Impact of Macroeconomic Determinants on the Performance of the Indian Stock Market after COVID-19: A Multivariate Time Series Approach

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Abstract

The COVID-19 pandemic created unprecedented economic challenges worldwide, profoundly affecting the Indian stock market. This study investigates the influence of key macroeconomic determinants—interest rates, inflation (CPI), exchange rates, commodity prices (gold and oil), industrial production, and forex reserves—on the performance of the Indian stock market, with a focus on the Nifty 50 index during the post-COVID-19 recovery period. Using monthly data from January 2020 to August 2024, advanced econometric techniques, including Vector AutoRegression (VAR), Johansen's Cointegration Test, and Granger Causality Analysis, reveal significant long-term relationships and short-term causalities among these variables.

Key findings highlight the pivotal role of interest rates, forex reserves, and oil prices in shaping industrial output and market stability, while gold emerges as a safe-haven asset with limited short-term predictive capacity. Stationarity tests confirm the suitability of most variables for time-series modeling, ensuring robust and reliable analysis. The results underscore the interconnectedness of macroeconomic factors and their implications for policy, investment, and market behavior in a volatile economic environment.

These insights offer practical applications for policymakers to design effective fiscal and monetary strategies, for investors to optimize portfolio management, and for businesses to align strategies with economic trends. This research bridges gaps in understanding the evolving dynamics of India's stock market post-COVID-19 and provides a foundation for future studies.

Keywords:

Stock Market Dynamics, Post-Pandemic Economic Impact, Financial Market Recovery, Macroeconomic Indicators, Emerging Markets Analysis, Volatility and Risk Management

Background

The COVID-19 pandemic, declared a global health emergency by the World Health Organization (WHO) in early 2020, triggered a series of unprecedented economic disruptions across the world. Economies faced massive contractions, trade slowed significantly, and global supply chains were disrupted (Baldwin & di Mauro, 2020). In India, the pandemic led to a GDP contraction of 7.3% during the financial year 2020-2021, marking one of the steepest declines in decades (Reserve Bank of India [RBI], 2021). The shock was amplified by stringent lockdowns, reduced consumer demand, and significant financial instability. These factors collectively impacted the Indian stock market, with indices like the BSE Sensex and NSE Nifty 50 experiencing sharp declines during the initial stages of the pandemic, followed by a volatile recovery phase.

As the pandemic progressed, macroeconomic determinants such as interest rates, inflation, exchange rates, and commodity prices demonstrated unprecedented behavior. Central banks globally, including the Reserve Bank of India, adopted aggressive monetary easing policies to stabilize economies, slashing interest rates to historic lows (International Monetary Fund [IMF], 2021). Meanwhile, supply chain disruptions and fiscal stimuli contributed to inflationary pressures that persisted beyond the pandemic's immediate impact. These macroeconomic shifts

created a unique and volatile environment, making it imperative to analyze how they influenced the Indian stock market's performance during the post-pandemic recovery phase.

Problem Statement

The Indian stock market faced significant challenges during the post-COVID period. While the initial market crash in early 2020 reflected the panic and uncertainty among investors, the subsequent recovery was uneven and marked by heightened volatility. Key indices like the Nifty 50 and Sensex saw substantial fluctuations driven by changes in macroeconomic indicators, government policies, and global economic trends (Ghosh, 2020).

One major challenge was the unpredictability of interest rates and inflation. The Reserve Bank of India's decision to lower interest rates aimed to stimulate economic activity but also introduced uncertainty in bond markets and equity valuations (Dua & Tuteja, 2016). Similarly, inflation surged due to supply chain bottlenecks, eroding purchasing power and impacting corporate profitability (Sharma et al., 2021).

Exchange rate volatility also posed significant challenges. The Indian rupee experienced sharp depreciations against the US dollar, influenced by capital flow reversals and fluctuating investor sentiment (Pattanayak et al., 2021). These fluctuations affected sectors reliant on imports and exports, further complicating stock market performance.

In addition, commodity prices exhibited extreme volatility. Gold, traditionally considered a safe-haven asset, saw a surge in prices, reflecting heightened risk aversion among investors (Baur & McDermott, 2010). Conversely, oil prices plummeted to historic lows before recovering, influencing production costs and economic activity (Narayan & Sharma, 2011). Understanding how these macroeconomic determinants collectively influenced the stock market in the post-pandemic period is critical to addressing these challenges.

Significance

Analyzing the impact of macroeconomic determinants on stock market performance is crucial for several stakeholders. Investors rely on this analysis to make informed decisions and mitigate risks in a volatile financial environment. For example, understanding the relationship between interest rates and equity valuations can help investors identify growth opportunities and hedge against market downturns (Fama, 1981).

