Oil Price Volatility Amid Geopolitical Crises: An Empirical Analysis for the Period 2000–2026

Nachi Sofiane [1*], Berrabah M'hamed [2]
[1] University of Oran 2 (Algeria), NACHI.Sofiane@univ-oran2.dz
[2] University of Blida 2 (Algeria), m.berrabah@univ-blida2.dz

Received: 09/06/2026 *Accepted: 26/06/2026* *Published: 31/07/2026*

Abstract:
This study aims to analyze the dynamics of oil prices in light of geopolitical fluctuations between 2000 and 2026, comparing the five most important time periods as important events .The results of the descriptive analysis revealed the existence of significant fluctuations in oil prices during crisis periods, where the covid-19 crisis recorded the highest level of volatility, followed by the financial crisis and the geopolitical crisis of 2026, represented by the war on Iran, where the latter showed severe shocks and unstable prices with the presence of sharp and more positive extremes. Finally, the results of statistical tests confirmed that there are significant differences in the levels of volatility resulting from the nature of each shock, and it was also found that there are fundamental differences in the distribution of these shocks during the specified time periods.

Keywords: *Oil Price, WTI crude oil, Geopolitical crises ; COVID-19.*

1. INTRODUCTION

History has highlighted that oil is no longer a natural resource, but an energy mystery that contributed to the major transformations that the world experienced in the late nineteenth century, making it a strategic and vital element in the economies of the countries of the modern world . With the expansion of wide scientific and academic

* ***Corresponding author***

interest, Global reports indicated that the global demand for oil continues despite the policies of orientation towards alternative energies, which made it important for economic stability and energy security, many countries rely on it, on the one hand, rentier countries rely on it as a factor in achieving their development goals and improving their economic performance, while consuming countries consider it a challenge to raise their industrial production, especially in the face of current economic conditions . Where oil is no longer limited to being a source of energy only, but it has become a source of geopolitical conflicts, as the oil crisis in 1973 caused a rise in prices that caused an imbalance in the economic stability of many countries of the world, and the unrest continues, as the world has witnessed various crises in recent decades, where the 2008-2009 Global Financial Crisis (GFC) collapsed demand via the worst synchronised global recession since the Great Depression, the 2020 COVID-19 pandemic simultaneously disrupted demand through lockdowns and supply through the Saudi Arabia-Russia price war , the 2022 Russia-Ukraine conflict threatened global energy architecture by targeting Europe's dominant energy supplier. And the nascent 2026 US-Iran confrontation - involving credible threats to the Strait of Hormuz - introduced chokepoint risk on a scale not seriously contemplated since the late 1980s. Each episode represents a qualitatively distinct shock to the oil market. Yet comparative empirical analysis across all five remains thin in the existing literature.

Against this background, the present paper makes four specific contributions. First, it constructs a comprehensive, five-crisis comparative dataset covering 2000 to 2026, extending the analytical horizon beyond existing comparative studies. Second, it applies a multi-layer statistical framework - covering both parametric tests (Levene, ANOVA, Tukey HSD) and non-parametric alternatives (Kruskal-Wallis) - that accounts for the well-documented fat tails and heteroscedasticity of oil returns during crises. Third, it introduces the Geopolitical Shock 2026

episode as a novel empirical case, providing one of the first quantitative assessments of this event's impact on WTI volatility. Fourth, by systematically distinguishing among geopolitical, financial, and health crises in their volatility profiles, it generates actionable evidence for investors, risk managers, and energy policymakers seeking to calibrate responses to different crisis archetypes.

The remainder of the paper proceeds as follows. Section 2 reviews the theoretical and empirical literature on oil price volatility, geopolitical risk, and crisis transmission. Section 3 describes the data, crisis classification, and methodological framework. Section 4 presents and interprets the empirical results. Section 5 discusses implications for theory and policy, and Section 6 concludes .

