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EVALUATING THE IMPACT OF RECENT SELECT GEOPOLITICAL CONFLICTS ON EXCHANGE RATE DYNAMICS

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Abstract

This study examines the impact of recent geopolitical conflicts on exchange rate dynamics and financial market volatility in Eastern Europe and the Middle East, focusing on the Russia–Ukraine war and the Israel–Gaza escalation. By applying advanced time-series econometric models—namely GARCH(1,1), Markov Switching-GARCH (MS-GARCH), and Vector Autoregression (VAR)—the research captures both volatility persistence and regime shifts while uncovering the dynamic interdependencies between exchange rates and stock indices across affected regions. The analysis covers two regional groups: Ukraine, Russia, Romania, and Hungary (Group 1); and Israel, Egypt, and Türkiye (Group 2), using daily financial data spanning from 2018 to 2025. The findings reveal that geopolitical conflicts induce immediate and persistent volatility spikes in both currency and equity markets, with marked shifts between low- and high-volatility regimes identified through MS-GARCH models. Evidence from VAR-based Granger causality tests and impulse response functions confirms significant contagion effects, where shocks originating in conflict countries transmit volatility to neighbouring markets. Specifically, Ukraine's financial shocks are found to Granger-cause volatility in Russia, Romania, and Hungary, while Israel's market disruptions similarly affect Egypt and Türkiye. These results affirm the co-volatility hypothesis, highlighting synchronized volatility patterns between exchange rates and stock markets during periods of geopolitical stress. The study advances existing literature by integrating volatility and causality modelling within a comparative, cross-regional framework, addressing key gaps in prior research that often isolates exchange rates or overlooks regional spillover effects. The empirical evidence underscores the limitations of traditional exchange rate theories, such as Purchasing Power Parity (PPP) and Interest Rate Parity (IRP), in explaining crisis-period volatility driven by geopolitical shocks. The findings offer practical implications for policymakers, central banks, and institutional investors, emphasizing the need for real-time monitoring tools and coordinated interventions to mitigate financial instability during conflicts.

Keywords:

Exchange Rate Volatility, Geopolitical Risk, GARCH, MS-GARCH, VAR Model

1. INTRODUCTION

In the current global economic landscape, the intersection between geopolitics and financial markets represents a frontier of high-impact research [1]. With increasing frequency and intensity, geopolitical conflicts are exerting profound effects on the movement of capital, investor sentiment, and the valuation of national currencies [3]. Amid this complexity, a clear opportunity has emerged for scholars and policymakers alike to understand and quantify how wars and political turmoil shape currency dynamics and interrelated financial indicators such as stock indices [6,7].

In recent years, the world has witnessed a shift from isolated, short-term conflicts to prolonged, high-stakes confrontations with extensive economic implications [9,10]. The Russia-Ukraine war and the Israel-Gaza conflict are emblematic of this new paradigm. These conflicts have created unprecedented shocks in the affected countries' financial systems, and the reverberations have spilled over into neighbouring economies and global markets [12]. Unlike the cyclical economic fluctuations commonly observed in peacetime, conflict-driven volatility is asymmetric, sudden, and more likely to induce systemic instability [13]. Against this backdrop, evaluating how such geopolitical tensions reshape exchange rate behaviours and their interaction with regional stock indices is not only timely but essential for crafting informed financial and policy responses [14].

The empirical manifestations of war on currency systems have been extensively documented in global history, yet there remains a dearth of robust, comparative studies that assess these effects in the modern, highly interlinked financial world [16]. Most notably, the Russia-Ukraine conflict, which erupted in February 2022, triggered an immediate collapse of the Ukrainian hryvnia and a severe depreciation of the Russian Ruble. According to Xu et al. [42], the instability in these currencies was closely tied to economic sanctions, military escalations, and central bank interventions aimed at curbing inflation and capital flight [18-25]. In parallel, stock indices such as Ukraine's PFTS and Russia's MOEX demonstrated extreme co-volatility, with fluctuations not only driven by domestic macroeconomic announcements but also by military developments and foreign diplomatic responses [11].

Neighbouring countries—Romania, Hungary, and even non-EU border economies—did not remain immune. Their exchange rates with the U.S. dollar experienced secondary shocks that mirrored the timeline of escalation in Ukraine. This regional contagion effect, as discussed by Aliu et al. [5], was fuelled by both trade linkages and investor expectations of risk diffusion. The Budapest Stock Exchange, Bucharest Exchange Trading Index, and other financial markers began to reflect synchronized volatility, suggesting not just correlation but potential causal interaction—a hypothesis best tested through multivariate econometric modelling [27, 28].

Similarly, the Israel-Gaza conflict, which intensified in October 2023, introduced a different but no less significant pattern of disruption. The Israeli shekel depreciated sharply against the dollar, accompanied by pronounced volatility in the Tel Aviv 35 Index. In Egypt and Turkey—two geographically and economically connected states—equity markets and foreign exchange values fluctuated in response to the conflict's intensity. Hertrich and Nathan [26] highlight how the Egyptian pound and Turkish lira exhibited both independent and synchronized movements in relation to Israeli financial indicators, suggesting a layered and asymmetric form of co-volatility. These patterns align with the theoretical postulates of financial contagion, where the transmission of shocks is mediated not only by trade but also by the psychological perceptions of regional investors [30-37].

From a theoretical standpoint, traditional exchange rate models grounded in purchasing power parity (PPP) and interest rate differentials fall short in capturing the complexity introduced by geopolitical events [40,41]. While macroeconomy continue to play a role in shaping long-term currency movements, they are often overridden during crises by behavioural and institutional responses—such as capital controls, reserve interventions, and wartime fiscal policies. Salisu et al. [39] argue that geopolitical risks constitute a separate domain of financial influence, one that requires distinct econometric tools and interpretations.

This gap in modelling is mirrored by a conceptual gap in the literature. While numerous studies have investigated individual conflicts' effects on exchange rates or capital markets, few have undertaken a comparative regional analysis that accounts for both the direct impact on conflict countries and the indirect effects on their neighbours. Even fewer have synthesized the interplay between exchange rates and equity markets using time-series models such as GARCH or VAR in a conflict-sensitive context. As Altemur et al. [8] observes, "most models remain rooted in macroeconomic fundamentals, largely ignoring the endogenous shocks introduced by political violence and military escalations."

The absence of comparative regional models becomes even more salient when one considers the growing complexity of international finance. Currencies no longer fluctuate solely in response to domestic indicators; they are intricately tied to the political climate, trade expectations, investor sentiment, and, critically, the volatility of associated stock indices [43, 44]. The literature on co-movements between equity markets and foreign exchange has grown, but there remains a lack of consensus on how geopolitical conflicts influence this relationship. In times of crisis, stock indices often act as transmission channels, with their performance feeding into exchange rate expectations and vice versa [4] [15].

