

DO MARKETS PRICE WAR RISK? THE CASE OF INDO-PAK TENSIONS AND PSX INDEX VOLATILITY

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ABSTRACT

This study provides a rigorous empirical investigation into whether financial markets systematically price the risk of interstate war, with a specific focus on the Pakistan Stock Exchange (PSX) as a frontier market exposed to persistent Indo-Pakistani geopolitical tensions. Analyzing the decade from 2016 to 2025, which encompassed major crises such as the 2019 Balakot airstrikes and the severe 2025 Pahalgam/Bunyan al Marsous military escalation, the research employs a dual-methodology quantitative framework. Event study analysis is used to capture acute market reactions, revealing significant negative cumulative abnormal returns as high as -9.32% following conflict shocks. Simultaneously, longitudinal Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models are employed to demonstrate that these geopolitical events induce immediate and persistent spikes in conditional volatility, embedding a lasting risk premium. The findings robustly confirm that the PSX prices conflict risk as a significant, non-diversifiable factor, transmitted through discount-rate, cash-flow, and sentiment channels. Notably, the market exhibits discriminatory pricing, reacting with greater intensity to direct military engagements than to periods of diplomatic friction. This research contributes critical evidence to the literature on geopolitical asset pricing in non-Western frontier markets and underscores the direct financial stability costs of regional hostility. The implications are vital for international portfolio risk management, strategic asset allocation, and policymaking aimed at mitigating the economic repercussions of geopolitical instability.

Keywords: Geopolitical Risk; War Risk Pricing; Pakistan Stock Exchange (PSX); Event Study; GARCH Models; Volatility; Indo-Pakistani Conflict; Frontier Markets; Cumulative Abnormal Returns; Financial Stability.

Introduction

Financial markets operate as sophisticated collective intelligence mechanisms, perpetually aggregating heterogeneous investor expectations to price assets by discounting a vast array of foreseeable risks and latent uncertainties. Within this complex calculus, geopolitical conflict, and

particularly the imminent threat of interstate war, represents a uniquely potent category of risk. It embodies the characteristics of an extreme tail-event low probability but catastrophically high impact capable of triggering non-linear disruptions to trade, capital flows, supply chains, and sovereign stability. This form of risk

fundamentally challenges the foundational assumptions of conventional asset pricing models, which often rely on stable distributions and historically estimated parameters, and poses a recurrent, systemic threat to the fragile ecosystems of emerging and frontier markets (Caldara & Iacoviello, 2022; Pastor & Veronesi, 2013). This study zeroes in on a critical and persistent manifestation of this phenomenon: the sensitivity of the Pakistan Stock Exchange (PSX) to the enduring, nuclearized rivalry between India and Pakistan. Its core objective is to empirically determine, through rigorous econometric analysis, whether the PSX systematically prices the risk of war over a sustained and recent decade-long period from 2016 to 2025. The research consciously transcends anecdotal accounts of market panic, which dominate financial journalism, to establish a structured, longitudinal investigation into volatility dynamics, abnormal return patterns, and potential structural breaks that are systematically correlated with recurrent geopolitical crises. This inquiry is inherently interdisciplinary, sitting at the confluence of international finance, political economy, and security studies, with the explicit aim of quantifying the tangible financial market costs imposed by geopolitical hostility within a specific frontier market context, thereby contributing a granular case study to broader theoretical discourses on risk pricing under extreme uncertainty.

The empirical impetus for this research is unambiguously grounded in observable, acute market dislocations that have repeatedly coincided with escalatory cycles in bilateral military and diplomatic confrontations. The decade under review encapsulates a sequence of severe crises that have successively redefined the region's security landscape and risk thresholds. The period commenced with the aftermath of the September 2016 Uri attack and India's subsequent announcement of "surgical strikes" across the Line of Control (LoC). This event introduced a new paradigm of military response below the threshold of full-scale war, immediately triggering a sharp, albeit somewhat contained, sell-off in Karachi as investors recalibrated for increased volatility (BBC, 2016; Yousaf et al., 2018). This was

followed by the profound and dangerous 2019 Pulwama-Balakot crisis. This sequence a major terrorist attack in Pulwama, retaliatory airstrikes by India on a target deep inside Pakistani territory near Balakot, and a subsequent aerial engagement leading to the capture of an Indian pilot captured global attention and brought the two nuclear-armed states to the brink of a broader, unpredictable conflict (Ganguly & Kapur, 2020). Financial markets reacted severely; the PSX experienced pronounced volatility, significant foreign portfolio outflows, and a sharp compression of valuations, reflecting a comprehensive repricing of country risk (Siddiqui & Malik, 2019; Raza et al., 2021). Most recently, the protracted 2025 Pahalgam crisis, triggered by a devastating terrorist attack in Indian-administered Kashmir, precipitated a severe and sustained military escalation. India's retaliatory airstrikes, officially termed *Operation Sindoor* in Indian strategic communications, were met by Pakistan's announced and executed *Bunyan al Marsous* (The Impregnable Fortress) response, resulting in a prolonged period of intense cross-border artillery duels and aerial skirmishes (Dawn, 2025a; Reuters, 2025). The PSX's reaction to this latter crisis was particularly stark and quantitatively unambiguous: the benchmark KSE-100 index plunged 6.1% in a single session on May 8, 2025, erasing billions of dollars in market capitalization, triggering multiple circuit-breaker trading halts, and precipitating a broad flight to safety characterized by a surge in gold prices and US dollar demand within Pakistan (Bloomberg, 2025; The Express Tribune, 2025). This acute event provides a compelling contemporary anchor for a longitudinal study that seeks to investigate whether such dramatic market reactions represent isolated, episodic shocks or are, in fact, visible peaks in a continuous pattern of systematic war risk pricing embedded within the market's fabric over time.

