

Macroeconomic Factors and their Impact on Stock Market Volatility: Trends, Drivers, and Policy Recommendations

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ABSTRACT

The study investigates how key macroeconomic factors contribute to stock market volatility from 2015 to 2024, a period marked by significant economic fluctuations and policy shifts. Focusing on variables such as GDP growth, inflation, interest rates, and economic policy uncertainty, this research examines their impact on market stability across developed and emerging economies. Using quantitative analysis and secondary data, the study highlights periods of heightened volatility in response to economic shocks, particularly around events like the COVID-19 pandemic and subsequent policy responses. Findings reveal that rising inflation and policy uncertainty are primary drivers of volatility, often exacerbating market instability during economic downturns. Additionally, GDP growth and interest rate changes are shown to influence investor sentiment and asset pricing, underscoring the importance of macroeconomic stability for market resilience. While these macroeconomic fundamentals are crucial in understanding market dynamics, this study also addresses challenges in maintaining stability, such as varying policy responses and global economic interdependence, emphasizing the need for adaptive policy frameworks to mitigate volatility risks. This analysis contributes to the broader understanding of how macroeconomic factors shape financial markets, offering valuable insights for policymakers and investors aiming to navigate uncertain economic landscapes.

KEYWORDS

Stock Market Volatility, Macroeconomic Factors, Inflation, GDP Growth, Interest Rates, Economic Policy Uncertainty, Market Behavior.

I. INTRODUCTION

In recent years, global stock markets have experienced significant volatility driven by changes in macroeconomic factors and geopolitical events. Key economic variables like inflation, GDP growth, interest rates, and policy uncertainty are crucial drivers of stock market behavior. These factors have become even more important as economies contend with disruptions such as the COVID-19 pandemic and shifting fiscal and monetary policies. Historically, economic instability, such as high inflation and low GDP growth, tends to increase investor risk-aversion, often leading to market downturns.

The effect of these variables has been amplified during periods of heightened uncertainty, which can destabilize markets and heighten investor concerns. Economic policy uncertainty, a key indicator of overall economic stability, has been shown to exacerbate market fluctuations. As policies shift, particularly in emerging markets, the resulting uncertainty often leads to volatile market reactions, highlighting the complex relationship between macroeconomic fundamentals and financial markets.

This study aims to examine how key macroeconomic indicators, such as GDP growth, inflation, and interest rates, affect stock market volatility from 2015 to 2024. By using regression and trend analysis, the research explores the role of macroeconomic stability in shaping investor confidence and market performance. The findings aim to provide insights for policymakers on strategies to mitigate market risks and promote stability, even amid uncertainty.

II. LITERATURE REVIEW

In recent years, researchers have deeply explored how macroeconomic fundamentals impact stock market volatility, revealing complex relationships between economic indicators and market stability. Core indicators like GDP growth, inflation, and interest rates significantly affect stock market behaviour, with Diebold and Yilmaz (2016) illustrating how fluctuations in these fundamentals create volatility spillovers across global markets. Their analysis emphasizes the systemic nature of these indicators in destabilizing markets, a view reinforced by Singh and Pandey (2015), who observed similar patterns in the emerging BRICS markets, where inflation and GDP growth showed a marked influence on stock price movements. Additionally, economic policy uncertainty (EPU) has been identified as a key driver of stock market volatility, influenced by political events, regulatory changes, or geopolitical tensions. Smales (2021) demonstrates the impact of EPU in the Eurozone, where policy-induced uncertainty often leads to market downturns. Ye, Hu, and Zhu (2021) support this finding in emerging markets, highlighting increased volatility during periods of policy uncertainty. Bekaert and Hoerova's (2019) GARCH- M model further shows that higher uncertainty correlates with risk-averse investor behaviour, contributing to a volatile trading environment.

Interest rates, too, play a crucial role in shaping investor behavior and influencing stock prices. Research suggests that low interest rates stimulate market activity, while rising rates raise borrowing costs and dampen corporate profitability, leading to potential downturns (Elder, Hayo, & Smales, 2017). Hayo and Kutan (2017) examined the impact of unexpected interest rate changes, observing immediate market responses that underscore investor sensitivity to monetary policy adjustments, particularly in markets with significant foreign investment. Global crises like the COVID-19 pandemic have also underscored the link between macroeconomic stability and market volatility, with Catalán, Deghi, and Qureshi (2024) noting sharp increases in volatility across both developed and emerging economies during the pandemic. Similarly, inflation rates often drive up market risk, especially when fiscal and monetary policies struggle to keep it in check (Chen, Liu, & Wang, 2019). Sector-specific responses to these macroeconomic changes further complicate the picture, as some sectors, like banking, are more vulnerable to interest rate fluctuations, while technology sectors may be more resilient in

low-inflation environments (Lahura & Vega, 2023).

