest rates. Due to the decreased current value of future dividends, stock prices consequently decline (Cogley and Sargent, 2001). This narrative has been tested and supported by a number of researchers through

empirical research. Another view is that inflation and the stock markets have a favorable association with each other. If inflation is caused by a rise in the money supply, it signifies that businesses have greater access to economic resources, which will lead to additional chances for investment. This increased investment would result in more profitability, which would then lead to a higher stock price. A number of research have shown that there is a positive relationship between inflation and stock market returns (Asmy et al., 2009; Antonakakis et al., 2017).

In light of the aforementioned context, this study aims to investigate the relationships between exchange rate (EXR), oil prices (OP), interest rate (IR), gold prices (GP), consumer price index (CPI), and industrial production index (IPI), and stock market index in the case of Pakistan. This study adds significantly to the body of existing literature in a number of ways. As far as we are aware, no previous research has looked at how EXR, OP, IR, GP, CPI, and IPI affect stock market performance over the long and short terms, especially in the context of Pakistan. Given the critical role of these macroeconomic factors in financial markets, it is essential to determine how they collectively influence stock market fluctuations. Earlier literature presents mixed findings on the connection between of macro indicators and stock market behavior. This study contributes by analyzing whether positive and negative shocks in EXR, IR, GP, CPI, and IPI have asymmetrical effects on the stock market index. Understanding these nonlinear effects will provide deeper insights into stock market volatility and investor behavior. Additionally, in comparison to the previous research that mostly used the ARDL or other traditional methodologies, this study utilizes the novel dynamic simulated ARDL (DARDL) approach developed by Jordan and Phillips (2018). This innovative approach allows for: The estimation of both short-run and long-run relationships. The simulation and visualization of counterfactual effects of macroeconomic shocks. A deeper comprehension of how changes in macroeconomic factors, both favorable and negative, affect the stock market. To ensure the robustness of the findings, this study also applies Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) methods. These techniques account for small sample bias, endogeneity issues, and serial correlation, thereby strengthening the reliability of the estimated relationships. While numerous studies have explored macroeconomic influences on stock markets in developed and emerging economies, limited research has focused on Pakistan using advanced econometric techniques. This study fills this gap by providing empirical evidence that can guide policymakers, investors, and financial analysts in making informed decisions regarding Pakistan's stock market.

The remainder of the paper is organized as follows: Section 2 reviews the literature on the relationship between macroeconomic factors and stock market. Section 3 outlines the data, variables, and methodology used for estimation. The research findings are presented in Section 4. Finally, Section 5 provides the conclusions and policy recommendations.

Literature Review

The connection between macroeconomic factors and stock markets is a key area of study for researchers, policymakers, and regulatory authorities. Academics and policymakers may find it valuable to examine how macroeconomic factors influence stock market performance. Likewise, regulators are keen to assess whether stock markets operate efficiently in response to information flow, as this insight plays a crucial role in shaping monetary policies. For instance, Hung et al., (2022) observed the dynamic relationships between macroeconomic fundamentals and the stock market returns in China utilizing monthly data. According to the results of the wavelet analysis, the relationship between stock market and macroeconomic variables is substantially significant at low, medium, and high frequencies. Nevertheless, macroeconomic variables have a short-term effect on

the stock market. Gupta et al., (2025) examined the impact of inflation and oil price variations on stock prices and returns through a bibliometric analysis of research articles from the past 22 years. The findings of the study indicate that stock market fluctuations are significantly driven by both inflation and oil price changes. Alamgir and Amin (2021) explored the oil price-stock market nexus in four South Asian countries using the Nonlinear Autoregressive Distributed Lag (NARDL) model for 1997 to 2018. They revealed a constructive association between OP and stock market indices, with asymmetric reactions to positive and negative OP variations. Similarly, a optimistic liaison between inflation and stock market is also discovered by (Asmy et al., 2010; Antonakakis et al., 2017).

Further, Alzoubi (2022) examined the impact of CPI and IR on the Amman Stock Exchange using the ARDL bounds test. The study outcomes indicate that CPI and interest rates significantly negatively impact stock market. Additionally, Ikeobi (2024) investigated the inflation-capital market relationship by analyzing the impact of inflation on stock prices in Nigeria (2006-2020) using the ARDL approach. The results indicate an adverse but statistically insignificant connection between inflation and stock market in both the short and long-run. Moreover, Eldomiaty et al. (2020) analyzed the impact of CPI and IR on stock prices by utilizing quarterly data from DJIA30 and NASDAQ 100 (1999 to 2016). They found that CPI negatively affects stock prices, and that inflation rate changes Granger-cause significant stock price variations. Similarly, Akani and Uzobor (2015) examined the impact of CPI on stock prices in Nigeria (1980–2012) using the VECM and Granger causality test. Their findings indicate a negative and significant relationship between inflation and stock prices. Ayinuola, (2023) investigated the impact of CPI on the stock returns along with other macroeconomic factors. The findings explained that inflation significantly negatively impact the stock market returns. Similarly, Islam, (2024) analyzed the connection between CPI and Bangladesh stock market performance. The author discovered an adverse linkage between rising CPI and the stock market performance.

