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The Impact of Geopolitical Risks on Gold Prices: Empirical Evidence from the Israeli-Palestinian Conflict

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Abstract

Geopolitical risks have long been recognized as important determinants of asset price movements, with gold historically regarded as a safe haven asset during periods of uncertainty. The Israeli-Palestinian conflict, which escalated on October 7, 2023, has intensified global geopolitical tensions, raising important questions about its impact on financial markets. This study investigates the influence of this conflict on gold prices, using daily data from two distinct periods, before the conflict, from January 1, 2023, to October 6, 2023, and during the conflict, from October 9, 2023, to September 30, 2024. By applying ARCH, GARCH, and EGARCH models, we aim to quantify the extent to which geopolitical instability affects gold prices. Our findings reveal a significant impact of the Israeli-Palestinian conflict on gold prices, reaffirming the role of gold as a safe haven asset amid geopolitical turbulence. These results contribute to the understanding of how geopolitical events influence different asset classes, providing valuable insights for investors and policymakers in managing risk and making informed investment decisions.

Keywords: Geopolitical Risks, Gold, ARCH, GARCH, EGARCH.

1. Introduction

In recent years, global financial markets have been increasingly susceptible to the influence of geopolitical events, highlighted their widespread presence, which compromises not only the impacted regions but also the national and global economies. These risks manifest in the form of conflicts, political instability, and increased uncertainty, all of which create significant implications for financial markets.

In response, finance researchers have concentrated their attention to understanding the effects of geopolitical risk, recognizing it as a significant field of study. Among the most widely recognized advancements in this study era is measuring these risks with the Geopolitical Risk Index (GPR), developed by Caldara and Iacoviello (2022), which has since inspired an enormous amount of research on how increased global tension affects various asset classes.

A prominent example of ongoing geopolitical tension is the Israeli-Palestinian conflict, a historically complicated and prolonged dispute. The latest resurgence of this conflict, which began on October 7, 2023. This escalation began with Hamas's attack, termed "Operation Al- Aqsa Flood," and Israel's response "Operation Swords of Iron," leading to a pronounced humanitarian crisis and far-reaching economic ramifications.

On a broader scale, this conflict has affected global financial markets. Investor sentiment shifted sharply towards safe-haven assets, contributing to volatility. The Israeli Shekel depreciated by approximately 2% against the US Dollar, prompting intervention by the Bank of Israel through significant foreign exchange operations and liquidity support. The TA-35 index declined by 6.47%, marking its lowest performance since March 2020. Additionally, as these conflicts arise, they have an impact on a variety of financial instruments, ranging from stock market indices and bonds to commodities, especially precious metals such as gold, which is frequently seen as a safe haven asset.

During times of turmoil, gold is often considered as a safe haven for investors, echoing the adage that "the

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beauty of gold is that it loves bad news⁴," the demand for gold surged, with prices increasing by over 3% in the conflict's initial week and reaching a record high by

December 2023⁵. This rise was driven by central bank purchases and investor caution amid rising geopolitical tensions. Oil prices also spiked, with Brent and WTI crude benchmarks reflecting the Middle East's pivotal role in global oil production and underscoring the vulnerabilities within global markets during periods of instability.

These developments underscore the deep interconnections between geopolitical stability and global economic performance, highlighting the far-reaching impacts of geopolitical risks on financial markets and the importance of maintaining geopolitical stability.

Over the years, researchers have attempted to understand the dynamics of geopolitical risks and the gold market, but their agreement has remained unresolved. The relationship between geopolitical risks and the gold market has been widely researched, yet consensus has not been achieved. Several studies (e.g., Bilgin et al., 2018; Bouoiyour et al., 2018; Selmi et al., 2018; Gozgor et al., 2019; Qin et al., 2020; Baur and Smales, 2020; Li et al., 2021; Triki and Ben Maatoug, 2021; Chiang, 2022) validate the view that heightened geopolitical tensions boost the demand for gold as a safe-haven asset. However, other research (e.g., Lucey et al., 2013; Baur and Smales, 2018; Jiang et al., 2020; Yilanci and Kilci, 2021; Gong and Xu, 2022; Qin et al., 2023) suggests that the relationship is more nuanced and context-dependent and varies in periods, market conditions, and the nature of the geopolitical events. This ongoing debate highlights the necessity of further study to better understand the hidden impacts of geopolitical risks on the global gold market.

Despite the pressing relevance of the Israeli-Palestinian conflict, academic research exploring its impact on financial markets remains scarce, likely due to the recent resurgence of the conflict. However, preliminary investigations (e.g., Goyal and Soni, 2024; Cui and Maghyreh, 2024; Han, 2024; Lin et al., 2024; Khan et al., 2024; Younis et al., 2024; Pandey et al., 2024; Martins, 2024) provide insights into how such geopolitical events extend market volatility and connection across asset classes.

These studies demonstrate that commodities and energy markets are significantly entangled in risk transmission and hedge strategies during moments of geopolitical stress, highlighting the complicated interdependencies across diverse asset classes.

Given this background, this study analyzed data from two periods: before the conflict (01/01/2023 to 06/10/2023) and during the conflict (09/10/2024 to 30/09/2024). The purpose is to seek how geopolitical tensions affected asset classes, especially gold. The findings showed a significant rise in asset prices and volatility during the conflict, indicating increased market uncertainty due to the geopolitical situation. We employed ARCH, GARCH, and EGARCH models to investigate the impact of the Israeli-Palestinian conflict on gold prices. The results showed that the conflict significantly increased gold price volatility, highlighting gold's role as a safe haven during geopolitical instability. This aligns with findings by Cui and Maghyreh (2024) and Khan et al. (2024).

In light of this context, this study aims to bridge this gap by examining the impact of the ongoing Israeli-Palestinian conflict on gold prices. It seeks to contribute to the literature by providing empirical evidence on how this significant geopolitical event has influenced the global gold market, advancing our understanding of the role of gold in periods of extreme geopolitical stress.

2. Literature Review

2.1. The Geopolitical Risk

Numerous scholars in the academic community have proposed various definitions of the term Geopolitical Risk. However, as noted by Lai et al. (2023), there is currently no universally accepted concept or definition. The term Geopolitics dates back to the late nineteenth century, introduced by the Swedish political geographer Johan Rudolf Kjellén in his book "Der Staat als Lebensform" (1917). Geopolitics can thus be described as the

⁴ This is how Harry "Rabbit" Angstrom, the principal character of John Updike's novel "RABBIT, RUN", justifies to his wife spending \$11,000 on 30 gold Krugerrands (Economist 2009).

The Krugerrands are gold coins created by the "Republic of South Africa" in 1967 to promote South African gold on worldwide markets and allow individuals to own it.

⁵ J.P. Morgan, (January 17, 2024), "Will gold prices hit another all-time high in 2024?"

struggle for control over geographical entities with international and global dimensions, and their application for political benefits (Flint, 2021).

