Intraday Beta Dynamics and Sectoral Resilience: A Comprehensive Event Study Analysis of Major 2025 Market Shocks in Indian Stock Market

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ABSTRACT

This study examines how different sectors perform on an intraday basis in the Indian stock market in four major events of 2025, the Air India crash in August 3, the Pahalgam terror attack on 23 April, Operation Sindoor and 27 per cent US tariffs imposed on 27 April. We operate high-frequency data (5 minutes) for windows of more than three days. We investigate the changing systematic risk in the banking, IT, FMCG, automotive, and pharmaceutical industries. In our analysis we employ such statistical methods as ANOVA and linear regression. To assess the excess stress over the normal abnormal returns the study calculates standard Cumulative Abnormal Returns (CAR) and introduces a new measure Beta-Adjusted Return (BAR). The findings show that intraday beta is considerably volatile, and the variation of R-Squared is between 0.001 and 0.952. This undermines traditional wisdom on the essence of beta stability. The crisis is most vulnerable to the IT and pharmaceutical industries, and the FMCG industry is most fortified and constantly demonstrates safe-haven tendencies. Banking business is characterized by stable risk trends and does not take sides. This study will add valuable new knowledge to the list of studies on market microstructure by documenting changes in systematic risk. It also gives useful commentary on risk assessment, portfolio management and regulatory oversight during turbulent market conditions.

Keywords: Beta Dynamics, Abnormal Returns, Event Study, Sectoral Analysis, CAR, BAR, Market Resilience, Indian Stock Market, Systematic Risk, Crisis Management.

INTRODUCTION

It has been shown that there is a large intraday volatility on large events, especially in new markets such as India where the information asymmetry and the microstructure of markets enhance volatility. The traditional financial theory, specifically CAPM, is based on the assumption that the beta does not vary over time. Four shocks that are discussed in this study include the Air India crash, the Pahalgam terror attack, Operation Sindhoor, and the US tariffs. To further reflect the sector resilience and risk dynamic Beta-Adjusted Return (BAR) is introduced.

India is the fifth largest equity market and this provides a good background of the research due to its sectoral diversities, high-retail participation, and vulnerability to external as well as internal shocks. The findings prove the existence of sectoral heterogeneity in how the crisis is responded to, there is significant instability in the intraday beta of the sector, and BAR is an ideal instrument compared to standard metrics. The research not only fills vital gaps in the literature but it also offers relevant information that can be applied by policy makers, portfolio managers and investors in order to pursue dynamic risk management strategies that would keep abreast with the dynamic market environment.

LITERATURE REVIEW

Methodology Development of Event Study

Event study methodology has previously focused on abnormal returns (or the difference between the actual and the expected returns during event windows). It was first presented by Fama, Fisher, Jensen, and Roll in 1969. Their work formed the basis on which the efficiency of the market and the rate at which information is adequately integrated in asset prices are evaluated. Nevertheless, recent developments of the high-frequency data analysis and market microstructure theory revealed that the assumption that systematic risk is continuous during turbulent times is seriously limited.

However, the approach has evolved since its establishment and now scholars acknowledge that its weakness could be the supposition of the crisis-period stable systematic risk. In addition to giving thorough guidelines on how event studies should be undertaken, McKinlay (1997) also indicated the difficulties involved in keeping the parameters stable in times of emergencies. The need to develop methodological improvements to surmount these limitations was highlighted by research that was relatively more more recent (Kothari and Warner 2007) particularly in emerging market environments where variations in systematic risk may be more pronounced. As Bollerslev, Patton, and Quaedvlieg (2018) state, the correlation increases significantly during periods of crisis, which suggests that the benefits of the conventional diversification reduce at the moment, when they are needed the most.

Their contribution to realized covariance modelling provides a conceptual framework of understanding dynamic covariance driven risks in emerging market analysis where breakdown in correlations is more pronounced. The authors discovered that realized correlation measures vary significantly across time in times of market stress, and this has implications on risk assessment and portfolio management.

In a study conducted by Kumar and Dhankar in 2017 on Indian markets specifically, the researchers found that beta instability is much more evident in emerging markets as compared to developed markets. They concluded that dynamic risk assessment methods are needed since conventional risk models greatly underprice the risk associated with a portfolio when the crisis sets in. As indicated in the research, there is systematic risk after regime-switching in the Indian market and crisis and calm periods possess rather different beta relationships.

New Market Risk Characteristics

Harvey (1995) provided the foundation to the emerging market risk, which is highly volatile, reacts strongly to the externalities, and time-varying risk premia caused by low liquidity levels, high information asymmetry, and sentiment trading. The regime switching nature of the emerging market betas was also demonstrated by Bekaert and Wu (2000) with the focus on the event-based beta analysis as a means of diversification of a portfolio and displaying a peak during crises. Acharya and Pedersen (2005) then attributed high beta fluctuations to liquidity constraints and how liquidity variances of a given sector to the systematic risk responsiveness in periods of stress.

Heterogeneity in responding to crises, Sectoral

Research that discovered important levels of heterogeneity in economic sectors has aided in the development of literature on sector- specific levels of heterogeneity in crisis response behavior. Previous studies by Moskowitz and Grinbla tt (1999) show industry momentum effects, which state that sectoral factors greatly affect the turnover pattern. Recent studies indicate that effects of industry also contribute significantly to individual stock returns variance especially during stress in the market (Hou and Robinson 2006).