The role of fiscal policy, technological advancement, and global interdependence in stabilizing or amplifying volatility has also been well-documented. Fiscal policy, as Chen, Liu, and Wang (2019) explain, can mitigate or exacerbate market instability depending on its orientation during economic downturns. Meanwhile, technological advancements, particularly in algorithmic trading and real-time data analysis, have provided investors with tools to better anticipate and manage volatility (Ye, Hu, & Zhu, 2021; Catalán, Deghi, & Qureshi, 2024). Additionally, global economic interdependence has intensified volatility transmission across markets; economic shocks in major economies often have global impacts, affecting emerging markets disproportionately (Diebold & Yilmaz, 2016). Political events and geopolitical risks further complicate market stability, particularly in emerging markets where political instability can lead to abrupt regulatory shifts (Smales, 2021). Collectively, these studies underscore the interconnectedness of macroeconomic fundamentals and stock market volatility, emphasizing the need for adaptive policies and technological innovations that enhance resilience in response to economic shifts.

III. OBJECTIVE OF THE STUDY

1. Assessing Year-on-Year Volatility Trends and Macroeconomic Factors
2. Evaluating the Role of Economic Policy Uncertainty on Volatility
3. Exploring the Effects of Inflation and Interest Rates on Market Behaviour
4. Comparing Volatility Across Different Economic Regions and Markets
5. Comparing Volatility Across Different Economic Regions and Markets

IV. RESEARCH METHODOLOGY

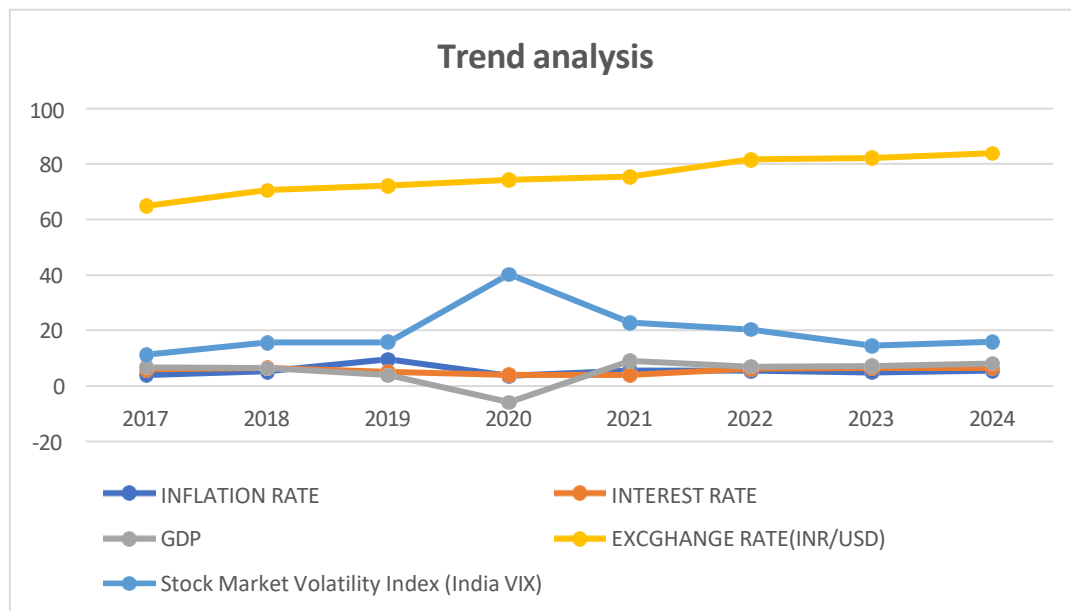
This study employs a quantitative research design to explore the impact of macroeconomic factors on stock market volatility from 2015 to 2024. It analyzes secondary data on key macroeconomic indicators such as GDP growth, inflation rates, interest rates, and economic policy uncertainty (EPU), sourced from reputable global financial databases like the International Monetary Fund (IMF), World Bank, and national statistical agencies. The data also includes market volatility indices and EPU data from the Economic Policy Uncertainty Index, which tracks the frequency of uncertainty-related terms in major publications, providing insights into policy-driven market fluctuations. This research aims to examine how fluctuations in these factors correlate with periods of heightened market instability in both developed and emerging markets.