According to Wang et al. (2024), geopolitical risk is influenced by both geography and politics. Lee and Wang (2021) define geopolitical risk as the risk associated with tensions between states that have the potential to disrupt international relations, particularly peace processes, and may involve elements such as war, terrorism, and other variables that disrupt the regular flow of international relations.

Bohl et al. (2017) offer another definition, describing geopolitical risk as the changes in politics and economy that might negatively impact human well-being. Their explanation categorizes geopolitical risk into three interconnected systems. Firstly, Political Risk, arising from interactions among actors involved in power rivalry. The most extreme expression of this risk is violent conflict, but it can also encompass other types of disruptive competition. Secondly, Economic Risk, Emerging through the dynamics of market interaction. Thirdly, Natural Risk, originating from changes within the non-human environment, even if those changes are caused by human activities such as climate change. Significantly, geopolitical risks occur not only within these systems but also across them. For instance, water shortages, a natural issue, can lead to political conflicts and ultimately affect trade, creating economic risks.

Engle and Campos-Martins (2020) define geopolitical risk as the exposure of one or more countries to political actions in other nations. While various definitions of the term Geopolitical Risk have been suggested, this study will use the definition proposed by Caldara and Iacoviello (2022), who define it as “the threat, realization, and escalation of adverse events associated with wars, terrorism, and any tensions among states and political actors that affect the peaceful course of international relations.”

Overall, Geopolitical Risks can be defined as the probable political, military, economic, financial, and social uncertainties that arise from a nation’s involvement in global affairs. Major shifts in power, conflicts, or crises can trigger these risks and may have complex implications for both the nation itself and the wider international community. A nation’s economic resilience, diplomatic ties, and military capabilities can contribute as potential factors to these risks. Additionally, over the past few years, globalization has exacerbated these risks through the heightened interdependence of global economies and societies.

2.2. Gold

2.2.1. Gold as a Financial Asset

Gold has long been regarded as a symbol of supreme value, as reflected in expressions like “good as gold” and “silver lining”. This precious metal is not only beautiful and rare but also possesses unique properties such as ductility and malleability, making it a valuable commodity throughout history (Gotthelf, 2005). Charles de Gaulle emphasized gold’s universal and unchanging value, describing it as a standard of worth that maintains its purchasing power over time (Capie et al., 2005). Timothy Green (2007) highlighted gold’s malleability, density, and attractiveness, noting its historical role as currency, investment, and store of value.

Gold’s unique status among financial assets is due to its limited industrial use compared to its investment and jewellery applications. It is seen as surrogate money, providing protection against inflation and serving as a stable commodity that supports the global monetary system (Batten et al., 2010; 2014). Other precious metals like platinum, palladium, and silver have significant industrial uses, but gold’s monetary role was prominent until the United States ended its convertibility with currency in 1971. This shift allowed gold to be freely traded on financial markets, with its price determined by supply and demand (Hoang, 2011).

The Global Financial Crisis of 2008 and the European Debt Crisis led to significant changes in financial markets, increasing the demand for gold as a safe haven asset. Gold’s role in global monetary reserves and its use for portfolio diversification, hedging against inflation, and risk management have made it a focal point of financial studies (Capie et al., 2005; Jena et al., 2018). Gold remains an attractive investment due to its ability to offer appealing risk-adjusted returns and its liquidity in global markets.

2.2.2. Gold as a Safe Haven

A safe haven asset is characterized by its lack of correlation, or negative correlation, with another asset or portfolio during periods of significant market stress or turbulence. Unlike traditional correlations that are assessed overall market conditions, a safe haven specifically demonstrates zero or negative correlation during extreme downturns. This unique feature allows such assets to mitigate losses by increasing in value when other assets decline.

As described by Baur and Lucey (2010), the term "Haven" is defined as a harbour or port, reflects a place of safety, implying that safe haven assets provide investors with protection during adverse market conditions. Their role in reducing downside risk makes them a valuable component for constructing resilient investment portfolios during volatile periods.

Gold's role as a safe haven asset has been extensively studied, the research by Baur and Lucey (2010) indicating that gold acts as a safe haven during extreme stock market events in the US, UK, and Germany. Subsequent study by Baur and McDermott (2010) confirmed gold's safe haven status during crises like the 1987 Stock Market Crash and the Global Financial Crisis, particularly for developed markets. Hood and Malik (2013) found gold to be a weak safe haven for the US stock market, while Reboredo (2013) highlighted its effectiveness against USD exchange rate fluctuations. Wen and Cheng (2018) demonstrated gold's safe haven role for emerging markets. During the COVID-19 pandemic, studies yielded mixed results, Ji et al., (2020) and Hasan et al. (2021) affirmed gold's safe haven status, whereas Corbet et al., (2020) and Akhtaruzzaman et al. (2021) noted its diminished role. Cheema et al. (2022) observed a weakened safe haven reputation for gold during COVID-19 compared to the GFC. Azimli (2024) found gold to be a significant hedge against currency risks during the COVID-19 pandemic and the Russia-Ukraine war.

2.3. The Relationship between Gold and Geopolitical Risks

The relationship between geopolitical risks and the international gold market has been extensively studied, yet conclusions remain mixed. Some researchers, such as Bilgin et al. (2018) and Bouoiyour et al. (2018), found that increased political instability and uncertainty lead to higher gold prices, with gold acting as a hedge and safe haven during crises (Selmi et al., 2018; Gozgor et al. 2019). Studies by Baur and Smales, (2020); Li et al. (2021); Triki and Ben Maatoug (2021) and Chiang's (2022) highlighted the role of gold in diversified portfolios and its response to geopolitical events. However, other scholars, such as Lucey et al. (2013) and Baur and Smales (2018); Jiang et al. (2020); Qin et al. (2020) Huang et al. (2021); Yilanci and Kilci (2021); Ding et al. (2022) and Gong and Xu (2022) argued that gold prices are not significantly influenced by political events and that geopolitical risks do not always increase gold prices volatility. Also a research by Qin et al., (2023) on Russia's geopolitical situation showed mixed impacts on gold prices, indicating that geopolitical risks can both positively and negatively affect the gold market depending on various factors.

2.4. The Impact of the Israeli-Palestinian conflict on Financial Assets

Starting from the early 20th century, the Israeli-Palestinian conflict has been a prolonged, intricate military and political confrontation based on conflicting nationalisms and territorial claims. It is then marked by the historical, religious and cultural factors and geopolitical interests in the Levant region. There have been various actions put forward to find a solution to this conflict. Still, the attempts have not been entirely successful, and there have been several occasions when the dispute has become especially violent, including widespread destruction and many deaths in the area (Goyal and Soni, 2024).