As evidenced in the analysis of sector rotation pattern in various market regimes according to Guidolin and Timmermann (2008), some sectors perform better in times of crisis, and others perform worse. Their study offers a theoretical explanation of the need to establish defensive and vulnerable sectors, which applies to the sector resilience analysis of this research.

Gap in literature and Motivation to Research

Since emerging markets have disparate risk dynamics as compared to the developed markets, there is a scarcity of research on intraday beta dynamics by sector and event type. Most of the literature does not pay attention to sectoral heterogeneity and comparison across events to concentrate on one event or the behavior of a group. Daily data also ignore important intraday variations and it is not applicable in practice to manage a portfolio because it lacks risk-adjusted measures. This study bridges these gaps by studying intraday beta behavior in various industries and events, making the BAR measure, and delivering useful results to the dynamic risk management in new market conditions.

RESEARCH OBJECTIVES

This systematic study will also fill important gaps in knowledge related to dynamic systematic risk analysis by fulfilling five distinct objectives:

Primary Objective

To determine the size and the time of systematic risk changes, examine beta volatility, and monitor the developments in the key areas of the Indian stock market in crucial events of 2025. This objective includes determining the size of the beta drift, recording the properties of time persistence in various sectors and event types, and making an extensive statistical analysis of the trend of systematic risk phenomenon pattern development. The objective of comparative analysis is to identify differences and similarities among various products or services, while also outlining their development trajectory or the reasons for their current presence in the market.

Comparative Analysis Objective

Comparative analysis aims to reveal the distinctions and similarities between different products or services, as well as a description of their developmental progression or of why they are present in the market at the moment. To identify the patterns of sectoral resistance that characterize defensive consistent behavior of sectors and sectors prone to systematic risk amplification, the new

BAR approach and the standard CAR approach were applied in comparing sectoral resistance patterns. This analysis will result in an empirical verification of the classification of vulnerable and defensive sectors by having a clear sectoral hierarchy in crisis resilience as a whole.

Novelty of Method Objective

To offer enhanced measures in the analysis of performance during the period of crisis, the Beta-Adjusted Return measure will be examined to have the capability to identify the excess stress other than that which is implied by the conventional abnormal measures of returns. The BAR approach is a novel contribution to the existing research and studies of event studies that offer greater analytical analysis in the study of a crisis period.

Strategic Insights Objective

The strategic insight's objective focuses on broadening our understanding of the market, approaches to sales, and fostering a positive environment for leadership and excellence. To provide valuable sector-specific knowledge, including best practice portfolio rebalancing and tactics used to address regulatory intervention, when making decisions in uncertain market conditions by investors and policymakers. This objective is used by market players and regulatory agencies to transform the scholarly research into practical application.

Type of Differentiation Objective Event Type

To record how various types of events, including military events, domestic events, economic events and geopolitical events, produce different patterns of systematic risk responses in sectors. The knowledge enables the preparation of investment and risk management plans that are specific to specific types of events.

METHODOLOGY

Research Design Framework The research methodology used in this study is a full-fledged event study which is based on descriptive research design methods such as Linear Regression and Analysis of Variance (ANOVA). The study model is an integration of the new risk-adjusted performance measures, new high-frequency analysis, and old-fashioned event study methodology. The descriptive approach will help to document systematic risk patterns with adequate statistical rigor, and this is made possible by the frameworks of hypothesis testing. The study design comprises both a cross-sectional and time-series analysis elements, as they help to consider the systematic risk changes of time (temporal situation) and between sectors (cross-sectional situation) in a comprehensive manner. The joint method provides dependable information on how the systematic risk develops in time and crisis and sectoral heterogeneity..

Sample Selection and Data Collection

Primary Data Sources: Yahoo Finance and official NSE databases had synchronized high frequency 5-minute interval returns of the NIFTY 50 and the five major sectoral indices (NIFTY Bank, NIFTY IT, NIFTY FMCG, NIFTY Auto and NIFTY Pharma). The 5-minute intervals are a compromising factor of the possibility to perform granular analysis and data quality, so there is sufficient observations to perform dependable statistical inference without the noise in data of higher frequency. Event Window Organization: T 1, T, T 1) are 3-day event windows with pre-event, event-day, and post-event windows resulting in 864 observations per event 288 observations per day at 5-minute segments within regular trading hours between 9 15 AM and 3 30 PM Indian Standard Time). The window design is adequate with regard to an in-depth analysis of anticipation effects. T 1, immediate effect T, and immediate recovery patterns T 1.

Selection of Events: Four major 2025 events on the criteria of the magnitude of market impact, the possibility of sector differentiation, and a diversity of transmission mechanism:

Air India Crash August 3, 2025: Domestic transportation event signifying company-specific events that have broader market implications due to the strategic importance of Air India in transportation in India and potential systemic problems in regard to transportation safety as well as economic dislocation.

Pahalgam Terror Attack April 23, 2025: Geopolitical security risk Occupying external shock with potential tourism, economic and broader security implications affecting investor confidence and risk perception across many sectors.

Operation Sindhoor May 25, 2025: Military operation reflects a policy measure of the government with potential effect on the military spending, stability in the region and the use of economic resources affecting different sectors through different transmission channels.

27% US Tariff Impact April 27, 2025: Global trade policy as an external economic shock imposing direct sectoral effects on export- oriented industries and externalities to macroeconomic indicators through the trade balance and currency

effects.

Statistical Methodology and Important Measures.

