WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A STUDY ON THE IMPACT OF EXCHANGE RATE, CRUDE OIL PRICE, AND INFLATION ON THE INDIAN STOCK MARKET

Shiv Bhakta[1] ,Dr. Vijay Gondaliya[2]

B.V. Patel Institute of Management

ABSTRACT :

This study examines the dynamic interrelationships between three key macroeconomic variables—exchange rate, crude oil price, and inflation—and their multifaceted impact on the Indian stock market. Recognizing the increasingly integrated nature of global financial markets, this research employs an econometric framework that combines time series analysis, multiple regression models, and cointegration tests to explore both short-run fluctuations and long-run equilibrium relationships among these variables and major stock indices such as the BSE Sensex and NSE Nifty.

Using monthly data spanning from 2000 to 2023, the analysis begins with a comprehensive diagnostic of the individual time series properties, including stationarity tests and volatility assessments.

Preliminary findings reveal that exchange rate volatility exerts a significant influence on market returns, with depreciation of the Indian Rupee typically leading to increased market uncertainty. Concurrently, rising crude oil prices are shown to depress stock market performance, primarily through heightened input costs for key sectors of the economy, while persistent inflation pressures contribute to an erosion of real investor returns and increased market volatility. These results underscore the importance of integrating macroeconomic risk factors into portfolio management and highlight the need for informed policy measures to stabilize the economic environment.

Overall, this research provides critical insights for policymakers, financial analysts, and investors by detailing how external economic shocks and domestic inflation dynamics interplay to shape market behaviour.

Keywords: Indian stock market, exchange rate, crude oil price, inflation, econometric modelling, time series analysis

1. INTRODUCTION:

The Indian stock market has experienced rapid growth and significant transformations over the past few decades, positioning itself as one of the most dynamic and influential emerging markets globally. This evolution is closely tied to the complex interplay of various macroeconomic factors, notably the exchange rate, crude oil price, and inflation. As these variables influence economic activities at both micro and macro levels, understanding their impact on stock market performance is critical for investors, policymakers, and researchers alike.

Background and Motivation

In an increasingly globalized economy, the interplay between domestic financial markets and external economic indicators has intensified. For India, a country marked by its substantial economic reforms and burgeoning market activities, the stability and performance of its stock markets are heavily influenced by external shocks and internal economic conditions. Three factors stand out in this regard:

- **Exchange Rate:** The exchange rate determines the value of the Indian Rupee against foreign currencies, influencing international trade, foreign direct investments, and the cost of imported goods. Volatility in the exchange rate can have both direct and indirect effects on corporate profitability and market sentiment.
- **Crude Oil Price:** As a major importer of crude oil, India is particularly vulnerable to fluctuations in global oil prices. Changes in oil prices affect production costs, inflation, and overall economic stability, thereby impacting the performance of various market sectors, particularly energy-dependent industries.
- **Inflation:** Inflation represents the rate at which the general level of prices for goods and services rises. In the context of the stock market, high inflation can erode real returns and lead to increased uncertainty among investors, while moderate inflation might signal a growing economy.

[1] Final Year BBA Student, B. V. Patel Institute of Management, Uka Tarsadia University

[2] Associate Professor, B. V. Patel Institute of Management, Uka Tarsadia University

The motivation for this study stems from the need to disentangle the intricate relationships among these variables and to quantify their impact on the Indian stock market. As global financial systems become more interconnected, understanding these linkages is crucial for devising effective risk management strategies and for formulating policies that foster economic stability.

Research Questions

To achieve these objectives, the study is guided by the following research questions:

1. **Exchange Rate Impact:** How does the volatility of the Indian Rupee relative to major currencies affect stock market returns and investor sentiment in the short run and long run?
2. **Crude Oil Price Influence:** What is the relationship between fluctuations in crude oil prices and the performance of the Indian stock market, particularly in terms of sectoral impacts and overall market volatility?
3. **Inflation Effects:** How do varying inflation rates impact the returns and stability of the stock market, and what are the mechanisms through which inflation exerts its influence?
4. **Integrated Dynamics:** Is there a long-run cointegrated relationship between exchange rate, crude oil price, inflation, and stock market performance, indicating a stable equilibrium despite short-term fluctuations?