Further, IPI a key macroeconomic factor reflects changes in the output of goods and services produced by manufacturers. Theoretically, an increasing IPI is linked to stronger stock market performance, while a decline suggests weaker market conditions. For instance, Narayan et al. (2014) identified a favourable association between IPI and sector-based stock prices. Likewise, Peiró (2016), using extensive time-series data, emphasized the considerable impact of IPI on stock prices. Shaique (2016) examined the long-term relationship between GP and the KSE-100 index in Pakistan (1993–2014) using VAR and Johansen co-integration tests. Findings suggest no long-term connection between the two factors. Laichena and Obwogi (2015) studied the role of key macroeconomic variables, including IR, EXR, GDP, and CPI, on stock returns in East Africa. Using panel data from Kenya, Uganda, and Tanzania covering the period 2005-2014, the study revealed a considerable association between stock returns and the analyzed macroeconomic factors. Mohamed and Ahmed (2018), using annual stock return data and quarterly macroeconomic data, examined the effect of six macroeconomic aspects on Jordanian SMI from 1976 to 2016. They utilized the ARDL approach for analysis and revealed that IPI exerts a statistically significant impact on stock market. Further, Demir (2019) evaluated the impact of key macroeconomic aspects on the Borsa Istanbul-100 (BIST-100) index. The study found that economic growth, portfolio investments, domestic currency, and foreign direct investment positively influenced the stock market index, while interest rates and crude oil prices had a negative effect on the index.

Methodology

Data and model

This research aims to empirically explore the impact of the EXR, OP, GP, IR, CPI, and IPI on the Pakistan stock market. For the empirical analysis, we use monthly data covering the period from January 1990 to August 2022. The measured variable is the index of the stock market, represented by the Pakistan Stock Exchange (PSX) index. The independent variables include EXR: determined as the Pakistani Rupee (PKR) per (USD). Oil prices: defined as the crude oil spot price, measured in USD per barrel. Gold prices: defined as the gold spot price per troy ounce in USD. Interest rate: represented by the bank rate. Inflation: measured using CPI. IPI: defined as the real output of the industrial sector. The data is collected from multiple sources, including Yahoo Finance, International Financial Statistics (IFS), the Federal Reserve Bank, and the State Bank of Pakistan (SBP).

The present study empirically examine the impact of the EXR, OP, GP, IR, CPI, and IPI on the Pakistan stock market by utilizing a novel econometric approach, taking into account the extant literature and addressing the gap. In this investigation, empirical analysis are conducted using the novel DARDL approach. This novel econometric approach overcomes the difficulties associated with the traditional ARDL model when it comes to the examination of multiple factors in both the long-run and short-run. Further, this novel approach is particularly suitable for gaining access to the real deviation in the explained factor that was induced by the explanatory variables.

The fundamental model that we have developed to explore the connection among the research variables as below:

$$SMI = f(EXR, OP, GP, IR, CPI, IPI) \quad (1)$$

Further, the regression model to establish the influence of exogenous factors on the endogenous variables is constructed as follows:

$$SMI_t = \beta_0 + \beta_1 EXR_t + \beta_2 OP_t + \beta_3 GP_t + \beta_4 IR_t + \beta_5 CPI_t + \beta_6 IPI_t + \varepsilon_t \quad (2)$$

In the above equation β_0 represents the constant, β_1 to β_6 portrays the coefficient linked with the independent variables, and ε_t denotes the disturbance term. Further, SMI represent the stock market index, EXR denotes the exchange rate, OP signify the oil prices, GP measure the gold prices, CPI represents consumer prices index, and IPI explains the industrial production index.

Estimation approach

Traditional ARDL models can be complex as they require different lag lengths for various variables, making estimation and interpretation more challenging. To address this issue, Jorden and Phillips (2018) introduced the novel dynamic simulated ARDL (DARDL) approach, which simplifies the model by employing a uniform lag structure for all variables. This method also enhances interpretability by providing a visual representation of counterfactual changes in variables. Using simulations, the novel DARDL model illustrates how measured variable respond to shocks from explanatory variables. It does so by plotting the counterfactual effect of a single independent variable on the measured variable while keeping all other independent factors constant. A key requirement for the DARDL approach is that the explained variable should be integrated of order I(1), with all variables exhibiting cointegration. Stationarity tests are performed

to determine the integration order of the dependent variable, while the bounds test proposed by Pesaran et al. (2001) is used to examine the cointegration relationship. Cointegration is confirmed if the computed F and t statistics exceed the critical values corresponding to I(1). To improve the bounds testing procedure, Kripfganz and Schneider (2020) incorporated critical values derived from response surface regressions, along with probability estimates, into the DARDL framework, improving its statistical robustness.

$$\Delta SMI_t = \alpha_0 + \theta_0 SMI_{t-1} + \gamma_1 \Delta EXR_t + \theta_1 EXR_{t-1} + \gamma_2 \Delta OP_t + \theta_2 OP_{t-1} + \gamma_3 \Delta GP_t + \theta_3 GP_{t-1} + \gamma_4 \Delta IR_t + \theta_4 IR_{t-1} + \gamma_5 \Delta CPI_t + \theta_5 CPI_{t-1} + \gamma_6 \Delta IPI_t + \theta_6 IPI_{t-1} + \varepsilon_t \quad (3)$$