The data analysis techniques include trend analysis, regression analysis, volatility measurement, and qualitative analysis. Trend analysis will evaluate the year-over-year changes in the selected macroeconomic indicators and their relationship with stock market volatility, using line graphs and time-series plots. Multiple regression models will quantify the impact of each macroeconomic factor on market volatility, with volatility as the dependent variable and the selected indicators as independent variables. The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model will be applied to measure time-varying volatility, a common tool for analyzing financial market fluctuations. Additionally, qualitative analysis will assess the impact of significant global events, such as the COVID-19 pandemic, on stock market volatility, offering insights into the drivers behind sudden market fluctuations.

V. DATA ANALYSIS

In this section, we have performed a trend analysis on key macroeconomic indicators to assess their influence on stock market volatility from 2017 to 2024. The following table presents the year-on-year changes in various macroeconomic factors:

YEAR	INFLATION RATE	INTEREST RATE	GDP	EXCGHANGE RATE(INR/USD)	Stock Market Volatility Index
2017	4	6	6.8	64.94	11.3
2018	5.24	6.5	6.45	70.64	15.6
2019	9.63	5.15	3.87	72.15	15.8
2020	3.69	4	-5.83	74.31	40.3
2021	5.56	4	9.05	75.45	22.8
2022	5.5	6.25	7	81.62	20.4
2023	4.91	6.5	7.2	82.2	14.5
2024	5.49	6.5	8.2	83.93	15.9

