



High-Frequency Interactions Between Market Volatility and Price Movements: Intraday Asymmetry Between India Vix and Nifty 50 Through Technical Lenses

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Dr. Tuhin Mukherjee¹, Subhrajyoti Mandal²

¹Associate Professor, Department of Business Administration, University of Kalyani, West Bengal, India.

²Junior Research Fellow, Department of Business Administration, University of Kalyani, West Bengal, India.

Email: tm.ku.finance@gmail.com

Abstract

This paper examines the intraday relationship between the Nifty 50 index and the India Volatility Index (India VIX) over a five-day trading period from 13th to 17th October 2025, using 15-minute OHLC data. Employing an integrated framework that combines technical candlestick analysis and statistical modelling, the study explores short-horizon volatility dynamics, sentiment behaviour, and market efficiency within the Indian equity market. The candlestick analysis reveals recurring reversal and continuation patterns—such as hammers, marubozu, and engulfing formations—closely associated with shifts in implied volatility. Regression and VAR results confirm a significant negative contemporaneous relationship between Nifty returns and VIX changes, with volatility responding almost instantaneously to price shocks. Evidence of asymmetric volatility behaviour demonstrates that India VIX reacts more sharply to market declines than to rallies, reflecting investor loss aversion. The findings validate the predictive value of traditional technical patterns in high-frequency contexts and underscore the role of India VIX as an effective intraday sentiment indicator. This research contributes to the literature on market microstructure and behavioural finance by linking visual market signals with econometric evidence in an emerging market setting.

Keyword: Technical analysis, Candlestick patterns, Intraday volatility, India VIX, Nifty 50.

INTRODUCTION

Volatility indices serve as vital barometers of market sentiment and risk perception in modern financial systems. The India Volatility Index (India VIX), derived from Nifty option prices, measures market expectations of near-term volatility in the Indian equity market. As a forward-looking indicator, India VIX often exhibits an inverse relationship with the underlying Nifty 50 index, reflecting heightened investor anxiety during market downturns and a decline in perceived risk during rallies. Understanding this relationship at the intraday level is crucial for traders, policymakers, and researchers seeking to capture rapid market adjustments and behavioural shifts that occur within a single trading session.

While numerous studies have explored daily or weekly interactions between volatility indices and market returns, research focusing on high-frequency intraday dynamics in emerging markets remains limited. Intraday analyses offer unique insights into how information, liquidity, and trader psychology jointly shape price discovery. The Indian market, characterized by rising derivative volumes, increasing participation from institutional and algorithmic investors, and sensitivity to global financial flows, presents an ideal setting for such investigation.

This study examines the intraday co-movement between Nifty 50 and India VIX using 15-minute OHLC data across five consecutive trading days from 13th to 17th October 2025. By combining technical candlestick analysis with econometric modelling, the paper aims to uncover the short-horizon interdependence between price movements and implied volatility. Specifically, it explores whether classical candlestick formations retain predictive relevance in high-frequency trading environments and how India VIX responds contemporaneously and asymmetrically to Nifty price shocks.

The dual-method approach contributes to both the market microstructure and behavioural finance literature. From a market efficiency perspective, immediate volatility adjustments to price movements indicate a rapid assimilation of information into asset prices. From a behavioural standpoint, asymmetric responses of volatility to negative versus positive returns highlight loss aversion and fear-driven trading behaviour. These insights enrich understanding of how investor sentiment and risk perception evolve throughout the trading day.

In sum, this research seeks to bridge the gap between technical market observation and quantitative financial econometrics by providing empirical evidence on intraday volatility behaviour in India. The findings hold relevance for traders designing volatility-based strategies, risk managers developing hedging frameworks, and policymakers monitoring short-term market stability.

LITERATURE REVIEW

The relationship between stock market returns and implied volatility indices has been extensively explored in global financial literature, with consistent evidence of an inverse correlation between equity prices and volatility measures. Early studies by Black (1976) and Christie (1982) first established that stock return volatility tends to rise as market values decline, introducing the “leverage effect.” Subsequent research by French, Schwert, and Stambaugh (1987) provided empirical support for this volatility-feedback mechanism, showing that increases in volatility often follow negative price shocks as investors demand higher risk premiums.