Results and Discussion

We conducted a descriptive analysis to gain a greater insight of the characteristics of the variables. The summary statistics, stated in Table 1, include the average, minimum, maximum values, as well as the standard deviations of the variables. The average values for SMI, EXR, OP, GP, IR, CPI, and IPI are 9.128, 4.364, 3.878, 6.608, 2.039, 4.445, and 4.513, respectively. Among these, SMI and GP have the highest average values matched to the other variables. Furthermore, the skewness statistics indicate that SMI, OP, GP, IR, and IPI are negatively skewed, while EXR and CPI exhibit positive skewness. The standard deviation analysis reveals that GP has the highest variability among the variables. Overall, the statistics suggest a general upward trend in all the underlying variables.

Table 1: Descriptive Statistics

	SMI	EXR	OP	GP	IR	CPI	IPI
Mean	9.128	4.364	3.878	6.608	2.039	4.445	4.513
Median	9.330	4.395	3.969	6.845	2.175	4.463	4.578
Maximum	10.831	5.119	4.896	7.585	2.997	5.358	5.240
Minimum	6.735	3.697	2.429	5.545	-0.301	3.638	3.662
Std. Dev.	1.244	0.358	0.568	0.676	0.521	0.548	0.297
Skewness	-0.398	0.328	-0.488	-0.310	-1.813	0.034	-0.895
Kurtosis	1.874	2.184	2.417	1.478	7.218	1.472	4.147
Jarque-Bera	22.728	13.115	15.497	32.282	370.097	27.969	54.082
Probability	0.000	0.001	0.000	0.000	0.000	0.000	0.000

Further, we applied the (Dickey and Fuller, 1979) and (Phillips and Perron, 1988) unit root tests to confirm the stationarity attributes of the variables and the results are presented in Table 2. These tests were conducted at both the level and 1st difference. The t-statistics for all variables at the level form are not statistically significant, indicating the presence of unit root and suggesting that all the series are non-stationary in their original form. However, at the 1st difference, the t-statistics became statistically significant, confirming the variables.

Following the completion of the stationarity test, a bounds cointegration test was conducted using the critical values suggested by Kripfganz and Schneider (2020) to validate the existence of a long-term cointegration relationship. The results in Table 3 show that the null hypothesis, which asserts no cointegration among variables, can be rejected at the 5% significance level, as the p-value of the bounds test is below 0.05. This evidence justifies a more detailed examination of the nature of long-term relationships.

Table 2: Stationarity outcomes

	ADF		PP	
	Level	1 st Δ	Level	1 st Δ
SMI	-0.801	16.559***	-0.803	-16.558***
EXR	-0.491	-14.124***	-0.556	-14.164***
OP	-2.365	-12.847***	-2.013	-12.405***
GP	-0.328	-14.631***	-0.398	-14.587***
IR	-2.790	-18.182***	-4.305***	-36.717***
CPI	0.537	-6.831***	0.772	-14.357***
IPI	-1.343	-6.159***	-3.157**	-43.826***
Note: ***, ** represents significance at 1% and 5%.				

Table 3: Cointegration outcomes

F-statistics	4.983	6	H0: No Cointegration		H1: Cointegration exist	
t- statistics	-2.750					
	F-statistics		t- statistics		p-values	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
10%	1.903	3.011	-1.616	-3.252	0.000***	0.000***
5%	2.281	3.481	-1.942	-3.592		
1%	3.111	4.482	-2.573	-2.226	0.000***	0.000***
Notes: *** denotes a 1% significance level.						

Next, Table 4 presents the outcome of the novel DARDL approach. These findings indicate that the EXR has a substantial an adverse impact on the SMI in both the long- and short-run in Pakistan. Specifically, a 1% change in the EXR leads to a decline in the SMI by (0.303%) in the long-term and (0.435%) in short-run. When the Pakistani Rupee (PKR) loses value against foreign currencies, such as the US Dollar (USD), it is referred to as a depreciating exchange rate. This depreciation negatively impacts the stock market due to increased costs for businesses, reduced investor confidence, and economic instability. A weaker PKR raises the cost of imported goods such as oil, machinery, raw materials, and electronics. Industries reliant on imports, including the automobile, pharmaceutical, and energy sectors, experience higher production costs, leading to lower profitability and declining stock prices. Additionally, increased import costs contribute to higher inflation, reducing consumer purchasing power and corporate earnings.

Regarding oil prices, findings suggest that rising OP have a negative connection with the SMI. The estimated results explains that a 1% increase in OP lowers the SMI growth by (0.246%) and (1.622%) in the long- and short-term, respectively. This outcome is expected, as Pakistan relies heavily on imported oil. When OP rises, businesses face higher production and transportation costs, leading to reduced earnings and lower stock valuations. Additionally, rising OP fuel inflationary pressures, leading central banks to implement monetary policy tightening by raising interest rates. As a results higher IR elevate borrowing costs for firms and businesses, further weakening stock market growth.