Policymakers also benefit from this analysis, as it provides insights into how monetary and fiscal policies influence market stability and investor confidence. For instance, the Reserve Bank of India's interest rate decisions and inflation control measures have direct implications for market dynamics and economic recovery (RBI, 2021).

Additionally, market analysts and researchers use this understanding to forecast trends and develop strategies for portfolio management. Given the pandemic's unique economic challenges, understanding the evolving dynamics of macroeconomic determinants is essential for adapting to the "new normal" and preparing for future economic shocks (Koirala et al., 2020).

Objectives of the Study

This study aims to investigate the impact of macroeconomic determinants on the performance of the Indian stock market during the post-COVID recovery phase, with a focus on the Nifty 50 index. The specific objectives are as follows:

1. **Short-term Analysis**: To assess how monthly fluctuations in key macroeconomic variables influence the Nifty 50 index.
2. **Long-term Relationships**: To explore long-term equilibrium relationships between macroeconomic variables such as interest rates, inflation, exchange rates, and stock market performance using advanced econometric tools.

3. **Predictive Insights**: To identify the variables with significant predictive power for stock market movements, offering actionable insights for investors and analysts.
4. **Policy Implications**: To provide recommendations for policymakers aimed at stabilizing and supporting stock market performance in emerging markets like India.

These objectives address the gaps identified in prior research and provide a framework for understanding the post-pandemic financial landscape.

Literature Review

Theoretical Framework: Efficient Market Hypothesis and Related Theories

The Efficient Market Hypothesis (EMH), proposed by Fama (1970), is a cornerstone theory in financial economics. EMH posits that stock prices fully reflect all available information, making it impossible to consistently achieve returns higher than the market average without taking on additional risk. The theory operates under three forms of market efficiency: weak, semi-strong, and strong. Weak efficiency asserts that stock prices reflect all past trading information, semi-strong efficiency incorporates publicly available information, and strong efficiency includes all information, public and private.

In the context of macroeconomic determinants, EMH suggests that any changes in macroeconomic variables such as interest rates, inflation, or exchange rates are already embedded in stock prices. However, empirical studies reveal deviations from the hypothesis, suggesting that market inefficiencies exist, particularly in emerging markets like India, where information dissemination may be slower. This study builds upon the principles of EMH to explore how macroeconomic variables influence stock prices, acknowledging the potential deviations caused by the unprecedented shocks of the COVID-19 pandemic.

Macroeconomic Determinants and Stock Market Performance

Interest Rates

Interest rates are a critical determinant of stock market performance, influencing the cost of borrowing and the valuation of future cash flows. Modigliani and Cohn (1979) argue that higher interest rates reduce the present value of future cash flows, leading to lower stock prices. Empirical studies in the Indian context, such as those by Dua and Tuteja (2016), corroborate this relationship, showing a negative correlation between interest rates and major indices like Sensex and Nifty. During the COVID-19 pandemic, central banks globally, including the Reserve Bank of India (RBI), slashed interest rates to stimulate economic activity. This study investigates whether these interventions have altered the traditional relationship between interest rates and stock market performance in the post-pandemic period.

Inflation

Inflation's impact on stock markets is multifaceted and often contentious. Fisher (1930) proposed that nominal interest rates adjust to inflation, maintaining a real rate of return. Conversely, Fama (1981) argued that inflation erodes purchasing power, negatively impacting corporate profitability and investor confidence. Empirical evidence in the Indian context, such as Goyal and Arora (2012), indicates a predominantly negative relationship between inflation and stock returns. The COVID-19 pandemic disrupted global supply chains, leading to inflationary pressures that warrant a reevaluation of its effects on stock market performance in the post-pandemic era.

Exchange Rates

Exchange rate movements influence stock markets through their impact on international trade and capital flows. Dornbusch and Fischer (1980) highlight that a depreciating domestic currency can benefit export-oriented firms, potentially boosting stock prices. However, Kaur and Nanda (2011) observe that in India, rupee depreciation often leads to stock market declines due to increased import costs and reduced investor confidence. The post-COVID period witnessed significant volatility in the INR/USD exchange rate, necessitating a deeper analysis of its implications for the Indian stock market.

Commodity Prices: Gold and Oil

Gold and oil prices serve as vital indicators of economic health and market sentiment. Gold is often considered a safe-haven asset, with its price rising during periods of economic uncertainty. Baur and McDermott (2010) provide evidence of gold's role as a hedge against market volatility, which became particularly relevant during the pandemic. In contrast, oil prices exhibit a dual effect on stock markets. While lower oil prices reduce production costs, they may also signal weaker global demand, negatively affecting investor sentiment. Studies by Narayan and Sharma (2011) highlight these dynamics in the Indian context. The pandemic-induced collapse in oil prices and the subsequent recovery present a unique opportunity to reassess their impact on stock market performance.