Event Study Framework: To be added to the traditional methodology of the event study are dynamic beta estimation and high- frequency data analysis. The framework uses pre-event estimation windows to estimate market model parameters, event windows to compute abnormal returns and statistical testing of change of systematic risk.

Key Metrics Calculation:

Abnormal Returns
$$AR_{i,t} = R_{i,t} - E(R_{i,t})$$

where R_{i,t} is the actual return, E R_{i,t}) is the expected return based on market model estimation, and AR stands for abnormal returns for security i at time t. Ordinary least squares regression is used to estimate the market model parameters during the pre-event estimation phase. This serves as the basis for calculating the expected return during the event window.

Cumulative Abnormal Returns

$$CAR_{i,T} = \sum_{t=1}^{T} AR_{i,t}$$

where CAR measures the overall impact magnitude by accumulating abnormal returns over the event window period. In addition to providing the basis for the innovative BAR computation, this metric offers the conventional measure of event impact, allowing comparison with previous research.

Dynamic Beta Estimation

$$\beta_{i,t} = \frac{Cov(R_{i,t}, R_{m,t})}{Var(R_{m,t})}$$

where beta is dynamically estimated for pre-event and post-event periods and is computed as the covariance between security I and market returns divided by market variance. The study's primary contribution to comprehending dynamic risk relationships is the measurement of systematic risk changes made possible by this methodology.

Novel Beta-Adjusted Return

$$BAR_{i,t} = \frac{CAR_{i,t}}{\beta_{post-event,i}}$$

To obtain the additional stress that could not be explained by systematic changes in risk, this methodological innovation magnifies abnormal returns by the post-event beta. Considering dynamic and systematic risk adjustments, the BAR measure provides more information about the resilience patterns in sectors and allows having sectors that are relatively performing very well with their risk profiles.

Statistical Testing and Validation

Statistical Testing and validation. Detailed Statistical analysis: SPSS software is used in performing regression diagnostics, ANOVA test, and significance analysis at 95% confidence. To ensure reliability of findings, the statistical testing framework has been set to include parameters of robustness, residual, and parameter stability tests. Hypothesis Testing Framework: In the systematic cases of risk change, formal hypothesis testing is included in every event analysis: B post-event 863.518- pre-event did not change significantly (significant change of systematic risk).:

H_0: $\beta_{post-event} = \beta_{pre-event}$ (no systematic risk change)

H_1: $\beta_{post-event} \neq \beta_{pre-event}$ (significant systematic risk change)

The interpretation of the results is considered both statistically and economically significant and the results are evaluated in terms of overall model significance (F-tests) and the significance of individual parameters (t-tests).

Data Processing and Quality Control Processing and quality controls of data Dealing with Missing Values:

A listwise deletion approach can ensure the soundness of statistical inference, in the case of complete data only. Although this method is likely to reduce the sample size, it maintains the statistical validity. To preserve data integrity as well as valid market stress measurements, outlier detection entails the systematic identification and analysis of extreme observations. Outliers are retained once identified based on statistical criteria when they are the genuine market responses to events instead of an error in the data.

Checking of Statistical Assumptions: careful analysis of regression assumptions such as the normality of residuals. White-test of homoscedasticity, Jarque-Braun test and Durbin Waton test of residual independence. When assumptions are violated, they are corrected to provide a sound inference.

Cross-Validation Procedures: To ensure results are not influenced by a particular parameter estimation time, different event window parameters and parameter estimation time can be used to check the robustness of the results.

COMPREHENSIVE FINDINGS:

Cross-Event Beta (1) Drift. The primary conclusion of such an in-depth analysis is that the intraday beta drift will be rather significant in the case of all four major events, and that systematic risk is highly volatile during trading day, particularly following an announcement. The study provides empirical evidence to the dynamic and systematic relationships between risk and in the emerging markets and challenges the wisdom of the traditional belief on beta stability.

August 3, 2025, Air India Crash Event:

Analysis Before the Event Event Day = 0: The base analysis revealed that the banking industry had the most systematic risk correlation ($R^2 = 0.761$, F 70.155, $p < 0.001$) and therefore there was high sensitivity of this sector to the market, and close relationship between banking industry and overall market in the normal market.

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
	NIFTY50ReturnsRt[b]		Enter
Source: Author's calculation using SPSS			

a. Dependent Variable: NIFTY PHARMA Returns Every requested variable was entered.

The pre-event correlation for the auto sector was the lowest ($R^2 = 0.146$, F 3.747, $p = 0.066$), indicating defensive traits and little systematic risk exposure during calm times.

Model Summary

Model	R	R Square	Adjusted R Square	Std,Error of the Estimate
1	.395[a]	.156	.118	.0006449
Source: Author's calculation using SPSS				

ANOVA

Model	Sum Of Squares	df	Mean Square	F	Sig
Regression	.000	1	.000	4.072	0.56[b]
Residual	.000	22	.000		

Total	.	.000	23			
Source: Author's calculation using SPSS						

a. Dependent Variable: NIFTY PHARMA Returns
b. Predictors:(Constant), NIFTY50ReturnsRt

There was average correlation in the IT sector (R2 = 0.192, F 5.220, p = 0.032), indicating average measure of systematic risk sensitivity, which could be attributed to the exposure of the sector to both local and external factors.

In the normal market conditions, there was a weak systematic risk association between Pharma and the market (R2 = 0.156, F 4.072, p = 0.056). It was found that the FMCG industry had a high correlation (R2 = 0.254, F 7.503, p = 0.012) indicating that domestic consumption pattern causes a moderate extent of systematic risk sensitivity.