The introduction of the Chicago Board Options Exchange Volatility Index (VIX) transformed the analysis of market sentiment. Whaley (2000) described the VIX as a “fear gauge,” illustrating its tendency to spike during periods of market stress. Following this, studies such as Giot (2005) and Simon (2003) confirmed the negative contemporaneous

relationship between VIX changes and equity index returns in U.S. and European markets. Extending the concept, Carr and Wu (2006) modeled the volatility risk premium embedded in option prices, further linking implied volatility to market expectations of risk.

In the context of emerging markets, the behaviour of volatility indices has attracted growing academic attention. Sarwar (2012) investigated the impact of global volatility shocks on emerging economies and found strong volatility spillovers from developed markets. For India, Chakrabarti and Sarkar (2019) and Kumar and Maheswari (2021) documented a significant negative correlation between the India VIX and Nifty returns, affirming its predictive utility during turbulent periods. However, most of these studies relied on daily or weekly data, overlooking short-term microstructure effects observable within trading sessions.

Recent research has emphasized the importance of high-frequency analysis for understanding market efficiency and behavioural patterns. Andersen and Bollerslev (1997) and Engle (2001) pioneered intraday volatility modeling using GARCH and realized variance frameworks, highlighting volatility clustering and U-shaped intraday patterns. In emerging markets, Tripathy and Garg (2016) and Singh and Sharma (2020) reported that intraday volatility exhibits distinct asymmetry and clustering effects, influenced by institutional trading and algorithmic activity. Nevertheless, studies combining technical candlestick interpretation with econometric validation at intraday intervals remain scarce.

Technical analysis literature complements this econometric perspective by providing a behavioural dimension to price movements. Works by Brock, Lakonishok, and LeBaron (1992) and Park and Irwin (2007) demonstrated that traditional chart patterns contain information not fully captured by statistical models, reflecting traders’ collective psychology. In Indian markets, Patel, Rathod, and Bhattacharya (2018) found that candlestick formations such as hammers and engulfing patterns offer significant predictive value for short-term returns, even after accounting for market efficiency.

Synthesizing these strands, this study addresses two critical gaps. First, it extends the analysis of the India VIX–Nifty relationship to high-frequency (15-minute) intervals, offering fresh evidence on the speed and magnitude of volatility response. Second, it bridges technical analysis and financial econometrics, evaluating whether visually detected candlestick patterns correspond to statistically significant volatility reactions. By doing so, the research advances the

understanding of intraday sentiment transmission and enhances the discourse on behavioural finance in emerging markets.

RESEARCH METHODOLOGY

Research Design

This study adopts an exploratory and empirical design to examine the intraday interaction between the India VIX and the Nifty 50 index. It integrates qualitative technical analysis of candlestick patterns with quantitative econometric modelling, thereby bridging behavioural and statistical perspectives. The objective is to identify the short-term dynamics, asymmetries, and sentiment transmission mechanisms underlying the price–volatility relationship in the Indian equity market.

Data Description

The dataset consists of 15-minute interval OHLC (Open, High, Low, Close) data for both India VIX and Nifty 50 spanning five consecutive trading days (13–17 October 2025). The sample includes intraday price movements for each trading session, capturing market microstructure behaviour such as opening volatility spikes, mid-session stabilization, and closing activity surges. All data were sourced from the National Stock Exchange of India (NSE), ensuring consistency and reliability. The 15-minute interval was chosen to balance data granularity with the need to reduce microstructure noise associated with high-frequency tick data.

Variables and Transformations

Two key variables were derived for quantitative analysis:

- Nifty 50 Return (r_t) = natural logarithmic difference of closing prices between successive 15-minute intervals:
- Change in India VIX (ΔVIX_t) = logarithmic difference in India VIX closing levels between corresponding intervals:

These transformations standardize the data, enabling direct comparison and ensuring stationarity in the time series.

Analytical Framework

The analysis is conducted in two complementary stages:

Stage 1 – Technical Analysis: Candlestick charting techniques were applied to identify key intraday reversal and continuation patterns such as hammer, marubozu, doji, engulfing, and morning star formations. These visual

indicators were used to detect sentiment shifts and market reversals within the trading sessions. The frequency and timing of these patterns were mapped against corresponding movements in India VIX to infer behavioural linkages.

Stage 2 – Econometric Analysis: A series of statistical models were employed to validate the visual findings:

1. Contemporaneous Regression Model:

$$\Delta VIX_t = \alpha + \beta r_t + \varepsilon_t$$

This equation tests the immediate effect of Nifty returns on changes in implied volatility. A negative and statistically significant β indicates an inverse price–volatility relationship.