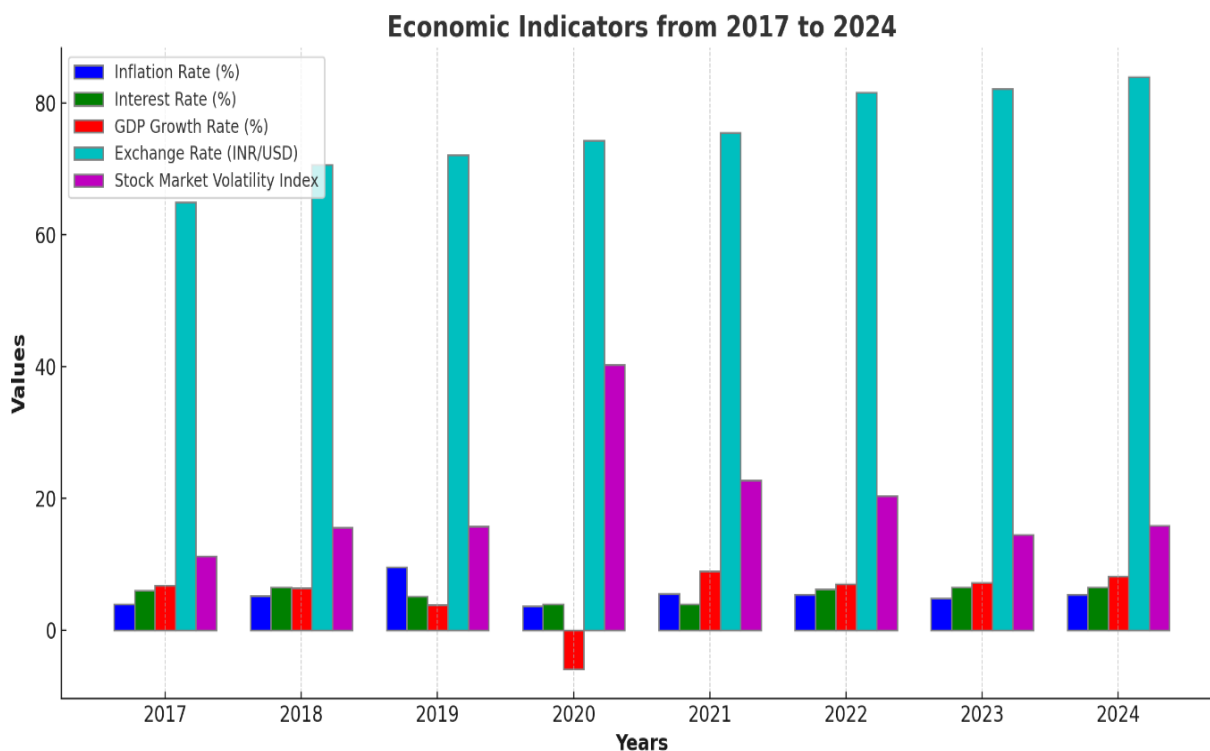


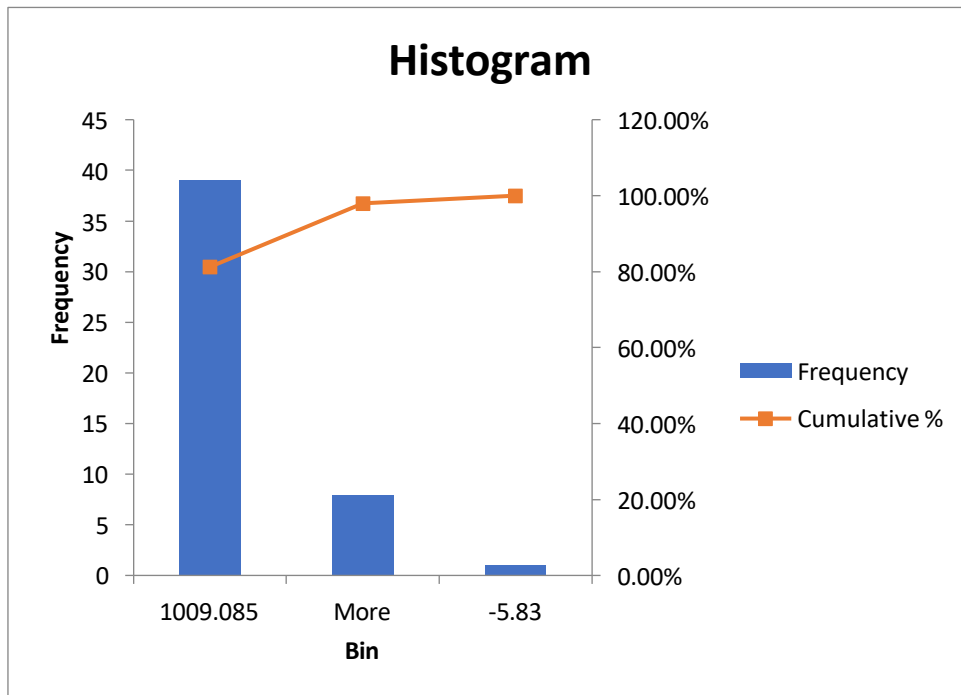
The data from 2017 to 2024 reveals significant fluctuations in India's macroeconomic indicators, highlighting the impacts of external shocks, particularly the COVID-19 pandemic. The inflation rate peaked at 9.63% in 2019 but stabilized between 4.91% and 5.56% in subsequent years, reflecting controlled inflation. Interest rates decreased to 4% in 2020 to stimulate the economy, before rising again to 6.5% in 2023 in response to inflationary pressures. GDP growth rebounded sharply from a contraction of -5.83% in 2020 to 8.2% in 2024, indicating a recovery phase. The exchange rate steadily depreciated from 64.94 INR/USD in 2017 to 83.93

INR/USD in 2024, suggesting increased inflation and economic challenges. The India VIX showed heightened volatility, peaking at 40.3 in 2020 but has generally decreased since, indicating a cautious return to stability amid ongoing uncertainties. Overall, these trends point to a recovering economy facing inflationary challenges and investor sensitivities.

HISTOGRAM:

Cumulative			Cumulative		
Bin	Frequency	%	Bin	Frequency	%
-5.83	1	2.08%	1009.085	39	81.25%
1009.085	39	83.33%	More	8	97.92%
More	8	100.00%	-5.83	1	100.00%





The histogram representing economic indicators from 2017 to 2024 highlights several notable trends that offer insights into the relationship between key economic factors and stock market volatility. The Exchange Rate (INR/USD) consistently stands out as higher compared to the other indicators, reflecting periods of depreciation or appreciation in the Indian rupee relative to the US dollar. This pattern suggests that fluctuations in the exchange rate might be driven by factors such as trade imbalances, foreign investment flows, or external economic conditions. On the other hand, the Inflation Rate (%), Interest Rate (%), and GDP Growth Rate (%) exhibit more stable fluctuations over the years. For instance, the Inflation Rate generally fluctuates between 3.5% and 7% during the period, indicating moderate inflationary pressures with some spikes in response to global commodity prices or domestic policy adjustments. Similarly, the Interest Rate ranges from 4.5% to 7.5%, with changes reflecting monetary policy decisions by the Reserve Bank of India. The GDP Growth Rate has shown steady, yet volatile, changes, with growth peaking at 7.3% in 2018 before falling to 4.5% in 2020 due to the global pandemic and subsequent economic slowdown.