The recent conflict between Israel and Palestine that started on October 7th 2023 has been analyzed by a relatively limited number of scholars, primarily due to its recent occurrence and the ongoing nature of events. Recent analyses, such as Cui and Maghyreh (2024), utilized the TVP-VAR approach to reveal significant higher-order moment spillovers between commodities and stock markets, with oil and natural gas driving volatility and the Israeli stock market influencing Skewness. Han, (2024) found increased ETF interconnectedness during geopolitical instability, highlighting the energy sector as a cost-effective hedge. Lin et al. (2024) observed heightened risk spillovers in global markets, particularly from the Palestinian stock market to agricultural commodities. Khan et al. (2024) demonstrated that commodities like silver, wheat, and gold are effective hedges against geopolitical risk. Younis et al. (2024) identified significant risk transmission in GCC stock markets and commodities during conflicts, emphasizing the dynamic nature of these interconnections. These findings underscore the importance of understanding risk spillovers for effective risk management and hedging strategies during geopolitical crises.

Recent studies have examined the immediate effects of the Israel-Hamas conflict on global financial markets using event study methodologies. Pandey et al. (2024) found that stock indices in happier nations are more resilient to geopolitical shocks, with the Europe, Middle East, and Africa markets being more vulnerable. Goyal and Soni (2024) observed a heterogeneous impact across 47 global stock markets, noting significant negative reactions in both emerging and developed markets on the event day. Some countries, like Poland and Egypt, showed resilience. Martins (2024) demonstrated that commodities and bonds had positive abnormal

returns, serving as effective hedges against equity market downturns, while negative abnormal returns were mainly confined to the Middle East. These findings highlight the varying sensitivities of different markets to geopolitical events and underscore the importance of commodities and energy sectors in risk transmission and hedging strategies during conflicts.

3. Data and Methodology

3.1. Data and Sample

This study examines the impact of geopolitical risk on gold prices, focusing on the recent Israeli-Palestinian conflict. The dataset integrates multiple sources to provide a comprehensive framework for analysis.

We employ Caldara and Iacoviello (2022)'s Geopolitical Risk Index (GPR) as the primary measure of geopolitical risk. To contextualise the study within the direct economic environments of the conflicting parties, we include the TA-35 Index (Israel's leading stock index by market capitalization) and the Al-Quds Index (Palestine's primary stock market index). Recognizing the significant global economic implications of this conflict, we also incorporate the S&P 500 Index, reflecting the reaction of a major global financial market influenced by the United States' explicit support for Israel, as stated in the White House joint statement on October 9, 2023⁶.

The dataset consists of daily data from January 1, 2023, to September 30, 2024, enabling an examination of the period before and during the conflict. To ensure a robust analysis, the dataset is segmented into two sub-periods: Before the Conflict period, from January 1, 2023, to October 6, 2023. During the Conflict period, from October 9, 2023 (beginning with the United States' support announcement), to September 30, 2024. This structure facilitates a comparative analysis of geopolitical risk's effects on gold prices before and during the conflict. By integrating geopolitical risk indicators and financial market data from relevant regions, this structure allows us to assess the representative effects of the conflict on gold prices.

3.2. Description of the Model and Variables

3.2.1. Model

The model developed in this study aims to assess the impact of geopolitical risks on gold prices, incorporating key stock indices to account for broader market influences (Table 1). The model is expressed as follows:

$$\ln_GOLD_t = \alpha_0 + \beta_1 \ln_GPR_t + \beta_2 \ln_TA35_t + \beta_3 \ln_ALQUDS_t + \beta_4 \ln_SP500_t + \varepsilon_t$$

Where:

- \ln_GOLD_t : The natural logarithm of the gold price at time t .
- α_0 : The intercept term, representing the baseline level of gold prices in the absence of changes in the independent variables.
- \ln_GPR_t : The natural logarithm of the Geopolitical Risk (GPR) index at time t , which measures geopolitical tensions, the index serves as a proxy for periods of elevated geopolitical uncertainty.
- \ln_TA35_t : The natural logarithm of the TA-35 index (Israel's benchmark stock index) at time t .
- \ln_ALQUDS_t : The natural logarithm of the Al-Quds index (the Palestinian stock index) at time t .
- \ln_SP500_t : The natural logarithm of the S&P 500 index (the benchmark U.S. stock market index) at time t .
- $\beta_1, \beta_2, \beta_3$ and β_4 : Are the coefficients for the independent variables.
- ε_t : The error term, capturing any random variation in gold prices not explained by the model's independent variables.

3.2.2. Variables Description

⁶ "Joint Statement on Israel": <https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/09/joint-statement-on-Israel/>

Table 1. Description of the variables

Variable	Definition	Frequency	Source
Dependent Variables			
GOLD	The price of the precious metal, (in USD).	Daily data from the website.	investing.com
Independent Variables			
GPR index	The Geopolitical Risk (GPR) Index developed by Caldara and Iacoviello (2022) is a quantitative measure of geopolitical risk based on the frequency of newspaper articles that report on adverse geopolitical events. The index is constructed by searching through major international newspapers for terms related to geopolitical tensions, wars, threats, and adverse events.	Daily data from the website.	matteoiacoviello.com/gpr.htm
TA-35	The TA-35 is a stock market index that measures the performance of the 35 largest companies listed on the Tel Aviv Stock Exchange in Israel, (in USD, converted to USD).		
Al-Quds	The Al-Quds is a stock market index that measures the performance of the largest companies listed on the Palestine Securities Exchange in Palestine, (in USD, converted to USD).		investing.com
S&P500	The S&P 500 is a stock market index that tracks the performance of the 500 largest companies listed on the New York Stock Exchange and the Nasdaq Stock Market in the United States, (in USD).		

3.2.3. Hypotheses

This study aims to determine which of these hypotheses is supported by the data, examining the impact of the Israeli-Palestinian conflict on gold prices.

- Null Hypothesis (H0): The Israeli-Palestinian conflict does not have a significant impact on the prices of gold.
- Alternative Hypothesis (H1): The Israeli-Palestinian conflict does have a significant impact on the prices of gold.

4. Results and Discussion

4.1. Descriptive statistics

4.1.1. Graphical Representations

The graphs below show the evolution of the daily movements of the geopolitical index (Figure 1), the prices of gold (Figure 2) and conventional assets (Figures 3, 4 and 5) over time.

The graph in (Figure 1) displays the Geopolitical Risk (GPR) index from early 2023 to late 2024, highlighting significant fluctuations. The index ranges from 50 to 200, with occasional spikes exceeding 200, indicating heightened geopolitical tensions, likely due to the Russian- Ukrainian war. On October 7, 2023, the Israeli-Palestinian conflict escalated, pushing the index above 300 as shown by the red shaded part of the graph. Another increase occurred on April 19, 2024, when

Iran launched missile attacks on Israel, driving the index close to 350. These spikes illustrate the index’s sensitivity to international conflicts.