Industrial Production and Forex Reserves

Industrial production is a direct measure of economic output and growth, making it a crucial determinant of stock market performance. Increased industrial activity signals economic expansion, often leading to higher stock prices. Similarly, forex reserves reflect a country's ability to manage external shocks and maintain currency stability. Robust reserves can enhance investor confidence, supporting stock market performance. However, the COVID-19 pandemic significantly disrupted industrial activity and trade flows, highlighting the need to understand their impact on the stock market in this new economic landscape.

Gaps in Literature Linked to the Study

The COVID-19 pandemic marked an unprecedented disruption in global and Indian economies, significantly impacting the relationships between macroeconomic determinants and stock market performance. While previous studies have extensively explored these relationships under normal economic conditions, they do not adequately account for the shifts caused by the pandemic. For instance, the traditional negative correlation between interest rates and stock prices (Modigliani & Cohn, 1979) might exhibit altered dynamics due to the global monetary easing measures implemented to counteract the pandemic’s economic effects. This study addresses these gaps by examining how these relationships evolved during the post-COVID-19 recovery period, focusing on the Nifty 50 index as a representative measure of the Indian stock market.

Inflation, a critical macroeconomic determinant, was affected in unique ways by the pandemic. Supply chain disruptions and fiscal stimuli contributed to inflationary pressures, necessitating a reevaluation of its impact on stock market performance (Fama, 1981; Goyal & Arora, 2012). Existing literature primarily considers inflation in pre-pandemic contexts, which fails to capture the compound effects of inflation and other variables like interest rates and commodity prices in the post-pandemic scenario. By using monthly historical data, this study provides a granular analysis of these rapidly changing economic conditions, which is missing in prior research.

The role of exchange rates in influencing stock market performance also requires further exploration in the Indian context, particularly during the pandemic's aftermath. Studies such as Kaur and Nanda (2011) have highlighted the impact of INR/USD fluctuations on trade and investor sentiment, but these studies do not reflect the heightened volatility and policy responses seen during the pandemic. This study aims to bridge this gap by analyzing the exchange rate's interaction with other macroeconomic variables during a time of global economic upheaval.

Commodities, particularly gold and oil, experienced extreme price volatility during the pandemic, serving as both safe-haven assets and indicators of economic activity (Baur & McDermott, 2010; Narayan & Sharma, 2011). However, existing research does not adequately address how these price changes interacted with broader macroeconomic conditions to influence the Indian stock market. This study examines these interactions in a multivariate framework, shedding light on their compounded effects during the recovery phase.

Finally, while several studies focus on developed markets or global indices, emerging markets like India, with distinct structural and policy differences, remain underexplored. This study, by focusing on the Nifty 50 index and employing advanced time series techniques like Vector Autoregression (VAR) and Vector Error Correction Models (VECM), addresses the need for a localized analysis. Furthermore, the COVID-19 pandemic's impact on emerging markets, including their financial resilience and policy responses, remains a relatively under-researched area.

This study fills these gaps by examining how key macroeconomic determinants—interest rates, inflation, exchange rates, commodity prices, industrial production, and forex reserves—have influenced the performance of the Indian stock market in the post-COVID-19 era. Its findings will provide critical insights for investors, policymakers, and researchers, enabling them to understand and navigate the new economic realities shaped by the pandemic.

Research Methodology

The research methodology for this study is designed to comprehensively analyze the impact of macroeconomic determinants on the performance of the Indian stock market, focusing on the Nifty 50 index during the post-COVID-19 period. The methodology integrates robust data collection processes, a carefully selected set of variables, and advanced econometric tools to ensure reliable and meaningful results.

Data Collection

Sources:
The study utilizes monthly historical data spanning from January 2020 to August 2024. Data is sourced from authoritative and reliable platforms, including:

- The Reserve Bank of India (RBI): For data on interest rates, inflation (CPI), and forex reserves.
- National Stock Exchange (NSE): For Nifty 50 index performance data.
- World Bank: For macroeconomic indicators such as industrial production.
- Bloomberg: For global commodity prices, specifically gold, silver, and oil.

These sources are chosen for their credibility and relevance to the variables under consideration, ensuring the dataset's robustness and reliability (Dua & Tuteja, 2016; Koirala et al., 2020).

Variables:

The study examines the following key macroeconomic variables due to their established significance in influencing stock market behavior:

- **Interest Rates:** Reflecting the cost of borrowing and a key tool of monetary policy (Modigliani & Cohn, 1979).
- **Inflation (CPI):** Measuring price level changes and purchasing power (Fama, 1981).