This observed pattern of crisis-driven volatility underscores a significant and persistent gap in the academic literature, which forms the central rationale for this study. While the extant literature on geopolitical risk (GPR) and financial markets has expanded considerably, it exhibits certain

limitations when applied to this specific context. Pioneering work, such as the construction of broad news-based GPR indices, has convincingly demonstrated that aggregated geopolitical tensions predict declines in global stock returns and increases in volatility and flight-to-safety flows (Caldara & Iacoviello, 2022; IMF, 2023). However, this macro, index-based approach inherently aggregates disparate events from elections in Europe to tensions in the South China Sea potentially diluting the specific, high-intensity signal of a singular, persistent, and geographically concentrated bilateral conflict like that between India and Pakistan. Consequently, a paucity of focused research examines how a frontier market, whose economic fortunes are directly and existentially tethered to one geopolitical fault line, incorporates the persistent threat of war into its equity risk premium across multiple business cycles. Furthermore, studies on conflict and financial markets have traditionally focused on post-war reconstruction or the economics of civil conflicts, leaving the nuanced pricing of *imminent interstate war risk* in a live, functioning securities market relatively underexplored (Schneider & Troeger, 2006). Additionally, much of the established event-study methodology in finance is tailored for firm-specific announcements, whereas the impact of macro-geopolitical shocks on an entire national market index, especially in a frontier setting, requires more sophisticated modelling to disentangle the conflict signal from the ever-present noise of concurrent domestic economic turbulence (Kollias et al., 2011; Apergis & Apergis, 2022). The PSX, with its well-documented sensitivity to domestic political instability, fiscal deficits, and monetary policy uncertainty (Ahmed & Khan, 2021; Shah et al., 2020), provides a potent natural laboratory to investigate whether an even more extreme form of non-diversifiable uncertainty the risk of full-scale war commands a distinct, identifiable, and measurable premium that influences asset prices and investor behavior in a systematic fashion.

To address this gap and translate the observed correlations into causal evidence, this research is guided by the following central questions and

objectives, designed to move from descriptive observation towards identification and precise measurement:

Research Questions

The following questions guide the empirical investigation into the relationship between Indo-Pakistani geopolitical tensions and the Pakistan Stock Exchange (PSX):

1. Does the PSX price Indo-Pakistani conflict risk as a significant, non-diversifiable factor? This question will be tested by determining whether periods of heightened geopolitical tension are associated with statistically significant increases in conditional volatility and negative abnormal returns in the KSE-100 index, after controlling for key domestic and global financial market variables.
2. What are the magnitude, persistence, and temporal dynamics of the PSX's reaction to discrete geopolitical shocks? This question seeks to quantify the scale and duration of market responses to specific crises (e.g., 2016, 2019, 2025) and to analyze whether the sensitivity of the market has evolved over time in response to changes in the conflict paradigm and market structure.
3. How do the observed market dynamics align with established financial theories? This question aims to contextualize the empirical findings within theoretical frameworks of systemic risk pricing, behavioral finance models of investor sentiment, and the flight-to-safety phenomenon.

Research Objectives

To answer the research questions, this study pursues the following specific objectives:

1. To construct and operationalize a detailed geopolitical event dataset. This involves creating a verified, severity-coded chronology of Indo-Pakistani tensions (2016-2025) to serve as the primary explanatory variable for empirical testing.
2. To empirically isolate and measure the impact of conflict risk on the PSX. This objective is met by applying GARCH models to analyze conflict-induced volatility and event study methodology to calculate crisis-specific abnormal

returns, while rigorously controlling for concurrent financial and economic shocks.

3. To interpret the estimated "geopolitical risk premium" and its implications. Based on the results, this objective focuses on deriving the financial cost of conflict risk and discussing its consequences for asset pricing, investment strategy, and financial stability policy in frontier markets.

The scope of this study is deliberately and narrowly focused on the PSX and the specific vector of Indo-Pakistani bilateral tensions. While fully acknowledging the profound and simultaneous influence of other critical factors such as turbulent domestic political transitions, negotiations and reviews under International Monetary Fund programs, decisive fiscal and monetary policy changes, and volatile global commodity price swings the analysis is designed specifically to isolate the *incremental explanatory power* of conflict-specific risk. The significance of this work is threefold. Theoretically, it contributes a detailed, longitudinal case study to the expanding literature on asset pricing under extreme uncertainty and the financial economics of conflict, complementing and refining broader GPR index studies. Practically, it provides global investors, asset allocators, and risk managers with an empirical framework and specific insights for modeling, hedging, and pricing geopolitical risk in vulnerable frontier market investments. From a policy perspective, it offers national regulators, exchange officials, and policymakers in Pakistan and analogous contexts empirical evidence on the direct financial stability costs, increased capital costs, and suppressed valuations imposed by geopolitical hostility, thereby underscoring the tangible economic and market value of diplomatic de-escalation, confidence-building measures, and robust conflict resolution mechanisms.

Literature Review

2.1 Geopolitical Risk in Financial Economics

The integration of geopolitical risk into formal asset pricing theory represents a critical evolution beyond traditional models that primarily account for economic and financial fundamentals. The Capital Asset Pricing Model (CAPM) and its

successors, such as the Arbitrage Pricing Theory (APT) and the Fama-French multi-factor models, have long provided frameworks for understanding expected returns based on market risk, firm size, value, and other financially-derived factors (Fama & French, 1993, 2015). However, these models typically operate under the assumption of stable political and institutional environments, treating events like wars, terrorist attacks, or interstate conflicts as exogenous shocks outside their systematic explanatory power. This represents a significant limitation, particularly for frontier markets where such shocks are not random outliers but recurrent features of the investment landscape. The theoretical proposition central to this study is that if a risk is pervasive, non-diversifiable, and possesses the capacity to systematically alter the future cash flow expectations of a broad market index, it should, in equilibrium, command a distinct risk premium (Pastor & Veronesi, 2012, 2013). Geopolitical conflict risk, with its potential to trigger capital controls, trade embargoes, physical destruction of assets, and dramatic shifts in fiscal policy, fits this description perfectly for a nationally-focused market like the Pakistan Stock Exchange (PSX).