The graph in (Figure 2) shows that gold prices fluctuated between \$1,800 and \$2,100, from January to September 2023. Starting in October 2023, prices surged to over \$2,500 by mid- 2024, likely due to the Israeli-Palestinian conflict and increased demand for gold as a safe haven asset.

The graph in (Figure 3) shows that the TA-35 index dropped sharply in early October 2023 due to the conflict, while the graph in (Figure 4) displays the AI-Quds index showed a steep decline from mid-2023, intensifying in October, coinciding with the escalation of conflict in Palestine. The graph in (Figure 5) presents the S&P 500 had a gradual upward trend with slight dips in October 2023.

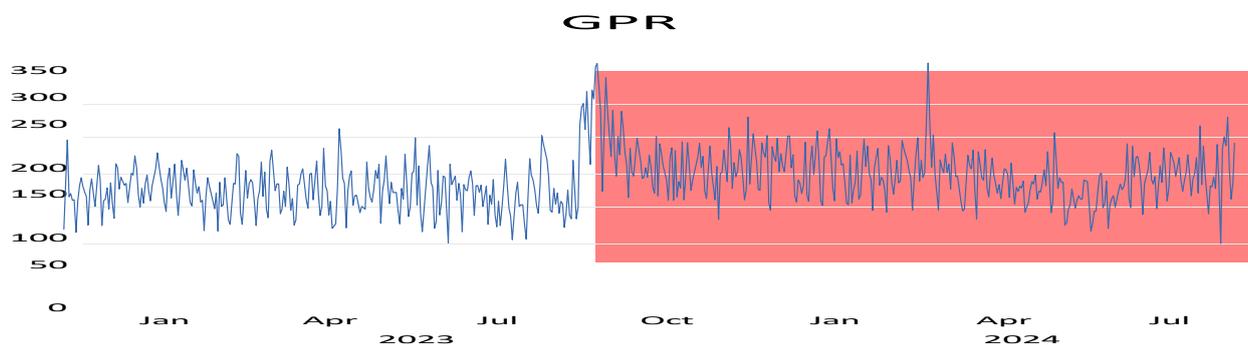


Figure 1. Geopolitical Risk Index from 01/01/2023 to 30/09/2024



Figure 2. Gold Prices (in USD) from 01/01/2023 to 30/09/2024

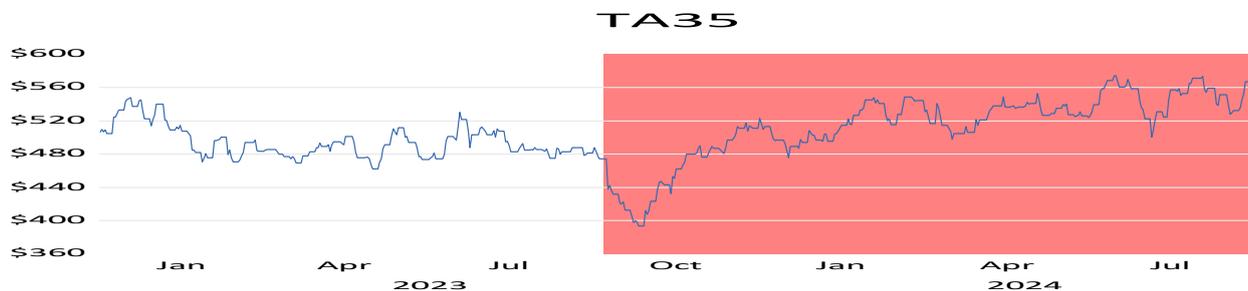


Figure 3. TA-35 Prices (in USD) from 01/01/2023 to 30/09/2024

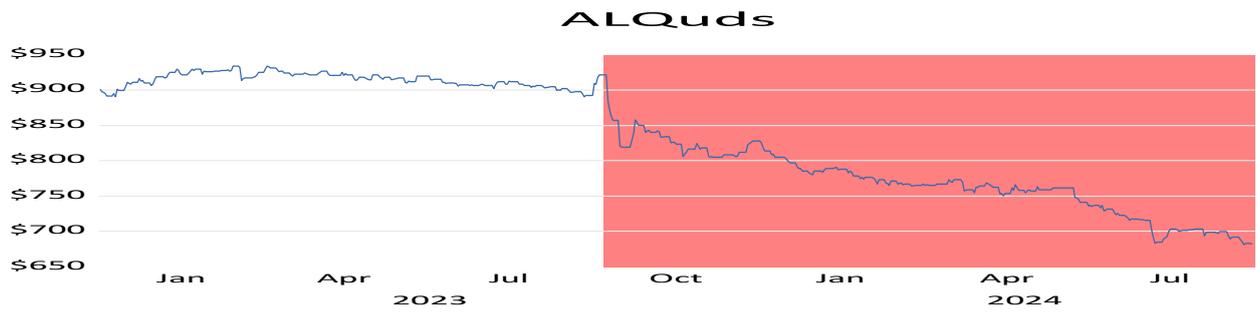


Figure 4. AI-Quds Prices (in USD) from 01/01/2023 to 30/09/2024



**Figure 5. S&P500 Prices (in USD)
from
01/01/2023 to
30/09/2024**

4.1.2. Descriptive Statistics

Table 2. Descriptive Statistics – Before the Conflict (from 01/01/2023 to 06/10/2023)

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations
LN_GOLD	7.5644	7.5651	7.6261	7.5015	0.0283	-0.3549	2.5313	8.4118	0.0149	279
LN_GPR	4.5560	4.6643	5.3917	2.3094	0.4504	-1.3303	5.9948	186.5534	0.0000	279
LN_TA35	6.2005	6.1888	6.3053	6.1346	0.0372	0.8125	3.0936	30.7969	0.0000	279
LN_ALQUDS	6.8182	6.8193	6.8392	6.7913	0.0112	-0.3582	2.4614	9.3398	0.0094	279
LN_SP500	8.3471	8.3380	8.4314	8.2449	0.0490	-0.0360	1.8319	15.9231	0.0003	279

Table 3. Descriptive Statistics – During the Conflict (from 09/10/2023 to 30/09/2024)

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations
LN_GOLD	7.7042	7.7368	7.8907	7.5284	0.0920	0.0651	1.6821	26.1596	0.0000	358
LN_GPR	4.8834	4.9009	5.8305	2.1947	0.3948	-1.1863	8.8992	603.0766	0.0000	358
LN_TA35	6.2386	6.2593	6.3512	5.9741	0.0823	-1.3337	4.5226	140.7145	0.0000	358
LN_ALQUDS	6.6416	6.6415	6.7842	6.5226	0.0597	-0.2063	2.3206	9.4239	0.0090	358
LN_SP500	8.5304	8.5442	8.6591	8.3230	0.0837	-0.5956	2.4621	25.4813	0.0000	358

Moving forward, we will apply the natural logarithm to all variables in this study, as this approach yields more accurate results compared to using raw data.