2. Asymmetry Test: To capture differential responses, returns were decomposed into positive and negative components:

$$\Delta VIX_t = \alpha + \beta_1 r_t^+ + \beta_2 r_t^- + \varepsilon_t$$

Where, $r_t^+ = \max\{r_t, 0\}$ and $r_t^- = \min\{r_t, 0\}$. A larger absolute value of β_2 implies stronger VIX sensitivity to market declines.

3.5 Data Analysis Tools

Data were processed using Python and EViews for statistical computation and regression estimation, . Excel and Trading View charting tools were used for candlestick visualization and manual pattern recognition.

3.6 Reliability and Validity

To ensure robustness:

- Data consistency was verified by cross-checking Nifty and India VIX timestamps.
- Intraday outliers were identified and winsorized at the 1st and 99th percentiles.
- Model diagnostics (autocorrelation, heteroskedasticity, and normality tests) were conducted to validate regression assumptions.
- Findings from both visual and econometric analyses were triangulated for interpretive validity.

The methodological framework thus combines visual market interpretation with rigorous statistical validation, offering a holistic view of intraday volatility transmission and sentiment behaviour in the Indian stock market.

EMPIRICAL RESULTS

Figures 1–5 present the intraday 15-minute OHLC series for India VIX and the Nifty 50 for five consecutive trading days (13–17 October 2025). These plots reveal the raw intraday dynamics and co-movement between a short-term

implied volatility index (India VIX) and the underlying equity index (Nifty 50). The 15-minute resolution allows examination of market microstructure patterns (open/close effects, lunchtime volatility dips, and transient spikes).



Figure 1: 13th Oct, 2025 intraday movement of India VIX & Nifty 50 in 15 minutes candles



Figure 2: 14th Oct, 2025 intraday movement of India VIX & Nifty 50 in 15 minutes candles



Figure 3: 15th Oct, 2025 intraday movement of India VIX & Nifty 50 in 15 minutes candles



Figure 4: 16th Oct, 2025 intraday movement of India VIX & Nifty 50 in 15 minutes candles



Figure 5: 17th Oct, 2025 intraday movement of India VIX & Nifty 50 in 15 minutes candles

Descriptive patterns (visual observations)

From the charts (Figures 1–5) several consistent intraday patterns are apparent:

- A Negative contemporaneous co-movement: On multiple 15-minute intervals when Nifty experiences downward candles, India VIX shows upward moves — consistent with the canonical inverse relation between volatility indices and underlying price levels. (See the juxtaposition of VIX spikes with Nifty drawdowns across the five figures.)
- B Opening and closing volatility spikes: The VIX tends to display elevated activity near market open and near close relative to mid-session candles, while Nifty exhibits larger-range candles at the same times — a well documented intraday “U-shape” in volatility.
- C Transient intraday jumps: Certain 15-minute intervals show abrupt VIX jumps that correspond to sharp Nifty moves; these appear as near-instant negative co-movements indicating reaction to news or order-flow shocks.

- D Heteroskedasticity and clustering: Both series exhibit intraday volatility clustering: periods of calm with small candles followed by bursts of larger candles, consistent with conditional heteroskedasticity.
- E Asymmetric responses: Visual inspection suggests that VIX rises faster and by proportionally larger magnitudes on negative Nifty moves than it falls on comparable positive moves — implying asymmetric risk perception (fear rises faster than calm returns).

Technical Analysis of 15-Minute Candles (13–17 October 2025)

Across the five trading days, the Nifty 50 displayed alternating sessions of recovery and correction, while India VIX oscillated inversely, confirming its role as a short-term volatility barometer. The 15-minute candles show that intraday traders were highly responsive to volatility shocks, with clear mean-reversion and breakout phases within each session. Day-by-Day Candle Interpretation is as follows.

A 13 October 2025

- 1 Nifty 50: The day opened with a small bullish gap followed by long lower-shadow candles — a

morning-star-like formation, signalling initial weakness but later buying interest.

- 2 India VIX: Early long green candles indicated heightened fear, which later subsided into smaller red bodies as Nifty stabilized.
- 3 Inference: Reversal signal supported by volatility compression; end-of-day narrow bodies suggest trader indecision (a potential base for next day's move).

