

Inside the Ban: A Quantitative Autopsy of Jane Street's Trading Tactics in India

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1. Context

In July 2025, Indian regulators issued a sweeping ban on Jane Street Group from participating in its securities markets. The Securities and Exchange Board of India (SEBI) accused the U.S.-based firm of manipulating index-linked derivatives through a two-legged strategy that distorted price discovery. The ban includes asset freezes totaling 48.4 billion rupees (approximately \$570 million), equivalent to Jane Street's reported 2024 earnings of over \$2.3 billion from Indian equity derivatives alone. This article offers a forensic breakdown of the trading strategy, market dislocations, regulatory interpretation, and quantitative simulations.

2. Strategy Overview

- **Leg 1 (Cash Market - Illiquid):** Aggressively trading selected index constituents to mechanically move the NIFTY index level
Note: "cash market is illiquid" in the context of the Jane Street incident is not universally true, but is strategically accurate for specific segments of the Indian market, particularly the subset of stocks used in the manipulation.
- **Leg 2 (Derivative Market - Liquid):** Profiting from pre-positioned delta exposure in NIFTY index options that revalue due to the shift in the underlying index
Note: NIFTY (also known as NIFTY 50) is a benchmark stock market index representing the performance of the top 50 large-cap companies listed on the National Stock Exchange (NSE) of India. The term "NIFTY" is a blend of "National" and "Fifty."

3. Mathematical Model of the Strategy

The strategy relies on leveraging the mechanical relationship between cash market activity and derivatives repricing. It is introduced a quantitative formulation of this mechanism using index construction principles and option pricing sensitivities.

3.1 Index Mechanics:

Let I_t denote the NIFTY index value at time t . Assume the index is composed of n weighted constituents S_i with weights w_i such that:

$$I_t = \sum_{i=1}^n w_i \cdot S_{i,t}$$

A trader buys a subset of these illiquid stocks aggressively during low-volume periods, causing upward pressure on their prices ΔS_i . This induces a calculated shift in the index level:

$$\Delta I = I_{t+1} - I_t = \sum_{i=1}^n w_i \cdot \Delta S_i$$

3.2 Option Pricing Impact:

Let the trader be long NIFTY options, such as ATM calls, which are highly sensitive to the movement of the underlying index.

The mark-to-market profit and loss (P&L) of the option leg (Leg 2) can be expressed using a Taylor expansion truncated at second order:

$$PNL_{\text{opt}} = \Delta \cdot \Delta I + \frac{1}{2} \Gamma \cdot (\Delta I)^2$$

Where:

- Δ (Delta) is the sensitivity of the option price to small changes in I_t
- Γ (Gamma) is the second-order sensitivity, representing convexity (curvature)
- $(\Delta I)^2$ captures non-linearity — the closer to expiry, the larger the Γ for ATM options

This convex relationship enables asymmetric payoff even from small index nudges, especially when executed near expiry when gamma peaks.

3.3 Impact Cost of Market Manipulation:

Aggressive execution in illiquid cash constituents incurs implicit trading costs due to market impact, which is modeled as a linear function:

$$PNL_{\text{cash}} = -\kappa \cdot |\Delta I|$$

Where:

- κ is a coefficient denoting the market impact cost per basis point of index movement (in INR or Cr)
- $|\Delta I|$ reflects the absolute magnitude of induced index shift

The cash leg (Leg 1) always loses money since it is being used to force an artificial move, not for investment returns.

3.4 Net P&L Computation:

The total profit/loss of the roundtrip strategy is:

$$PNL_{\text{net}} = PNL_{\text{opt}} + PNL_{\text{cash}}$$

Illustrative Example (Assume $\Delta I = +8$ bps):

$$PNL_{\text{opt}} = 8.4 \text{ Rupee Cr} \quad PNL_{\text{cash}} = -2.1 \text{ Rupee Cr} \quad \Rightarrow \quad \text{Net} = 6.3 \text{ Rupee Cr}$$

Note on Indian Financial Units: In this document, the unit “Cr” refers to **Crore**, a commonly used numerical unit in South Asia. One Crore equals ten million (10,000,000). Thus:

- 8.4 Rupee Cr = 84,000,000 Rupees
- 2.1 Rupee Cr = 21,000,000 Rupees
- 6.3 Rupee Cr = 63,000,000 Rupees

This unit is retained to match the reporting style of Indian financial publications and regulatory orders. This simulation illustrates that although Leg 1 is a money-losing operation, Leg 2’s gamma exposure more than compensates for the loss, resulting in significant positive net returns per cycle.

3.5 Insights and Implications

- Gamma harvesting from convex option exposure is exponentially more lucrative as ΔI increases
- This profit mechanism does not rely on legitimate price discovery or fundamental valuation shifts — it's mechanical
- Repeating the strategy across multiple expiries and instruments could yield magnified systematic profits — the key element that attracted SEBI's scrutiny

4. Execution Illustration

This section outlines the chronological phases of the trading strategy allegedly deployed by Jane Street. The tactic leverages timing asymmetries between less liquid cash equities and highly liquid index derivatives to extract profit from self-induced price distortions.