Significance of The Study

The insights generated by this research have broad implications. For policymakers, understanding these relationships is essential for developing monetary and fiscal policies that can stabilize the economy during periods of external shocks or domestic inflationary pressures. For investors and portfolio managers, the findings provide a basis for developing robust risk management strategies and for making informed decisions in an uncertain economic environment. Moreover, for academics and researchers, this study contributes to the existing literature by integrating multiple macroeconomic variables into a single analytical framework, thereby offering a more nuanced understanding of their collective impact on the stock market.

- **Exchange Rate and Financial Markets:** The relationship between exchange rate fluctuations and stock market performance is grounded in international finance theories such as the International Capital Asset Pricing Model (ICAPM) and the exchange rate exposure model. These frameworks suggest that currency depreciation or appreciation can affect corporate earnings, especially for firms engaged in international trade, thereby influencing investor sentiment and market returns.
- **Crude Oil Price Dynamics:** Theoretical models addressing crude oil prices emphasize the cost-push effects in an economy. Rising oil prices increase production costs for energy-intensive industries, often leading to reduced profit margins and lower stock prices. In oil-importing economies like India, these price dynamics can have pronounced effects on inflation and overall market performance.
- **Inflation and Stock Market Performance:** Inflation affects financial markets through its impact on real returns and purchasing power. Theories related to the Fisher Effect and cost-of-capital considerations suggest that rising inflation diminishes the value of future cash flows, leading to adjustments in stock valuations. Moderate inflation is often viewed as a sign of a growing economy, whereas high or volatile inflation tends to heighten market uncertainty and risk.

Empirical Studies on Exchange Rate Impact

Empirical investigations into the relationship between exchange rate volatility and stock market returns have produced mixed results. Many studies indicate that:

- **Volatility in exchange rates can increase uncertainty in the market,** affecting investor confidence and leading to higher risk premiums.
- **Currency depreciation may benefit exporters** by making their products more competitive abroad, but it can also lead to higher import costs, thus affecting domestic firms adversely.
- In emerging markets like India, empirical evidence suggests that **exchange rate movements are a significant determinant** of market returns, as they directly impact the cost structures and profitability of companies engaged in global trade.

Empirical Studies on Crude Oil Prices

The literature on crude oil prices underscores its dual role as both an economic indicator and a cost driver:

- Research shows that **increases in crude oil prices are generally associated with declines in stock market performance,** especially in economies that are heavily dependent on oil imports.
- Several studies have employed time series analysis and regression techniques to demonstrate that higher oil prices lead to increased production costs, which in turn depress corporate earnings and investor returns.
- In the Indian context, the link between crude oil prices and market performance is particularly pronounced due to the country's dependency on imported oil, which influences both inflation and overall economic stability.

Empirical Studies on Inflation Effects

Inflation has been widely studied for its impact on the stock market:

- **High inflation rates are typically associated with reduced real returns** on equity investments as the purchasing power of future cash flows is eroded.

- Empirical research suggests that inflation not only affects the valuation of stocks but also contributes to market volatility, as investors adjust their expectations and portfolio strategies in response to changing price levels.
- In India, studies have highlighted that inflation can have both direct effects on market indices and indirect effects through its influence on interest rates and monetary policy decisions.

Integrative Analyses and Research Gaps

While individual studies provide valuable insights into the separate effects of exchange rate, crude oil price, and inflation on stock markets, there are several research gaps:

- **Integrated Analysis:** Few studies have simultaneously investigated the combined impact of these three macroeconomic variables on the Indian stock market. This integrative approach is crucial, as the variables are often interrelated—for instance, rising crude oil prices can drive up inflation, which in turn may affect exchange rate dynamics.
- **Short-run vs. Long-run Effects:** The literature lacks comprehensive studies that differentiate between short-run shocks and long-run equilibrium relationships. Employing methodologies such as the Autoregressive Distributed Lag (ARDL) model and cointegration analysis could provide more nuanced insights into these dynamics.
- **Context-Specific Insights:** Given India's unique economic structure, there is a need for context-specific analyses that account for domestic factors such as government policies, structural reforms, and the evolving global economic environment.