Furthermore, the findings suggest that GP are negatively linked with the SMI only the long-run. Particularly, a 1% rise in gold prices lowers stock market growth by (0.733%) if all other variables

remain constant. This is due to gold's role as a "safe-haven" asset, which investors prefer during the time of economic and political uncertainty, geopolitical risks, or financial crises. When stock markets decline, investors shift their capital into gold, driving its price higher. This inverse relationship between gold prices and stock markets is well-documented. Additionally, investors tend to buy gold to hedge against inflation or currency depreciation, both of which often coincide with declining stock market performance.

Similarly, the results exert a significant negative association between IR and Pakistan's stock market. The coefficients suggest that a 1% upsurge in IR suggest a decline in SMI by (1.312%) and (0.586)% in the long- and short-term. Rising interest rate impact the stock market through multiple economic channels. Higher IR increase costs of borrowing for businesses, lowering capital investment, expansion, and prosperity. This, in turn, lowers stock prices. Additionally, higher interest rate discourage consumer spending, leading to lower corporate revenues and earnings. Reduced consumer expenditure negatively affects company sales and stock market performance.

Moreover, outcomes suggest that inflation (CPI) negatively effects the stock market in Pakistan. However, this impact is statistically insignificant in the short-run. The computed coefficients imply that a 1% expansion in CPI lowers the stock market growth by approximately (0.105%). Rising inflation directly affects the stock market by influencing purchasing power, interest rates, corporate profitability, and investor confidence. Further, rising inflation raises the cost of raw materials, labour, and energy, reducing corporate profit margins and leading to declining stock prices, particularly in industries sensitive to input costs. Furthermore, higher inflation weakens consumer purchasing power, reducing demand for goods and services, which negatively affects corporate revenues and stock market growth. Our outcomes are steady with earlier studies (Alzoubi 2022; Eldomiaty et al., 2020).

Table 4: Dynamic ARDL outcomes

Variables	Coeff.	P-values
Long run estimates		
EXR	-0.303**	0.013
OP	-0.246**	0.015
GP	-0.733*	0.068
IR	-1.312***	0.001
CPI	-0.105**	0.839
IPI	0.531**	0.036
Short run estimates		
EXR	-0.435***	0.007
OP	-1.622**	0.055
GP	-0.634	0.486
IR	-0.586**	0.017
CPI	-0.676	0.365
IPI	0.254***	0.002
ECT (-1)	-0.754***	0.002
Constant	6.294	0.893
R ²	0.844	
Notes: ***, ** & * represent significance levels at 1%, 5% and 10%.		

Further, the results suggest a significant positive association between IPI and the stock market. Explicitly, a 1% increase in IPI enhances stock market performance by approximately (0.531%) in long and (0.254%) in the short-run, assuming all other factors remain constant. This outcome is in harmony with the findings of (Naryan et al., 2014; Peiró, 2016), who also established a positive relationship between IPI and stock market growth. The IPI serves as a key factor of economic activities, and its growth signals increased productivity, higher corporate earnings, and stronger investor sentiment. When industrial output rises, businesses generate higher revenues and profits, particularly in sectors such as manufacturing, energy, and raw materials. As a result, stock prices tend to rise, reflecting investors' expectations of future profitability.

In summary, our study confirms that exchange rates, oil prices, gold prices, interest rates, and inflation negatively impact stock market performance in Pakistan, while industrial production has a positive impact. These conclusions are consistent with previous research and emphasize the importance of macroeconomic stability in supporting stock market growth.

Furthermore, we evaluated the counterfactual positive and negative impacts of the EXR, OP, GP, IR, CPI, and IPI on the stock market using novel DARDL simulations. This novel simulation approach automatically predicts and visualizes real changes in the explanatory factors and their influence on measured variable. The influence of macroeconomic factors on the SMI is expected to increase or decrease by 10% due to positive and negative shocks, respectively.

For instance, Figure 1(a) and (b) illustrate the impact of a 10% positive and negative change in the EXR on the SMI. Keeping all other variables constant, a 10% incline in the EXR diminishes the SMI performance, while a 10% decrease in the EXR positively influences the SMI. Similarly, Figure 2(a) and (b) show the stock market's response to positive and negative fluctuations in oil prices. Keeping other factors unchanged, a 10% increase in oil prices reduces stock market performance by lowering stock prices. Conversely, a 10% decline in oil prices benefits stock market growth.

Additionally, the counterfactual impact of positive and negative shocks in GP is depicted in Figure 3(a) and (b). Specifically, Figure 3(a) indicates that a 10% increase in gold prices leads to a decline in the stock market performance, whereas Figure 3(b) suggests that a 10% decrease in gold prices enhances stock market performance. Likewise, Figure 4(a) and (b) visualize the SMI reaction to a 10% upward and downward shock in the IR. A 10% rise in IR adversely affects the SMI in Pakistan. Contrary to this, a 10% decline in IR has a favourable impact on the SMI.