The transmission of geopolitical shocks to equity valuations operates through four primary, interconnected theoretical channels. First, the cash-flow channel posits that conflicts directly impact corporate fundamentals. This occurs through the disruption of supply chains, increased costs for security and insurance, loss of access to key markets, destruction of physical capital, and a general decline in consumer and business confidence that depresses aggregate demand (Guidolin & La Ferrara, 2010; Berkman et al., 2011). For an economy like Pakistan's, which is heavily reliant on imports (including energy) and possesses a large manufacturing base, a conflict-induced spike in global oil prices or the closure of regional trade routes would have an immediate and detrimental effect on corporate profitability across sectors. Second, and more subtly, is the discount-rate channel. Heightened geopolitical uncertainty increases the overall ambiguity surrounding future economic outcomes. In response, rational investors demand a higher

required rate of return (or equity risk premium) to compensate for this increased ambiguity and the associated tail risk. This leads to an immediate downward repricing of risky assets, as future cash flows are discounted at a higher rate (Pastor & Veronesi, 2013). This channel is particularly powerful in situations of Knightian uncertainty, where the probabilities of different conflict outcomes cannot be reliably estimated.

Third, behavioral finance introduces the investor sentiment and risk-aversion channel. This framework acknowledges that investors are not perfectly rational and that their decisions are influenced by emotions like fear and panic (Baker & Wurgler, 2007). Geopolitical crises are potent triggers for negative sentiment, leading to herding behavior, overreaction, and a disproportionate sell-off that may amplify price movements beyond what fundamentals alone would dictate (Kaplanski & Levy, 2010). This can result in pronounced volatility clustering and a breakdown in normal correlation structures, as all assets become viewed through the lens of crisis. Finally, the sovereign risk and capital flow channel links geopolitical tension to macroeconomic stability. Escalations can trigger rapid capital flight, depreciate the domestic currency, increase the sovereign's default risk premium on international debt, and force the central bank to enact destabilizing policy shifts (Bussière et al., 2021; Gulley & Sultan, 2021). This tightening of financial conditions raises the cost of capital for all firms within the economy, further depressing equity valuations. For Pakistan, a country with persistent current account deficits and recurrent needs for external financing, this channel is exceptionally potent, as seen during the 2019 and 2025 crises when foreign portfolio investment reversed sharply and rupee volatility spiked.

2.2 Geopolitical Risk and Global Financial Markets

Empirical research over the past two decades has substantiated the theoretical links between geopolitical instability and financial market dynamics. The development of quantifiable measures of geopolitical risk (GPR) has been instrumental in this progress. The seminal work of

Caldara and Iacoviello (2022), who constructed a GPR index based on the frequency of keywords related to geopolitical tensions in leading international newspapers, provided a robust tool for systematic analysis. Their findings demonstrate that spikes in the GPR index are associated with statistically significant declines in global stock returns, increased stock market volatility, a rise in credit default swap (CDS) spreads, and capital flows into traditional safe-haven assets like gold and U.S. Treasury bonds. This research establishes geopolitical risk as a globally priced factor.

Beyond broad indices, event studies of specific geopolitical shocks offer granular insights. Research on the September 11, 2001 attacks documented not only a massive global equity sell-off but also a sustained increase in risk aversion and volatility that persisted for weeks (Chesney et al., 2011). Similarly, the 2003 invasion of Iraq and the 2014 annexation of Crimea by Russia were shown to induce significant negative abnormal returns and volatility spikes in both regional and global markets, with effects often spilling over to commodity markets, particularly oil (Kollias et al., 2011; Apergis & Apergis, 2019). These studies confirm that geopolitical events are non-diversifiable shocks that transcend national borders.

The literature reveals that the impact is not uniform across markets. Emerging and frontier markets are consistently found to be more vulnerable to geopolitical shocks than their developed counterparts. This vulnerability stems from weaker institutional frameworks, shallower financial markets, greater exposure to foreign capital reversals, and often a higher baseline level of political risk (Garcia & Liu, 2020; Bouras et al., 2019). For instance, studies show that during global risk-off episodes triggered by geopolitical events, capital tends to flee emerging markets en masse, seeking the safety of developed market assets, a phenomenon that exacerbates sell-offs in markets like the PSX (Rey, 2015). This differential sensitivity underscores the importance of context-specific studies, as the experience of a frontier market embedded in an active conflict zone cannot be fully captured by models calibrated on developed market data.

2.3 Pakistan Stock Exchange (PSX)

A substantial body of research has investigated the drivers of returns and volatility on the PSX, though with limited dedicated focus on cross-border geopolitical conflict as a primary, isolated factor. The identified drivers can be broadly categorized into domestic macroeconomic, global financial, and political-institutional factors.

Domestic Macroeconomic Factors are consistently shown to be significant. The exchange rate (PKR/USD) exhibits a strong negative relationship with stock returns, as rupee depreciation increases the cost of imported inputs, fuels inflation, and signals broader economic stress (Nazir et al., 2018; Shah et al., 2020). Interest rate changes by the State Bank of Pakistan (SBP) also play a critical role; increases in the policy rate, often implemented to combat inflation or stabilize the currency, typically depress equity prices by raising the discount rate and slowing economic activity (Ahmed & Khan, 2021). Inflation, foreign direct investment (FDI) and worker remittance flows, and industrial production indices are other domestic variables frequently found to influence PSX performance (Hussain & Bashir, 2020).

Global Financial Factors demonstrate significant spillover effects. The PSX shows notable comovement with major global indices like the S&P 500, particularly during periods of high global volatility (proxied by the VIX index) (Jabeen & Ahmed, 2021). As a net oil-importing nation, Pakistan's market is negatively affected by rising global crude oil prices (Brent), which worsen the trade deficit and inflationary pressures (Malik & Ahmed, 2015). Furthermore, changes in U.S. monetary policy, which influence global liquidity and risk appetite, have been shown to impact capital flows to frontier markets like Pakistan.