Referring to the tables above, we can see that the (Table 2) includes the descriptive statistics before the conflict of Israel and Palestine and the (Table 3) includes the descriptive statistics during the conflict.

We can see that for gold, both the mean (rising from 7.5644 to 7.7042) and the median (from 7.5651 to 7.7368) increased during the conflict, suggesting an increase in gold prices. This aligns with gold's well-known role as a safe haven asset in times of uncertainty. The standard deviation also jumped (from 0.0283 to 0.0920), signalling higher volatility in gold prices during the conflict.

Looking at the Geopolitical Risk (GPR) index, the mean rose from 4.5560 before the conflict to 4.8834 during it, while the median climbed from 4.6643 to 4.9009. This indicates an increase in perceived geopolitical risk. Interestingly, the standard deviation slightly decreased (from 0.4504 to 0.3948), suggesting that while geopolitical risk rose, its variations became more stable and predictable during the conflict.

The Israeli TA-35 stock index showed a modest rise, with the mean increasing from 6.2005 to 6.2386 and the median from 6.1888 to 6.2593. This reflects a slight boost in the index during the conflict. However, the standard deviation also increased, indicating greater market volatility.

However, for the Palestinian Al-Quds index, the mean value decreased during the conflict, while the median remained steady, suggesting relative stability in the index. Despite this, the standard deviation rose, pointing to increased volatility in the Palestinian stock market.

Lastly, the S&P 500 also saw an increase in both mean and median values, indicating rising prices. The increase in standard deviation again highlights the higher volatility experienced during the conflict.

Regarding Skewness, most variables remained left-skewed, with gold shifting from slightly left-skewed to nearly symmetric, balancing risk and reward during the conflict. In contrast, the TA-35 index moved from right-skewed to left-skewed, signaling a higher likelihood of adverse outcomes.

The kurtosis of most variables increased, particularly in the GPR index (rising from 5.9948 to 8.8992), indicating heavier tails and a greater likelihood of extreme events.

Finally, Jarque-Bera tests for normality returned low p-values (below 0.05) for all variables, rejecting the null hypothesis of normal distribution. This outcome, along with observed Skewness and kurtosis, confirms that the data deviates significantly from normality, characterized by asymmetry and fat tails.

Overall, the conflict led to increased prices, volatility, and the likelihood of extreme events across several asset classes, reflective of the broader market uncertainty during this period.

4.1.3. Correlation Matrices

This study investigates the correlations between the natural logarithms of all variables, gold prices, the geopolitical risk index, and stock indices prices from Israel, Palestine, and the United

States. The analysis covers two periods: before (Table 4) and during (Table 5) the Israeli-Palestinian conflict. The objective is to assess how geopolitical risks and financial markets of the involved countries influence gold markets. By examining these relationships, the study aims to clarify the extent to which geopolitical risks and stock indices affect gold assets often seen as safe havens during instability.

Table 4. Correlation Matrix – Before the Conflict (from 01/01/2023 to 06/10/2023)

	LN_GOLD	LN_GPR	LN_TA35	LN_ALQUDS	LN_SP500
LN_GOLD	1				
LN_GPR	-0.0388	1			
LN_TA35	-0.1554	0.0571	1		
LN_ALQUDS	0.2033	0.1041	-0.2655	1	
LN_SP500	0.1726	-0.0788	-0.1368	-0.3892	1

Table 5. Correlation Matrix – During the Conflict (from 09/10/2023 to 30/09/2024)

	LN_GOLD	LN_GPR	LN_TA35	LN_ALQUDS	LN_SP500
LN_GOLD	1				
LN_GPR	-0.3045	1			
LN_TA35	0.7442	-0.4018	1		
LN_ALQUDS	-0.9216	0.3052	-0.7849	1	
LN_SP500	0.8857	-0.3977	0.9191	-0.9117	1

Based the correlation matrices above, before the conflict, GPR displayed weak or insignificant correlation with gold (-0.0388), suggesting that gold financial markets were not significantly influenced by geopolitical tensions during this period. However, during the recent Israeli-Palestinian conflict, GPR showed more pronounced negative correlation with gold (-0.3045). The shift suggests that geopolitical risk became a more significant factor influencing financial markets. Investors' behavior changed, possibly reflecting increased caution.

Similarly, TA-35 had negative correlation with gold (-0.1554) before the conflict. However, during the conflict, however, TA-35's correlation with gold (0.7442) increased significantly, reflecting stronger interdependence between Israeli stock markets and these assets. This shift suggests a more unified investor response to uncertainty during times of instability.

The Al-Quds index initially showed positive correlation with gold (0.2033), indicating some alignment with these assets before the conflict. However, during the conflict, the correlation between Al-Quds and gold turned sharply negative (-0.9216). This significant separation indicates that during the conflict, Palestine's financial market became more isolated from this global asset.

The S&P 500 also showed moderate positive correlation with gold (0.1726) before the conflict, indicating a certain degree of alignment with the U.S. stock market. However, during the conflict, this correlation strengthened considerably (0.8857). Indicating that U.S. stock markets and this asset became more synchronized, likely showing a collective market reaction to global uncertainty during the geopolitical instability.

Overall, during the recent Israeli-Palestinian conflict, correlations between gold and stock indices increased, highlighting heightened global interconnectedness. Geopolitical risks had a more significant adverse effect, prompting investors to seek hedges in this asset while increasing volatility in regional stock markets. Notably, the Al-Quds index diverged sharply from the gold markets due to the direct economic impacts of the conflict, while the S&P 500 and TA-35 demonstrated greater resilience.

4.2. Unit Root tests

4.2.1. The Augmented Dickey–Fuller and The Phillips-Perron Tests

We conduct tests for non-stationarity without considering trend breaks for each variable in the periods before and during the Israeli-Palestinian conflict. Specifically, we assess non-stationarity at both the level and first difference using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. These tests are applied to the five variables presented in (Table 6 and 7) below.

The Augmented Dickey-Fuller (ADF) (1984) test is a statistical procedure employed to ascertain whether a time series possesses a unit root, thereby indicating non-stationarity.

The Philips Perron (PP) (1988) test extends the Dickey-Fuller test by addressing serial correlation and heteroskedasticity within the error term. This test evaluates the presence of a unit root in a time series, offering a more robust alternative to the Dickey-Fuller test through the application of a non-parametric method to adjust the test statistics.

The PP test enhances the Dickey-Fuller test by utilizing a Newey-West estimator to correct for serial correlation in the residuals, obviating the need to specify lagged differences.

Both tests adhere to the following hypotheses:

- Null Hypothesis (H0): The time series has a unit root (it is non-stationary).
- Alternative Hypothesis (H1): The time series does not have a unit root (it is stationary).