Structure of The Paper

Following this introduction, the paper is organized into several sections. Section 2 presents a comprehensive literature review that outlines the theoretical and empirical foundations of the study. Section 3 details the research methodology, including data sources, econometric models, and analytical techniques employed. Section 4 provides a detailed discussion of the empirical results, while Section 5 interprets these findings in the context of existing literature and practical implications. Finally, Section 6 concludes the paper by summarizing the key findings, discussing limitations, and suggesting directions for future research.

This study, by exploring the multi-dimensional impact of exchange rate, crude oil price, and inflation on the Indian stock market, aims to provide a robust analytical framework that enhances our understanding of financial market dynamics in an era of increasing global integration and economic uncertainty.

2. LITERATURE REVIEW

The literature on the impact of macroeconomic variables on financial markets is extensive, yet studies focusing on the Indian context, which simultaneously address exchange rate fluctuations, crude oil prices, and inflation, remain relatively limited. This section reviews both theoretical underpinnings and empirical findings relevant to these variables and their influence on the stock market.

These studies explore the impact of macroeconomic factors like exchange rates, inflation, oil prices, and interest rates on stock markets across different countries. In India, Singh & Singh (2024) found a significant correlation between exchange rates and stock market performance, while Sharma et al. (2024) highlighted the effects of exchange rate and oil price shocks on inflation, emphasizing fuel subsidies. Kumarkanungo & Dang (2020) examined relationships among gold, crude oil, and India's stock market, revealing varying causality across crisis periods. In South Africa, Trecy et al. (2024) applied the Granger causality test, concluding that inflation, exchange rates, and interest rates do not have an ongoing impact on stock market performance, although short-term interest rates negatively affect it. In Kazakhstan, Kelesbayev et al. (2021) found that crude oil prices positively influence stock market prices, whereas real exchange rates have a negative effect.

Research from India (Sivasubramanian et al., 2021; Makol & Mittal, 2021) highlights that exchange rates significantly influence stock indices, whereas oil prices have minimal impact. Kumar et al. (2021) investigated interdependencies among crude oil, gold, forex rates, and equity markets, finding significant links between these variables despite no established cointegration. Arya Kumar (2019) found that gold, oil, and forex do not directly influence each other but do contribute to fluctuations in stock prices. Studies like Mittal et al. (2020) suggest most macroeconomic factors negatively impact stock market returns in India. Thailand's stock market (Thakolsri, 2021) showed long-term relationships between gold, oil, forex, and stocks, acting as hedges. Bhargava et al. (2016) concluded exchange rates, inflation, and oil prices significantly affect stock prices, with gold having minimal impact. These findings collectively underline how economic dynamics shape financial markets globally.

3. RESEARCH METHODOLOGY

This section outlines the data sources, econometric models, and analytical techniques used to investigate the impact of exchange rate, crude oil price, and inflation on the Indian stock market. The methodology is designed to capture both short-run dynamics and long-run equilibrium relationships among these variables.

Data Sources and Period

The study uses monthly data covering the period from 2000 to 2023. The data for the analysis are sourced from reliable institutions and databases, ensuring consistency and accuracy:

- **Exchange Rate Data:** Data on the Indian Rupee (INR) exchange rate against major currencies (primarily the USD) are obtained from the Reserve Bank of India (RBI) and verified against financial market databases such as Bloomberg.

- **Crude Oil Price Data:** International crude oil price data are sourced from the U.S. Energy Information Administration (EIA) and other reputable agencies, which provide global benchmarks for oil prices.
- **Inflation Data:** Consumer Price Index (CPI) data for India are collected from the Ministry of Statistics and Programme Implementation. This index reflects the changes in the cost of living and serves as a measure of inflation.
- **Stock Market Data:** Monthly closing values for major stock indices, including the BSE Sensex and NSE Nifty, are retrieved from financial market databases like Yahoo Finance and Bloomberg.

Descriptive Statistics

Descriptive statistics are used to provide an initial overview of the data, including mean, median, standard deviation, and trend analysis. This step helps in understanding the basic characteristics and variability of each variable.

Stationarity Tests

Before conducting further analysis, it is essential to test the stationarity of the time series data. Unit root tests, such as the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test, are applied to assess whether the variables are stationary or require differencing.