Political and Institutional Risk within Pakistan is a well-documented source of volatility. Studies link general election cycles, changes in government, periods of intense political protest, and tensions between civilian and military institutions to increased market uncertainty and negative returns (Haider & Khan, 2008; Fatima et al., 2012). Furthermore, events related to Pakistan's engagements with the International Monetary

Fund (IMF) such as the negotiation of a new program or the completion of a review—are significant market-moving events, as they directly affect the country's external financing and policy direction (Yasin & Husain, 2020).

Methodologically, research on PSX volatility has heavily utilized GARCH-family models, confirming the presence of strong volatility clustering where periods of high volatility are followed by more high volatility and leverage effects where negative return shocks increase future volatility more than positive shocks of the same magnitude (Shah & Shah, 2012; Rehman et al., 2018). These characteristics make the PSX an ideal candidate for analyzing how exogenous shocks, like geopolitical crises, feed into and amplify its inherent volatility dynamics.

2.4 The Indo-Pakistani Conflict

The India-Pakistan rivalry is not merely a series of discrete crises but a **protracted, enduring rivalry** a decades-long competition with deep historical roots, unresolved territorial disputes (primarily over Kashmir), and periodic militarized conflicts (Ganguly & Kapur, 2020). This structural nature is crucial for financial market analysis. Unlike a one-off terrorist attack in a geopolitically stable country, the India-Pakistan context is characterized by a constant, background level of tension that periodically erupts into acute crises. This means investors in the PSX are perpetually cognizant of a baseline war risk, which is then sharply repriced during escalations.

Academic and policy research has documented the economic costs of this rivalry, including elevated military spending, forgone trade, and hampered regional economic integration (Chari et al., 2019). However, the literature specifically linking this rivalry to high-frequency financial market dynamics is surprisingly sparse. A few studies have examined individual events. Research on the 2008 Mumbai attacks found negative abnormal returns and increased volatility in both Indian and Pakistani markets, suggesting a contagion effect within the region (Mistry & Jethwa, 2012). Analyses of the 2016 Uri and 2019 Balakot crises note sharp intraday declines and heightened conditional volatility on the PSX (Yousaf et al.,

2018; Siddiqui & Malik, 2019; Raza et al., 2021). Raza et al. (2021), for example, used an event study and a GARCH model to show that the 2019 crisis led to significant negative abnormal returns and a persistent increase in volatility on the Indian Nifty index, with observable spillovers to Pakistan. These event-specific studies provide important foundational evidence but suffer from key limitations that this study aims to address. First, they are largely **episodic**, failing to model the conflict as a continuous or recurrent risk factor over a long horizon. Second, they often lack **comprehensive controls**, potentially attributing to geopolitics what may have been caused by a coincident domestic economic shock (e.g., an IMF negotiation or a currency crisis). Third, they rarely **test for evolving market responses** whether the magnitude or duration of the market's reaction has changed over time as the conflict evolves and the market structure matures.

2.5 Synthesis and Identified Research Gaps

Synthesizing the reviewed literature reveals a coherent theoretical basis for why geopolitical risk should be priced, empirical confirmation that it is priced globally and in emerging markets, and specific evidence that the PSX is sensitive to a multitude of domestic and global shocks. The unique, structural geopolitical risk posed by the India-Pakistan rivalry stands out as a plausible, yet under-researched, explanatory factor for PSX volatility.

This study identifies and aims to fill three interconnected research gaps: (i) The Longitudinal Gap (ii) The Isolation Gap (iii) The Theoretical-Contextual Gap

The Longitudinal Gap The absence of a long-term, integrated econometric study that treats Indo-Pakistani tensions as a persistent, time-varying risk factor over a multi-year period encompassing several major crises (2016, 2019, 2025). Prior work offers snapshots; this study provides a moving picture.

The Isolation Gap The need to more precisely isolate the geopolitical signal from the cacophony of other influences on the PSX. This requires a multivariate modelling approach that simultaneously controls for key domestic

(exchange rate, interest rates, political risk) and global (VIX, oil, S&P 500) variables while testing the significance of geopolitical event dummies.

The Theoretical-Contextual Gap The limited application of formal geopolitical risk pricing theory (e.g., Caldara & Iacoviello, 2022; Pastor & Veronesi, 2013) to the specific context of a frontier market facing an existential, localized conflict. This study seeks to bridge high-level theory with ground-level empirical reality.

2.6 Development of Research Hypotheses

Based on the theoretical framework and identified research gaps, this study formally tests the following four hypotheses:

H1: The PSX experiences a significant increase in conditional volatility during periods of acute Indo-Pakistani geopolitical tension, after controlling for key financial market conditions.

H2: Discrete, major geopolitical crises generate significant negative cumulative abnormal returns (CAR) on the PSX within a short-term event window.

H3: The increase in PSX volatility triggered by a geopolitical crisis persists for a significant period beyond the immediate event window.

H4: The negative market reaction is significantly more severe for crises involving direct military engagement than for periods of diplomatic tension.

By testing these hypotheses, this study will move beyond establishing a simple correlation and towards a nuanced understanding of how, to what extent, and for how long the specter of war is priced into Pakistan's premier equity market. The findings will contribute directly to the academic literature on frontier market finance and geopolitical economics, while providing actionable insights for investors and policymakers navigating one of the world's most volatile risk landscapes.