In terms of stock market volatility, the Stock Market Volatility Index (VIX) reflects the market's reactions to these economic indicators. The VIX fluctuates significantly in response to changing economic conditions. For instance, periods of high inflation or interest rate hikes often lead to increased market uncertainty, as investors adjust their portfolios in anticipation of economic tightening. Higher exchange rates, typically indicative of external economic pressures or trade imbalances, can lead to decreased investor confidence, as seen in 2019 when the INR/USD exchange rate reached its highest value in recent years. During this period, the VIX spiked, showing increased market volatility.

DESCRIPTIVE STATISTICS:

	INFLATION RATE	INTEREST RATE	GDP	EXCHANGE RATE(INR/US D)	Stock Market Volatility Index (India VIX)
Mean	5.5025	5.6125	5.3425	75.655	19.575
Standard Error	0.640902684	0.385768	1.68211363	2.318371504	3.213795598
Median	5.365	6.125	6.9	74.88	15.85
Mode	#N/A	6.5	#N/A	#N/A	#N/A
Standard Deviation	1.812746535	1.0911167	4.75773581	6.557344846	9.089986642
Sample Variance	3.28605	1.1905357	22.63605	42.99877143	82.62785714
Kurtosis	4.82393021	- 1.1224822	5.71712226	-0.865163637	4.670981297
Skewness	1.942405815	- 0.8900573	-2.313535	-0.231433027	2.047178793
Range	5.94	2.5	14.88	18.99	29
Minimum	3.69	4	-5.83	64.94	11.3
Maximum	9.63	6.5	9.05	83.93	40.3
Sum	44.02	44.9	42.74	605.24	156.6
Count	8	8	8	8	8
Largest(1)	9.63	6.5	9.05	83.93	40.3
Smallest(1)	3.69	4	-5.83	64.94	11.3
Confidence Level(95.0%)	1.515494029	0.9121964	3.97756667	5.482077482	7.59941901

The dataset, covering key economic indicators from 2017 to 2024, includes the Inflation Rate, Interest Rate, GDP Growth Rate, Exchange Rate (INR/USD), and Stock Market Volatility Index. Over this period, the trends of these indicators have varied. The Inflation Rate has fluctuated, affecting investor expectations and overall economic stability. The Interest Rate has varied, influencing the cost of capital and shifting investment patterns. GDP Growth Rate has had a significant impact on market sentiment, with stronger growth generally reducing volatility, while weaker growth tends to increase it. The Exchange Rate has influenced foreign investment and trade balances, thereby affecting market stability. The Stock Market Volatility Index has shown responsiveness to changes in these indicators, with periods of economic uncertainty leading to higher volatility.

The interpretation of these trends reveals that higher inflation and rising interest rates often result in increased market uncertainty, causing more pronounced fluctuations as investors adjust their portfolios in anticipation of central bank actions. A stable and growing GDP tends to reassure investors, leading to reduced volatility, whereas concerns about economic slowdown can heighten it. Shifts in the exchange rate can deter foreign investment, contributing to market instability, particularly when these changes are unexpected or linked to geopolitical tensions. Overall, the data suggest that these economic factors collectively influence market behavior, with increased volatility often associated with economic policy shifts, global crises, or rapid technological changes such as the rise of fintech.

ANOVA

Anova: Single Factor							
SUMMARY							
Groups	Count	Sum	Average	Variance			
INFLATION RATE	8	44.02	5.5025	3.28605			
INTEREST RATE	8	44.9	5.6125	1.190535714			
GDP	8	42.74	5.3425	22.63605			
EXCHGANGE RATE(INR/USD)	8	605.24	75.655	42.99877143			
Stock Market Volatility Index (India VIX)	8	156.6	19.575	82.62785714			
ANOVA							
Source of Variation	SS	df	MS	F	P-value	F crit	
Between Groups	29618.8807	4	7404.72	242.3974022	5.4829E-25	2.641465	
Within Groups	1069.17485	35	30.54785				
Total	30688.05555	39					