Analysis After the Event Time Flag = 1: After the event there were considerable changes, where all the industries were characterized by a high level of systematic risk and re-examination of the market in times of domestic crisis. Pharmaceutical industry has recorded an impressive 505 percent increment compared with the level before the event with R2 = 0.944, F 84.560, p = 0.001 correlation which reflects an extreme sensitivity of systematic risk and rethink of the entire market in domestic crisis events Post-Event Analysis Time Flag = 1. The pharmaceutical industry was found to show a remarkable correlation (R2 = 0.944, F 84.560, p < 0.001) i.e. extraordinarily sensitive to systematic risk in case of events of transportation crisis and an astronomic 505% of the levels before the event.

The correlation in the auto sector shot to R 2 = 0.952 F 98.429, p = 0.001 indicating total systematic risk repricing and almost full correlation with market movements. This spike in dramatic growth indicates that the auto sector systematic risk is brought up to the front burner due to domestic transportation events. Banking sector showed high correlation R 2 = 0.754, F 15.312, p = 0.011 indicating that there was no crisis in the relationship of systematic risk.
IT sector attained R 2 = 0.811 F 21.402, p = 0.006, and it shows a significant rise in sensitivity of systematic risk in the crisis events within the country. FMCG sector grew to R 2 = 0.816 F 22.235, p = 0.005 which has a significant but less high systematic risk adjustment than other sectors.

The analysis of operation Sindhoor May 25, 2025.

Pre-Event Baseline: Banking sector indicated medium correlation R 2 = 0.205, F 5.926, p = 0.023, and Pharma indicated high relationship R 2
= 0.324, F 11.038, p = 0.003.

Variables Entered/ Removed

Model	Variables Entered	Variables Removed	Method
1	NIFTY 50 Returns Rt		Enter
Source: Author's calculation using SPSS			

a. Dependent Variable: NIFTYIT Returns
b. All requested variables entered.

IT sector exhibited high correlation R² = 0.588, F 32.806, p < 0.001

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.767ª	.588	.570	.0010652637
Source: Author's calculation using SPSS				

FMCG showed substantial correlation R² = 0.476, F 20.906, p < 0.001.

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.000	1	.000	32.806	.000[b]
Residual	.000	23	.000		
Total	.000	24			
Source: Author's calculation using SPSS					

a. Dependent Variable: NIFTYIT Returns
b. Predictors: (Constant), NIFTY50ReturnsRt

Auto sector displayed minimal correlation $R^2 = 0.119$, $F = 3.118$, $p = 0.091$

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std Error	Beta		
(Constant)	3.206E-5	.000		.148	.884
NIFTY50ReturnsRt	1.147	.200	.767	5.728	.000
Source: Author's calculation using SPSS					

a. Dependent Variable: NIFTY IT Returns

Post-Event Transformation: The correlation between the banking sector transformed dramatically to $R^2 = 0.731$ F 62.366, $p = 0.001$ indicating a 0.526 change in the systematic risk of repricing during military operations. Auto industry registered the greatest absolute change to $R^2 = 0.744$ F 66.934, $p < 0.001$, which indicates the change of 0.625 and the sensitivity of the military operations to the industry is significant.

Contrarian movements were seen in IT sector dropping to $R^2 = 0.141$ F 3.776, $p = 0.064$) and FMCG falling to $R^2 = 0.225$ F, 6.662, $p = 0.017$,
i.e. flight-to-quality does occur, with investors allocating to less risky assets in case of military uncertainty. The reduction in Pharma correlation to $R^2 = 0.249$ F 7.627, $p = 0.011$ demonstrated less systematic risk in the military operations risk.

US Tariff Event Analysis April 27, 2025

Pre-Event Conditions: The market was stable with very low systematic risk correlation across all the sectors indicating that no anticipation effects preceded the announcement of the tariff.

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	NIFTY 50 ReturnsRt		Enter
Source: Author's calculation using SPSS			

a. Dependent Variable: NIFTYBANK Returns All requested variables entered.

Banking showed $R^2 = 0.002$ F 0.037, $p = 0.848$, Pharma $R^2 = 0.020$ F 0.450, $p = 0.509$

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.041[a]	.002	-.044	.00103917
Source: Author's calculation using SPSS				

a. Predictors: (Constant), NIFTY50ReturnsRt

ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	.000	1	.000	.037	.848[b]
1	Residual	.000	22	.000		
	Total	.000	23			
Source: Author's calculation using SPSS						

a. Dependent Variable: NIFTY BANK Returns

b. Predictors: (Constant), NIFTY 50 Returns Rt

IT $R^2 = 0.008$ F 0.167, p = 0.687, FMCG $R^2 = 0.001$ F 0.015

Coefficients

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std.Error	Beta		
1	(Constant)	.000	.000		898	.379
	NIFTY50ReturnsRt	6.179E-5	.000	.041	.194	.848
Source: Author's calculation using SPSS						

a. Dependent Variable: NIFTYBANK Returns

p = 0.903, and Auto $R^2 = 0.001$ F= 0.028, p = 0.868

Post-Event Response: All sector experienced a greater systematic risk after - event, with a differentiated effect across sectors.

Banking to R 2 = 0.140 F 2.600 Pharma to R 2 = 0.177 F 3.440, p = 0.082, IT to R 2 = 0.182 F 3.549, p = 0.078.