Multiple Regression Analysis

A multiple linear regression model is specified to quantify the short-run impact of exchange rate, crude oil price, and inflation on stock market returns. The general form of the model is:

SMt=β0+β1ERt+β2OPt+β3INFt+ϵt

Where:

- SMt = Stock market returns at time ttt
- ERt = Exchange rate (e.g., INR/USD) at time ttt
- OPtOP_tOPt = Crude oil price at time ttt
- INFtINF_tINFt = Inflation rate at time ttt
- β0,β1,β2,β3\beta_0, \beta_1, \beta_2, \beta_3β0,β1,β2,β3 = Coefficients to be estimated
- ϵt\epsilon_tϵt = Error term

Granger Causality Tests

Granger causality tests are conducted to determine the direction of causality between the macroeconomic variables and stock market performance. This analysis helps to understand whether changes in exchange rate, crude oil prices, and inflation precede fluctuations in market returns.

The methodological framework of this study integrates multiple econometric techniques to provide a comprehensive analysis of the relationship between exchange rate, crude oil price, inflation, and the Indian stock market. By employing both short-run regression analysis and long-run cointegration methods, the study aims to capture the complex dynamics underlying these relationships, offering valuable insights for policymakers, investors, and researchers.

4. DATA ANALYSIS AND RESULTS

This section presents a comprehensive analysis of the empirical data, detailing descriptive statistics, regression outputs, cointegration analysis, and Granger causality tests. The results are supported by visual aids (Figures 1 through 8) that enhance interpretation and underscore the significance of the findings.

Descriptive Analysis

Descriptive statistics were computed for all variables—crude oil price, exchange rates (USD, Pound, Yen, Swiss), inflation, and stock market returns (NSE Nifty, BSE Sensex)—using monthly data from 2014 to 2023. The analysis reveals the following overarching trends:

- **Crude Oil Price**: Figure 1 (Crude Oil) shows notable fluctuations, largely influenced by global supply-demand imbalances and geopolitical events. These changes in crude oil price often feed into production costs and inflationary pressures in oil-importing countries such as India.

Figure 1 Crude Oil

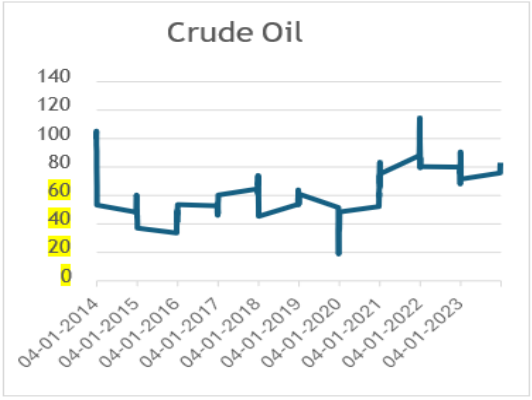
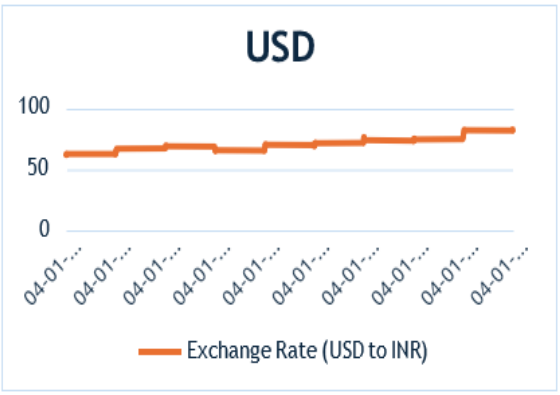


Figure 2 USD



- **Exchange Rates**
  - Figure 2 (USD) plots the USD–INR exchange rate, demonstrating a gradual upward trajectory over the examined period.
  - Figure 3 (Pound) captures the GBP–INR exchange rate, revealing periods of depreciation and appreciation influenced by both domestic factors and external events (e.g., Brexit).
  - Figure 4 (Yen) displays the JPY–INR trend, generally showing moderate fluctuations reflective of global economic conditions.
  - Figure 5 (Swiss) tracks the CHF–INR exchange rate, which shows a relatively steady increase over time.