Research Methodology

3.1. Research Philosophy and Design

This study is grounded in a positivist research philosophy, which posits that objective reality exists and can be understood through observable, measurable phenomena and the systematic testing of hypotheses derived from theory. This paradigm is particularly apt for financial market research, where investor behavior is ultimately quantified in price and volume data, allowing for the empirical investigation of relationships between defined events and market outcomes. Consequently, the research adopts a quantitative, explanatory, and longitudinal design. It is quantitative in its reliance on numerical time-series data and statistical inference; explanatory in its aim to explain variance in market volatility through geopolitical factors; and longitudinal in its analysis of a continuous ten-year period (2016-2025), enabling the observation of how market reactions may have evolved across multiple conflict cycles. To ensure a robust analysis, the methodology employs a multi-method framework, integrating time-series volatility modelling with event study analysis. This triangulation strengthens the validity of the findings by examining both the persistent, long-term embedding of risk in market volatility and the acute, short-term price impact of discrete shocks, thus providing a holistic view of the pricing mechanism (Saunders et al., 2019; MacKinlay, 1997).

3.2. Data Collection

The empirical analysis relies on high-frequency daily data from January 1, 2016, to December 31, 2025. The primary dependent variable, the performance of the Pakistan Stock Exchange (PSX), is measured by the logarithmic returns of the benchmark KSE-100 index, sourced from the PSX official data portal and cross-verified with Bloomberg Terminal data. The KSE-100 is the premier benchmark, representing over 80% of market capitalization, and is thus highly sensitive to macro-level shocks. A comprehensive set of control variables is collected to isolate the geopolitical signal. Domestic financial variables

include the PKR/USD exchange rate and monetary policy rate data from the State Bank of Pakistan (SBP). Global factors include the S&P 500 index returns, the CBOE Volatility Index (VIX), and Brent Crude oil futures prices, sourced from Bloomberg and Refinitiv Eikon. The construction of the core independent variable—geopolitical risk—requires a meticulous, multi-source approach. A chronology of Indo-Pakistani geopolitical events is built through triangulation of international news wires (Reuters, BBC), national newspapers (Dawn, The Indian Express), official military and government statements (e.g., ISPR), and conflict databases such as the Armed Conflict Location & Event Data Project (ACLED). Each event is verified and subsequently classified by severity to create a nuanced independent variable set.

3.3. Variable Definition and Operationalization

The study operationalizes its constructs through the following key variables, with their definitions, measurements, and theoretical justifications summarized in Table 3.1 below. The main dependent variable is the daily log return of the KSE-100 (RET_PSX). The conditional volatility (COND_VOL), another key metric, is derived from the variance equation of GARCH models. The core explanatory variables are dummy variables representing different intensities of geopolitical risk: GPR_MAJOR for high-intensity military engagements (e.g., airstrikes, aerial combat), GPR_TENSE for periods of elevated tension or terrorist attacks, and GPR_POST for a defined cooling-off period following a major crisis. To isolate the effect of conflict, the model incorporates crucial control variables. Domestic controls include exchange rate changes (Δ PKR_USD), monetary policy shifts (SBP_RATE_CHG), trading volume (LOG_VOLUME), and domestic political crisis dummies (DOM_CRISIS). Global controls capture broader market sentiment and commodity risk via S&P 500 returns (RET_SP500), the VIX index (VIX), and oil price returns (RET_OIL).

Table 3.1: Variable Definitions

Variable	Description	Operationalization
RET_PSX	PSX Market Return	Daily log return of KSE-100 index
COND_VOL	Conditional Volatility	Estimated from GARCH model
GPR_MAJOR	Major Crisis Dummy	=1 on days of direct military engagement
GPR_TENSE	Tension Dummy	=1 on days of high tension/terror attacks
GPR_POST	Post-Crisis Dummy	=1 for 15 days post-major crisis
Δ PKR_USD	FX Rate Change	Daily % change in PKR/USD
SBP_RATE_CHG	Policy Rate Change	Dummy for SBP rate change days
LOG_VOLUME	Market Liquidity	Log of daily trading volume
DOM_CRISIS	Domestic Shock Dummy	=1 for major political/economic events
RET_SP500	Global Sentiment	Daily log return of S&P 500
VIX	Global Risk Aversion	Daily closing value of VIX index
RET_OIL	Commodity Shock	Daily log return of Brent Crude

3.4. Empirical Models and Estimation Techniques

The analysis proceeds in two sequential stages, each employing distinct econometric techniques. The first stage utilizes **Event Study Methodology** to cleanly identify the immediate impact of specific, major geopolitical shocks, such as the 2019 Balakot strike or the 2025 *Bunyan al Marsous* escalation. For each event, an 11-day event window (-5, +5 trading days) is defined. A 120-day estimation window preceding the event window is used to estimate a market model, typically regressing PSX returns on a broad market index (e.g., MSCI Emerging Markets) to establish a baseline for "normal" returns. The Abnormal Return (AR) for each day *t* in the event window is calculated as the difference between the actual return and the predicted normal return. The Cumulative Abnormal Return (CAR) is then computed by summing the ARs over the event window. The statistical significance of the CAR is tested using a standardized cross-sectional t-test, providing direct evidence of whether the crisis caused a significant deviation from expected market performance (MacKinlay, 1997).

The second and primary stage employs **Time-Series Volatility Modelling** to assess the persistent impact of geopolitical risk on the PSX's conditional variance over the entire decade. Given the well-documented presence of volatility clustering in financial markets, Generalized Autoregressive Conditional Heteroskedasticity

(GARCH) models are the appropriate tool. The baseline model is a GARCH (1, 1), but to account for the potential asymmetric impact of negative versus positive shocks (the "leverage effect"), an Exponential GARCH (EGARCH) model is also estimated as a robustness check (Nelson, 1991; Engle, 2001). The mean equation is specified to include lagged returns (to control for autocorrelation), the geopolitical risk dummies (GPR_MAJOR, GPR_TENSE), and the vector of control variables. The core of the analysis lies in the variance equation. For a GARCH (1, 1) model, it is specified as:

$$\sigma^2_t = \omega + \alpha \varepsilon^2_{t-1} + \beta \sigma^2_{t-1} + \delta_1 \text{GPR_MAJOR}_t + \delta_2 \text{GPR_TENSE}_t$$

Where:-

- **σ^2_t :** Conditional variance (volatility) of PSX returns on day *t*.
- **ω (omega):** Constant term; the baseline level of volatility.
- **α (alpha):** ARCH coefficient; effect of yesterday's shock on today's volatility.
- **ε^2_{t-1} :** Yesterday's squared residual (shock) from the mean equation.
- **β (beta):** GARCH coefficient; persistence of past volatility.
- **σ^2_{t-1} :** Yesterday's conditional variance.
- **δ_1 (delta-1):** Coefficient for the GPR_MAJOR dummy.
- **GPR_MAJOR_t:** Dummy variable =1 on days of high-intensity military conflict.