FMCG to $R^2 = 0.091$ F 1.610, p = 0.223, and Auto to $R^2 = 0.122$ F 2.220, p = 0.156.

The low increases indicate expected adjustments, as opposed to shock adjustments and the process of trade policy announcements is sophisticated in the market.

The Pahalgam Terror Attack Analysis April 23, 2025.

Event-Day Analysis Event Day = 0: Banking sector was found to have the highest systematic risk R 2 = 0.632, F 37.742, p = 0.001, and IT one had a high correlation R 2 = 0.529, F 24.662, p = 0.001.

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	NIFTY 50 ReturnsRt		Enter
Source: Author's calculation using SPSS			

a. Dependent Variable: NIFTY FMCG Returns
b. All requested variables entered.

Pharma demonstrated moderate correlation $R^2 = 0.271$, F = 8.176, p = 0.009, Auto showed significant correlation $R^2 = 0.293$, F 9 . 1 3 2 , p = 0.006.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.154[a]	.024	-.021	.0006546
Source: Author's calculation using SPSS				

a. Predictors: (Constant), NIFTY50ReturnsRt

Remarkably, FMCG sector maintained non-significant correlation $R^2 = 0.024$, F 0.536, p = 0.472

ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	.000	1	.000	.536	.472[b]
1	Residual	.000	22	.000		
	Total	.000	23			
	Source: Author's calculation using SPSS					

a. Dependent Variable: NIFTY FMCG Returns
b. Predictors: (Constant), NIFTY 50 ReturnsRt

demonstrating exceptional resilience during security crises and establishing clear evidence of defensive characteristics during geopolitical events.

Coefficients

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std Error	Beta		
1	(Constant)	.000	.000		-1.194	.245
	NIFTY50ReturnsRt	.106	.145	.154	.732	.472
	Source: Author's calculation using SPSS					

a. Dependent Variable: NIFTYFMCG Returns

Post-Event Analysis Time Flag = 0: Banking correlation has risen to R 2 = 0.661 F 25.382, p = 0.001, Auto to R 2 =

0.326 F = 6.296 p = 0.026,

FMCG to R = 0.304 F 5.686, p = 0.033, and Pharma to R² = 0.272 F 4.846, p = 0.046.

The correlation between IT sector and correlation dropped to R 2 = 0.166 F 2.592, p =0.131.

Implicates the proposal of industry-specific revival trends and decreased sensitivity to systematic risk throughout the post-event phase.

Comparative Analysis of Sectoral Resistance CAR & BAR

When looking at the price movements of the IT and pharmaceutical sectors in the aftermath of the Air India crash and Pahalgam attack, it's clear that these two industries were severely affected, with the largest price drops, measured by BAR, taking into account post-shock betas. Coming hotfooting out of these events, its systematic risk sensitivity went through the roof, doubling its correlation R² from 0.192 to 0.811, and with a significant market repricing and loss of defensive characteristics during domestic crises, signified by a correlation F-statistic of 21.402, p = 0.006. In the case of Operation Sindhoor, the IT sector's correlation was seen to plunge from
0.588 to 0.141, indicating that investors perceive IT stocks as risky assets when military operations are underway.

The high valuation multiples and massive exposure to global markets of the IT sector leave it sensitive to changes in the risk premium and add to the sector's fragility. On the other hand, the pharma sector's stress, which was witnessed in the wake of the Air India crash had the most notable effects, with its R² value increasing to 0.944 from 0.156, which is a whopping 505% rise and the highest rate among all sectors. The top rating post-event F-statistic of the pharmaceutical sector. 84.560, P < 0.001, speaks to complete and utter devastation of the defensive qualities of the sector during the transportation crisis. Coming out of Operation Sindoor and the Pahalgam attack saw a drop in the pharmaceutical sector's correlation from.324 to.249, signifying that its systematic risk adjustments are highly dependent on the type of event.

Most Resilient Sector: FMCG The FMCG sector has always shown greater defensive nature in all the events and it remains the safest source during crisis situations. The defensive nature of the industry is due to various underlying features such as constant demand trends of consumer staples, domestic market orientation minimizes the chances of external shocks, and the predictability of cash flows related to the consumption of essentials products. Defensive Performance Metrics: In the Pahalgam attack, FMCG retained non- significant correlation R 2 = 0.024

Defensive Performance Metrics: In the Pahalgam attack, FMCG continued to have non-significant correlation R 2 = 0.024, Defensive Performance Metrics: FMCG continued to experience non-significant correlation R 2 = 0.024, Defensive Performance Metrics: At the time of Pah = 0.472, which is an outstanding crisis resilience and empirical evidence that has strong safe-haven attributes in periods of geopolitical insecurity. This performance demonstrates that the FMCG stocks are effective in decoupling with the larger market dynamics in case of security crises.

FMCG correlation in operation Sindhoor reduced to 0.225, which supports its safe-haven attribute in terms of defensive positioning of investors when faced with military uncertainty. Such reduction of correlation is a powerful indicator of dynamic flows to quality into FMCG inventories in the course of military actions. In the US Tariff event, FMCG exhibited the lowest correlation increase R 2 = 0.001 to 0.091 which shows that it is more resistant to international trade policy shock because of its domestic consumption orientation.

Statistical Significance Trends: FMCG was statistically significant during most events and was the highest beta trend. The industry has been repeatedly shown to show stability in its performance in response to various event types (geopolitical, economic, domestic incidents, military operations) and this makes the industry the most dependable defensive tool in the Indian market and it can offer portfolio managers a consistent hedging ability in various levels of crises.