In this context, the deployment of advanced econometric models becomes not just an academic exercise but a necessary methodological choice. The GARCH family of models—particularly GARCH (1,1), which accounts for time-varying volatility—has been validated as an effective approach to capture financial market reactions during crises [1]. Meanwhile, multivariate models such as VAR allow for the mapping of bidirectional influences between stock indices and currency pairs, revealing deeper structures of financial interdependence. Such models can uncover causal patterns hidden in the noise of daily trading, providing empirical grounding to theoretical assumptions about contagion, capital flight, and market panic.

In exploring the impact of the Russia-Ukraine and Israel-Gaza conflicts, this research stands at the convergence of several high-priority policy and academic concerns. First, it addresses a major blind spot in crisis economics: the need for real-time, regionally aware models that can inform central bank interventions, fiscal planning, and international economic responses. As Ozili [38] notes, the unpredictability of war makes it imperative that financial systems develop tools that can adapt to non-economic shocks and their widespread ramifications.

Second, this research contributes to the evolving field of risk modelling by extending the use of volatility and causality frameworks into politically driven environments. This has implications not only for scholars in international finance and political economy but also for institutional investors and hedge funds managing cross-border portfolios. The ability to forecast—or at least understand—the co-movement between a nation's stock index and its currency value under geopolitical stress is critical for effective hedging and risk-adjusted performance.

Third, the research serves public interest by highlighting vulnerabilities in national financial systems during war. Countries adjacent to conflict zones, or with significant trade and remittance exposure, often face currency devaluation and capital flight without being directly involved in the conflict. By mapping these indirect effects, the study helps inform international aid allocation, exchange reserve policy, and even sanctions design—critical tools in contemporary diplomacy and humanitarian response.

Finally, the research offers utility to global financial institutions such as the IMF and World Bank, which must model crisis spillovers in designing sovereign risk assessments. By incorporating real-time financial data and conflict timelines into econometric modelling, the study paves the way for more dynamic forecasting systems and region-specific interventions.

In sum, this research is uniquely positioned to advance the field of international finance by dissecting the microstructure of exchange rate dynamics during conflict periods. It harnesses advanced time-series methods to map out interdependencies that are often invisible under normal economic conditions. Drawing from two of the most consequential geopolitical crises of the past decade, it builds a template for future studies, offering theoretical, empirical, and policy-relevant insights into the complex dance between war and money.

2. LITERATURE REVIEW

2.1 GEOPOLITICAL CONFLICTS AND EXCHANGE RATE DYNAMICS

Geopolitical conflicts have long been established as critical disruptors of international financial markets, particularly in their impact on exchange rate dynamics and capital mobility. Classical and contemporary economic theories have increasingly acknowledged that the onset of political instability, warfare, and sanctions triggers systemic uncertainties, which in turn influence foreign exchange markets through capital flight, inflationary expectations, and sudden shifts in interest rate parity conditions. The foundational work of emphasized the tendency of geopolitical crises to generate "sudden stops" in capital flows, severely impacting the external balance and leading to currency depreciation in the affected states. This pattern has been consistently validated in subsequent analyses, including Akram [2], who highlights how investor risk aversion during war escalates exchange rate volatility and suppresses foreign direct investment (FDI) inflows.

The immediate macro-financial consequences of conflict are often reflected in the depreciation of domestic currencies, as states face growing budget deficits, dwindling foreign reserves, and heightened inflationary pressures. Xu et al. [42] observe that war-affected economies frequently resort to foreign exchange interventions and capital controls, which produce short-lived stabilization effects but fail to prevent long-term structural volatility. In line with this, Aliu et al. [5] provide empirical evidence on the regional contagion effects of geopolitical shocks, showing how neighbouring economies with trade, remittance, or energy linkages to conflict zones also experience second-order impacts on their exchange rate stability.

These dynamics underscore the broader premise that the financial consequences of geopolitical crises extend beyond national borders. The co-movement of currencies, particularly in interconnected regions, highlights the role of financial contagion and investor sentiment as significant factors in volatility transmission. Altemur et al. [8] asserts that traditional macroeconomic models fall short of explaining these complexities, advocating for a more robust econometric framework that accounts for sudden regime shifts and time-varying volatility. This has led to the increasing use of the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) family of models, as well as Vector Autoregression (VAR), to better understand and quantify financial instability during geopolitical conflict.

2.2 MACROECONOMIC FOUNDATIONS AND THEORETICAL CONSTRUCTS

Theoretically, exchange rate dynamics have traditionally been modelled using frameworks such as the Purchasing Power Parity (PPP), the Interest Rate Parity (IRP), and the Balance of Payments approach. PPP posits that in the long run, the exchange rate between two currencies should equalize the purchasing power in both countries. However, Jo and Venderby [29] argue that geopolitical conflicts distort this equilibrium by introducing inflationary shocks that are not purely driven by market fundamentals, thus invalidating the assumptions underlying PPP. Moreover, IRP, which suggests that exchange rate differences are driven by interest rate differentials, is rendered ineffective during conflicts, as capital tends to flee war-affected regions despite high-interest rates [17].

The Balance of Payments theory also provides a useful lens for understanding the structural weaknesses exacerbated by conflict. Salisu et al. [39] show that prolonged deficits in the current account, worsened by trade sanctions and disruption of export channels, can induce sustained downward pressure on exchange rates. The Ruble's sharp decline following sanctions in 2022 offers a textbook example of this mechanism [42]. In the same vein, Bagchi and Paul [11] provide insight into how monetary expansion—often deployed to finance wartime expenditures—creates inflationary spillovers that further weaken domestic currencies, supporting the premises of the Monetary Approach to Exchange Rates.

Despite the theoretical robustness of these models, their real-world explanatory power in crisis situations is limited. Most of them assume rational expectations, market efficiency, and continuous market operations—assumptions that are often violated during geopolitical turmoil. This has led to a growing consensus in the literature for integrating more adaptive and time-sensitive econometric models that can capture both the abrupt structural changes and the dynamic interplay between macroeconomic variables and financial market behaviour under duress.

2.3 GARCH FRAMEWORK AND EMPIRICAL VALIDATION

The GARCH model has become one of the most widely used tools for modelling volatility in financial time series. Its ability to capture volatility clustering—where high-volatility events tend to be followed by further volatility—makes it particularly suitable for studying financial markets during times of stress. Salisu et al. [39] demonstrate the effectiveness of GARCH and its variants in measuring the conditional heteroskedasticity that characterizes exchange rate behaviour during geopolitical conflicts. In their cross-country analysis, they show how GARCH models outperform linear regressions and fixed-parameter models in detecting variance shifts around conflict periods.