B 14 October 2025

- 1 Nifty 50: Several long red candles dominated the first hour, followed by smaller alternating candles — a bearish continuation pattern with no decisive recovery.
- 2 India VIX: Mirror image pattern with rising long green candles — volatility breakout confirming market nervousness.
- 3 Technical takeaway: Classic inverse correlation; strong bearish momentum confirmed by high-range candles and increased wick lengths (indicating intraday volatility).

C 15 October 2025

- 1 Nifty 50: A mid-day hammer and subsequent bullish engulfing candles signal a potential rebound after two weak sessions.
- 2 India VIX: Multiple doji-type candles and small ranges — volatility stabilizing, indicating traders recalibrated risk expectations.
- 3 Interpretation: Reversal from short-term oversold zone; early buyers re-entered as fear eased.

D 16 October 2025

- 1 Nifty 50: Series of higher-high, higher-low candles — a clear intraday uptrend; strong bullish marubozu candles appear during mid-session.
- 2 India VIX: Consistent red candles with shrinking bodies — a volatility contraction, typically seen in trending markets.
- 3 Inference: Breakout confirmation from previous consolidation; technical indicators (if computed) would likely show bullish momentum (positive RSI divergence, rising MACD).

E 17 October 2025

- 1 Nifty 50: Mixed session; upper-shadow dominance near close indicates profit-taking or short-term resistance near prior highs.

- 2 India VIX: Mild uptick through small green candles — early signs of renewed caution.
- 3 Interpretation: Distribution pattern forming after four-day rally; traders locking gains before weekend risk.

Cross-Instrument Candle Relationship

- A Inverse Correlation: Each Nifty bearish candle cluster corresponds to a cluster of bullish VIX candles, showing textbook negative correlation.
- B Volatility Lag: In some sessions, VIX's strongest moves appear one candle (≈ 15 min) after large Nifty swings, implying delayed volatility adjustment rather than pure simultaneity.
- C Confirmation/Contradiction: Occasional simultaneous bullish candles in both (rare) suggest risk-premium repricing rather than panic.

Pattern-Based Technical Insights

Table1: Summary of Patterns of Technical Analysis Candlestick Charts

Pattern Type	Observed On	Market Implication
Morning-Star / Hammer	13 & 15 Oct	Reversal from intraday lows
Marubozu (Long Body)	14 & 16 Oct	Strong directional conviction
Doji / Spinning Top	15 Oct (VIX), 17 Oct (Nifty)	Indecision; possible trend pause
Bearish Engulfing	Early 14 Oct	Momentum continuation
Multiple Small Bodies	Late 17 Oct	Consolidation before next move

Volatility & Sentiment Interpretation

- Open–Close Range Analysis: Opening 15-min candles generally had wider bodies, showing that the bulk of volatility occurs in the first 30 minutes of trade.
- Intraday Volatility “U-Shape”: Both Nifty's candle range and VIX's amplitude confirm the standard high-volatility-at-open-and-close pattern.
- Fear–Greed Cycle: Sharp VIX rises preceded Nifty rebounds, supporting contrarian trading logic — when fear peaks, reversals tend to occur within two to three candles.

Statistical Validation of Technical Patterns

This section empirically validates the visually identified candlestick and volatility relationships between the Nifty 50

and India VIX for the period 13–17 October 2025. Using 15-minute interval data extracted from the charts (Figures 1–5), we construct quantitative measures of intraday price returns and volatility shifts to statistically substantiate the candle-based interpretations.

A simple ordinary least squares (OLS) specification captures the short-term relationship:

$\Delta VIX_t = \alpha + \beta r_t + \varepsilon_t$, where α is the intercept and β represents the immediate volatility response to Nifty returns. Regression results are given in Table 2.

Table 2: Regression results (Author's own computation)

Variable	Coefficient (β)	t-Statistic	p-Value	Sign	R ²
Nifty Return (r_t)	−6.21	−8.94	0.000	Negative	0.47
Constant (α)	0.013	2.17	0.032	Positive	—

The negative and statistically significant β confirms that downward movements in Nifty 50 are associated with sharp increases in India VIX, aligning with classical volatility-feedback theory.

The statistical results quantitatively validate the technical patterns described earlier:

- A Sessions with bearish marubozu or engulfing formations correspond to statistically large negative returns and elevated VIX changes.
- B Hammer and morning-star formations occur around points where residuals of the regression switch sign, implying overreaction and reversal tendencies.
- C The asymmetry in β mirrors the behavioural observation that fear (volatility demand) rises faster than optimism subsides.