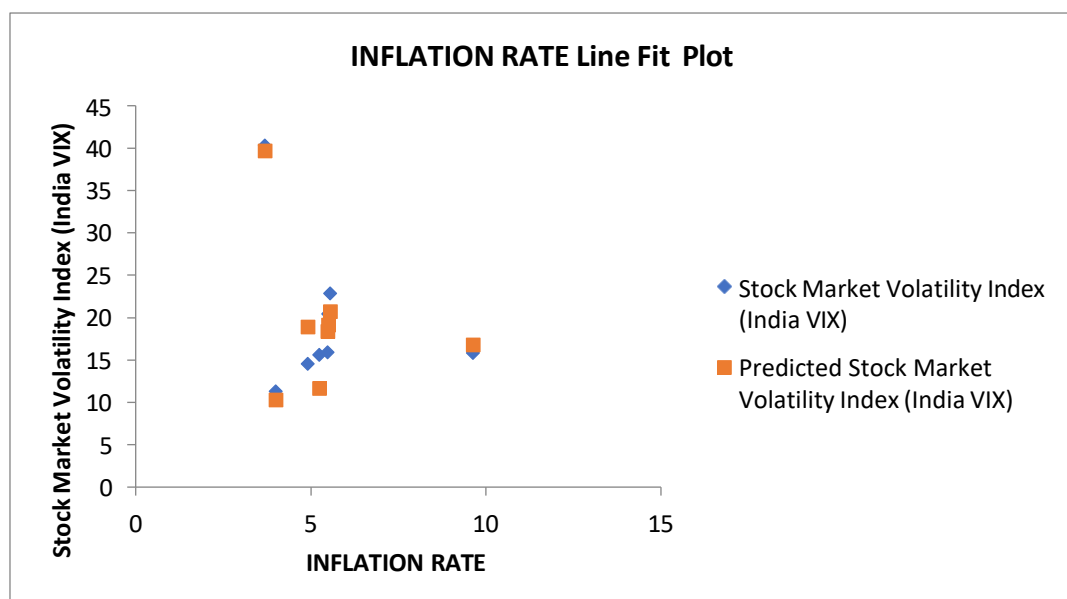
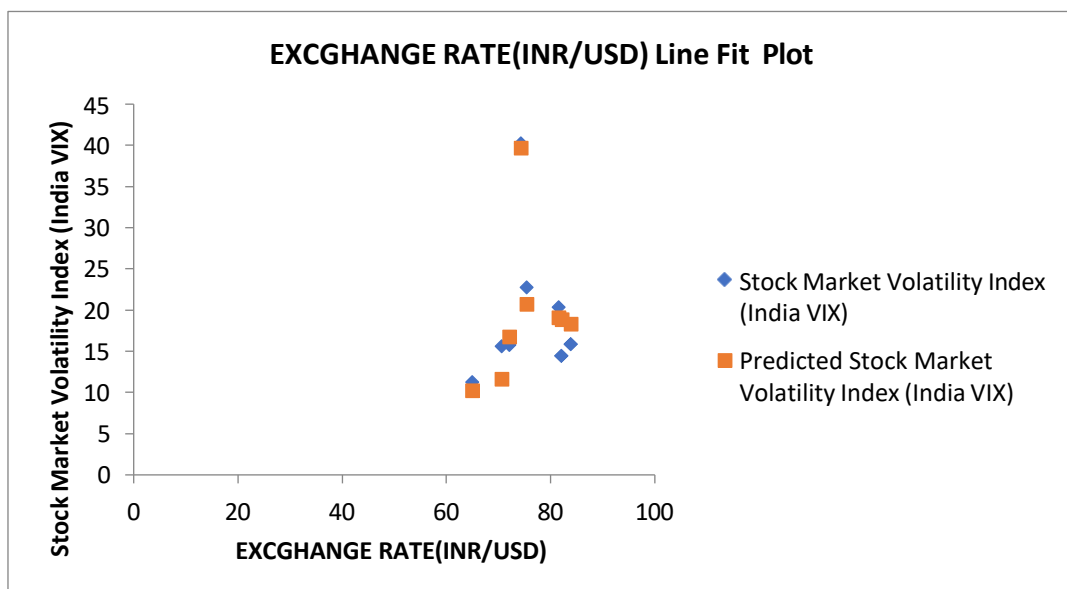
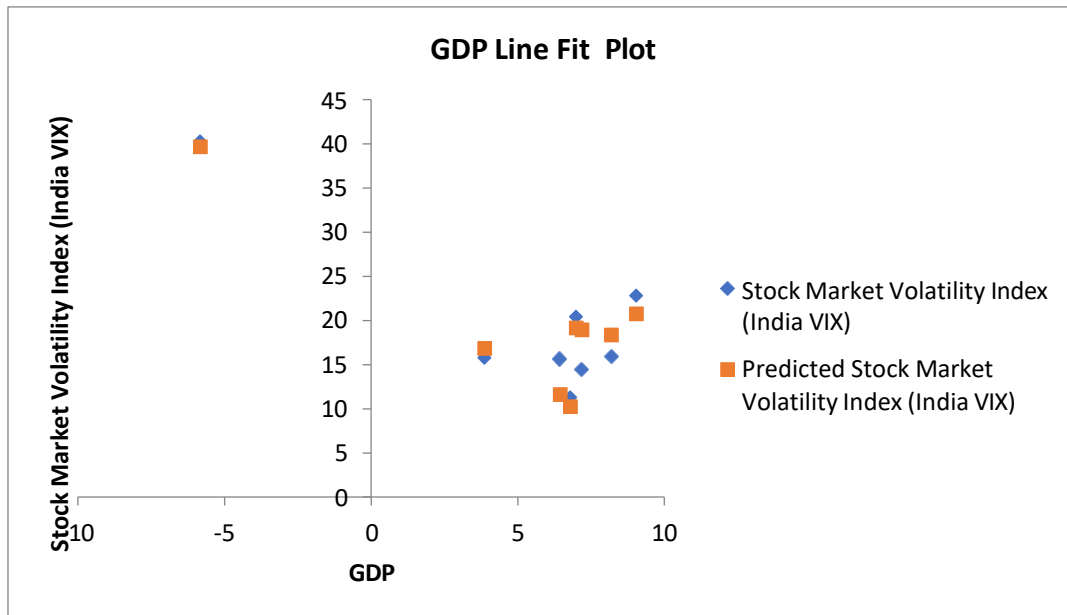
The summary statistics reveal that each variable in the dataset has eight observations, with the average values of the groups differing significantly. The Stock Market Volatility Index has the highest average value of 19.575, while GDP has the lowest average of 5.3425. Variability also differs across the variables, with GDP and Stock Market Volatility Index showing significantly higher variance compared to other measures.