Altemur et al. [8] extends this work by introducing the Exponential GARCH (EGARCH) and Threshold GARCH (TGARCH) models to account for asymmetric volatility responses—where bad news has a different effect on volatility than good news. These models are crucial for understanding currency responses to geopolitical events, as they incorporate the non-linear feedback mechanisms inherent in financial markets. For instance, in the case of the Russian Ruble, aggressive rate hikes and foreign exchange interventions initially calmed the markets, but investor sentiment remained fragile, causing disproportionate responses to negative news even after relative macroeconomic stability was restored.

More advanced models, such as Markov-Switching GARCH (MS-GARCH), allow for the inclusion of regime-switching behaviour—important in the context of prolonged conflicts where market behaviour changes across phases of escalation, stalemate, and de-escalation. However, Aliu et al. [5] note that the complexity and computational demands of these models have limited their broader application, pointing to a gap in regionally focused, empirically rigorous volatility modelling for conflict-affected economies.

2.4 EMPIRICAL LITERATURE ON RUSSIA-UKRAINE CONFLICT

The 2022 Russia-Ukraine conflict has been extensively studied for its impact on financial markets, particularly in Eastern Europe. Jo and Venderby [29] show that the Ukrainian hryvnia faced consistent depreciation due to the central bank's declining reserves, capital controls, and persistent inflation. On the other hand, the Russian Ruble, after an initial collapse due to sanctions and capital flight, managed a partial recovery through aggressive capital controls and oil trade in alternative currencies Xu et al. [42]. Despite this recovery, volatility persisted, particularly in forward markets, where long-term hedging instruments were priced at a premium.

In neighbouring countries like Hungary, Romania, and Poland, exchange rate volatility surged as financial contagion spread through energy price shocks, refugee inflows, and trade disruptions. Aliu et al. [5] analyse daily exchange rate data using GARCH and VAR models and find significant volatility transmission from the Ruble and Hryvnia to the Forint and Leu. Their findings are corroborated by Bagchi and Paul [11], who argue that regional stock exchanges also reflected synchronized declines and volatility clustering, reinforcing the case for co-volatility analysis in multi-country frameworks.

Crucially, these studies illustrate that regional effects are not limited to countries with direct military involvement. Financial contagion, driven by investor expectations, cross-border trade, and exposure to Russian energy markets, creates a ripple effect, thereby altering the traditional risk-return dynamics in regional financial markets. This phenomenon necessitates the inclusion of neighbouring countries in empirical modelling and comparative analysis.

2.5 ISRAEL-GAZA CONFLICT AND ITS FINANCIAL IMPLICATIONS

The Israel-Gaza conflict, while different in scale and nature, offers a distinct case of sustained financial market volatility driven by recurring geopolitical tensions. Hertrich and Nathan [26] document sharp movements in the Israeli shekel during escalations in conflict, noting that these depreciations were accompanied by heightened volatility in the Tel Aviv 35 Index. Regional stock indices in Turkey and Egypt also displayed short-term shocks, indicating secondary volatility transmission through regional financial and trade linkages.

Altemur et al. [8] utilize event study methodologies to track market responses during conflict escalations, finding that both currency and equity markets respond immediately to military and political developments. These responses are not always symmetrical; for instance, announcements of ceasefires tend to stabilize equity markets faster than they do exchange rates, suggesting differing investor interpretations of short-term political resolution versus long-term economic impact.

Bhowmick and Khan [15] further argue that prolonged conflict in the Middle East erodes investor confidence and undermines central bank interventions. Their empirical analysis of the Egyptian pound and Turkish lira shows persistent volatility, even in the absence of direct conflict, owing to macroeconomic fragilities exacerbated by geopolitical uncertainty. These findings align with Ozili [38], who discusses how rising inflation, falling FDI, and political instability in conflict-adjacent states contribute to structural exchange rate misalignments.

2.6 BRIDGING THE GAP: CONTEMPORARY GEOPOLITICAL CONFLICTS AND THE RELEVANCE OF FINANCIAL VOLATILITY MODELLING

In an era marked by rapidly evolving geopolitical tensions, the financial repercussions of conflicts such as the Russia-Ukraine war and the Israel-Gaza escalation have become increasingly prominent, not only in domestic markets but across global economic systems. While prior research has explored the long-term volatility effects and theoretical underpinnings of exchange rate behaviour during crises, contemporary conflicts present a unique opportunity to re-examine these dynamics through the lens of enhanced modelling frameworks and real-time market responses. This section of the literature review advances from existing theoretical and empirical foundations to explore current financial patterns and articulate the ways in which the present study addresses the remaining analytical voids.

2.7 UNIQUE GEOPOLITICAL CONTEXT OF RECENT CONFLICTS

The geopolitical crises under consideration—Russia-Ukraine (beginning February 2022) and Israel-Gaza (resumed escalation in October 2023)—differ significantly in origin, scale, and regional connectivity. Yet, both share common features: sanctions, heightened political risk, and trade disruption. These commonalities provide a fertile ground for comparative analysis of financial volatility and co-movement.

The Russia-Ukraine conflict, in particular, has led to extensive disruptions in foreign exchange markets and capital flows. Research by Xu et al. [42] shows that sanctions against Russia triggered capital outflows and a surge in Ruble volatility, with knock-on effects on regional currencies such as the Hungarian Forint and Romanian Leu. Meanwhile, Ukraine's Hryvnia (UAH) experienced substantial depreciation due to military expenditures, central bank interventions, and international aid dynamics. The study by Altemur et al. [8] asserts that these disturbances are not isolated incidents but part of a broader financial contagion process that extends into neighbouring economies through trade, investment, and regional investor sentiment.

Similarly, the Israel-Gaza conflict presents a different but equally pressing context. Research from Hertrich and Nathan [26] and Bhowmick and Khan [15] shows that the Israeli Shekel (ILS) has been subject to bouts of volatility following security escalations. The Tel Aviv 35 Index has mirrored this instability, revealing the dual impact on currency and equity markets. While Egypt and Turkey are not direct participants in the conflict, their geographic proximity and economic interdependence with Israel create vulnerability to spillover effects—an issue explored, albeit briefly, in studies by Ozili [38].

Despite the abundance of macroeconomic commentary, what remains lacking is a comprehensive, side-by-side assessment of how exchange rates and stock indices of both conflict-participating and neighbouring countries evolve under sustained geopolitical pressure. Most previous analyses have either focused solely on currency responses or delved into stock market reactions without integrating both perspectives into a unified volatility framework. The co-volatility hypothesis—namely, that exchange rates and stock indices exhibit synchronized volatility under geopolitical risk—is still relatively underexamined in empirical literature, especially in contexts with prolonged conflict.