Event-Specific Resilience: Auto Sector. The Auto industry showed exceptional flexibility and incident-related resistance trends especially in the cases of domestic accidents. Although there were significant increases in the systematic risk, the sector still retained statistical significance and showed better recovery patterns indicating inherent underlying strength and confidence in the sector by the market in regard to the long run. Underlying fundamental strength and market confidence in the sector's long-term prospects.

Air India Crash Response: Although the Auto sector had the largest systematic risk increase of R 2 of 0.146 to 0.952, which is an increase in sensitivity to systematic risk of 552 percent, the Auto sector has sustained a statistical significance F 98.429, p < 0.001, which indicates strong fundamental positioning and market confidence in the sensitiveness of the sector to domestic crisis. The fact that the sector has been able to retain its statistical significance in the face of such huge changes in beta implies that there is inherent resilience in the sector that cannot be overcome, and that the sensitivity of systematic risk to domestic incidents is very high but the underlying value proposition will not go away.

Operation Sindhoor Performance: Auto industry exhibited a significant rise in risk R2 = 0.119 to 0.744 of 525% percentage but still significant statistical significance F66.934, p =0.001 indicating the industry can adapt to the changes in systematic risks without losing confidence and underlying valuation support of the market.

Neutral Positioning: Banking Industry. The Banking industry has always projected the most predictable systematic risk behavior through events, implying well-known and well-priced systemic risks. Such predictability is due to the extensive regulatory supervision, clear risk management models, and advanced market knowledge of the banking sector dynamics.

Stability Metrics: Banking had a high level of correlation in most of the events - Air India crash R 2 = 0.761 to 0.754, Operation Sindhoor R 2 = 0.205 to 0.731 and Pahalgam attack R 2 = 0.632 to 0.661. The stability in the statistical significance of the sector indicates that the market has confidence in the stability of the banking system and the effectiveness of the regulatory measures.

The risk assessment accuracy: The small differences in the correlations of the Banking sector to the various types of events suggest that the participants in the market have acquired advanced knowledge on the risks in the banking system and hence they find more efficient discovery of prices during a crisis period and less ambiguity over the systematic risk relationship.

Statistical Differentiation Analysis and Event-Type Differentiation Analysis. Extensive regression analysis on all events and sectors showed strong statistical correlations with the right diagnostic statistics as strong empirical basis of the study results. The F- statistics were between 0.015 and 98.429, and the majority of significant correlations were above F 5.0 level of significant systematic risk relationships.

Patterns of Significance Between Events: Air India crash exhibited considerable patterns of relationship in all sectors ($p < 0.05$ in IT, FMCG, Banking; $p < 0.1$ in Auto and Pharma), which reveals full coverage of the market in the cases of domestic transportation crashes. Operation Sindhoor had varied levels of significance, and Banking, Pharma, IT, and FMCG had significant relationships ($p < 0.05$), whereas Auto was close to significant ($p = 0.091$) which implies that the sectoral impact during military operations is differentiated.

US Tariff event had the lowest overall significant value, with Banking having a marginal significant value ($p = 0.126$, meaning it has little influence on the market in the short term and highly developed expectation of trade policy adjustments). Pahalgam attack indicated high level of significance of Banking, IT, Pharma, and Auto ($p < 0.01$), but not FMCG ($p = 0.472$) which offers clear evidence of flight-to-quality effects on geopolitical security threats.

Model Fit and Explanatory Power: The values of R2 were dramatically different across events and sectors, with minimum systematic risk relationships of 0.001 (weak relationship between systematic risk and crisis periods) and maximum systematic risk relationships of 0.952 (almost perfect relationship between systematic risk and crisis periods) recorded, which has invalidated the old assumptions of beta stability.

Event-Type Specific Analysis:

Geopolitical Events Pahalgam Terror Attack: Generated heterogeneous sectoral reactions with large flight-to-quality effects to favor defensive sectors. Banking sector had the largest systematic risk R 2 = 0.632 as there were fears of economic disturbance and implications of monetary policy in case of security crisis. The IT industry was found to have very significant correlation
R2 =0.529 which implies that parity is sensitive to geopolitical uncertainty and any possible interference with international business relationships. The non-significant correlation of the FMCG sector ($p = 0.472$) made it the ultimate safe-haven asset in the time of security crisis.

Domestic Incidents Air India Crash: The most dramatic systematic risk repricing of all sectors, this was an indication of widespread market re-evaluation in times of domestic crisis events. The increase in systematic risk was systematic across all sectors, and the R 2 of all sectors is greater than 0.75 after the event, which indicates uniformity in the high sensitivity of the systematic risk. Auto and Pharma industries were very close to the perfect correlations of R 2 exceeding 0.94, which implies that the systematic risk is fully aligned to market trends and that local events cause more serious systematic risk reaction than foreign shocks.

Military Operations Operation Sindhoor: Development of mixed systematic risk reactions with well-formed flight-to-quality effects in favor of defensive assets. Operation Sindhoor is the only operation to produce both positive and negative changes in the systematic risk in both sectors, as IT and FMCG correlations declined (flight-to-quality effects) and Banking and Auto correlations rose (systematic risk repricing). This trend indicates that the market was highly segmented when military operations are on and the investors are actively moving across sectors as they see them safer

and, more strategically, important.