Moreover, Figure 5(a) and (b) illustrate the impact of a 10% rising and decreasing shock in CPI on the stock market. Assuming all other variables remain stable, a 10% incline in CPI adversely influence the stock market in Pakistan, whereas a 10% decrease in CPI enhances stock market performance. Finally, Figure 6(a) and 6(b) depict the counterfactual impact of IPI on the SMI. Keeping all other variables constant, a 10% rise in the industrial production index improves stock market performance (Figure 6(a)), while a 10% decline in the industrial production index hinders stock market growth in Pakistan (Figure 6(b)).

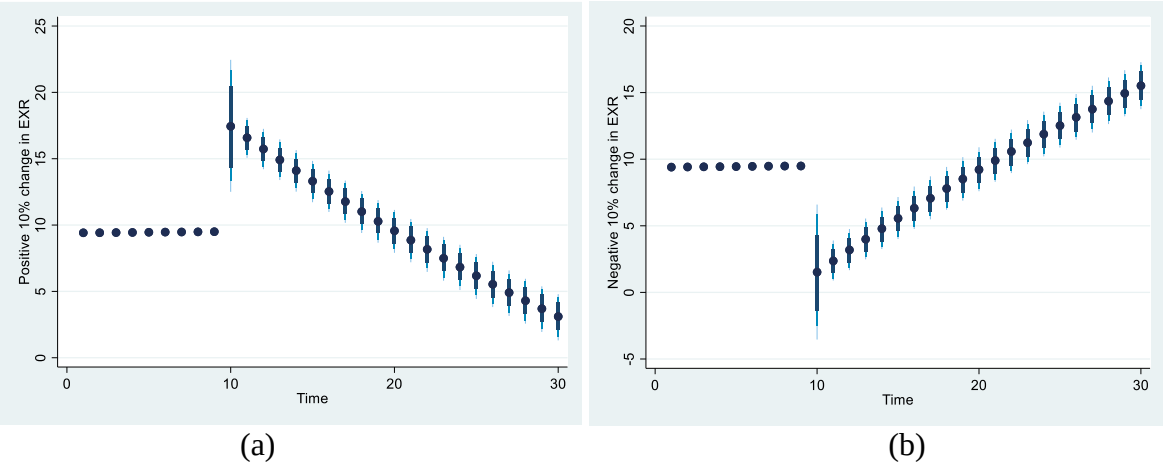


Figure 1: Counterfactual impacts of EXR on SMI