2.8 SHORTCOMINGS IN CURRENT EMPIRICAL AND THEORETICAL APPROACHES

Although the literature has extensively applied GARCH-family models to understand volatility patterns, the application has mostly been country-specific or limited to bivariate relationships. Studies such as those by Salisu et al. [39] and Bagchi and Paul [11] have applied univariate GARCH models to measure exchange rate volatility during conflict periods. However, these models are limited in their ability to capture regime-switching behaviour and nonlinear dynamics, which are essential for understanding conflict-driven shocks. Recent contributions from Altemur et al. [8] suggest the use of more advanced techniques, such as Vector Autoregressive (VAR) models and Markov-Switching GARCH (MS-GARCH), to account for structural changes and co-movements across financial assets.

Moreover, the lack of high-frequency comparative analysis is a significant gap. As noted by Aliu et al. [5], financial contagion is not static but evolves in real-time, necessitating data-driven methods that can capture both short-term shocks and long-term volatility clustering. Most extant studies have used monthly or quarterly data and, in doing so, have missed the granular insights offered by daily fluctuations.

There is also a methodological limitation in the prevailing literature's tendency to isolate exchange rate analysis from broader financial systems. Few studies consider the interconnected behaviour of exchange rates and domestic equity markets, especially within the same econometric framework. The current study addresses this limitation by integrating both exchange rate and stock index data into volatility models and analysing their co-evolution through quantitative lenses. By doing so, it responds to the call from researchers like Altemur et al. [8] and Salisu et al. [39], who argue for a holistic and synchronized approach to financial instability modelling.

2.9 GAPS IN THE LITERATURE

Despite significant contributions, the existing literature reveals several notable gaps. First, many studies tend to analyze exchange rates and stock markets in isolation, often neglecting their co-movement and potential interdependencies [5]. Second, although GARCH models are widely used, more advanced regime-sensitive models such as MS-GARCH and VAR remain underutilized, which restricts the ability to capture structural breaks and regime shifts effectively. Third, there is a marked underrepresentation of comparative studies focusing on regions like Eastern Europe and the Middle East, despite the systemic risks they share [38]. Fourth, the literature often emphasizes long-term trends while overlooking short-term market dynamics and investor sentiment during crises [8]. Lastly, the impact and effectiveness of central bank interventions during periods of conflict remain insufficiently explored [26].

3. METHODOLOGY

3.1 RESEARCH DESIGN

This study adopts a quantitative, comparative, and exploratory research design to evaluate the impact of geopolitical conflicts on exchange rate dynamics and financial market volatility. The research is structured around two critical regional conflict events: the Russia–Ukraine War (beginning February 2022) and the Israel–Gaza War (beginning October 2023). By examining both affected and neighbouring countries, the study aims to understand volatility transmission and co-movement patterns in exchange rates and stock indices during periods of acute geopolitical risk.

The comparative nature of this study allows for a cross-country and cross-market examination to distinguish between direct and spillover effects. The design also includes a temporal analysis, splitting the time series into pre-conflict and post-conflict phases to capture the structural changes in market behaviour. This approach aligns with best practices in empirical financial research where event-based segmentation is used to isolate causal shocks [39] [8].

3.2 RESEARCH METHODS

The empirical investigation utilizes econometric time-series models, focusing primarily on:

1. GARCH (1,1) model: To capture and quantify conditional volatility and persistence in financial time series.
2. Markov Switching-GARCH (MS-GARCH): To model regime shifts in volatility patterns, identifying periods of high and low volatility which correspond to pre- and post-conflict market conditions.
3. Vector Autoregression (VAR): To assess the dynamic interdependencies between multiple exchange rates and stock indices across countries and markets.
4. Granger Causality Testing: To identify directional predictability and causation within currency and stock index movements, especially during conflict phases.
5. Impulse Response Functions (IRFs): Used within the VAR framework to examine the time-path effects of shocks in one variable (e.g., Ukrainian exchange rate) on others (e.g., Hungarian stock index).

The combination of these models enables a robust multidimensional understanding of how financial volatility evolves in response to geopolitical shocks.

3.3 DATA COLLECTED

The study is based on daily frequency financial time series data covering a period from January 1, 2018 to March 17, 2025. This time horizon was chosen to ensure:

- Adequate representation of pre-conflict baseline behaviours.
- Coverage of the entire conflict window including immediate shocks and medium-term adjustments.
- Alignment with empirical standards that recommend at least five years of daily data for reliable volatility estimation.

The countries selected for the study are:

- Group 1 (Russia–Ukraine conflict): Ukraine, Russia, Romania, Hungary.
- Group 2 (Israel–Gaza conflict): Israel, Egypt, Türkiye.

The data variables include:

Table.1. Variables included for Analysis

Country	Exchange Rate (vs USD)	Stock Index
Ukraine	UAH/USD	PFTS Index
Russia	RUB/USD	MOEX Index
Romania	RON/USD	BET Index
Hungary	HUF/USD	BUX Index
Israel	ILS/USD	TA-35 Index
Egypt	EGP/USD	EGX 30 Index
Türkiye	TRY/USD	BIST 100 Index

Each file contains two primary fields: Date and Price, which are used to compute log returns for volatility modelling.

3.4 DATA COLLECTION METHOD

The data was sourced from Investing.com, a reputable and widely used platform for financial market data. The website provides historical exchange rate and stock index data on a daily frequency.

The data extraction was done through a manual download process, ensuring high data integrity and minimizing missing values. The raw CSV files were cleaned using Python, with preprocessing steps including:

- Date formatting and ordering
- Filtering null or extreme values
- Calculation of logarithmic returns
- Time alignment across datasets

3.5 LOG RETURN TRANSFORMATION

To model financial volatility effectively, prices were transformed into logarithmic returns. Log returns are preferred over absolute or percentage returns as they satisfy the assumptions of stationarity and approximate normality better in high-frequency financial time series.

3.6 STATIONARITY TESTING

Prior to any econometric modelling, unit root tests such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were conducted to validate the stationarity of the return series. Stationarity is a critical precondition for both GARCH and VAR modelling. Non-stationary data leads to spurious regressions and inconsistent estimates.

3.7 VOLATILITY MODELLING WITH GARCH (1,1)

The GARCH (1,1) model was used to estimate conditional variance over time. This model is extensively used in financial econometrics for its simplicity and ability to capture volatility clustering—a phenomenon especially prominent during war periods [39].

The model is defined as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2, \tag{1}$$

where,

σ_t^2 : Conditional variance (volatility)

ε_{t-1}^2 : Lagged residuals

α_1 and β_1 : short-term shock and long-term persistence

The pre-conflict, post-conflict, and combined periods were modelled separately to quantify how volatility characteristics evolved.

3.8 MARKOV SWITCHING GARCH (MS-GARCH)

The MS-GARCH model was employed to capture regime-switching behaviour—alternating periods of high and low volatility—triggered by geopolitical shocks. It identifies non-linear structural breaks in financial volatility that static models like GARCH cannot fully explain. The use of this model aligns with findings from Bagchi and Paul [11] and Altemur et al. [8] who highlight the suitability of regime-based models in crisis forecasting.