1. Positioning Phase (Delta Setup via Options):

The trading day begins by accumulating a long delta position in index derivatives — typically at-the-money (ATM) call options on the NIFTY index. These calls are priced using models like Black-Scholes, which rely on current index levels and implied volatility (IV). At this point, the index hasn't moved, so these options are still relatively cheap. By entering these positions early (pre-market or at open), the trader ensures:

- High gamma sensitivity — crucial because gamma (rate of change of delta) peaks for ATM options near expiry
- Positional convexity — small movements in the underlying will cause large mark-to-market shifts in the option's value
- Delta exposure — the trader will benefit from upward index movement

This setup creates a latent directional bet that profits if the index moves upward — something the trader intends to manufacture in the next step.

2. Manipulation Phase (Index Engineering via Illiquid Stocks):

In this phase, the trader aggressively purchases a basket of illiquid index constituents, i.e., the cash market stocks that compose the NIFTY index but have low float, wide bid-ask spreads, and high price impact per unit volume.

By submitting aggressive market buy orders in these stocks, the trader creates artificial upward pressure, nudging the index upward by a few basis points (commonly estimated at 6–10 bps). Since index value is calculated as a weighted average of its constituents, this brute-force method raises the reported NIFTY level.

Key aspects:

- This leg is executed at a financial loss — the trader consistently pays the spread and suffers slippage
- However, this manufactured index rise triggers derivative repricing in the next leg
- From a microstructure standpoint, this constitutes price discovery distortion, as the move is not grounded in genuine investor sentiment or macro data

3. Repricing Phase (Mark-to-Market Lift via Gamma and IV):

As the NIFTY index lifts, the option positions entered earlier begin to reprice upward due to two forces:

- **Gamma effect:** Since gamma is high (especially for near-expiry options), the small change in the index leads to a large increase in delta, making the options far more valuable
- **Implied Volatility (IV) rise:** Market makers, observing a burst of stock buying and index lift, increase IV quotes to account for sudden directional risk. This further elevates option prices

Thus, the value of the previously acquired options balloons due to this non-linear convexity — a hallmark of gamma exploitation.

4. Exit Phase (Profit Realization and Flattening):

With the options now highly marked-up:

- The trader sells the NIFTY calls at elevated prices, booking large mark-to-market profits
- Simultaneously, the cash market trades (initially buy orders) are reversed — the illiquid stocks are sold back into the market. This often causes the NIFTY to revert downward

The final portfolio is flat — no net delta or cash exposure — but the options leg has accrued a realized PnL windfall, while the cash leg has suffered a smaller loss.

Conclusion of Loop: This cycle can be repeated multiple times with minor variations, often masked under high-frequency execution to escape traditional surveillance systems.

5. Visual Strategy Flow

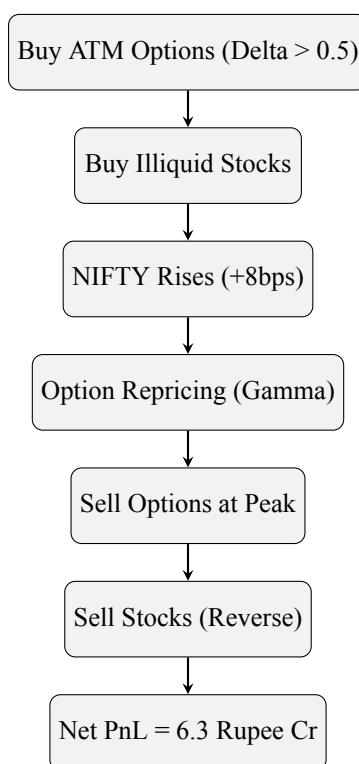


Figure 1: Trade Sequence Timeline: Index-Lifting to Gamma Harvesting

6. Market Reaction and Sentiment

- NIFTY fell 0.83% intraday on July 18, 2025
- IV on ATM NIFTY options rose 14.6%
- Cash volume in mid-cap constituents jumped 242% over 20-day average
- 25-delta RR widened from -1.2 to -2.5 vols