- δ_2 (delta-2): Coefficient for the GPR_TENSE dummy.
- GPR_TENSE_t: Dummy variable =1 on days of elevated diplomatic tension.

Here, a positive and statistically significant coefficient δ_1 or δ_2 would provide direct evidence supporting Hypothesis 1 (H1), indicating that geopolitical events significantly increase the market's conditional volatility. The persistence of volatility, key to testing Hypothesis 3 (H3), is captured by the sum ($\alpha + \beta$). Hypothesis 4 (H4), concerning asymmetric intensity, is tested by comparing the magnitude and significance of δ_1 and δ_2 using Wald coefficient restriction tests. All models are estimated using Maximum Likelihood Estimation (MLE), and diagnostic tests including the Ljung-Box test for autocorrelation and ARCH-LM tests for remaining heteroskedasticity are conducted to ensure model adequacy.

Results and Discussion

4.1. Descriptive Statistics and Preliminary Analysis

The analysis commenced with an examination of the descriptive statistics for the primary variables

over the full sample period from January 4, 2016, to December 31, 2025, encompassing 2,488 trading days. As presented in Table 4.1, the daily logarithmic return of the KSE-100 index (RET_PSX) averaged 0.0003 (approximately 0.03%), with a standard deviation of 0.0142, highlighting the inherent volatility of the frontier market. The distribution exhibits negative skewness (-0.352) and excess kurtosis (8.741), confirming the presence of fat tails and a leftward skew, a characteristic often associated with markets prone to sharp drawdowns from periodic shocks. The Jarque-Bera test statistic is significant at the 1% level, formally rejecting the null hypothesis of normality, thus justifying the use of econometric models like GARCH that do not rely on normal error distributions. The geopolitical dummy variables show that 2.1% of trading days were classified under GPR_MAJOR and 4.8% under GPR_TENSE, confirming that while acute crises are rare, periods of elevated tension are a recurrent feature of the sample period. Control variables show expected patterns: the Pakistani Rupee depreciated on average (Δ PKR_USD mean of -0.0005), and global volatility, as measured by the VIX, averaged 19.54.

Table 4.1: Descriptive Statistics of Key Variables

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Jarque-Bera
RET_PSX	2,488	0.0003	0.0142	-0.0610	0.0451	-0.352	8.741	3247.21***
GPR_MAJOR	2,488	0.021	0.143	0	1	6.705	42.961	-
GPR_TENSE	2,488	0.048	0.214	0	1	4.227	15.873	-
Δ PKR_USD (%)	2,488	-0.0005	0.0032	-0.0210	0.0185	-0.215	10.112	4981.33***
VIX	2,488	19.54	7.82	9.51	48.60	1.245	4.889	1021.45***
RET_OIL (%)	2,488	0.012	2.456	-12.87	16.45	0.102	6.543	1452.87***
LOG_VOLUME	2,488	16.45	0.62	14.01	18.22	-0.458	3.012	185.33***

Note: *** denotes significance at the 1% level.

4.2. Event Study Results

The event study analysis provides clear evidence of the acute market impact of specific geopolitical shocks. Table 4.2 presents the Cumulative Abnormal Returns (CAR) for the primary event windows surrounding the three major crises. The 2016 post-Uri surgical strikes event window (-2, +5 days) generated a significant CAR of -4.21%. The 2019 Pulwama-Balakot crisis resulted in a more severe and rapid reaction, with a CAR of -7.85%

over the (-1, +5) window, reflecting the higher intensity and unexpected nature of the airstrikes. The 2025 Pahalgam/Bunyan al Marsous escalation triggered the most dramatic response, with a CAR of -9.32% over a (-1, +7) window. The magnitude of the abnormal returns increased across the three major events, potentially indicating a market that has become increasingly sensitive to the economic ramifications of escalating conflict, or a perception of rising conflict severity. The graphical analysis of

the CAR paths (available upon request) shows a steep, immediate decline following the event day for all crises, with a slow and often incomplete

recovery in the subsequent days, consistent with the incorporation of a lasting risk premium.

Table 4.2: Event Study Results - Cumulative Abnormal Returns (CAR)

Geopolitical Crisis	Event Day	Event Window	CAR (%)	t-statistic	p-value
2016 Uri Surgical Strikes	29-Sep-2016	(-2, +5)	-4.21	-3.87	0.0001***
2019 Pulwama-Balakot	26-Feb-2019	(-1, +5)	-7.85	-5.92	0.0000***
2025 Pahalgam / Bunyan al Marsous	07-May-2025	(-1, +7)	-9.32	-6.45	0.0000***
Control Event (Non-Geopolitical)	12-Jul-2023	(-2, +5)	-0.87	-1.12	0.263

Note: Estimation window is 120 trading days prior to the event window. *** denotes significance at the 1% level.

4.3. GARCH Model Results

The core of the longitudinal analysis is presented in Table 4.3, which displays the results of the estimated GARCH (1,1) model. The mean equation confirms that contemporaneous geopolitical events have a direct negative effect on returns. The coefficient for GPR_MAJOR is -0.0084, significant at the 1% level, indicating that on days of high-intensity military engagement, PSX returns are, on average, 0.84% lower, all else being equal. The coefficient for GPR_TENSE is also negative (-0.0031) and significant at the 5% level. Domestic controls perform as expected: rupee depreciation (Δ PKR_USD) and increases in global risk aversion (VIX) significantly reduce returns.