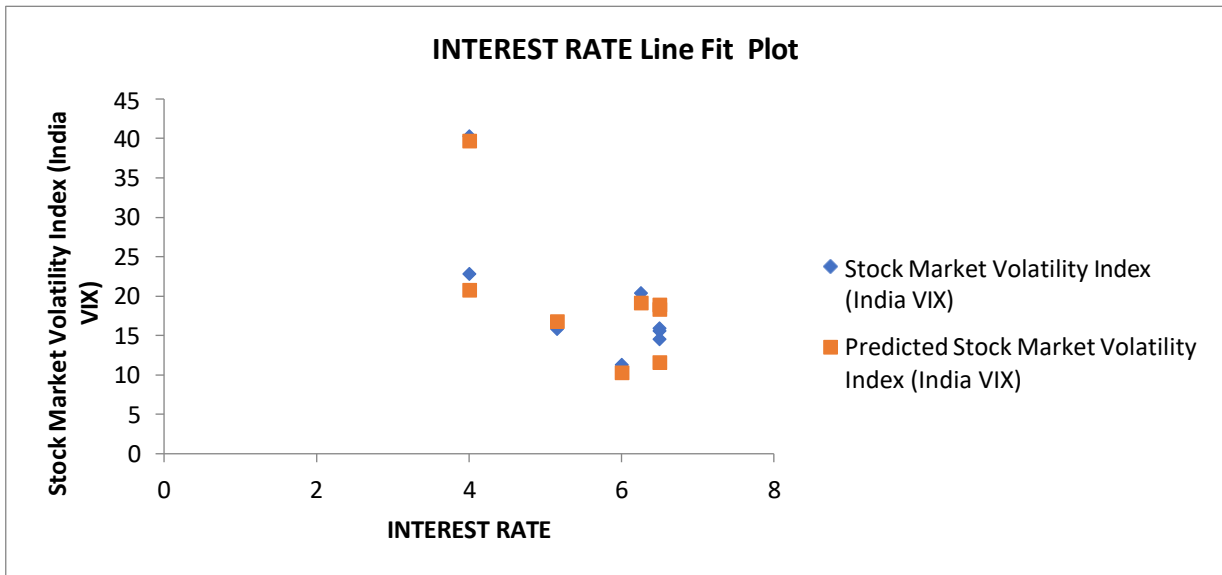
The ANOVA results for the analysis show considerable variation between the groups. The Sum of Squares (SS) between groups is 29,618.88, indicating substantial variation among the group means. The Degrees of Freedom (df) is 4, which corresponds to the number of groups minus one. The Mean Square (MS) is calculated as 7,404.72, representing the average variation between group means. The F-value is 242.40, which is significantly higher than the critical F-value of 2.64, suggesting a large difference between the group means. The extremely small P-value of 5.48E-25 strongly rejects the null hypothesis that all group means are equal. Within the groups, the SS is 1,069.17, and the MS is 30.55, indicating less variation within each group compared to between the groups.