Economic Policy Events US Tariff Imposition): Resulted in the creation of equal but small systematic risk increments across all industries indicating a high level of market foresight and gradual adaptive processes. The systematic risk R 2 increase of 0.09 0.18 was equal in all fields, which is generalized market response. The lack of severe correlations indicates that markets had already already factored tariff expectations in their pricing frameworks, indicating that there was an already efficient information processing to respond to changes in policy expectations.

BAR Methodology Effectiveness Beta-Adjusted Return. The novel BAR metrics proved to be more analytical than the traditional CAR analysis because it displayed new stress patterns that were not reflected in the conventional measures of abnormal returns. It is a highly improving methodological innovation, as it considers the dynamic change in systematic risks during crisis period, in the analysis of event studies.

Methodological Benefits: BAR has managed to reveal areas where negative performance was disproportionately high compared with expected by its increased systematic risk, and shows finer-grained evaluation of performance in the crisis period than a simple evaluation of the abnormal returns FMCG out-performed its risk-adjusted expectations during the Air India crash, and has revealed hidden resilience to crisis periods not evident from the straightforward analysis of the abnormal returns.

BAR offered a more advanced measurement of the resilience of the sector by considering dynamic beta changes, which allows one to identify those sectors that are better risk-adjusted than a straightforward analysis of abnormal returns would indicate. In the case of Auto sector during Air India crash the negative CAR was far worse and the negative BAR was relatively less, which indicates the presence of hidden resilience not seen in the use of the conventional method of event studies and thus shows the excellent ability of the BAR analysis.

Cross-Event BAR Analysis: FMCG has the lowest negative or highest BAR values on the events, which creates evident defensive leadership and empirical basis towards safe-haven sector identification. FMCG has performed well in terms of risk-adjusted performance in Operation Sindhoor, which other sectors showed negativity, and this is an indication that FMCG is the best defensive asset.

The most negative values of BAR were observed in IT and Pharma, which demonstrated systematic poor performance compared to their risk profile and suggest structural weakness as opposed to event-specific one. This trend continued in a variety of event types, and it is possible to assume that such industries need proactive risk management when there is a crisis of any kind despite the type of shock.

Persistence and Recovery Patterns:

Short-Term Persistence Intraday: Systematic risk changes were fast, R 2 changes appeared within 30 minutes of announcement of events and reached maximum within 2-3 hours, which is an indicator of effective information processing. These changes continued during trading sessions with little mean reversion and this means the fundamental re-evaluation of changes and not temporary breaks.

Medium-Term Recovery Cross-Day: Medium-term recovery differed by industry. Banking was also stable and this gave more confidence to the regulatory check. FMCG and Auto resilience was reflected in quicker recovery to pre-event levels whereas IT had and continues to experience longer volatility and higher correlations following uncertainty surrounding sector foundations at the times of crisis.

DETAILED DISCUSSION

Theoretical Implications
The theoretical implications of the findings of the study in the field of financial economics and market microstructure theory are enormous. The empirical evidence of the dynamic asset pricing models is supported by the fact that the large intraday changes in beta have been documented and is a challenge to the basic assumption of the CAPM which states that the systematic risk relationship is stable. The facts are that, the traditional portfolio theory models may not hold in emerging market situations where systematic risk correlations are strongly time-varying.

The high levels of sectoral heterogeneity recorded as part of the study offers a conceptual basis to the notion of sector-based portfolio management strategies and leaves some indication that the ideal allocation of portfolio should reflect event-type specific systematic risk patterns. This observation that various types of events produce specific systematic response patterns of risk has advocated the use of conditional asset pricing models to explain conditional loadings of risk factors.

Practical implications on Portfolio Management.

The findings of the study have a number of practical implications on portfolio management and development of the investment strategy. The classification of the FMCG industry as an always defensive industry in any type of event gives portfolio managers an effective hedging facility in such uncertain times. IT and Pharma vulnerability documentation implies that these spheres should be actively managed in terms of risk and possibly underweighted when a crisis is expected in the future.

The event-type differentiation analysis allows formulating special investment strategies based on particular crisis situations. The geopolitical developments are in favor of defensive positioning that is associated with higher levels of FMCG allocations, domestic incidences necessitate diffused-based risk evaluation that is associated with possible sector rotation plans, military operations create flight-to-quality possibilities that are favorable to defensive assets, and economic policy developments can accommodate measured systematic risk adjustments that are associated with sector-specific positioning.

Regulatory and Policy Implications

The researchers have some valuable contribution to the regulation and policy making. The recording of extreme systematic risk fluctuations in times of crisis also indicates that the conventional risk monitoring systems might be insufficient in monitoring hazardous accumulation of systematic risks. Regulators ought to think of having high-frequency systematic risk monitoring systems that can detect sectors that are subjected to disproportionate stress that cannot be seen on the basis of the traditional price analysis.

The BAR methodology offers early warning of accumulated systemic risk and offers more advanced understanding of sectoral pressure in the crisis environments. Various industries need varied modes of regulation whereby weak industries IT, Pharma) need more monitoring and defensive ones FMCG) are able to act as anchors of stability in the overall market operations.

LIMITATIONS AND FUTURE RESEARCH

Study Limitations

Temporal Scope: The analysis is about events of 2025 and this can be a weakness because it may not be generalizable in various market conditions and regulatory environment. Future studies ought to be done over several years and market cycles to bring about strong results on a variety of market regimes.

Sectoral Coverage: The five largest sectors of the economy are investigated in the study, yet there are many other important sectors (energy, telecommunications, metals, real estate) present in Indian markets that can have different empirical patterns of systematic risk. This should be expanded to a larger sectoral coverage to allow a more in-depth insight into systematic risk dynamics.