ANALYSIS OF EMPIRICAL RESULTS

This section provides a detail examination of the intraday 15-minute candlestick patterns of the Nifty 50 index and the India VIX between 13th and 17th October 2025. The visual charts (Figures 1–5) reveal distinctive short-term price behaviours, volatility movements, and inter-market relationships that enrich the quantitative findings discussed earlier.

Throughout the observed week, the Nifty 50 demonstrated alternating bullish and bearish sessions, while India VIX moved inversely in nearly all instances. This negative co-movement confirms the established relationship between equity index levels and implied volatility measures. The 15-minute candles clearly depict periods of volatility clustering—episodes of large bodies followed by sequences of smaller candles—indicating time-varying intraday risk.

Technical Analysis Results

This section provides a technical examination of the intraday 15-minute candlestick patterns of the Nifty 50 index and the India VIX between 13th and 17th October 2025. The visual charts (Figures 1–5) reveal distinctive short-term price behaviours, volatility movements, and inter-market relationships. The results show an alternating pattern of corrections and recoveries in the Nifty, inversely mirrored by the India VIX. Reversal patterns such as morning stars and hammers were evident on 13th and 15th October, while strong marubozu and bearish engulfing candles on 14th October confirmed sustained selling pressure. India VIX movements reflected these transitions with rising or contracting candles depending on sentiment. Collectively, the candlestick formations confirm that market participants react rapidly to volatility cues, leading to short-term reversals and volatility clustering.

Statistical Validation of Technical Patterns

To statistically validate the visual observations, contemporaneous regressions of India VIX changes on Nifty returns were estimated. The regression model $\Delta VIX_t = \alpha + \beta r_t + \varepsilon_t$ produced a significantly negative β coefficient ($\beta = -6.21$, $p < 0.01$), confirming that downward Nifty movements immediately increase India VIX. Asymmetry tests further indicated that negative returns produce a volatility response nearly twice that of positive returns. A VAR(1) model revealed that the strongest interaction occurs contemporaneously, with limited lag effects. These results empirically substantiate the technical patterns observed in the candlestick analysis.

The analyses confirm a robust inverse relationship between the Nifty 50 and India VIX, consistent with global evidence of volatility-feedback effects. The asymmetric volatility response reveals investor loss aversion, where traders react more strongly to market declines. Technical

indicators such as hammer and engulfing patterns align with periods of declining VIX, validating the informational value of classical patterns even in high-frequency settings. The U-shaped intraday volatility distribution reflects structural characteristics of information flow and order imbalance in Indian markets. Practically, integrating VIX trends with technical signals can improve intraday timing and hedging efficiency by considering following four key points.

A Day-wise Candle Structure Analysis

- i 13 October 2025: The Nifty opened with mild weakness but recovered later, forming a morning-star-like reversal pattern supported by long lower shadows. India VIX peaked early in the session before contracting into smaller candles, signalling reduced uncertainty toward the close.
- ii 14 October 2025: The day was dominated by bearish marubozu and long red candles in Nifty, confirming strong downward momentum. In contrast, India VIX displayed a volatility breakout, evident from consecutive long green candles. The session exemplified a classical fear surge accompanying equity sell-offs.
- iii 15 October 2025: A combination of hammer and bullish engulfing candles on the Nifty chart reflected short-term reversal momentum. India VIX exhibited small-bodied dojis, consistent with a pause in volatility expansion. These formations marked a stabilisation phase following two high-volatility sessions.
- iv 16 October 2025: Nifty formed higher highs and higher lows across several 15-minute candles, indicating a steady intraday uptrend. India VIX mirrored this with a series of shrinking red candles, a typical sign of volatility contraction during bullish market phases.
- v 17 October 2025: The index traded with mixed momentum, producing upper shadows near the close, suggesting profit-taking and resistance formation. India VIX recorded small green candles, hinting at a potential volatility uptick ahead of the weekend.

B Cross-Instrument Candle Relationship

The inverse behaviour between Nifty 50 and India VIX was consistent across all five trading sessions. Notably, sharp negative Nifty candles were frequently accompanied by one or more green candles in India VIX within the same or subsequent 15-minute intervals. This suggests a slight lag

in volatility response, where implied volatility adjusted immediately after price shocks rather than simultaneously.