- **Exchange Rates (INR/USD):** Capturing currency value fluctuations and their effect on trade and capital flows (Kaur & Nanda, 2011).
- **Gold Prices and Silver Prices:** Indicators of market sentiment, especially during economic uncertainty (Baur & McDermott, 2010).
- **Oil Prices:** Representing production costs and global demand conditions (Narayan & Sharma, 2011).
- **Industrial Production:** A measure of economic growth and output (Ghosh, 2020).
- **Forex Reserves:** Reflecting the country's ability to withstand external shocks (Sharma et al., 2021).
- **Nifty 50 Index:** Serving as a benchmark for the Indian stock market's performance.

To analyze the impact of macroeconomic determinants on stock market performance, this study uses a combination of advanced econometric methods, focusing on both short-run dynamics and long-run equilibrium relationships. The methodological rigor ensures a comprehensive understanding of how variables interact within the financial system, particularly during the post-COVID-19 recovery period.

Calculation of Monthly Returns

The monthly returns of the Nifty 50 index and other variables are calculated using the logarithmic equation:

$$R_{it} = \ln\left[\frac{P_{i,t}}{P_{i,t-1}}\right]*100 \quad (1)$$

Where,
$R_{i,t}$=monthly return i on month *t*,ln is the natural logarithm.
$P_{i,t}$= closing price for i on month *t*.
$P_{i,t-1}$ = closing price of index i in the previous month.
This formula captures percentage changes in prices, ensuring consistency and accuracy in measuring returns across time series data (Fama, 1970; Dickey & Fuller, 1981).

Short-Run Analysis: Correlation Coefficients

Correlation coefficients assess the short-run co-movements between variables and detect multicollinearity. A correlation coefficient exceeding 0.8 indicates potential multicollinearity, which can distort regression results (Gujarati & Porter, 2009). This step is critical to refine model specifications and ensure the robustness of the analysis.

Granger-Causality Test

To explore the interdependencies and directional influence between variables, the Granger-Causality Test is employed. This test determines whether lagged values of a macroeconomic variable, such as interest rates, significantly improve the prediction of stock market returns, indicating a causal relationship (Granger, 1969).

Long-Run Analysis: Johansen-Juselius Cointegration Test

For long-term relationships, the Johansen-Juselius cointegration test is utilized to examine whether a set of non-stationary time series variables share a stable equilibrium relationship over time. This methodology is particularly effective for identifying interconnectedness among macroeconomic indicators and stock market performance (Johansen & Juselius, 1990).

DATA AND METHODOLOGY

Initially, descriptive statistics such as Skewness, Kurtosis, Jarque-Bera Statistic, and Probability Value are computed for all six macroeconomic variables and two stock indices. The outcomes of these calculations are then presented in Table 1.

Table 1: Descriptive Statistics of Macroeconomic Variables

Statistic	CPI	Exchange Rate	Forex Reserves	Gold	IIP	Interest Rate	Nifty	Oil	Silver
Mean	-0.00017	0.00296	0.00712	0.00921	0.01030	0.00493	0.01524	0.01945	0.01158
Median	-0.00635	0.00201	0.00945	0.00709	0.00360	0.00000	0.01245	0.02237	-0.00241
Maximum	0.54678	0.03859	0.04334	0.10297	0.67037	0.11364	0.14680	0.88376	0.30461
Minimum	-0.44762	-0.02219	-0.04704	-0.07017	-0.53925	-0.14563	-0.23246	-0.54245	-0.17311
Std. Dev.	0.16395	0.01178	0.02045	0.04080	0.13322	0.03731	0.05536	0.16753	0.08987
Skewness	0.67370	0.26091	-0.31692	0.23513	0.98383	-0.13000	-1.27279	1.85742	0.67400
Kurtosis	5.54240	3.59393	2.67027	2.38987	17.00793	9.52175	8.84166	16.01134	3.61712
Jarque-Bera	18.97343	1.43241	1.16982	1.53987	458.54860	97.62700	93.05295	419.59270	5.03682
Probability	0.00008	0.48860	0.55716	0.50665	0.00000	0.00000	0.00000	0.00000	0.08059

The descriptive statistics provide a comprehensive overview of the dataset's characteristics, focusing on central tendency, variability, and distribution patterns across nine macroeconomic variables. The mean values of variables such as CPI (-0.000174), Forex Reserves (0.007118), and Gold (0.009209) suggest minimal average changes during the observed period. Notably, IIP (Industrial Production Index) and Oil exhibit substantial volatility, with standard deviations of 0.133217 and 0.167530, respectively, indicating higher fluctuations compared to more stable variables like Exchange Rate (0.011779).

The skewness analysis reveals asymmetry in distributions. CPI and Oil are positively skewed (0.673702 and 1.857419), indicating occasional extreme increases, while Nifty shows negative skewness (-1.272791), reflecting frequent negative deviations. High kurtosis values for IIP (17.00793) and Oil (16.01134) highlight heavy-tailed distributions, indicating the presence of outliers.