The unit root tests presented in (Table 6 and 7) below for both the ADF and PP methods provide important insights into the stationarity of the key variables, during two distinct periods, before and during the conflict.

Before the conflict, most variables are non-stationary at their levels, as indicated by insignificant test statistics, but become stationary after taking the first differences, which reflects their I(1) nature.

However, ((LN_GPR) is a notable exception, as it shows evidence of stationarity at levels at 1% significance level, respectively, using the both methods. Conversely, (LN_TA35) shows evidence of stationarity only when using the PP test, but not the ADF test, all with constant and without linear trend (M2).

During the conflict, all variables exhibit similar behaviour, characterized by non-stationarity at levels but clear stationarity at first differences, as confirmed by both the ADF and PP tests. However, the significance of stationarity at levels is observed for (LN_GPR) and (LN_ALQUDS), with results varying depending on the model specification (M2 and M1).

Overall, the empirical tests conducted indicate that, for both periods under consideration, the majority of variables necessitate differencing to attain stationarity. This finding substantiates the application of first differences in subsequent econometric modelling. Furthermore, the pronounced significance of results observed during the conflict period may imply heightened market reactions and structural transformations attributable to geopolitical instability.

Table 6. Unit Root Tests, Before the Conflict (from 01/01/2023 to 06/10/2023).

	Before the Conflict (from 01/01/2023 to 06/10/2023)					
	Augmented Dickey–Fuller test			Philips–Perron (1988)		
	Model	At Level	At First difference	Model	At Level	At First difference
LN_GOLD	M2	-2.0944	-16.6153***	M2	-2.076	-16.6154***
LN_GPR	M2	-3.8273***		M2	-13.559***	
LN_TA35	M2	-2.4302	-15.5756***	M2	-2.7068*	
LN_ALQUDS	M2	-2.3784	-17.0728***	M2	-2.4188	-17.0676***
LN_SP500	M2	-1.9338	-16.9754***	M2	-1.9155	-16.9912***

Note: Bold values indicate that the variables are stationary in level. (***) Significance of 1%; (**) Significance of 5%; (*) Significance of 10%. (M1) without constant and without linear trend; (M2) with constant and without linear trend and (M3) with constant and with linear.

Table 7. Unit Root Tests, During the Conflict (from 09/10/2023 to 30/09/2024).

	During the Conflict (from 09/10/2023 to 30/09/2024)					
	Augmented Dickey–Fuller test			Philips–Perron (1988)		
	Model	At Level	At First difference	Model	At Level	At First difference
LN_GOLD	M3	-2.8266	-19.5557***	M3	-2.7372	-19.5709***
LN_GPR	M2	-3.3866**		M2	-13.377***	
LN_TA35	M3	-2.4237	-18.9149***	M3	-2.5648	-18.9158***

LN_ALQUDS	M1	-2.7549***		M1	-2.5201**	
LN_SP500	M3	-2.4404	-18.4335***	M3	-2.5361	-18.4333***

Note: Bold values indicate that the variables are stationary in level. (***) Significance of 1%; (**) Significance of 5%; (*) Significance of 10%. (M1) without constant and without linear trend; (M2) with constant and without linear trend and (M3) with constant and with linear.

4.2.2. Zivot-Andrews Breakpoint Test

To further confirm the stationarity of the variables, this study will employ the Zivot-Andrews, (1992) breakpoint test. This test is particularly advantageous for identifying structural breaks within time series data, thereby enhancing the robustness of our analysis.

The Zivot-Andrews test is a sophisticated statistical method used to ascertain the presence of a unit root in the context of structural breaks. It extends the Dickey-Fuller test by accommodating a single structural break at an unknown point in the time series, thus providing a more comprehensive assessment of stationarity.

The Zivot-Andrews breakpoint test hypotheses:

- Null Hypothesis (H0): The time series has a unit root (it is non-stationary).
- Alternative Hypothesis (H1): The time series does not have a unit root (it is stationary), allowing for the presence of a structural break.

Table 8. Zivot-Andrews Breakpoint Test

	Before the conflict (from 1/01/2023 to 06/10/2023)		During the conflict (from 09/10/2023 to 30/09/2024)	
	t-Statistic	Chosen break point	t-Statistic	Chosen break point
LN_GOLD	-5.0690***	09/03/2023	-3.8586***	01/03/2024
LN_GPR	-10.1139*	22/07/2023	-9.8434***	05/08/2024
LN_TA35	-4.2211	16/02/2023	-2.9455	04/12/2023
LN_ALQU DS	-4.4808*	17/02/2023	-5.1153***	15/07/2024
LN_SP500	-3.1843***	25/05/2023	-3.4858**	17/07/2024

Note: Bold values indicate that the variables are stationary in level. (***) Significance of 1%; (**) Significance of 5%; (*) Significance of 10%.

As presented in (Table 8) above, before the conflict, most of variables including (LN_GOLD) and (LN_SP500), exhibited stationarity at the 1% significance level, additionally, (LN_GPR) and (LN_ALQU) were stationary at the 5% significance level, with breakpoints predominantly occurring in early 2023. This indicates that these variables were subject to significant market shifts, resulting in stationary behavior post-break. However, (LN_TA35)

remained non-stationary, even when accounting for the breakpoint.

During the conflict, stationarity persists across the variables, although the breakpoints shift to 2024, reflecting the impact of the geopolitical situation. (LN_GOLD) remain stationary at the 1% significance level, while (LN_GPR) and (LN_ALQUDES) also achieve stationarity at the 1% level. (LN_SP500) becomes stationary at the 5% significance level. Conversely, (LN_TA35) remains non-stationary at conventional significance levels, indicating its relative resilience or lesser response to structural changes. Overall, the test confirms that many financial series achieve stationarity with a breakpoint, underscoring the importance of structural shifts in market dynamics.

Table 9. Zivot-Andrews Breakpoint Test

	Before the conflict (from 01/01/2023 to 06/10/2023)		During the conflict (from 09/10/2023 to 30/09/2024)	
	t-Statistic	Chosen break point	t-Statistic	Chosen break point
DLN_TA35	-15.6584**	20/07/2023	-19.03250*	06/08/2024

Note: Bold values indicate that the variables are stationary. (***) Significance of 1%; (**) Significance of 5%; (*) Significance of 10%.

As illustrated in (Table 9), before to the conflict, the first difference of (LN_TA35), denoted as (DLN_TA35), showed significant stationarity at the 5% significance level, with a breakpoint identified on 20/07/2023. Furthermore, during the conflict, the stationarity persisted, although at the 10% significance level, with the breakpoint shifting to 06/08/2024.

4.3. Models Representation

4.3.1. Definition of ARCH Model (Autoregressive Conditional Heteroscedasticity)

The ARCH model, developed by Robert Engle in 1982, is a fundamental model in econometrics for modelling time-varying volatility, notably in financial time series.