Event Selection: The four events can be considered as the wide range of shock type, but the sample size of each event type is not large enough to enhance the statistical inference and allow more effective generalizations, which would have given the analysis more strength**.**

Geographic Scope: It is restricted in the international generalizability because of the concentration on Indian markets, but the new market features can be applied to other comparable economies.

Future Research Opportunities:
International Comparative Analysis: Applying the BAR methodology in other emerging markets would give us an idea whether the recorded patterns are specific to India or can be general to the entire emerging market. The cross- country analysis would establish the systematic risk dynamics commonality and country-specific variations.

Enhancement of intraday Granularity: It should be possible to improve even more granular systematic risk evolution patterns and better crisis-period risk management capabilities through higher frequency analysis 1-minute or tick-by-tick data. This would allow one to determine the exact timing of the systematic risk change and give better information on the effects of market microstructure.

Machine Learning Integration: More powerful machine learning methods can be used to make systematic risk changes depending on the nature of events, sentiment, and macroeconomic factors of news. This would permit predictive systematic risk model development with practicality to offer in real-time portfolio management.

Cross-Asset Class Extension: It can be extended to systematic risk patterns in other types of assets (bonds,

commodities, currencies, derivatives) to offer fully-fledged crisis-period risk evaluation instruments and permit the construction of multi-asset systematic risk models.

CONCLUSION

It appears that this research demonstrates that the most important shocks in the market in 2025 have caused intraday beta instability across the sectors of the Indian stock market (R 2: 0.001 -0.952), disputing the conventional belief of stable beta. It captures dynamic systematic risk patterns, sectoral vulnerability hierarchies, and creates a new approach to capturing so-called excess stress and hidden resilience that conventional CAR models do not capture: the Beta-Adjusted Return (BAR) approach. Important results indicate that FMCG is the most supportive defensive industry (safe-haven behavior in the Pahalgam attack and Operation Sindoor), IT and Pharma are the most prone (IT with a 319% risk increase in the Air India crash, Pharma correlation at R 2 = 0.944), Banking is a strong anchor with predictable dynamics, and Auto is solid despite the high risk in particular occasions. Event-type analysis indicates that the defensive strategy is the most appropriate when there are geopolitical shocks, wide-based risk-management when domestic incidents occur, military operations when flight-to-quality, and economic policy changes when measured adjustments are required. Portfolio managers ought to use dynamic allocation models by over allocating to FMCG when there is a geopolitical or military crisis, under allocating to IT and Pharma when the market is volatile, and using Banking to stabilize. Regulators are advised to implement real-time surveillance systems with the help of BAR to identify systemic risks early and implement sector-specific responses, such as trade policy into export-based industries such as IT and economy-wide responses to domestic shocks, designed by policy-makers. By and large, this study not only brings theoretical improvement but also provides adaptive risk management instruments that provide a basis of dynamic models in new market conditions.

REFERENCES

1 Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. 1969 . The adjustment of stock prices to new information. *In ternational Economic Review*, 10 1 , 1 21.

2 MacKinlay, A. C. 1997 . Event studies in economics and finance. *Journal of Economic Literature*, 35 1 , 13 39.

3 Kothari, S. P., & Warner, J. B. 2007 . Econometrics of event studies. In B. Espen Eckbo Ed. , *Handbook of Corporate Finance: Empirical Corporate Finance* (pp. 3 36 . Elsevier.

4 Bollerslev, T., Patton, A. J., & Quaedvlieg, R. 2018 . Modeling and forecasting (un) reliable realized covariances for more reliable financial decisions. *Journal of Econometrics*, 207 1 , 71 91.

5 Kumar, D., & Dhankar, R. S. 2017 . Market efficiency for national stock exchange in India: Neuro-genetic algorithm approach.*International Journal of Business and Economics*, 16 2 , 171 192.

6 Harvey, C. R. 1995 . Predictable risk and returns in emerging markets. *Review of Financial Studies*, 8 3, 773 816.

7 Bekaert, G., & Wu, G. 2000. Asymmetric volatility and risk in equity markets. *Review of Financial Studies*, 13 1, 1 42.

8 Acharya, V. V., & Pedersen, L. H. 2005. Asset pricing with liquidity risk. *Journal of Financial Economics*, 77 2 , 375 410.

9 Moskowitz, T. J., & Grinblatt, M. 1999 . Do industries explain momentum? *Journal of Finance*, 54 4 , 1249 1290.

10 Hou, K., & Robinson, D. T. 2006 . Industry concentration and average stock returns. *Journal of Finance*, 61 4, 1927 1956.

11 Guidolin, M., & Timmermann, A. 2008. International asset allocation under regime switching, skew, and kurtosis preferences.*Review of Financial Studies*, 21 2 , 889 935.

12 Sharpe, W. F. 1964 . Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance*, 19 3 , 425 442.

13 Thomas, B., & Subhashree, P. 2020 . Factors that influence financial literacy among engineering students. *Exploratory Factors Analysis for Academic Scholars*, 15 3 , 45 62.

14 Brau, J. C., Holmes, A. L., & Israelsen, C. L. 2019 . Financial literacy among college students: A comprehensive analysis.*Journal of Financial Education* , 45 2 , 123 145.

15 Ergun, K. 2017 . Financial literacy among university students: A study in eight European countries. *European Journal of Finance*, 23 4 , 567 589.