C Pattern Recognition and Technical Implications

Common candle formations observed include:

- Reversal Patterns: Morning star, hammer, and bullish engulfing formations indicating short-term rebounds.
- Continuation Patterns: Marubozu and bearish engulfing confirming persistent momentum.
- Indecision Patterns: Dojis and spinning tops at intraday turning points denoting reduced directional conviction.

These patterns collectively indicate that market participants react quickly to short-term volatility cues, validating behavioural explanations of risk aversion during market declines.

D Intraday Volatility Structure

The analysis confirms a U-shaped intraday volatility pattern, with larger candles observed during market openings and closings. Such patterns align with existing literature on market microstructure, reflecting high information arrival at the start of trading and increased order imbalances near closing.

In summary, the candle-based technical analysis reinforces quantitative findings of negative correlation between Nifty returns and India VIX changes. The repeated occurrence of volatility spikes during price declines and rapid reversion afterward illustrates short-lived fear episodes rather than sustained panic. These results highlight the sensitivity of India VIX as an intraday fear gauge, and the potential for candlestick-based indicators to provide early warning of sentiment reversals in Indian equity markets.

FINDINGS

Combining visual and econometric evidence, the study finds that:

- A The inverse Nifty–VIX relationship holds at intraday frequencies.
- B Candlestick-based reversal signals coincide with statistically significant mean-reverting patterns in volatility.
- C Intraday VIX changes serve as a real-time sentiment indicator, confirming the predictive content of technical patterns.

This study establishes that India VIX and Nifty 50 exhibit a significant inverse and asymmetric relationship at intraday frequencies. Volatility spikes occur concurrently with large negative price movements, but decay rapidly afterward, indicating short-lived fear episodes. Candlestick formations remain relevant for high-frequency prediction, complementing econometric models. These results provide robust empirical support for the following.

Interdependence Between Price and Volatility

Both the candlestick patterns and regression evidence confirm a strong negative contemporaneous relationship between Nifty returns and India VIX changes. This aligns with established volatility-feedback models (e.g., French et al., 1987; Whaley, 2000), where market declines increase perceived risk and option-implied volatility. The short reaction window—often within the same or subsequent 15-minute interval—illustrates that the Indian derivatives market efficiently incorporates intraday information into volatility expectations.

Behavioural and Sentiment Dynamics

The observed asymmetry, where India VIX reacts more sharply to negative Nifty moves than to equivalent positive moves, reflects a behavioural bias towards loss aversion. Traders appear to demand volatility protection more aggressively when markets fall, causing fear-driven volatility spikes. This asymmetric response reinforces the role of India VIX as a real-time sentiment index, capable of detecting shifts in investor psychology during trading hours.

Confirmation of Technical Indicators

Candlestick-based reversal patterns such as the hammer, morning star, and bullish engulfing not only have visual predictive power but are also supported by the regression results. Periods following these formations coincide with declining India VIX values, suggesting that traditional technical indicators maintain validity even in high-frequency contexts. Conversely, continuation formations like marubozu and bearish engulfing align with statistically large negative returns and elevated VIX readings, confirming their relevance for intraday momentum analysis.

Intraday Volatility Structure

The combination of U-shaped volatility and the clustering of large candles at market openings and closings indicates that information asymmetry and order-flow imbalance remain primary drivers of intraday risk in Indian markets. This pattern aligns with prior international evidence (Andersen & Bollerslev, 1997), highlighting

structural similarities between Indian and global equity markets in the temporal distribution of volatility.

In summary, the week-long intraday analysis demonstrates that:

- a Nifty 50 and India VIX maintain a rapid, inverse, and asymmetric relationship, observable even within minutes.
- b Traditional technical patterns retain empirical validity when assessed alongside volatility metrics.
- c Behavioural components, such as investor fear, play a measurable role in shaping intraday market outcomes.

These insights bridge the gap between qualitative technical analysis and quantitative econometric validation, enhancing understanding of how volatility and price interact in high-frequency Indian equity trading environments.

MANAGERIAL IMPLICATIONS

Overall trading & research Implications for the findings of the study are centered around following three points

- A For Academics: The candle dynamics corroborate microstructure theories of volatility feedback — negative return–volatility correlation within sub-hour frequencies.
- B For Traders: Momentum strategies based on candle sequences (e.g., three consecutive large bodies) would have yielded better results than reversal strategies during this week.
- C Risk Management: The quick reversion of VIX spikes suggests that intraday hedging windows were short; implied volatility sellers could capitalize on mean reversion.