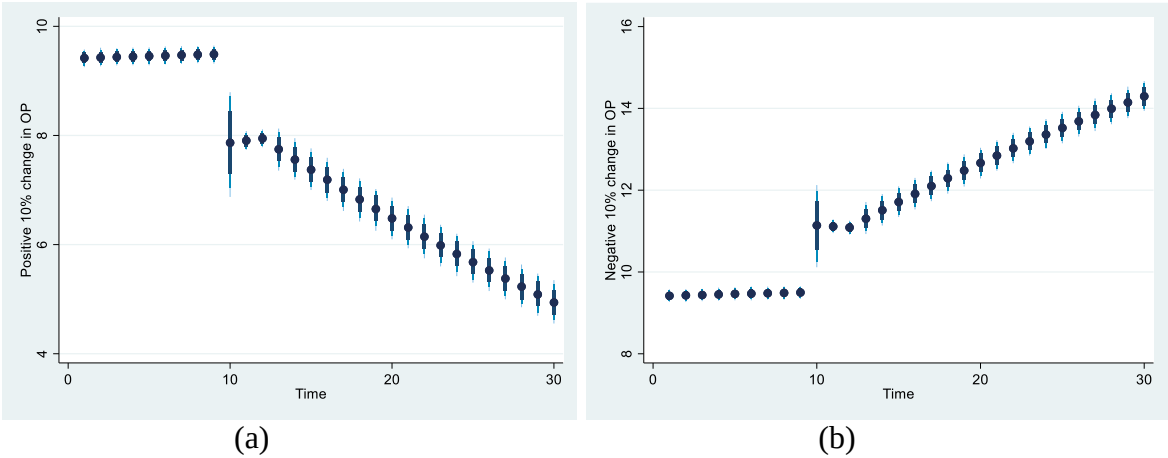


Figure 2. Counterfactual impacts of OP on SMI

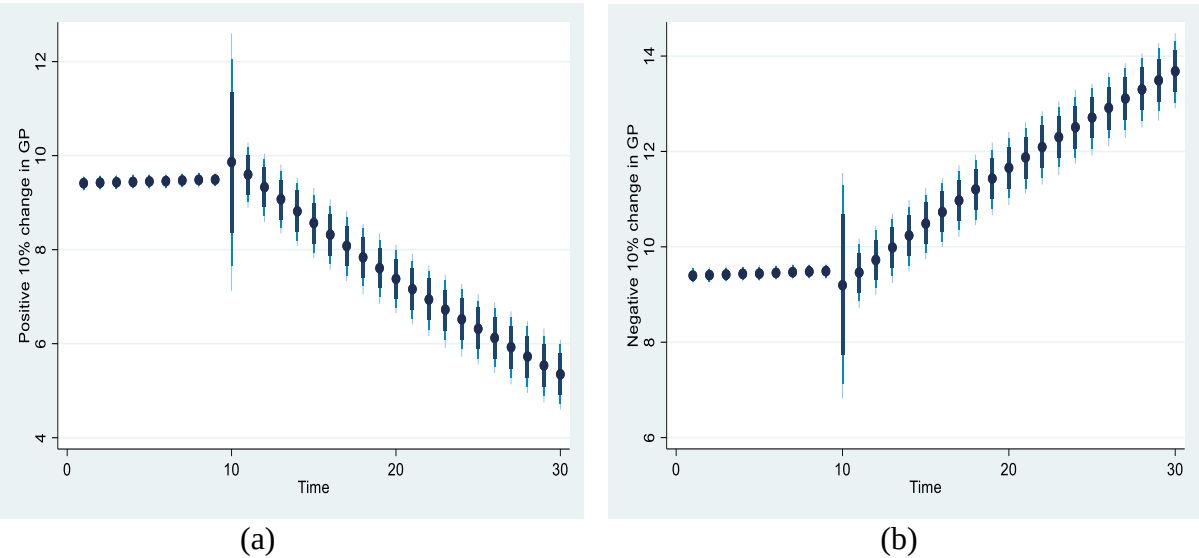


Figure 3: Counterfactual impacts of GP on SMI

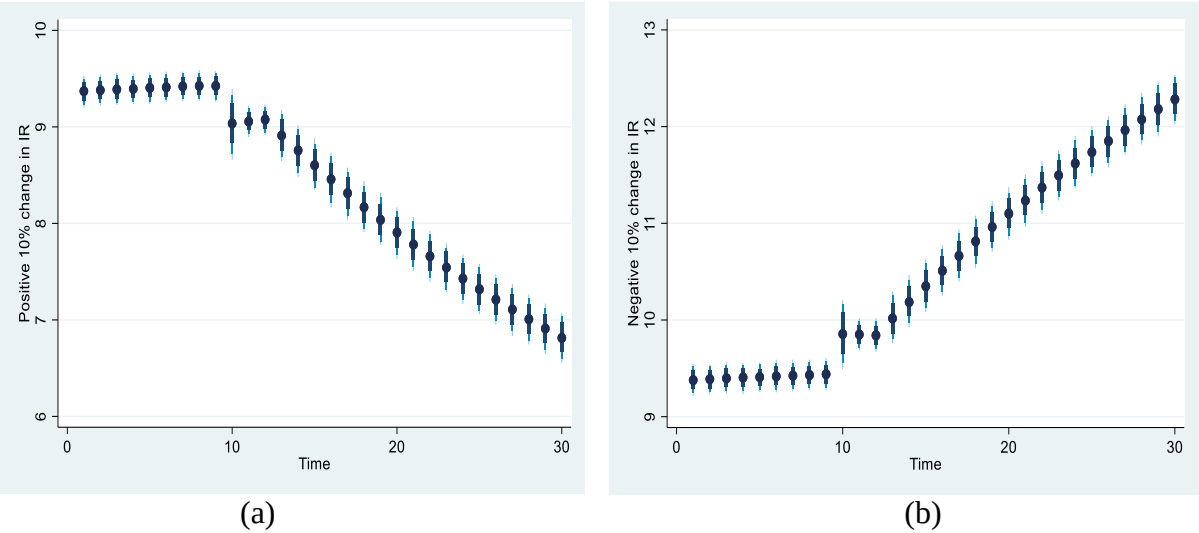


Figure 4: Counterfactual impacts of IR on SMI

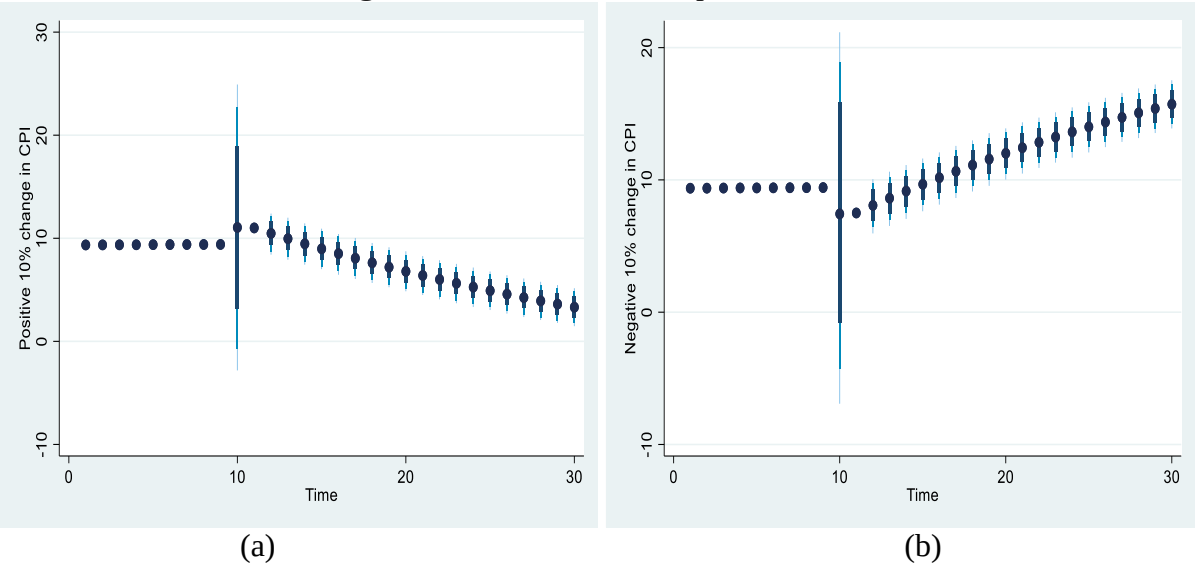


Figure 5: Counterfactual impacts of CPI on SMI

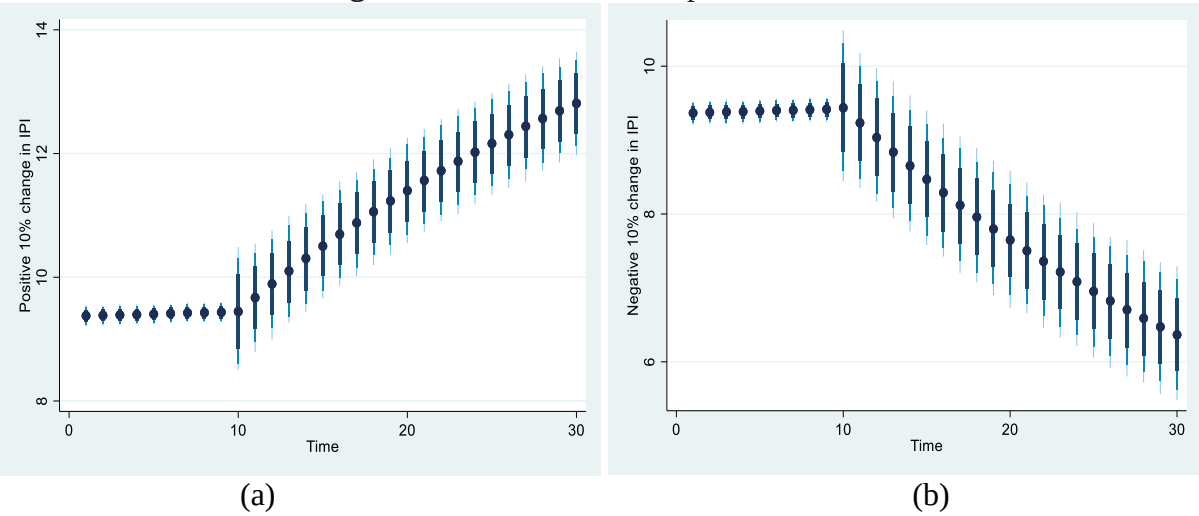


Figure 6: Counterfactual impacts of IPI on SMI

We also employed several diagnostic tests to confirm the stability of the estimated model. The findings of these tests are shown in Table 5. The findings of the diagnostic checks show that the model is good and correctly specified. Additionally, we conducted CUSUM to assess structural stability. Figure 7 shows the visual assessments of CUSUM. If the plots remain within a critical border range of 5%, it can be concluded that the model dimensions are consistent. The graphs below show that CUSUM is inside the crucial bounds.

Table 5: Diagnostics tests outcomes

Tests	χ^2	P-Values	Decision
Breusch-Godfrey LM	1.455	0.235	No problem of serial correlation
Breusch-Pagan-Godfrey	4.248	0.173	No issue of Heteroscedasticity
ARCH test	1.156	0.283	No Heteroscedasticity issue
Normality	6.741	0.328	Residuals are distributed normally
Ramsey RESET Test	0.175	0.861	Model is correctly specified
CUSUM			Stability is confirmed