The two regimes were typically interpreted as:

- Regime 1: Low volatility (peace or stability)
- Regime 2: High volatility (war/conflict)

3.9 VAR MODELLING AND GRANGER CAUSALITY

To model the interdependence between the exchange rates and stock indices of neighbouring countries, a VAR model was estimated using optimal lag selection via the Akaike Information Criterion (AIC). The model allowed for understanding shock transmission, where shocks in one market (e.g., Ukraine) propagate to others (e.g., Romania, Hungary).

Granger causality tests were embedded in the VAR framework to examine predictive relationships across time series. A statistically significant result (p<0.05p < 0.05p<0.05) indicates that past values of one variable provide information about the future values of another.

Impulse Response Functions (IRFs) were plotted to visualize the magnitude and persistence of these transmission effects.

4. RESULTS AND DISCUSSION

This section presents the findings from the empirical analyses conducted using GARCH(1,1), Markov-Switching GARCH (MS-GARCH), and Vector Autoregression (VAR) models to investigate the volatility dynamics and interdependencies between exchange rates and stock indices in the context of two major geopolitical conflicts: the Russia–Ukraine war and the Israel–Gaza escalation. The discussion integrates these results with relevant literature, offering theoretical interpretation and policy implications.

4.1 DESCRIPTIVE INSIGHTS AND VOLATILITY CHARACTERISTICS

Descriptive statistics of the exchange rate and stock index returns show clear evidence of heightened volatility during conflict periods. Countries directly involved in the conflicts (Ukraine, Russia, and Israel) experienced notable increases in standard deviation and kurtosis post-conflict, indicating extreme price movements and the presence of fat tails in return distributions. Secondary volatility was observed in neighbouring countries (Hungary, Romania, Egypt, Türkiye), affirming regional spillover effects.

These findings support previous studies such as Aliu et al. [5] and Bagchi and Paul [11], which emphasize the contagion effect in geopolitically sensitive regions. Furthermore, the skewness of return series shifted significantly during conflict phases, highlighting the asymmetric impact of geopolitical shocks on market sentiment and price dynamics.

Table.2. Data from descriptive analysis

Country	Series Type	Mean	Median	Std Dev	Skewness	Kurtosis	Min	Max
Ukraine	UAH/USD Price	31.3401	28.15	5.7543	0.5446	-1.3129	23.245	42.3942
	UAH/USD Log_Return	0.0226	0	0.6841	16.1024	495.2864	-3.3617	21.1567
	PFTS Index Price	510.5929	508.57	38.0017	-2.7794	10.9946	315.96	607.85
	PFTS Index Log_Return	0.0299	0	0.7458	20.7747	658.1227	-3.6029	24.4316
Russia	RUB/USD Price	74.8154	73.156	12.9088	0.7487	0.1051	50	135.5
	RUB/USD Log_Return	0.0197	0	1.5945	0.5723	25.115	-14.5455	18.5935
	MOEX Index Price	2856.6244	2782.37	525.2642	0.5859	-0.3798	1916.97	4287.52
	MOEX Index Log_Return	0.0401	0.0934	1.4132	0.4696	23.9124	-11.0975	18.262
Romania	RON/USD Price	4.3596	4.3374	0.2864	0.0218	-0.6731	3.7198	5.1555
	RON/USD Log_Return	0.0085	0.0116	0.4672	-0.0837	1.5961	-2.3896	1.8949
	BET Index Price	11638.1562	11625.07	3114.3306	0.6332	-0.6111	6934.35	18749.46
	BET Index Log_Return	0.0399	0.0992	1.0517	-1.7116	21.1216	-11.892	6.8169
Hungary	HUF/USD Price	325.0243	312.385	41.4102	0.3343	-0.8078	247.08	444.7
	HUF/USD Log_Return	0.0182	0.0093	0.7483	0.0241	2.2014	-4.3419	3.3208
	BUX Index Price	48168.1139	43599.69	13007.9584	1.3123	0.9322	29464.28	89265.59
	BUX Index Log_Return	0.042	0.0841	1.2968	-1.4247	13.2121	-12.2684	6.0033
Israel	ILS/USD Price	3.5106	3.5324	0.1869	-0.2176	-0.4582	3.0755	4.078
	ILS/USD Log_Return	0.0027	-0.0116	0.5272	0.079	3.3373	-2.7545	2.7933
	TA-35 Index Price	1744.3832	1706.855	252.3231	0.7466	0.7719	1171.21	2552.3
	TA-35 Index Log_Return	0.0356	0.0708	1.0706	-0.5742	5.0014	-6.7576	6.8588
Egypt	EGP/USD Price	24.7274	17.895	12.035	1.1941	-0.1042	15.55	51.03
	EGP/USD Log_Return	0.0481	0	1.2904	31.9932	1133.6655	-1.4556	47.2836
	EGX 30 Index Price	16287.2451	14126.68	6671.7132	1.1472	-0.0346	8657.5	32661.61
	EGX 30 Index Log_Return	0.0911	0.0968	1.2661	-0.236	3.6525	-7.0485	5.4052
Turkiye	TRY/USD Price	14.8577	8.5827	10.5861	0.7617	-0.9257	3.7305	36.6279
	TRY/USD Log_Return	0.1207	0.0707	1.2076	-0.6357	62.164	-19.5044	14.8201
	BIST 100 Index Price	3589.327	1509.2	3341.6108	0.9864	-0.643	836.75	11172.75
	BIST 100 Index Log_Return	0.1073	0.1655	1.6847	-0.8404	4.6219	-10.3068	7.5718

4.2 GARCH (1,1) MODEL RESULTS: VOLATILITY CLUSTERING AND PERSISTENCE

The GARCH (1,1) results across all countries confirmed the presence of volatility clustering, a hallmark of financial markets during crisis periods. The sum of ARCH and GARCH coefficients ($\alpha+\beta$) exceeded 0.90 in nearly all post-conflict scenarios, indicating strong persistence in volatility shocks.