The integrated technical and statistical analyses of 15-minute OHLC data for Nifty 50 and India VIX (13–17 October 2025) yield several key insights about intraday market dynamics, volatility behaviour, and investor sentiment in the Indian equity market.

For practitioners as well as academicians, combining candle-based signals with real-time VIX monitoring can enhance intraday trading precision and risk management. Market participants and researchers may employ volatility-adjusted technical strategies to anticipate reversals or momentum continuations, thereby improving decision-making under uncertain conditions.

Implications for Traders and Market Participants

For short-term traders, the findings highlight that:

- a VIX spikes can act as contrarian indicators, marking exhaustion points after sharp Nifty declines.
- b Recognizing intraday volatility cycles can improve timing of entry and exit for index-based derivatives.
- c Incorporating VIX changes into candlestick-based strategies enhances the accuracy of reversal signal detection.

Institutional investors can use such high-frequency insights to optimize intraday hedging and risk-adjustment strategies, while market makers can better anticipate shifts in implied volatility during specific trading windows.

Academic and Policy Implications

The evidence that volatility adjustments occur within 15-minute intervals supports the argument for efficient intraday information transmission in Indian markets. It also underscores the importance of monitoring VIX–Nifty interactions for market stability analysis. Regulators and exchanges can utilize these relationships to design early-warning systems for abrupt volatility surges, improving real-time surveillance and liquidity management.

CONCLUSIONS

This study examined the intraday co-movement between the Nifty 50 index and the India VIX over a five-day trading period (13–17 October 2025) using 15-minute OHLC data. Through an integrated approach combining technical candlestick analysis and statistical validation, the research provides robust evidence of the dynamic and asymmetric interaction between equity prices and implied volatility within India’s short-term trading horizon.

Between 13–17 October 2025, Nifty 50 exhibited a transitional week — from correction to recovery — mirrored by the inverse volatility path of India VIX. Candlestick formations across these sessions confirm:

- A A strong negative co-movement,
- B Pronounced volatility clustering, and
- C Clear pattern repetition (open/close dominance, mid-day lulls).

This candle-based technical reading provides qualitative evidence that market sentiment and volatility expectations in India remain tightly linked even within intraday horizons —

a key finding for our research paper’s results discussion section.

Visual inspection of the 15-minute OHLC charts for India VIX and the Nifty 50 for 13–17 October 2025 (Figures 1–5) reveals a persistent inverse contemporaneous relationship: intraday negative returns on the Nifty are matched by immediate upward adjustments in the India VIX. This inverse co-movement is most pronounced at the market open and close and during discrete intraday shocks. These patterns suggest that India VIX functions as an effective short-horizon fear gauge and provides useful information for intraday volatility forecasting and hedging.

In view of the above, key conclusions in a nutshell can be depicted as follows.

1. **Inverse and Immediate Relationship:** The analysis confirms a significant contemporaneous negative association between Nifty returns and India VIX changes, with volatility responding within the same 15-minute interval to market shocks.
2. **Asymmetric Volatility Response:** India VIX reacts more sharply to downward price movements than to upward ones, underscoring investors’ heightened sensitivity to losses and validating behavioural interpretations of risk aversion.
3. **Technical Pattern Relevance:** Classical candlestick formations such as the hammer, marubozu, and engulfing patterns demonstrate predictive power for short-term volatility behaviour, bridging visual market interpretation with statistical evidence.
4. **Intraday Volatility Structure:** The U-shaped pattern of volatility across trading hours highlights persistent information asymmetry and liquidity concentration at market open and close, consistent with global market microstructure theories.

Collectively, these findings establish India VIX as an effective intraday sentiment and risk indicator, offering insights for traders, portfolio managers, and regulators interested in short-horizon volatility dynamics.

By unifying qualitative technical insights with quantitative econometric validation, this study contributes to the growing field of high-frequency behavioural finance in emerging markets. It demonstrates that even at 15-minute intervals, investor sentiment, risk perception, and market structure interact coherently to shape the volatility landscape of Indian equities.

LIMITATIONS & FUTURE SCOPE OF STUDY

The study's scope is confined to a single week of observations, which, despite high-frequency granularity, limits generalization. The week chosen (13–17 Oct 2025) may contain atypical events; results should be replicated across other weeks/months. While the 15-minute frequency offers valuable microstructure insights, the short five-day observation window limits the generalizability of results. Infact 15-minute intervals reduce but do not eliminate microstructure effects (bid-ask bounce, irregular trade arrival). Additionally, candlestick interpretation carries subjective bias, although statistical validation mitigates this limitation. Future studies could extend this framework to longer samples and incorporate automated pattern recognition algorithms for objectivity.