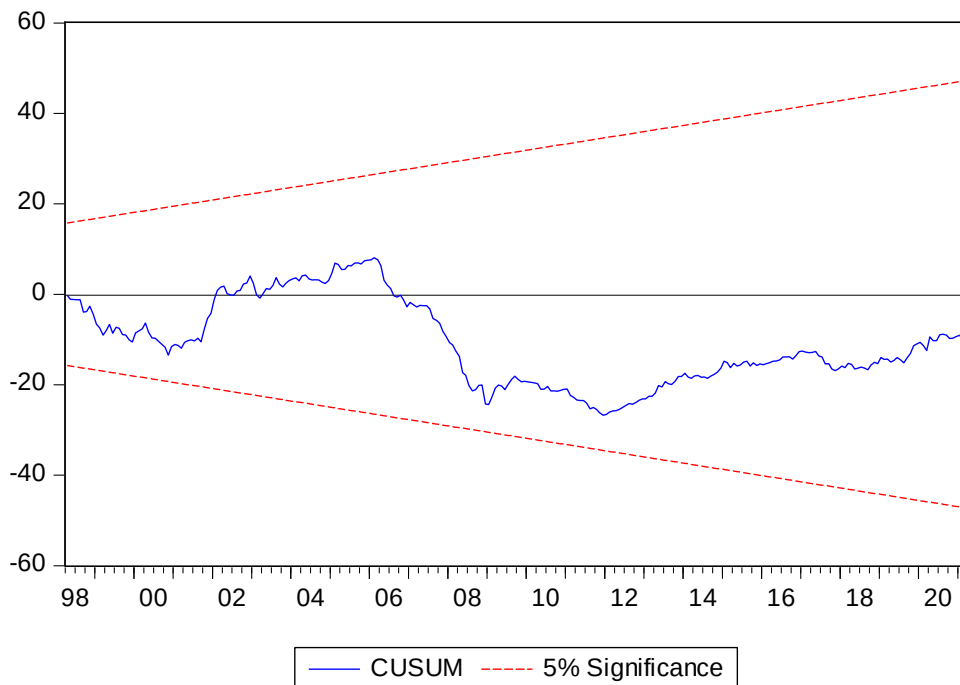


Figure 7: CUSUM test for stability

Further, the study also checked the robustness and sensitivity of the long-term findings. The current study additionally used the DOLS and FMOLS approaches to investigate the reliability of the novel DARDL outcomes. The findings of both models are shown in Tables 6, respectively. The results of both models are in harmony with the results of the novel DARDL calculations. For example, EXR and OP significantly negatively influence the SMI which is in line with the conclusions of DARDL calculations. As a result, the findings of DARDL can be utilized for policy and forecasting purposes.

Table 6: DOLS and FMOLS outcomes

	DOLS		FMOLS	
Variables	Coeff.	Std. Error	Coeff.	Std. Error
EXR	-3.454***	0.523	-3.407***	0.484
OP	-0.512***	0.019	-0.292***	0.017
GP	-0.806***	0.268	-0.754***	0.242
IR	1.198***	0.343	-0.266***	0.073
CPI	-0.307***	0.033	-0.136***	0.011
IPI	1.198***	0.343	1.086***	0.261
Notes: *** denotes significance level at 1%.				

Conclusion and Policy Implications

Over the past few decades, the relationship between macroeconomic dynamics and stock market performance has remained a persistent topic of debate among policymakers and researchers. This study explore the impact of the EXR, OP, GP, IR, CPI, and IPI on the Pakistan SMI using monthly data from 1997 to 2022. A novel dynamic simulated ARDL technique is employed to examine the relationships between these variables. This advanced method overcomes the issues associated with the traditional ARDL model by effectively visualizing the actual impact of both favourable (positive) and harmful (negative) variations in the explanatory factors on the measured variable while keeping all other parameters constant. The results of unit root tests confirm that all the series are stationary at either level or first difference. Furthermore, the bounds cointegration approach validate the presence of long-term cointegration association.

The findings of novel DARDL approach indicate that the EXR, OP, GP, IR, and CPI exert a adverse impact on the Pakistan SMI, advocating that increases in these variables hinder stock market growth. Conversely, a rise in the IPI positively influences stock market performance. Additionally, robustness checks using the FMOLS and DOLS methods confirm the reliability of the novel DARDL findings. Various post-estimation diagnostic tests were also performed to assess the model's validity. The outcomes suggest that the model is free from autocorrelation, heteroskedasticity, misspecification, normality issues, and instability, ensuring the robustness of the study's conclusions.

This research offers insightful policy recommendations to government officials and policymakers. Given the adverse effects of EXR volatility, rising oil prices, inflation (CPI), interest rate, and gold prices on Pakistan's stock market, it is important for policymakers to implement targeted strategies to stabilize these macroeconomic variables and create a conducive investment climate. To alleviate excessive fluctuations in the EXR, the government and the State Bank of Pakistan should adopt effective foreign exchange management policies, including maintaining adequate foreign exchange reserves and employing strategic market interventions. A stable exchange rate fosters investor confidence and reduces uncertainty in stock market performance. To counter the negative impact of rising oil prices, the government should focus on diversifying energy sources, increasing domestic production, and securing long-term import agreements. These measures would help stabilize fuel costs and reduce dependence on volatile international oil prices.

Further, inflationary pressures, reflected in a rising CPI, adversely affect stock market performance. Therefore, a well-balanced mix of monetary and fiscal policies should be

implemented to control inflation effectively. The State Bank of Pakistan must maintain an optimal interest rate policy that strikes a balance between managing inflation and fostering economic growth. Given that excessively high interest rates can deter stock market investment, policymakers should ensure that interest rate adjustments are data-driven and market-responsive to support capital market expansion while keeping inflation in check. Additionally, as rising gold prices often lead to capital flight from the stock market, policy measures should promote stock market investment through incentives such as tax benefits, financial literacy programs, and investor-friendly regulations. Encouraging investors to view equities as a viable alternative to gold as a safe-haven asset will help strengthen the stock market. By implementing these strategic measures, policymakers can enhance stock market stability, boost investor confidence, and foster sustainable economic growth in Pakistan.

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