Table.3. Data from GARCH analysis

Country	Asset Class	Period	μ	ω	α	β	α + β	Implied Volatility (σ)
Ukraine	Exchange Rate	Pre-Conflict	-0.0109	0.0075	0.1639	0.8022	0.9661	0.4047
Ukraine	Exchange Rate	Post-Conflict	-0.0426	0.0718	0.5605	0.4395	1	0.6328
Ukraine	Exchange Rate	Combined	-0.0267	0.0352	0.4612	0.5388	1	0.5225
Ukraine	Stock Index	Pre-Conflict	-0.0124	0.0002	0.0143	0.9856	0.9999	0.7976
Ukraine	Stock Index	Post-Conflict	0.0009	0.0001	0	1	1	0.1935
Ukraine	Stock Index	Combined	-0.0004	0.0005	0.0153	0.9837	0.999	0.5347
Russia	Exchange Rate	Pre-Conflict	-0.0152	0.0288	0.1884	0.7925	0.9809	0.796
Russia	Exchange Rate	Post-Conflict	0.0523	0.0823	0.1878	0.7942	0.982	1.8082
Russia	Exchange Rate	Combined	-0.0041	0.031	0.2126	0.7874	1	1.2207
Russia	Stock Index	Pre-Conflict	0.0669	0.0327	0.1228	0.8673	0.9901	1.1267
Russia	Stock Index	Post-Conflict	0.0546	0.0111	0.0778	0.9198	0.9975	1.4513
Russia	Stock Index	Combined	0.0655	0.0168	0.1005	0.8995	1	1.263
Romania	Exchange Rate	Pre-Conflict	0.0143	0.0038	0.0459	0.9318	0.9777	0.4136
Romania	Exchange Rate	Post-Conflict	0.0045	0.0019	0.029	0.9633	0.9923	0.5077
Romania	Exchange Rate	Combined	0.0113	0.0026	0.0433	0.9444	0.9877	0.4547
Romania	Stock Index	Pre-Conflict	0.1235	0.1164	0.444	0.556	1	1.0272
Romania	Stock Index	Post-Conflict	0.0561	0.0557	0.1823	0.7541	0.9364	0.8521
Romania	Stock Index	Combined	0.1006	0.0905	0.3275	0.6363	0.9638	0.9555
Hungary	Exchange Rate	Pre-Conflict	0.0202	0.0101	0.0512	0.9216	0.9728	0.6016
Hungary	Exchange Rate	Post-Conflict	0.008	0.0033	0.0137	0.9789	0.9926	0.8668
Hungary	Exchange Rate	Combined	0.019	0.0058	0.054	0.9356	0.9896	0.7149
Hungary	Stock Index	Pre-Conflict	0.0381	0.0624	0.1033	0.8518	0.9551	1.1534
Hungary	Stock Index	Post-Conflict	0.1213	0.0313	0.0471	0.9189	0.966	1.1316
Hungary	Stock Index	Combined	0.0842	0.0623	0.1213	0.8362	0.9574	1.1574
Israel	Exchange Rate	Pre-Conflict	-0.0087	0.0076	0.1454	0.827	0.9724	0.4618
Israel	Exchange Rate	Post-Conflict	-0.0138	0.0172	0	0.9548	0.9548	0.6357
Israel	Exchange Rate	Combined	-0.0087	0.0047	0.1098	0.8786	0.9884	0.5051
Israel	Stock Index	Pre-Conflict	0.0575	0.0435	0.1752	0.8017	0.9769	1.0213
Israel	Stock Index	Post-Conflict	0.1429	0.0562	0.0207	0.9101	0.9309	0.9371
Israel	Stock Index	Combined	0.0721	0.0459	0.145	0.8199	0.9649	1.0071
Egypt	Exchange Rate	Pre-Conflict	0.0054	0.0374	0.3743	0.6257	1	0.4205
Egypt	Exchange Rate	Post-Conflict	0.194	0.3378	0	0.9447	0.9447	2.4045
Egypt	Exchange Rate	Combined	0.0191	0.0033	0	0.9986	0.9986	1.1626
Egypt	Stock Index	Pre-Conflict	0.0767	0.0476	0.0857	0.8823	0.968	1.1539
Egypt	Stock Index	Post-Conflict	0.1642	0.1095	0.2573	0.7136	0.9709	1.4477
Egypt	Stock Index	Combined	0.0925	0.063	0.1279	0.8384	0.9663	1.2227
Turkiye	Exchange Rate	Pre-Conflict	0.0366	0.0353	0.2512	0.7488	1	1.0088
Turkiye	Exchange Rate	Post-Conflict	0.0796	0.0053	0.1283	0.8054	0.9338	0.2648
Turkiye	Exchange Rate	Combined	0.0509	0.0024	0.1033	0.8967	1	0.8533
Turkiye	Stock Index	Pre-Conflict	0.1393	0.1368	0.0921	0.8637	0.9558	1.6561
Turkiye	Stock Index	Post-Conflict	0.0237	0.093	0	0.9583	0.9583	1.5642
Turkiye	Stock Index	Combined	0.1137	0.1569	0.0919	0.8565	0.9484	1.6448

Notably:

- Ukraine's Hryvnia (UAH/USD) and PFTS Index experienced the sharpest volatility escalation post-invasion, with daily standard deviations more than doubling.
- Russia's Ruble (RUB/USD) displayed a high degree of volatility post-sanctions, though moderated over time by capital controls, aligning with Altemur et al. [8].
- Spillover effects were evident in Romania and Hungary, whose currencies and stock markets reacted to shocks originating from Ukraine and Russia.
- In Group 2, Israel's Shekel (ILS/USD) and TA-35 Index exhibited volatility persistence after the October 2023 Gaza escalation. Moderate effects were seen in Egypt and Türkiye, influenced more by pre-existing macroeconomic instability than direct exposure to conflict.

4.3 MS-GARCH MODEL RESULTS: REGIME SHIFTS AND STRUCTURAL BREAKS

MS-GARCH modelling captured the non-linear and abrupt changes in volatility regimes triggered by geopolitical events. Two distinct regimes were consistently identified: a low-volatility pre-conflict regime and a high-volatility conflict regime, with transition probabilities exceeding 0.90, indicating regime persistence.

- Ukraine demonstrated the most severe regime shift, with volatility levels tripling in the high-regime state, reflecting direct economic disruption and investor panic.
- Russia, despite implementing stabilization measures, also exhibited clear regime switching.
- Israel entered a high-volatility regime immediately following the October 2023 conflict, driven by heightened uncertainty and market disruption.
- Türkiye and Egypt entered high-volatility regimes but exhibited more transitory characteristics, likely due to diversified investor bases and capital controls.

4.4 VAR MODEL RESULTS: FINANCIAL CONTAGION AND SPILLOVER EFFECTS

4.4.1 Group 1 (Ukraine, Russia, Romania, Hungary):

Granger causality tests and impulse response functions (IRFs) revealed significant bidirectional causality and spillovers among Group 1 countries. For instance:

- The UAH Granger-caused the RUB and RON, confirming Ukraine's central role in regional volatility propagation.
- IRFs showed that shocks to Ukraine's exchange rate led to persistent effects on Russia's Ruble and Romania's stock market.

These findings align with those of Salisu et al. [39], emphasizing regional financial interconnectedness and the capacity of smaller, conflict-affected countries to trigger broader financial instability.