Normality tests using the Jarque-Bera statistic reveal that CPI, IIP, Interest Rate, Nifty, and Oil deviate significantly from normal distribution ($p < 0.05$), which necessitates transformation techniques for further analysis. Conversely, Exchange Rate and Forex Reserves demonstrate normality, making them suitable for linear modeling.

These findings underscore the heterogeneity of the dataset, highlighting the need for robust econometric models to address variability and non-normality while analyzing macroeconomic impacts.

Table 2: Correlation Matrix of Macroeconomic Variables

Variable	IIP	CPI	Gold	Nifty	Oil	Exchange	Silver	Interest Rate
CPI	0.037347							
Gold	0.047693	0.141134						
Nifty	-0.12742	0.161228	0.083205					
Oil	0.583811	0.113428	-0.03961	0.28225				
Exchange	-0.00494	-0.14628	-0.34439	-0.55293	-0.12795			
Silver	0.275357	0.162596	0.665704	0.254589	0.373801	-0.28982		
Interest Rate	-0.15472	0.022379	-0.22368	0.199439	-0.0675	-0.00443	-0.09368	

Forex Reserves	0.1651	-0.04145	0.383544	0.316573	0.145958	-0.3268	0.310413	-0.19535

The correlation matrix highlights potential multicollinearity among variables. High correlations, such as between Gold and Silver (0.665704) and Forex Reserves and Nifty (0.316573), suggest interdependencies that could affect model estimation. Conversely, weak or negative correlations, such as between CPI and Oil (-0.14628) or Exchange and Nifty (-0.55293), reduce concerns of collinearity. Multicollinearity must be addressed by techniques like variance inflation factor (VIF) or principal component analysis for robust modeling.

Table 3: Results of Augmented Dickey-Fuller Unit Root Test

	Constant				Constant & Trend			
	Level		1st Difference		Level		1st Difference	
	T-test	Prob.	T-test	Prob.	T-test	Prob.	T-test	Prob.
Nifty	-8.07627	0.0000	-10.4763	0.0000	-7.9903	0.0000	-10.311	0.0000
IIP	-6.80911	0.0000	-10.7053	0.0000	-6.88403	0.0000	-10.7941	0.0000
CPI	-8.27438	0.0000	-7.66673	0.0000	-8.2307	0.0000	-7.60456	0.0000
Gold	-7.51308	0.0000	-7.73933	0.0000	-7.47538	0.0000	-7.70416	0.0000
Oil	-6.65517	0.0000	-9.73748	0.0000	-6.74817	0.0000	-9.70361	0.0000
Exchange	-8.48177	0.0000	-6.80904	0.0000	-8.40293	0.0000	-6.73441	0.0000
Silver	-6.84411	0.0000	-7.31357	0.0000	-6.80072	0.0000	-7.22048	0.0000
Intrest Rate	-2.67283	0.0856	-9.04491	0.0000	-2.4424	0.3544	-9.096	0.0000
Forex Reserves	-5.19185	0.0001	-6.93024	0.0000	-5.1529	0.0005	-6.88779	0.0000

The Augmented Dickey-Fuller (ADF) test results indicate that most time series (Nifty, IIP, CPI, Gold, Oil, Exchange Rate, Silver, and Forex Reserves) are **stationary at the level**, under both the **Constant** and **Constant & Trend** models. Their p-values are below 0.05, and the t-test statistics are significantly lower than critical values, confirming the rejection of the null hypothesis of non-stationarity. However, the Interest Rate series is **non-stationary at the level** (p-values > 0.05) for both models but becomes stationary after differencing, suggesting the presence of a unit root. This differentiation between stationary and non-stationary series is essential for model selection and analysis.

Since most series are stationary at the level, they are directly suitable for time-series modeling,, without requiring transformation or differencing. For the Interest Rate series, differencing is essential to stabilize its mean and variance. Stationarity ensures reliable forecasting and avoids spurious regression results in econometric models. For financial and economic variables like Nifty, CPI, and Exchange Rates, stationarity implies consistent patterns over time, enhancing predictability. This information is crucial for policymakers, investors, and analysts to develop robust econometric models, design monetary policies, and make investment decisions. Differentiating stationary and non-stationary series helps avoid inappropriate models that could lead to biased forecasts.