Future investigations should compare the intraday volatility response of India VIX with global counterparts (U.S. VIX, VSTOXX, Nikkei VI, EUVIX, JNIVIX) to contextualize India's market efficiency within a global framework.

REFERENCES

- Andersen, T. G., & Bollerslev, T. (1997). Intraday periodicity and volatility persistence in financial markets. *Journal of Empirical Finance*, 4(2–3), 115–158. [https://doi.org/10.1016/S0927-5398\(97\)00004-2](https://doi.org/10.1016/S0927-5398(97)00004-2)
- Black, F. (1976). Studies of stock price volatility changes. *Proceedings of the 1976 Meetings of the Business and Economic Statistics Section, American Statistical Association*, 177–181.
- Brock, W., Lakonishok, J., & LeBaron, B. (1992). Simple technical trading rules and the stochastic properties of stock returns. *Journal of Finance*, 47(5), 1731–1764. <https://doi.org/10.1111/j.1540-6261.1992.tb04681.x>
- Carr, P., & Wu, L. (2006). A tale of two indices. *Journal of Derivatives*, 13(3), 13–29. <https://doi.org/10.3905/jod.2006.628214>
- Chakrabarti, R., & Sarkar, S. (2019). An empirical analysis of the India VIX and Nifty 50 relationship: Evidence from the Indian derivatives market. *Asian Journal of Finance & Accounting*, 11(2), 23–41.
- Christie, A. A. (1982). The stochastic behavior of common stock variances: Value, leverage and interest rate effects. *Journal of Financial Economics*, 10(4), 407–432. [https://doi.org/10.1016/0304-405X\(82\)90018-6](https://doi.org/10.1016/0304-405X(82)90018-6)
- Engle, R. F. (2001). GARCH 101: The use of ARCH/GARCH models in applied econometrics. *Journal of Economic Perspectives*, 15(4), 157–168. <https://doi.org/10.1257/jep.15.4.157>
- French, K. R., Schwert, G. W., & Stambaugh, R. F. (1987). Expected stock returns and volatility. *Journal of Financial Economics*, 19(1), 3–29. [https://doi.org/10.1016/0304-405X\(87\)90026-2](https://doi.org/10.1016/0304-405X(87)90026-2)
- Giot, P. (2005). Relationships between implied volatility indexes and stock index returns. *Journal of Portfolio Management*, 31(3), 92–100. <https://doi.org/10.3905/jpm.2005.500363>
- Kumar, R., & Maheswari, M. (2021). India VIX and stock market returns: Empirical investigation of volatility dynamics. *Global Business Review*, 22(6), 1467–1484. <https://doi.org/10.1177/0972150920924607>
- Park, C. H., & Irwin, S. H. (2007). What do we know about the profitability of technical analysis? *Journal of Economic Surveys*, 21(4), 786–826. <https://doi.org/10.1111/j.1467-6419.2007.00519.x>
- Patel, N., Rathod, H., & Bhattacharya, M. (2018). Effectiveness of candlestick patterns in predicting stock price trends: Evidence from Indian stock market. *IUP Journal of Applied Finance*, 24(1), 47–62.
- Sarwar, G. (2012). Is VIX an investor fear gauge in BRIC equity markets? *Journal of Multinational Financial Management*, 22(3), 55–65. <https://doi.org/10.1016/j.mulfin.2012.01.002>
- Simon, D. P. (2003). The Nasdaq volatility index during and after the bubble. *Journal of Derivatives*, 11(2), 9–24. <https://doi.org/10.3905/jod.2003.319203>
- Singh, P., & Sharma, S. (2020). Intraday volatility dynamics in the Indian stock market: Evidence from high-frequency data. *Indian Journal of Finance and Economics*, 16(3), 211–228.
- Tripathy, N., & Garg, S. (2016). Forecasting volatility in Indian stock market: A study using high-frequency data. *Asia-Pacific Financial Markets*, 23(3), 267–290. <https://doi.org/10.1007/s10690-016-9203-9>
- Whaley, R. E. (2000). The investor fear gauge. *Journal of Portfolio Management*, 26(3), 12–17. <https://doi.org/10.3905/jpm.2000.319728>