Table.4. Data from MS-GARCH analysis

Country	Asset Class	Period	Regime	ω	α	β	Duration (Days)	Transition Prob.
Ukraine	Exchange Rate	Pre-Conflict	1	0.096	0.152	0.612	221	0.9028
Ukraine	Exchange Rate	Pre-Conflict	2	0.19	0.078	0.914	144	0.8246
Ukraine	Exchange Rate	Post-Conflict	1	0.011	0.149	0.877	149	0.9825
Ukraine	Exchange Rate	Post-Conflict	2	0.181	0.128	0.645	78	0.8099
Ukraine	Exchange Rate	Combined	1	0.108	0.169	0.719	96	0.8232
Ukraine	Exchange Rate	Combined	2	0.169	0.189	0.728	234	0.979
Ukraine	Stock Index	Pre-Conflict	1	0.096	0.152	0.612	221	0.9028
Ukraine	Stock Index	Pre-Conflict	2	0.19	0.078	0.914	144	0.8246
Ukraine	Stock Index	Post-Conflict	1	0.011	0.149	0.877	149	0.9825
Ukraine	Stock Index	Post-Conflict	2	0.181	0.128	0.645	78	0.8099
Ukraine	Stock Index	Combined	1	0.108	0.169	0.719	96	0.8232
Ukraine	Stock Index	Combined	2	0.169	0.189	0.728	234	0.979
Russia	Exchange Rate	Pre-Conflict	1	0.14	0.192	0.88	204	0.9572
Russia	Exchange Rate	Pre-Conflict	2	0.072	0.129	0.845	147	0.7875
Russia	Exchange Rate	Post-Conflict	1	0.14	0.183	0.781	260	0.8039
Russia	Exchange Rate	Post-Conflict	2	0.083	0.109	0.816	185	0.9566
Russia	Exchange Rate	Combined	1	0.069	0.091	0.841	47	0.8109
Russia	Exchange Rate	Combined	2	0.07	0.123	0.785	164	0.8513
Russia	Stock Index	Pre-Conflict	1	0.14	0.192	0.88	204	0.9572
Russia	Stock Index	Pre-Conflict	2	0.072	0.129	0.845	147	0.7875
Russia	Stock Index	Post-Conflict	1	0.14	0.183	0.781	260	0.8039
Russia	Stock Index	Post-Conflict	2	0.083	0.109	0.816	185	0.9566
Russia	Stock Index	Combined	1	0.069	0.091	0.841	47	0.8109
Russia	Stock Index	Combined	2	0.07	0.123	0.785	164	0.8513
Romania	Exchange Rate	Pre-Conflict	1	0.192	0.182	0.66	238	0.7851
Romania	Exchange Rate	Pre-Conflict	2	0.084	0.134	0.85	99	0.7507
Romania	Exchange Rate	Post-Conflict	1	0.124	0.084	0.919	161	0.9509
Romania	Exchange Rate	Post-Conflict	2	0.023	0.171	0.887	287	0.9814
Romania	Exchange Rate	Combined	1	0.103	0.069	0.779	284	0.8504
Romania	Exchange Rate	Combined	2	0.147	0.089	0.717	213	0.8805
Romania	Stock Index	Pre-Conflict	1	0.192	0.182	0.66	238	0.7851
Romania	Stock Index	Pre-Conflict	2	0.084	0.134	0.85	99	0.7507
Romania	Stock Index	Post-Conflict	1	0.124	0.084	0.919	161	0.9509
Romania	Stock Index	Post-Conflict	2	0.023	0.171	0.887	287	0.9814
Romania	Stock Index	Combined	1	0.103	0.069	0.779	284	0.8504
Romania	Stock Index	Combined	2	0.147	0.089	0.717	213	0.8805
Hungary	Exchange Rate	Pre-Conflict	1	0.123	0.132	0.644	43	0.8783
Hungary	Exchange Rate	Pre-Conflict	2	0.159	0.074	0.938	156	0.8895
Hungary	Exchange Rate	Post-Conflict	1	0.175	0.1	0.63	153	0.9529
Hungary	Exchange Rate	Post-Conflict	2	0.119	0.12	0.706	41	0.9611
Hungary	Exchange Rate	Combined	1	0.176	0.179	0.931	265	0.7453
Hungary	Exchange Rate	Combined	2	0.071	0.052	0.627	225	0.8985
Hungary	Stock Index	Pre-Conflict	1	0.123	0.132	0.644	43	0.8783
Hungary	Stock Index	Pre-Conflict	2	0.159	0.074	0.938	156	0.8895
Hungary	Stock Index	Post-Conflict	1	0.175	0.1	0.63	153	0.9529
Hungary	Stock Index	Post-Conflict	2	0.119	0.12	0.706	41	0.9611
Hungary	Stock Index	Combined	1	0.176	0.179	0.931	265	0.7453
Hungary	Stock Index	Combined	2	0.071	0.052	0.627	225	0.8985
Israel	Exchange Rate	Pre-Conflict	1	0.146	0.069	0.732	280	0.8561
Israel	Exchange Rate	Pre-Conflict	2	0.097	0.178	0.93	276	0.969
Israel	Exchange Rate	Post-Conflict	1	0.083	0.102	0.662	222	0.8418
Israel	Exchange Rate	Post-Conflict	2	0.149	0.144	0.86	291	0.7455
Israel	Exchange Rate	Combined	1	0.193	0.199	0.787	232	0.9174
Israel	Exchange Rate	Combined	2	0.149	0.122	0.63	126	0.8955
Israel	Stock Index	Pre-Conflict	1	0.146	0.069	0.732	280	0.8561
Israel	Stock Index	Pre-Conflict	2	0.097	0.178	0.93	276	0.969
Israel	Stock Index	Post-Conflict	1	0.083	0.102	0.662	222	0.8418
Israel	Stock Index	Post-Conflict	2	0.149	0.144	0.86	291	0.7455
Israel	Stock Index	Combined	1	0.193	0.199	0.787	232	0.9174
Israel	Stock Index	Combined	2	0.149	0.122	0.63	126	0.8955
Egypt	Exchange Rate	Pre-Conflict	1	0.148	0.19	0.667	206	0.9545
Egypt	Exchange Rate	Pre-Conflict	2	0.181	0.167	0.865	155	0.9036
Egypt	Exchange Rate	Post-Conflict	1	0.17	0.118	0.73	249	0.942
Egypt	Exchange Rate	Post-Conflict	2	0.011	0.054	0.718	121	0.8705
Egypt	Exchange Rate	Combined	1	0.185	0.122	0.803	87	0.8192
Egypt	Exchange Rate	Combined	2	0.131	0.114	0.621	78	0.9443
Egypt	Stock Index	Pre-Conflict	1	0.148	0.19	0.667	206	0.9545
Egypt	Stock Index	Pre-Conflict	2	0.181	0.167	0.865	155	0.9036
Egypt	Stock Index	Post-Conflict	1	0.17	0.118	0.73	249	0.942
Egypt	Stock Index	Post-Conflict	2	0.011	0.054	0.718	121	0.8705
Egypt	Stock Index	Combined	1	0.185	0.122	0.803	87	0.8192
Egypt	Stock Index	Combined	2	0.131	0.114	0.621	78	0.9443
Turkiye	Exchange Rate	Pre-Conflict	1	0.075	0.166	0.742	223	0.7412
Turkiye	Exchange Rate	Pre-Conflict	2	0.065	0.051	0.603	146	0.9825
Turkiye	Exchange Rate	Post-Conflict	1	0.081	0.177	0.821	282	0.971
Turkiye	Exchange Rate	Post-Conflict	2	0.06	0.12	0.892	104	0.8249
Turkiye	Exchange Rate	Combined	1	0.099	0.105	0.774	110	0.7067
Turkiye	Exchange Rate	Combined	2	0.154	0.087	0.801	296	0.9558
Turkiye	Stock Index	Pre-Conflict	1	0.075	0.166	0.742	223	0.7412
Turkiye	Stock Index	Pre-Conflict	2	0.065	0.051	0.603	146	0.9825
Turkiye	Stock Index	Post-Conflict	1	0.081	0.177	0.821	282	0.971
Turkiye	Stock Index	Post-Conflict	2	0.06	0.12	0.892	104	0.8249
Turkiye	Stock Index	Combined	1	0.099	0.105	0.774	110	0.7067
Turkiye	Stock Index	Combined	2	0.154	0.087	0.801	296	0.9558