In an ARCH model, the conditional variance of a series at time t depends on past squared errors. This allows the model to capture periods of high and low volatility in the data.

The conditional variance in an ARCH model is defined as:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 \quad (2)$$

Where: σ_t^2 is the conditional variance at time t . ε_{t-i} are past squared errors (shocks). α are parameters to be estimated. q is the number of lags. The ARCH model is effective when volatility clusters, that is, when high volatility is followed by additional high volatility and low volatility by low volatility.

4.3.2. Definition of GARCH Model (Generalized Autoregressive

Conditional Heteroscedasticity)

The GARCH model, developed by Bollerslev in 1986, generalizes the ARCH model by incorporating both past squared shocks (errors) and past conditional variances. This allows the model to be more flexible and parsimonious, as it avoids the need for a large number of lagged terms.

The conditional variance in a GARCH (p, q) model is defined as:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^q Q_j \text{Log} \sigma_{t-j}^2 \quad (3)$$

Where: α_0 , α_i , Q_j are parameters to be estimated. The model captures both the ARCH effect (past shocks) and the GARCH effect (past variances). GARCH models are frequently used in financial econometrics to model and forecast volatility because they can account for both short-term shocks and long-term volatility persistence.

4.3.3. Definition of EGARCH Model (Exponential Generalized Autoregressive Conditional Heteroscedasticity)

The EGARCH model, introduced by Nelson in 1991, extends the GARCH model by allowing for asymmetric effects of shocks on volatility. It captures the phenomenon where negative shocks often have a stronger impact on volatility than positive shocks of the same magnitude, a common observation in financial markets (leverage effect).

The EGARCH model defines the conditional variance logarithmically:

$$\text{Log} \sigma_t^2 = m + \sum_{j=1}^q Q_j \text{Log} \sigma_{t-j}^2 + \sum_{i=1}^q \alpha_i \left(\frac{|\varepsilon_{t-i}|}{\sigma_{t-i}} - \sqrt{\frac{2}{\pi}} \right) + \sum_{i=1}^p \gamma_i \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \quad (4)$$

Where:

m is a constant term. Q captures the persistence in volatility, reflecting the impact of past variance on current variance. α measures the magnitude effect (the size of shocks), capturing how the absolute size of past shocks influences current volatility. γ measures the leverage effect, allowing the model to capture the asymmetric impact of positive and negative shocks. Negative values of γ indicate that negative shocks increase volatility more than positive shocks of the same magnitude.

The EGARCH model is particularly suited for data where volatility reacts more strongly to negative shocks (bad news) than to positive ones (good news).

4.4. Estimations and Results Interpretations

Table 10. ARCH, GARCH and EGARCH Models Estimation for LN_GOLD

	ARCH				GARCH				EGARCH			
	Before the conflict		During the conflict		Before the conflict		During the conflict		Before the conflict		During the conflict	
	Coefficient	z-Statistic	Coefficient	z-Statistic								
Constant	-2.1354	-2.1476***	8.9051	24.1377***	-1.8780	-5.7956***	11.0090	25.5853***	0.8600	9.3101***	8.7778	470.2350***
LN_GPR	9.78E-05	0.0328	0.0054	2.8364***	0.0007	0.5172	0.0012	0.6180	0.0017	3.0748***	0.0038	3.5129***
DLN_TA35	0.0784	0.9119	-0.1103	-2.6536***	-0.0438	-1.4653	-0.09134	-1.8893*	0.0516	1.4047	-0.0507	-1.0199
LN_ALQUDS	1.3338	10.2031***	-0.8234	-29.075***	1.2670	28.3155***	-0.9790	-30.162***	0.8578	639.3583***	-0.7774	-152.623***
LN_SP500	0.0736	2.3709**	0.4975	23.2343***	0.0971	9.3141***	0.3742	14.6654***	0.1023	9.5053***	0.4780	152.5417***
Variance Equation												
C	0.0002	6.7115***	4.79E-05	4.8161***	2.22E-05	4.7081***	6.32E-05	5.1337***				
RESID(-1)^2	0.1712	7.4778***	1.0267	4.8125	1.0855	5.0099***	1.0224	4.4748***				
GARCH(-1)					0.0162	-0.5206	-0.0398	-0.6137				
C(6)									-2.9884	-3.3194***	-2.1685	-2.6020***
C(7)									1.5127	5.0433***	1.0693	3.5546***
C(8)									-0.0408	-0.2627	-0.0134	-0.1208
C(9)									0.8031	9.1065***	0.8401	10.0180***
R-squared	-0.0976		0.85523		-0.0816		0.8595		0.04007		0.85165	
Heteroskedasticity Test: ARCH												
F-statistic	436.2248		762.3791		4.3706		722.0254		29.4970		24.2427	
Prob. F(1,275)	0.0000		0.0000		0.0375		0.0000		0.0000		0.0000	
Obs*R-squared	169.8960		243.1136		4.3335		238.8801		26.8333		22.8171	
Prob. Chi-Square(1)	0.0000		0.0000		0.0374		0.0000		0.0000		0.0000	

Note: Bold values indicate that the variables are significant. (***) Significance of 1%; (**) Significance of 5%; (*) Significance of 10%.

The (Table 10) above provides insights into the behavior of gold prices volatility (LN_GOLD) employing ARCH, GARCH, and EGARCH models, focusing on periods before and during the Israeli-Palestinian conflict. The independent variables include the volatility of the Geopolitical Risk Index (LN_GPR) and several stock market indices (DLN_TA35, LN_ALQUDS, LN_SP500).

Firstly, the intercept term in each model represents the baseline volatility of gold prices. Before the conflict, the ARCH and GARCH models show significant negative intercepts (-2.135 and -1.878), while EGARCH has a slight significant positive intercept (0.860). However, during the conflict, across ARCH (8.905), GARCH (11.009), and EGARCH (8.778) models indicate a sharp rise in baseline volatility of gold prices. This shift reflects increased uncertainty and risk aversion among investors during the conflict, leading to higher volatility in gold prices.

Secondly, the (LN_GPR) coefficient shows the impact of geopolitical risk on gold price volatility. Before the conflict, (LN_GPR)'s influence is largely insignificant, except for a slight positive significance in the EGARCH model (0.0016). However, during the conflict, the significant positive coefficients in the ARCH (0.0053), EGARCH (0.0038) models suggest that higher geopolitical risks lead to increased volatility in gold prices. This aligns with the theory that geopolitical uncertainties heighten market volatility, with gold often seen as a safe haven asset during such times.