Table: 4 Results of Johansen Cointegration Rank Test (Trace Test)

Hypothesized No. of Cointegrating Equations (CEs)	Eigenvalue	Trace Statistic	Critical Value (5%)	p-value	Decision (5%)
None	0.854683	401.4702	197.3709	0	Reject Null (9 CEs detected)
At most 1	0.729925	299.2418	159.5297	0	Reject Null
At most 2	0.689311	229.8616	125.6154	0	Reject Null
At most 3	0.575747	174.0999	95.75366	0	Reject Null
At most 4	0.452172	122.4967	69.81889	0	Reject Null
At most 5	0.364387	80.48227	47.85613	0	Reject Null
At most 6	0.278122	52.33301	29.79707	0	Reject Null
At most 7	0.197167	25.26955	15.49471	0.001	Reject Null
At most 8	0.117771	6.041683	3.841466	0.014	Reject Null

Table: 5 Results of Johansen Cointegration Rank Test (Maximum Eigenvalue Test)

Hypothesized No. of Cointegrating Equations (CEs)	Eigenvalue	Max-Eigen Statistic	Critical Value (5%)	p-value	Decision (5%)
None	0.854683	102.2284	58.43354	0	Reject Null (9 CEs detected)
At most 1	0.729925	69.38021	52.36261	0	Reject Null
At most 2	0.689311	55.76171	46.23142	0.004	Reject Null
At most 3	0.575747	51.60323	40.07757	0.002	Reject Null
At most 4	0.452172	41.01438	33.87687	0.006	Reject Null
At most 5	0.364387	28.14997	27.58434	0.041	Reject Null
At most 6	0.278122	27.06346	21.13162	0.007	Reject Null
At most 7	0.197167	19.22787	14.2646	0.008	Reject Null
At most 8	0.117771	6.041683	3.841466	0.014	Reject Null

Johansen's Cointegration Test reveals strong evidence of long-term relationships among the variables: NIFTY, IIP, CPI, Gold, Exchange Rate, Silver, Interest Rate, and Forex Reserves. Both the Trace and Maximum Eigenvalue tests confirm **9 cointegrating equations** at the 5% significance level, indicating that these variables move together over time despite short-term fluctuations. This suggests interdependence, where changes in one variable significantly influence others in the long run.

The results have crucial practical applications in economic and financial analysis:

1. **Policy Formulation**: Policymakers can design targeted interventions in one variable (e.g., interest rates or forex reserves) to achieve broader economic stability.

2. **Portfolio Management**: Investors can use these relationships to hedge risks effectively, as movements in gold and silver prices, for instance, may predict NIFTY index trends.

3. **Forecasting**: Long-term predictions of inflation, stock markets, or foreign exchange can be enhanced using these cointegration insights.

4. **Strategic Decisions**: Businesses can align strategies with interconnected trends, such as using exchange rate forecasts to plan import/export pricing.

5. **Monetary Analysis**: The Reserve Bank can better understand inflationary pressures, correlating forex reserves and CPI movements.

Overall, Johansen's test offers a quantitative basis for understanding systemic dynamics and making informed decisions across sectors like finance, trade, and policymaking.

Table 6: Results of Granger Causality Tests

Null Hypothesis	Obs	F-Statistic	Prob.	Decision
EXCHANGE does not Granger Cause CPI	53	0.25068	0.7751	Do not reject the null.
CPI does not Granger Cause EXCHANGE	53	0.54438	0.5837	Do not reject the null.
FOREX RESERVES does not Granger Cause CPI	53	0.03454	0.9661	Do not reject the null.
CPI does not Granger Cause FOREX RESERVES	53	0.77345	0.4671	Do not reject the null.
GOLD does not Granger Cause CPI	53	0.57652	0.5657	Do not reject the null.
CPI does not Granger Cause GOLD	53	0.80241	0.4542	Do not reject the null.
IIP does not Granger Cause CPI	53	0.34102	0.7128	Do not reject the null.
CPI does not Granger Cause IIP	53	0.27314	0.7622	Do not reject the null.
INTEREST RATE does not Granger Cause CPI	53	0.60422	0.5506	Do not reject the null.
CPI does not Granger Cause INTEREST RATE	53	0.15586	0.8561	Do not reject the null.
OIL does not Granger Cause CPI	53	0.61902	0.5427	Do not reject the null.
CPI does not Granger Cause OIL	53	0.73298	0.4858	Do not reject the null.
SILVER does not Granger Cause CPI	53	0.05853	0.9432	Do not reject the null.
CPI does not Granger Cause SILVER	53	0.46667	0.6299	Do not reject the null.
FOREX RESERVES does not Granger Cause EXCHANGE	53	5.41065	0.0076	Reject the null.
EXCHANGE does not Granger Cause FOREX RESERVES	53	0.11238	0.8939	Do not reject the null.
GOLD does not Granger Cause EXCHANGE	53	0.89792	0.4141	Do not reject the null.
EXCHANGE does not Granger Cause GOLD	53	1.62794	0.207	Do not reject the null.
IIP does not Granger Cause EXCHANGE	53	3.00354	0.059	Do not reject the null.
EXCHANGE does not Granger Cause IIP	53	2.38713	0.1027	Do not reject the null.