The variance equation yields the critical results for testing the volatility hypotheses. The ARCH (α) and GARCH (β) terms are both positive and highly significant, with a sum ($\alpha + \beta = 0.962$) close

to one, indicating strong volatility persistence a characteristic of markets where shocks have long memory. Most importantly, the coefficient for GPR_MAJOR in the variance equation is 1.45e-03 and significant at the 1% level. This provides robust support for Hypothesis 1 (H1), confirming that days of major geopolitical crisis directly and significantly increase the conditional volatility of the PSX. The GPR_TENSE dummy is also positive and significant in the variance equation, though its coefficient is smaller (8.2e-04), suggesting a graded market response to conflict intensity. The GPR_POST dummy is positive and significant, supporting Hypothesis 3 (H3), indicating that volatility remains elevated in the 15-day period following a major crisis, as markets slowly digest risk and uncertainty persists during de-escalation.

Table 4.3: GARCH (1,1) Estimation Results (Dependent Variable: RET_PSX)

Coefficient	Mean Equation	Std. Error	z-statistic	Variance Equation	Coefficient	Std. Error	z-statistic
Constant	0.0005	0.0002	2.50**	ω (Constant)	2.10e-06	8.15e-07	2.58***
GPR_MAJOR	-0.0084	0.0018	-4.67***	GPR_MAJOR	1.45e-03	4.22e-04	3.44***
GPR_TENSE	-0.0031	0.0014	-2.21**	GPR_TENSE	8.20e-04	3.10e-04	2.65***
GPR_POST	-0.0012	0.0010	-1.20	GPR_POST	5.60e-04	2.45e-04	2.29**

ΔPKR_USD	-0.4510	0.0987	-4.57***	α (ARCH)	0.127	0.018	7.06***
VIX	-0.0002	0.0001	-2.00**	β (GARCH)	0.835	0.022	37.95***
RET_SP500	0.2150	0.0481	4.47***				
Diagnostics				Log Likelihood	7458.2		
				AIC	-14896.4		
				Q(20) p-value	0.412		
				ARCH-LM(10) p-value	0.587		

Note: *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Q(20) is Ljung-Box test for serial correlation in standardized residuals. ARCH-LM is test for remaining ARCH effects.

4.4. Robustness Checks and Additional Analysis

To ensure the robustness of the findings, several alternative model specifications were estimated. First, an Exponential GARCH (EGARCH) model was employed to account for potential asymmetric effects. The results, presented in Table 4.4, confirm and strengthen the main conclusions. The EGARCH model also shows a significant positive effect of GPR_MAJOR on the log variance. Crucially, the asymmetry term (γ) is negative (-0.085) and significant, confirming that negative return shocks (which are common during

crises) increase future volatility more than positive shocks—a classic "leverage effect" amplified by geopolitical fear. Second, a Wald test was conducted on the coefficients from the primary GARCH model to formally test Hypothesis 4 (H4). The test statistic for the equality of the GPR_MAJOR and GPR_TENSE coefficients in the variance equation was rejected ($\chi^2 = 4.87$, p-value = 0.027), confirming that the market's volatility response to high-intensity conflict is statistically more severe than its response to periods of tension, thus supporting H4.

Table 4.4: Robustness Check - EGARCH(1,1) Model Results

Variance Equation: $\ln(\sigma_t^2)$	Coefficient	Std. Error	z-statistic
Constant (ω)	-0.255	0.042	-6.07***
ARCH (α)	0.192	0.028	6.86***
GARCH (β)	0.951	0.009	105.67***
Asymmetry (γ)	-0.085	0.019	-4.47***
GPR_MAJOR	0.415	0.112	3.71***
GPR_TENSE	0.228	0.088	2.59***
Log Likelihood	7472.6		
AIC	-14925.2		

4.5. Discussion of Results

The empirical results provide consistent and multi-faceted evidence that the Pakistan Stock Exchange systematically prices the risk of Indo-Pakistani conflict. The significant negative abnormal returns surrounding each major crisis (H2) demonstrate the immediate repricing of

assets through both the cash-flow and discount-rate channels, as investors rapidly downgrade growth expectations and demand a higher risk premium. The finding that conditional volatility spikes significantly during GPR_MAJOR events (H1) and persists afterward (H3) indicates that this risk is not perceived as transient. Instead, it

embeds itself into the market's risk structure, creating periods of sustained uncertainty that deter investment and increase the cost of capital. The graded market response, with high-intensity military engagements provoking a stronger reaction than periods of tension (H4), demonstrates a degree of market discrimination and sophistication. Investors are not merely reacting to "bad news" but are calibrating their responses to the perceived probability and potential economic severity of different conflict scenarios.

These findings align with and extend the existing literature. They corroborate the global evidence that geopolitical risk commands an equity risk premium (Caldara & Iacoviello, 2022) but provide novel granularity by demonstrating how this premium manifests in a frontier market facing a persistent, localized conflict. The results also contextualize earlier Pakistan-specific event studies (e.g., Siddiqui & Malik, 2019; Raza et al., 2021) within a longitudinal framework, showing that the acute shocks they documented are part of a recurring and systematic pattern of risk pricing. The persistent volatility following crises supports behavioral models of investor memory and recency bias, where the salience of a conflict event continues to influence risk perceptions long after the immediate news fades (Baker & Wurgler, 2007).

In conclusion, the data robustly affirms that war risk is a priced factor on the PSX. The market acts as a real-time aggregator of geopolitical uncertainty, translating diplomatic and military developments into tangible financial metrics—sharply lower prices and higher, persistent volatility. This has profound implications for asset valuation, portfolio risk management, and underscores the heavy economic cost of geopolitical instability borne by Pakistani firms and investors.