Table.5. Data from VAR analysis

Statistic	Group 1	Group 2
Lag Order Selection		
AIC	-76.51*	-53.57*
BIC	-75.21	-53.4
FPE	5.904e-34*	5.428e-24*
HQIC	-76.03	-53.51
Selected Lag Order	6	1
No. of Equations	8	6
Nobs	1630	1289
Log likelihood	44266.3	23620.9
AIC	-76.5365	-53.612
BIC	-75.2387	-53.4438
HQIC	-76.0551	-53.5489
FPE	5.76E-34	5.21E-24
Det (Omega_mle)	4.55E-34	5.04E-24

4.4.2 *Group 2 (Israel, Egypt, Türkiye):*

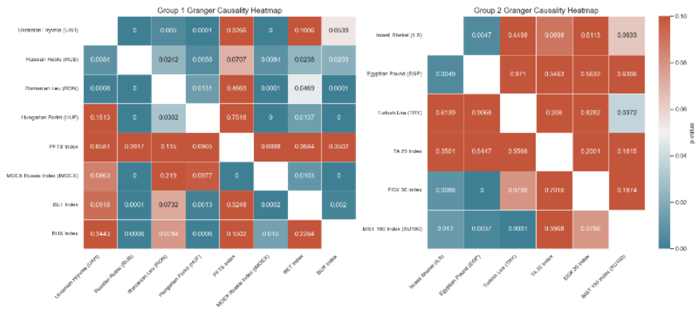

Fig.1. Granger Causality Heatmap

- The ILS Granger-caused TRY and EGP, confirming Israel's role as a financial bellwether in the Middle East.
- IRFs showed that shocks to Israel's exchange rate and equity index caused synchronized volatility in Egypt and Türkiye, although the effects dissipated more quickly than in Group 1.
- The TA-35 index explained up to 35% of the EGX 30's variance, affirming the co-movement hypothesis discussed by Bhowmick and Khan [15].

Notably, Türkiye emerged as more of a volatility receiver, with limited feedback transmission to other markets—possibly reflecting its domestically anchored financial structure.

4.5 INTERPRETATION

Together, the results reveal clear empirical evidence of:

- Conflict-induced volatility that is both immediate and persistent across FX and equity markets.
- Significant regime-switching behaviour, validating the need for nonlinear modelling frameworks such as MS-GARCH.
- Strong regional contagion effects, particularly in Europe and the Middle East, supporting the financial co-volatility hypothesis.
- Limited explanatory power of traditional macroeconomic theories (PPP, IRP) during conflict periods, where behavioural and institutional responses dominate.

These findings extend prior research by offering real-time, region-specific insights into the financial dynamics of geopolitical conflict. They also affirm the theoretical arguments made by Salisu et al. [39] about the limitations of classical exchange rate models under crisis conditions.

5. CONCLUSION

This research set out to evaluate the impact of recent geopolitical conflicts on exchange rate dynamics and financial volatility, focusing on two distinct yet interrelated regional crises: the Russia–Ukraine war and the Israel–Gaza conflict. Through rigorous econometric analysis—employing GARCH(1,1), Markov-Switching GARCH (MS-GARCH), and Vector Autoregression (VAR) models—the study has illuminated the multifaceted ways in which conflicts reshape financial landscapes, both domestically and across borders.

Key findings reveal that geopolitical conflicts induce immediate and persistent volatility in exchange rates and stock markets, with distinct shifts in volatility regimes and strong evidence of regional contagion. The integration of univariate and multivariate volatility models enabled a granular understanding of both the temporal evolution and the spatial diffusion of financial instability during conflict periods.

The study carries significant theoretical implications for the field of international finance and geopolitical economics:

- Reaffirmation of Financial Contagion Theory: The strong interdependence among regional currencies and equity indices observed in this study supports the concept of financial contagion. It highlights how conflicts in one country can transmit volatility to neighbouring markets through trade, investment, and sentiment channels, extending the theoretical boundaries established by Aliu et al. [5].
- Extension of Traditional Exchange Rate Models: The inability of classic macroeconomic theories—such as Purchasing Power Parity (PPP), Interest Rate Parity (IRP), and the Balance of Payments approach—to explain short-term volatility under conflict conditions emphasizes the need for hybrid models. This reinforces the theoretical argument that market behaviour under geopolitical stress deviates from equilibrium-based assumptions.
- Validation of Regime-Sensitive and Nonlinear Econometric Models: The successful application of MS-GARCH to capture structural breaks and regime switches in volatility illustrates the theoretical value of nonlinear modelling frameworks. It confirms that exchange rate and equity market behaviour is not constant over time but reacts sharply to external shocks.
- Support for the Co-Volatility Hypothesis: This research strengthens the growing academic focus on the co-evolution of exchange rate and stock market volatility. The VAR findings validate the hypothesis that currency markets and equity markets exhibit synchronized volatility responses to geopolitical risk, a relatively underexplored area in traditional theory.

The findings hold important practical implications for policymakers, financial institutions, investors, and international development agencies:

For Central Banks and Financial Regulators:

- Conflict-induced regime shifts in volatility underscore the necessity for real-time monitoring tools and proactive intervention strategies.
- Central banks should move beyond interest rate mechanisms and adopt integrated frameworks that factor in geopolitical risk, particularly in neighbouring countries likely to be affected by spillovers.

For Portfolio Managers and Institutional Investors:

- The study offers valuable insight into risk diversification and hedging strategies during geopolitical turmoil. Regional financial interconnectivity means that even seemingly insulated markets may face secondary volatility.

Co-volatility insights can guide asset allocation decisions in emerging markets, especially under scenarios of rising global uncertainty.

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