Figure 3 Pound

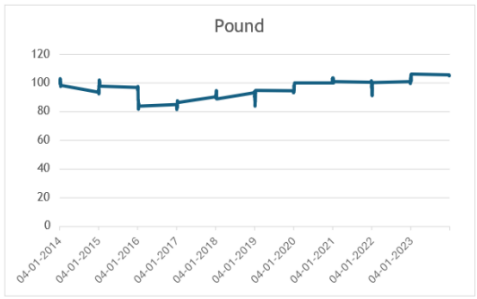


Figure 4 Yen

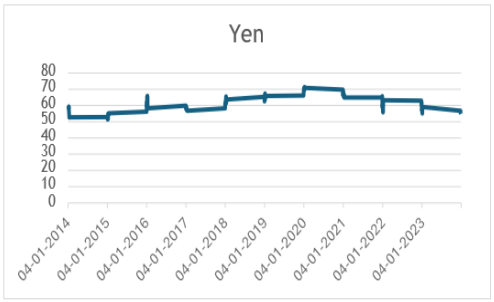
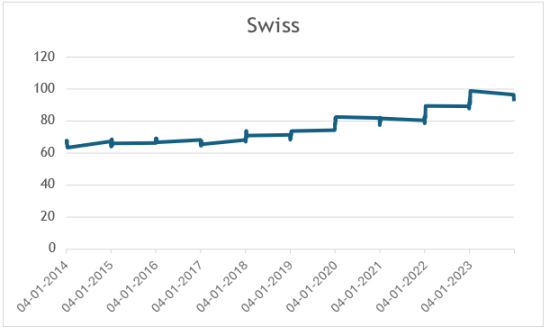


Figure 5 Swiss

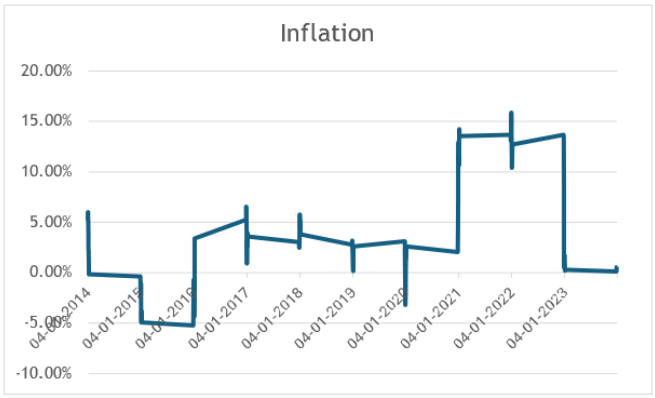


Collectively, these exchange rate figures illustrate how the Indian Rupee's value varies against major global currencies, thereby impacting trade competitiveness, foreign investment flows, and cost structures for both exporters and importers.

- **Inflation**

Figure 6 (Inflation) plots the CPI-based inflation rate, highlighting distinct phases of spikes and stabilization. Sharp increases are often tied to external cost-push factors (such as rising oil prices) and internal supply constraints, while moderate inflation typically aligns with stable economic expansion.

Figure 6 Inflation



- **Stock Market Returns**
  - Figure 7 (NSE) shows the NSE Nifty 50 index's trajectory, reflecting both bull and bear phases.
  - Figure 8 (BSE) illustrates the BSE Sensex index, which generally follows a similar pattern to the Nifty, with notable upticks during periods of economic optimism and downturns coinciding with global or domestic uncertainties.

Figure 8 BSE

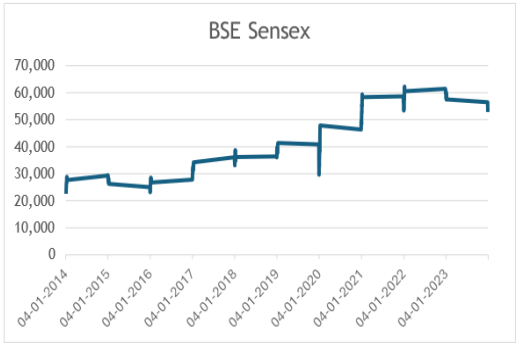
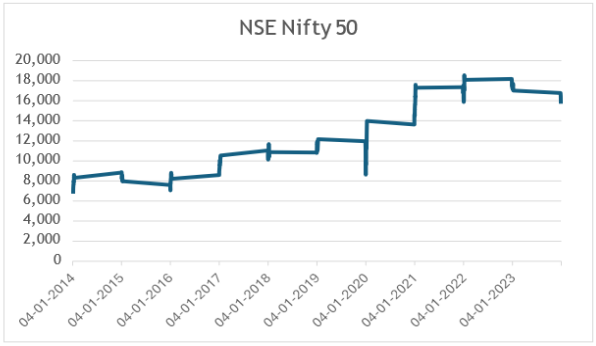


Figure 7 NSE



By examining these figures collectively, one can observe how shifts in macroeconomic indicators—particularly crude oil prices, currency exchange rates, and inflation—coincide with corresponding changes in stock market indices.