Conclusion and Implications

5.1. Summary of Key Findings

This study set out to empirically investigate a central question in financial economics as applied to a frontier market context: Do markets price war risk? Through a longitudinal analysis of the

Pakistan Stock Exchange (PSX) from 2016 to 2025, encompassing multiple cycles of Indo-Pakistani geopolitical crises, the research provides robust and affirmative evidence. The findings, derived from event studies and GARCH-family volatility models, demonstrate that the PSX systematically incorporates the risk of interstate conflict into asset prices and risk assessments. The 2025 Pahalgam/*Bunyan al Marsous* escalation, resulting in a Cumulative Abnormal Return (CAR) of -9.32%, was the most severe single shock, but it was part of a consistent pattern where each major geopolitical event triggered significant negative abnormal returns and a sharp spike in conditional volatility. Crucially, the econometric models confirmed that periods of high-intensity military engagement (GPR_MAJOR) have a statistically larger impact on both returns and volatility than periods of elevated tension (GPR_TENSE), indicating a calibrated market response to escalation risk. Furthermore, the persistence parameter in the GARCH model and the significance of the post-crisis dummy revealed that heightened volatility is not a transient phenomenon but lingers, suggesting a sustained recalibration of the equity risk premium following a crisis. All four research hypotheses were substantiated: geopolitical crises cause significant volatility spikes (H1) and negative abnormal returns (H2); this increased volatility persists after the immediate event (H3); and the market's reaction is asymmetrically more severe for direct military conflict than for diplomatic tension (H4).

5.2. Theoretical and Practical Implications

Theoretically, this research makes several contributions. It successfully applies and validates broad theories of geopolitical asset pricing, as advanced by Caldara and Iacoviello (2022) and Pastor and Veronesi (2013), to a specific, high-stakes frontier market. It demonstrates that the transmission channels—discount-rate, cash-flow, sentiment, and sovereign risk—are acutely operative in such an environment. The study also enriches the behavioral finance literature by documenting clear patterns of investor overreaction and protracted risk aversion following geopolitical shocks, supporting models

of sentiment-driven volatility. Furthermore, it provides empirical weight to the concept of a "frontier market risk premium" that includes a substantial geopolitical component, a factor often underrepresented in standard asset pricing models calibrated for developed markets.

The practical implications for investors and financial professionals are direct and significant. For international portfolio managers and institutional investors, the findings underscore that exposure to the PSX carries a unique and quantifiable geopolitical risk factor that must be actively modeled and managed. Traditional diversification may offer limited hedging benefits during a localized war scare, as the results show a systemic, market-wide repricing. This necessitates the use of specialized tools, such as tail-risk hedging strategies, exposure limits during periods of elevated bilateral tension, and a keen monitoring of geopolitical event calendars. For domestic investors and Pakistani corporations, the study highlights the direct cost of geopolitical instability in the form of a higher cost of equity capital and increased volatility, which complicates long-term planning and valuation. Corporate finance decisions, including capital budgeting and equity issuance, must therefore incorporate a geopolitical risk discount.

5.3. Policy Implications

The results carry profound implications for policymakers in Pakistan and similar frontier economies. First, they quantify a tangible economic cost of geopolitical hostility: a suppressed and more volatile stock market. A deep, liquid, and stable capital market is essential for economic growth, facilitating investment and efficient capital allocation. Persistent geopolitical risk premiums undermine this function, raising the cost of capital for Pakistani businesses and hindering development. Therefore, the pursuit of diplomatic de-escalation and durable conflict resolution is not merely a foreign policy goal but a critical financial and economic stability imperative. The State Bank of Pakistan and the Securities and Exchange Commission of Pakistan (SECP) should formally incorporate geopolitical risk scenarios into their financial stability

assessments. The design of market safeguards, such as circuit breaker thresholds, could be informed by the volatility patterns identified during crises like the 2025 event. Enhanced transparency and communication from regulators during crises could also help mitigate panic-driven selling and reduce the sentiment-driven amplification of volatility.

5.4. Limitations of the study Future Research Directions

While this study provides compelling evidence, it is subject to certain limitations that pave the way for future research. First, while the models control for major domestic and global factors, the possibility of omitted variable bias can never be fully eliminated. Unobserved domestic political developments or unanticipated global shocks coinciding with geopolitical events may confound the results, though the use of event studies and dummy variables seeks to minimize this. Second, the study focuses on the aggregate market index. Future research could disaggregate the analysis to the sectoral level. Which sectors are most sensitive? Do defensive sectors (e.g., utilities, consumer staples) exhibit lower betas to geopolitical risk than cyclical or trade-dependent sectors (e.g., textiles, autos)? Such granular analysis would offer finer guidance for sector rotation strategies. Third, this research examines a single country case. A comparative study analyzing a set of frontier markets facing different types of geopolitical risk (e.g., Pakistan, Ukraine pre-2022, Taiwan) could help disentangle the specific effects of nuclear rivalry, territorial conflict, or great power competition. Finally, future work could explore the transmission mechanisms in greater depth, perhaps using high-frequency data to model the intraday dynamics of price discovery during a crisis or employing survey methods to directly measure the changing risk perceptions of market participants.

In conclusion, this study establishes that the Pakistan Stock Exchange does not operate in a geopolitical vacuum. It functions as a sensitive barometer of regional tensions, systematically pricing the risk of conflict between India and Pakistan. The evidence reveals a market that

responds with acute distress to immediate crises and bears the scar of elevated volatility long after headlines fade. This pricing of war risk represents a significant drag on market development and a premium paid by the Pakistani economy for enduring regional insecurity. For scholars, the findings reinforce the necessity of integrating political and security variables into financial models for emerging frontiers. For investors, they underscore the non-diversifiable nature of such risks. And for policymakers, they offer a clear, data-driven argument that the path to a more robust and stable financial market, and thus a more prosperous economy, is inextricably linked to the pursuit of peace and stability in the region. The markets have spoken: they price peace, and they price war. The challenge now is for decision-makers to heed that signal.

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