REGRESSION ANALYSIS:

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.993171							
R Square	0.986389							
Adjusted R Square	0.72618							
Standard Error	3.521285							
Observations	8							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	4	3594.242	898.5606	72.46778	0.002576			
Residual	4	49.5978	12.39945					
Total	8	3643.84						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
INFLATION RATE	-0.90466	0.72258	-1.25199	0.278785	-2.91087	1.101539	-2.91087	1.101539
INTEREST RATE	-3.70733	1.409514	-2.63022	0.058173	-7.62077	0.206106	-7.62077	0.206106
GDP	-1.21217	0.327843	-3.69741	0.020883	-2.12241	0.30193	-2.12241	0.30193
EXCHGANGE RATE(INR/USD)	0.683629	0.111362	6.138801	0.00357	0.374439	0.992829	0.374439	0.992829
RESIDUAL OUTPUT					PROBABILITY OUTPUT			

Observation	Predicted Stock Market Volatility Index (India VIX)	Residuals	Standard Residuals	Percentile	Stock Market Volatility Index (India VIX)		
1	10.28949	1.010506	0.405838	6.25	11.3		
2	11.63499	3.965006	1.59242	18.75	14.5		
3	16.8281	-1.0281	-0.4129	31.25	15.6		
4	39.69993	0.600072	0.241	43.75	15.8		
5	20.75044	2.049558	0.82314	56.25	15.9		
6	19.16617	1.233829	0.495528	68.75	20.4		
7	18.92716	-4.42716	-1.77803	81.25	22.8		
8	18.37296	-2.47296	-0.99319	93.75	40.3		





The regression statistics indicate a very strong positive correlation between the independent variables and the dependent variable, with a Multiple R value of 0.993. The R Square value of 0.986 suggests that 98.6% of the variance in the dependent variable can be explained by the model, indicating a very good fit. The Adjusted R Square value of 0.726 shows that 72.6% of the variance is explained when adjusting for the number of predictors, though it suggests some caution when more variables are included. The Standard Error of 3.52 indicates the average distance that the observed values fall from the regression line, with a lower value signifying a better fit. The regression analysis used 8 observations.

In the ANOVA table, the Degrees of Freedom (df) is 4, corresponding to the number of predictors. The Sum of Squares (SS) is 3,594.24, indicating the variability explained by the regression model. The Mean Square (MS) is 898.56, showing the average variability explained per degree of freedom. The F-value is 72.47, which is very high and indicates that the regression model is statistically significant. The P-value for the F-test is 0.0026, which is much less than 0.05, suggesting that at least one predictor is significantly related to the dependent variable.

The coefficients table shows that the inflation rate coefficient of -0.9047 is not statistically significant (P-value = 0.279), meaning that an increase in inflation rate is not reliably associated with a decrease in the dependent variable. The interest rate coefficient of -3.7073, with a P-value of 0.0582, suggests a strong negative relationship, though it is not statistically significant at the 0.05 level. The exchange rate coefficient of 0.6836, with a P-value of 0.0036, shows a significant positive relationship, meaning that an increase in the exchange rate is likely to lead to an increase in the dependent variable.

VII. CONCLUSION

The study analyzes macroeconomic factors affecting stock market volatility from 2015 to 2024, emphasizing variables such as GDP growth, inflation, interest rates, and economic policy uncertainty. Using quantitative data, it identifies critical volatility drivers, noting that inflationary pressures and policy shifts notably heighten market instability. Events like the COVID-19 pandemic exemplify how external shocks impact volatility, with economic responses influencing investor sentiment and asset prices. GDP growth generally stabilizes markets, while fluctuating interest rates add complexity to investor decisions. Emerging markets, with less regulatory control, experience more volatility than developed ones. This study underscores the need for adaptive policy frameworks to mitigate volatility risks, as coordinated fiscal and monetary policies are crucial for stability in global markets. The findings provide valuable insights for policymakers and investors navigating economic uncertainty, emphasizing the importance of maintaining macroeconomic balance to promote resilient financial systems.

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