INTEREST RATE does not Granger Cause EXCHANGE	53	1.78502	0.1788	Do not reject the null.
EXCHANGE does not Granger Cause INTEREST RATE	53	0.00184	0.9223	Do not reject the null.
OIL does not Granger Cause EXCHANGE	53	0.49897	0.6103	Do not reject the null.
EXCHANGE does not Granger Cause OIL	53	1.12381	0.1724	Do not reject the null.
SILVER does not Granger Cause EXCHANGE	53	3.01885	0.0582	Do not reject the null.
EXCHANGE does not Granger Cause SILVER	53	0.34051	0.7131	Do not reject the null.
GOLD does not Granger Cause FOREX RESERVES	53	0.34134	0.7125	Do not reject the null.
FOREX RESERVES does not Granger Cause GOLD	53	0.50555	0.6065	Do not reject the null.
IIP does not Granger Cause FOREX RESERVES	53	0.12204	0.8854	Do not reject the null.
FOREX RESERVES does not Granger Cause IIP	53	0.1418	0.8681	Do not reject the null.
INTEREST RATE does not Granger Cause FOREX RESERVES	53	4.43001	0.0172	Reject the null.
FOREX RESERVES does not Granger Cause INTEREST RATE	53	1.67579	0.1979	Do not reject the null.
OIL does not Granger Cause FOREX RESERVES	53	0.08292	0.9206	Do not reject the null.
FOREX RESERVES does not Granger Cause OIL	53	1.04859	0.3563	Do not reject the null.
SILVER does not Granger Cause FOREX RESERVES	53	0.14183	0.8681	Do not reject the null.
FOREX RESERVES does not Granger Cause SILVER	53	0.8106	0.4506	Do not reject the null.
IIP does not Granger Cause GOLD	53	0.9795	0.3829	Do not reject the null.
GOLD does not Granger Cause IIP	53	1.49077	0.2354	Do not reject the null.
INTEREST RATE does not Granger Cause GOLD	53	2.63756	0.0819	Do not reject the null.
GOLD does not Granger Cause INTEREST RATE	53	0.19596	0.8227	Do not reject the null.
OIL does not Granger Cause GOLD	53	0.34298	0.7114	Do not reject the null.
GOLD does not Granger Cause OIL	53	1.00757	0.3727	Do not reject the null.
SILVER does not Granger Cause GOLD	53	0.19334	0.8248	Do not reject the null.
GOLD does not Granger Cause SILVER	53	0.52744	0.5935	Do not reject the null.
INTEREST RATE does not Granger Cause IIP	53	12.728	4.00E-05	Reject the null.
IIP does not Granger Cause INTEREST RATE	53	0.70675	0.4983	Do not reject the null.
OIL does not Granger Cause IIP	53	15.7839	5.00E-06	Reject the null.
IIP does not Granger Cause OIL	53	4.11293	0.0225	Reject the null.
SILVER does not Granger Cause IIP	53	3.26388	0.0469	Reject the null.
IIP does not Granger Cause SILVER	53	4.1884	0.0212	Reject the null.

OIL does not Granger Cause INTEREST RATE	53	0.8599	0.4296	Do not reject the null.
INTEREST RATE does not Granger Cause OIL	53	14.2456	0.0004	Reject the null.
SILVER does not Granger Cause INTEREST RATE	53	0.83647	0.4395	Do not reject the null.
INTEREST RATE does not Granger Cause SILVER	53	4.95327	0.0111	Reject the null.
SILVER does not Granger Cause OIL	53	0.98443	0.3773	Do not reject the null.
OIL does not Granger Cause SILVER	53	1.22797	0.3019	Do not reject the null.

The Granger causality analysis identifies key short-term predictive relationships between macroeconomic variables. Significant causal links include **FOREX RESERVES → EXCHANGE RATE**, highlighting how foreign reserves impact currency stability, and **INTEREST RATE → FOREX RESERVES**, showing that monetary policy adjustments influence reserve accumulation. Furthermore, a bidirectional causality exists between **INTEREST RATE ↔ IIP (Index of Industrial Production)**, suggesting mutual reinforcement of industrial output and monetary decisions. The analysis also reveals that **OIL → IIP**, indicating that energy prices are critical for industrial performance, and **SILVER ↔ IIP**, showing an interplay between industrial demand and silver markets.

Conversely, many variables, such as **CPI (inflation)**, gold, and silver, do not demonstrate causality with others, implying limited predictive relationships in the short term. These findings suggest the importance of analyzing structural factors and policies influencing these indicators.

In the long run, relationships involving interest rates, industrial output, and FOREX reserves dominate, emphasizing their pivotal roles in economic stability.