Thirdly, the (DLN_TA35) coefficient indicates the relationship between the volatility of the Tel Aviv 35 Index and gold price volatility. Before the conflict, no significant relationship exists, likely due to market stability. During the conflict, on the contrary, the coefficients turned significantly negative in the ARCH (-0.1103) and GARCH (-0.0913) models, where increased volatility in the stock market index corresponds with decreased volatility in gold prices. This inverse relationship is typical during periods of economic distress, where investors shift their capital to safer assets like gold, stabilizing gold price volatility. This highlights gold's protective role during periods of market turbulence.

Similarly, the (LN_ALQUDS) coefficient shows how the Al-Quds Index affects gold price volatility. Before the conflict, it illustrates significant positive coefficients across all models. However, during the conflict, this reversed, with significant negative coefficients (ARCH -0.823, GARCH: -0.979, EGARCH: -0.777), indicating that as Al-Quds volatility rises, investors shift to gold, lowering its volatility. This reflects the broader economic impact of the conflict on regional markets, where heightened local market volatility pushes investors towards gold, thereby stabilizing its volatility.

The (LN_SP500) coefficient captures the link between S&P 500 volatility and gold price volatility. It showed a positive influence on gold prices volatility, both before and during the conflict. On one hand, before the conflict, positive and significant coefficients between the two of them, which suggest that increased volatility in the S&P 500 is associated with, increased volatility in gold prices. On the other hand, during the conflict, this relationship remained strong, with even larger coefficients. This could be due to the global nature of the conflict, where both U.S. equities and gold experience heightened volatility as investors react to broader uncertainty.

The variance equation analysis reveals that shocks to gold prices had an immediate impact on volatility in both periods, as indicated by the significant ARCH (1) (RESID (-1) ^2) terms. However, the GARCH (1;1) (as indicated in (Table 10) as GARCH (-1)) term remained

insignificant, suggesting that while volatility spiked in response to shocks, these effects did not persist over time, highlighting the unique impact of the conflict on market dynamics.

The coefficients C(6) and C(7) are significant and positive, indicating that past shocks significantly increase current volatility. In contrast, C(8) is not significant, while C(9) is significant and positive, highlighting the varying impact of different lagged terms on gold price volatility. In other words, this implies that gold prices were reactive to sudden events, but the market quickly adjusted, leading to short-lived volatility spikes.

The model diagnostics reveal a significant improvement in explanatory power during the conflict, with R-squared values exceeding 0.85, compared to near-zero values before the conflict. This indicates that the models captured much more of the variation in gold prices during periods of heightened uncertainty. Additionally, the ARCH test results show significant heteroscedasticity before and during the conflict for all models, confirming the presence of time-varying volatility, suggesting less evidence of volatility clustering.

The GARCH model emerges as the most effective in explaining gold price volatility during the conflict period, as indicated by its higher R-squared values, which signify a greater capacity to capture variance in gold price movements. Additionally, the significant coefficients for key variables like (DLN_TA35), (LN_ALQUDS), and (LN_SP500) demonstrate its robustness in capturing the relationships between these factors and volatility. The GARCH model's capacity to account for volatility clustering further enhances its suitability for analyzing the complex and dynamic market conditions experienced during the conflict.

To summarize, based on the findings, the analysis provides evidence supporting that the Israeli-Palestinian conflict does significantly affect gold prices. During the conflict period, the GARCH model demonstrates significantly higher volatility in gold prices, alongside meaningful relationships with key variables such as the Tel Aviv 35 Index (DLN_TA35), Al-Quds Index (LN_ALQUDS), and S&P 500 Index (LN_SP500). These significant coefficients, particularly the positive relationship with geopolitical risk according to the findings of the ARCH and EGARCH models, cannot be neglected, (especially when their R-squared values are very close to those of the GARCH model), indicate that heightened uncertainty due to the conflict leads to increased volatility in gold prices, affirming gold's role as a safe haven asset

5. Conclusion

In an era where geopolitical risks are an inescapable global reality, financial markets are especially vulnerable to the uncertainties and instabilities that this risk brings. This study investigated the impacts of geopolitical risk on financial assets, focusing specifically on gold, in light of the contemporary Israeli-Palestinian conflict. The ongoing conflict, which intensified on October 7, 2023, provided a unique context for analyzing how such geopolitical tensions influence asset prices. This research is dedicated to the empirical investigation of the ongoing Israeli-Palestinian conflict and its impact on gold. Through this analysis, the study showed how geopolitical risk associated with the conflict has influenced the prices of this asset, contributing to the broader understanding of asset behavior under extreme geopolitical tensions.

We Examined data from periods both before the conflict (from 01/01/2023 to 06/10/2023) and during the conflict (from 09/10/2024 to 30/09/2024). The aim was to explore how heightened

geopolitical tensions influenced various asset classes, focusing specifically on gold. Descriptive statistics demonstrated a clear increase in asset prices and volatility during the conflict period, highlighting the pervasive market uncertainty associated with the geopolitical tensions.

The correlation matrices further underscored these effects, showing intensified correlations between the examined assets and stock indices during the conflict. This suggests an increase in global interconnectedness, with geopolitical risks exerting a marked influence on investor behavior.

To establish the stationarity of the time series data, we employed unit root tests, including the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Zivot-Andrews tests. The Zivot-Andrews test, which accounts for potential structural breaks, provided the most robust results. All variables were found to be stationary at the level with a structural break point, except for the TA-35 index, which required first-differencing to achieve stationarity.

To explore the influence of this conflict, we applied the Autoregressive Conditional Heteroscedasticity (ARCH), Generalized Autoregressive Conditional Heteroscedasticity (GARCH), and Exponential GARCH (EGARCH) models. The analysis revealed that the Israeli-Palestinian conflict exerts a substantial impact on gold prices, with heightened geopolitical uncertainty leading to increased volatility. This finding reinforces the established role of gold as a safe haven asset during periods of geopolitical instability, consistent with the work of Cui and Maghyreh (2024) and Khan et al. (2024).

The findings of this study have several practical implications for policymakers, investors, and market regulators. For policymakers, understanding the dynamics between geopolitical risk and gold prices can inform decisions about economic stability and interventions during periods of heightened geopolitical tensions. Investors may benefit from the insights provided by this study, particularly in terms of diversifying portfolios with safe haven assets such as gold during geopolitical instability. Market regulators could use these insights to anticipate periods of increased market volatility, ensuring that markets remain resilient during periods of instability.

While this study offers valuable insights, there are limitations that should be addressed in future research. One limitation is the focus on only one geopolitical event, the Israeli-Palestinian conflict, while other conflicts may yield different results. Additionally, the study does not account for the impact of other factors, such as monetary policy or global economic conditions, on gold prices. Future research could explore the effects of multiple geopolitical conflicts over a longer time period and examine the interplay of geopolitical risks with other financial instruments beyond gold. Moreover, further studies could incorporate other models that account for asymmetric volatility or explore how geopolitical risks impact the broader commodity market

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