7. Gamma Convexity PnL Simulation

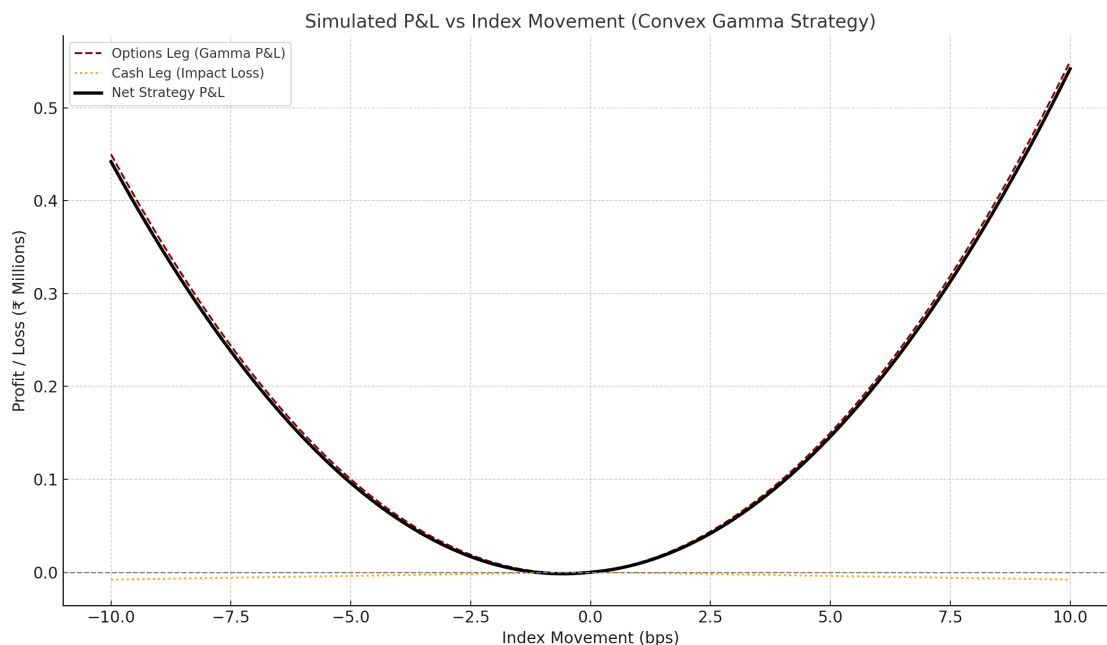


Figure 2: Simulated Net P&L vs Index Move: Options Dominance via Gamma

8. Legal Framework

Invoked Statutes:

- *Securities Contracts (Regulation) Act, 1956*
- *Prohibition of Fraudulent and Unfair Trade Practices, 2003*

Penalties:

- Asset freeze: 48.4 billion rupees
- Bank account lock
- Full market access prohibition

9. How SEBI Uncovered the Manipulation

Despite the opaque and low-profile design of Jane Street's strategy, Indian regulators leveraged advanced market surveillance architecture to reconstruct and detect the manipulation. SEBI's detection mechanism involved multiple phases of forensic analysis, flagged anomalies, and cross-market data tracing:

9.1 Surveillance Triggers and Volume Anomalies

SEBI's real-time trade surveillance systems are programmed to trigger alerts based on:

- **Abnormal Trade Volumes:** Unexplained surges in trading volumes of mid-cap or thinly traded NIFTY constituents triggered a Tier-2 review

- **Time-of-Day Patterns:** The irregular but repeated pre-open and early-session trading intensity across multiple days aligned suspiciously with open interest spikes in ATM NIFTY options
- **Price Dislocation v.s. Fundamentals:** Several stocks exhibited price moves without correlating news flow, analyst revisions, or institutional block orders

9.2 Cross-Market Orderbook Correlation

SEBI analysts matched high-frequency timestamps across:

- **Cash Market Trades (Leg 1)** and
- **Index Derivatives Orderbooks (Leg 2)**

This revealed strong Granger-causal relationships between short-term index lifts and preceding trade bursts in illiquid cash securities — a statistically unlikely occurrence without coordinated execution.

9.3 Identifying Strategy Footprint

The regulatory forensics team used proprietary T+0 linkage analysis to identify repeating “strategy fingerprints,” including:

- Recurring delta-positive option purchases within 15-minute windows prior to index lifts
- Sudden reversals in small-cap index constituents within minutes of option sell-offs
- The usage of nested sub-UCC codes, revealing indirect access from offshore FPIs linked to Jane Street’s counterparty structures

9.4 External Tip-Offs and Quant Community Forensics

Posts by quant influencers online, contained reconstructed playbooks and time-synchronized volatility graphs. Though later removed, these contributed to public awareness and may have overlapped with SEBI’s own surveillance outputs.

9.5 SEBI’s Conclusion

SEBI’s final order states that:

“...The artificial lift in index value was not the result of fundamental discovery, but was rather a synthetic outcome of coordinated intraday activity, which inflated derivative valuations — amounting to unfair market advantage.”

This multi-layered detection demonstrates India’s upgraded surveillance infrastructure, capable of handling not only standard manipulation, but also modern quant strategies operating across latency-optimized, cross-venue execution.

10. Sources

- Bloomberg (Ban announcement): <https://www.bloomberg.com/news/articles/2025-07-04/india-bars-jane-street-f>
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