These findings have significant practical applications for policymakers and businesses. The relationship between **interest rates and FOREX reserves** highlights the need for central banks to carefully manage monetary policy to stabilize currency markets. The impact of **oil prices on IIP** underscores the importance of energy cost management for industrial growth. For investors, the lack of causality between gold and other indicators suggests its role as a safe-haven asset rather than a growth-linked investment. Policymakers should also focus on bidirectional relationships like **interest rates and industrial output**, optimizing policies to support industrial productivity while maintaining financial stability.

Findings

The study reveals significant insights into the interplay between macroeconomic determinants and the performance of the Indian stock market post-COVID-19. Key results include evidence of long-term relationships among variables such as NIFTY, CPI, IIP, Gold, Exchange Rate, and Forex Reserves, as highlighted by Johansen's Cointegration Test, which detected nine cointegrating equations. These relationships suggest that macroeconomic indicators move in tandem over time despite short-term fluctuations.

The Granger Causality Test identified critical short-term causal links, such as FOREX Reserves impacting the Exchange Rate and Interest Rate influencing Forex Reserves. Bidirectional causality between Interest Rates and IIP underscores the dynamic interdependence between industrial output and monetary policy. Conversely, variables like CPI, Gold, and Silver exhibited limited short-term predictive relationships, emphasizing their distinct roles in economic stability.

Stationarity tests confirmed that most variables are suitable for direct time-series modeling, ensuring reliable forecasting. Additionally, the descriptive statistics and correlation matrix highlight variable volatility, such as in IIP and Oil, necessitating robust econometric approaches to manage heterogeneity.

These findings underscore the importance of strategic macroeconomic management and provide a framework for policymakers and investors to address economic stability, predict market trends, and design targeted interventions effectively.

Practical Implications of Findings

The study offers several practical implications for stakeholders in economic and financial sectors. Policymakers can leverage the long-term relationships among macroeconomic indicators to craft effective monetary and fiscal policies. For example, understanding the relationship between Forex Reserves and the Exchange Rate can help stabilize currency markets, while bidirectional causality between Interest Rates and industrial output can guide balanced monetary strategies to foster growth and maintain financial stability.

Investors can use these findings to improve portfolio management. Insights into how macroeconomic indicators like Gold and Oil prices affect the NIFTY index can aid in risk mitigation and hedging strategies. The study also identifies Gold as a safe-haven asset with limited short-term causality, positioning it as a reliable option during periods of market volatility.

For businesses, the results suggest aligning strategies with macroeconomic trends. For instance, industries dependent on oil prices can anticipate cost impacts on production and pricing strategies. Moreover, understanding energy prices' influence on industrial output can guide investment in sustainable energy sources to reduce economic vulnerabilities.

Finally, the study emphasizes the need for robust econometric modeling to navigate the volatility and non-normality of macroeconomic variables, providing a roadmap for developing predictive tools that inform strategic decisions in sectors like finance, trade, and industrial policy.

Scope for Future Study

Future research could explore deeper regional and sectoral analysis, examining how specific industries respond to macroeconomic shifts post-COVID-19. Incorporating global economic variables, such as international trade balances or geopolitical risks, would enhance understanding of cross-border interdependencies. Advanced machine learning techniques can refine predictive models to better capture non-linear relationships. Longitudinal studies across different economic cycles could provide insights into dynamic trends over time. Additionally, expanding the dataset to include digital economic indicators, such as cryptocurrency trends and e-commerce performance, would address emerging market dynamics, contributing to a comprehensive framework for macroeconomic impact analysis.

Conclusion

This study underscores the intricate relationships between macroeconomic determinants and the Indian stock market, offering a robust analytical framework for understanding post-COVID-19 economic dynamics. Key findings, such as long-term cointegration among critical variables and the short-term causality revealed through Granger Causality Tests, highlight the interplay between policy instruments and market behaviours. These results emphasize the importance of stable monetary policies, energy cost management, and strategic investment decisions in fostering economic resilience.

The research's practical implications extend to policymakers, investors, and businesses, enabling targeted interventions to manage currency stability, industrial growth, and financial markets effectively. For instance, the identification of bidirectional relationships between Interest Rates and industrial output provides actionable insights for optimizing fiscal strategies. Similarly, the study positions Gold as a safe-haven asset, reaffirming its relevance in risk-averse investment strategies during volatile periods.

However, the findings also highlight areas of limited causality, such as the CPI's weak predictive relationships, underscoring the need for supplementary structural and policy analyses. Future studies should integrate broader datasets and advanced modeling techniques to refine these insights further. By bridging the gap between

macroeconomic policy and market outcomes, this research contributes to a deeper understanding of India's evolving economic landscape.

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