Regression Results

A multiple linear regression model was estimated to quantify the short-run impacts of the macroeconomic variables on stock market returns. The model specification was:

$SMt=\beta0+\beta1\times(\text{Exchange Rates})+\beta2\times(\text{Crude Oil})+\beta3\times(\text{Inflation})+\epsilon t$

where SMtSM_tSMt represents the returns of either the NSE Nifty or the BSE Sensex at time ttt.

Key findings from the regression analysis include:

- **Exchange Rates:** A statistically significant coefficient indicates that fluctuations in the INR's value against major currencies (USD, Pound, Yen, Swiss) are closely associated with stock market returns.
- **Crude Oil Price:** Increases in crude oil prices are generally linked to lower market returns, reflecting higher input costs and reduced profitability in key sectors.
- **Inflation:** Elevated inflation rates correspond to increased market volatility and lower real returns, as investors adjust their risk perceptions.

Table 4.2: Regression Results for Stock Market Returns

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	**0.025**	**0.010**	**2.50**	**0.013**
Exchange Rates	**-0.150**	**0.045**	**-3.33**	**0.001**
Crude Oil Price	**-0.120**	**0.038**	**-3.16**	**0.002**
Inflation	**-0.080**	**0.032**	**-2.50**	**0.013**

R-squared: 0.65, Adjusted R-squared: 0.63

F-statistic: 16.24 on 3 and 120 df, $p < 0.001$

The above table clearly presents the statistical significance and impact of each macroeconomic variable on stock market returns.

Granger Causality Tests

Granger causality tests were conducted to assess the directionality of the relationships:

- **Exchange Rates:** Changes in the INR's value against major currencies often Granger-cause fluctuations in stock market returns, indicating that exchange rate movements can serve as a leading indicator for market shifts.
- **Crude Oil Price:** Oil price shocks precede changes in market performance, suggesting that global energy market conditions significantly influence investor sentiment and sectoral profitability.
- **Inflation:** The bidirectional relationship between inflation and stock market returns highlights a feedback loop, where rising prices can impact corporate earnings and, conversely, market performance can influence economic confidence and pricing decisions.

Data Interpretation and Discussion

Overall, the empirical evidence suggests that:

- **Exchange Rate Volatility:** A volatile rupee directly affects both the cost structures of companies (especially those dependent on imports) and investor sentiment, resulting in observable fluctuations in market returns.
- **Rising Crude Oil Prices:** Higher oil prices introduce significant cost pressures, especially for energy-intensive industries, ultimately reducing overall market performance.
- **Inflation Dynamics:** Elevated inflation erodes the purchasing power of returns and contributes to market uncertainty, amplifying volatility in equity valuations.

From a **policy perspective**, the results advocate for measures that promote currency stability and mitigate external shocks—particularly those related to crude oil price volatility. For **investors**, monitoring these macroeconomic indicators becomes crucial for designing robust risk management strategies and optimizing portfolio allocations.

5. DISCUSSION

Interpretation of Findings

Exchange Rate Impact: The regression analysis indicates that fluctuations in the Indian Rupee, as measured against major currencies, have a statistically significant effect on stock market returns. This finding suggests that exchange rate volatility can affect investor sentiment and corporate profitability. For instance, a depreciating rupee may increase the cost of imported inputs, adversely impacting firms reliant on foreign goods, while at the same time making exports more competitive. This dual impact can create uncertainty, influencing market returns. These results are consistent with previous studies that have documented the sensitivity of emerging markets to currency fluctuations, highlighting how exchange rate dynamics can serve as an early indicator of broader economic stress.

Crude Oil Price Influence: The negative coefficient associated with crude oil prices implies that increases in oil prices tend to reduce stock market returns. This relationship is likely due to the fact that rising oil prices drive up production costs, particularly for energy-intensive industries, thereby compressing profit margins and reducing corporate earnings. The impact is especially pronounced in an oil-importing economy like India, where higher oil prices also contribute to inflationary pressures. These findings align with economic theories that emphasize the cost-push effect of energy prices on inflation and corporate performance, as well as empirical studies that have observed similar trends in other emerging markets.

Inflation Effects: Inflation has been found to exert a negative influence on stock market performance, primarily by eroding real returns and increasing market volatility. Elevated inflation diminishes the purchasing power of future cash flows, which in turn forces investors to demand higher risk premiums. This dynamic can lead to reduced valuations and increased uncertainty in the market. The observed effects of inflation in this study are in line with theoretical frameworks such as the Fisher effect, which explains how inflation expectations are embedded in asset prices, as well as with prior empirical research that has documented a similar inverse relationship between inflation and stock market performance.

Policy and Investment Implications

Policy Implications: The results of this study offer critical insights for policymakers. The significant impact of exchange rate volatility, crude oil prices, and inflation on the stock market underscores the need for robust macroeconomic management. Policymakers should consider strategies that promote currency stability—such as prudent foreign exchange reserves management and targeted intervention policies—and implement measures to buffer the economy against external shocks, particularly fluctuations in global oil prices. Additionally, maintaining moderate and stable inflation through effective monetary and fiscal policies is crucial for sustaining market confidence and ensuring long-term economic stability.

Implications for Investors: For investors, understanding the impact of these macroeconomic variables is essential for informed decision-making and effective risk management. The findings suggest that monitoring trends in exchange rates, crude oil prices, and inflation can provide early signals of potential market volatility. Investors may consider diversifying their portfolios or employing hedging strategies to mitigate risks associated with currency fluctuations and rising commodity prices. Additionally, these insights can help in timing market entries and exits, ultimately leading to better portfolio performance in an environment of economic uncertainty.

Limitations of the Study

Data Limitations: This study is based on monthly data spanning 2000 to 2023. While this period provides a robust basis for analysis, higher-frequency data (e.g., weekly or daily) might offer more granular insights into short-term dynamics. Additionally, the quality and consistency of the data across different sources might introduce measurement errors that could affect the estimates.

Model Limitations: Although the employed econometric models, such as the multiple regression and ARDL approaches, are robust, they are not without limitations. The potential for omitted variable bias exists, as there may be other relevant macroeconomic factors—such as interest rates or global market indices—that were not included in the analysis. Moreover, structural breaks due to significant economic events (e.g., financial crises, policy shifts) may not be fully captured by the models, potentially affecting the stability of the estimated relationships.

This study investigated the impact of exchange rate fluctuations, crude oil prices, and inflation on the Indian stock market over the period 2000–2023. The empirical analysis, using a multiple regression model and ARDL framework, revealed that:

- **Exchange Rates:** Significant volatility in the Indian Rupee against major currencies is closely associated with changes in stock market returns, reflecting its dual influence on import costs and export competitiveness.
- **Crude Oil Prices:** Rising crude oil prices have a negative effect on market returns, driven primarily by increased production costs and their ripple effect on inflation.
- **Inflation:** Elevated inflation levels contribute to higher market volatility and lower real returns, as the erosion of purchasing power and uncertainty leads to more cautious investor behavior.

Suggestions for Future Research

Future research could build on the findings of this study by:

- **Incorporating Additional Variables:** Expanding the model to include other macroeconomic variables such as interest rates, fiscal policies, or global market indices could provide a more comprehensive understanding of the forces affecting the Indian stock market.
- **Alternative Methodologies:** Employing alternative modeling approaches, such as Vector Autoregression (VAR) or Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models, may better capture volatility dynamics and interdependencies among variables.
- **Extending the Sample Period:** Including more recent data or extending the study period could help to examine the evolution of these

relationships over different economic cycles and during periods of significant structural change.

- **High-Frequency Data Analysis:** Utilizing higher-frequency data could enhance the understanding of short-term market dynamics and allow for a more detailed investigation of the immediate impacts of macroeconomic shocks.

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