2. Literature Review

2.1 Theoretical Framework: Oil Price Dynamics and Crisis Transmission

The theoretical literature on oil price determination has evolved considerably from the simple competitive models of the 1970s toward multi-channel frameworks integrating supply-side geology, demand-side macroeconomic cycles, inventory dynamics, and geopolitical risk premia. The foundational contribution of Kilian (2009), refined subsequently by Baumeister and Hamilton (2019), decomposed oil price movements into three orthogonal structural shocks: crude oil supply disruptions, aggregate global demand shocks, and oil-market-specific demand shocks (often read as precautionary or speculative demand). Baumeister and Hamilton (2019) showed that supply disruptions account for a larger share of historical oil price variance than earlier estimates suggested, while inventory accumulation plays a smaller role - a finding with direct implications for how geopolitical supply disruptions propagate into price volatility.

A further theoretical extension came from Basak and Pavlova (2015) and Tang and Xiong (2012), who modelled the financialisation of commodity markets as a structural shift amplifying price co-movement and volatility. Under the financialisation hypothesis, institutional investor flows, mediated

through commodity index products, transmit shocks from financial markets into commodity spot and futures prices and generate volatility in excess of what fundamental supply-demand models predict. Singleton (2014) and Henderson et al. (2015) provided empirical confirmation of significant price impacts from investor flows in oil futures. For the present study, this matters because financial crises - originating in financial markets and transmitting to commodities via investor de-leveraging - may generate disproportionate oil return volatility relative to their real-economy severity. That mechanism helps explain why the GFC ranks second, after COVID-19, in the volatility rankings reported below.

The transmission of geopolitical risk to oil prices operates through different channels: anticipated supply disruptions raise precautionary demand; actual conflict damages production infrastructure; and elevated uncertainty raises the risk premia that market participants demand. Cunado et al. (2020) showed, using a time-varying structural VAR, that geopolitical risk primarily operates through the demand channel by reducing global economic activity rather than uniformly through supply restriction. This challenges the common narrative that geopolitical tensions always push oil prices higher and is consistent with the finding below that geopolitical crises produce elevated price levels without necessarily generating the highest return volatility, which is more a function of the speed and magnitude of price swings than of their level.

2.2 Oil Market Volatility and Geopolitical Risk: Empirical Evidence

The empirical literature linking geopolitical risk to oil price volatility has grown substantially since the development of news-based geopolitical risk indices, notably the Caldara-Iacoviello index and its sub-components. Antonakakis et al. (2017), drawing on more than a century of monthly data, established that geopolitical risk exerts a statistically significant negative effect primarily on oil returns and volatility, operating mainly through the demand channel, while having smaller effects on the equity-oil covariance. This long-horizon perspective places the episodic volatility spikes of 2003 to 2026 in context, suggesting recent crises are not historically exceptional in

their geopolitical dimensions but are novel in their interaction with financialised market structures.

Lee et al. (2021) examined the predictive power of geopolitical threats - war threats, terrorism, and political violence - for global oil price volatility using frequency-domain, nonlinear non-parametric, and Fourier Toda-Yamamoto causality tests, finding robust and significant predictive power at multiple horizons. Plakandaras et al. (2019), using Dynamic Model Averaging with linear and nonlinear models, demonstrated that war-related geopolitical risks are the most accurate short-run oil return predictors, while composite geopolitical risk from emerging markets predicts at medium to long horizons.

The specific salience of the Strait of Hormuz as a price-relevant chokepoint has been underlined by several studies. Talmadge (2008) estimated that an extended Strait closure would remove approximately 25% of global oil supply, generating a supply shock without modern precedent. Shepard and Pratson (2020) quantified the energy security implications of maritime piracy in the Strait for Persian Gulf crude exports, finding that soft restrictions on transit generate significant price responses with two-year lags. The 2026 episode, which involved direct threats of Hormuz closure, is thus the realisation of a risk scenario long modelled in the energy security literature but rarely observed in practice. Lee et al. (2026), using a scenario matrix incorporating the GeoShock, estimated global GDP losses between $330 billion and $2.2 trillion depending on blockade duration.

2.3 The Global Financial Crisis and Oil Market Dynamics

The 2008-2009 GFC is the canonical case of demand-driven oil price collapse. Following a historically unprecedented speculative peak of approximately $147 per barrel in July 2008, partly driven by commodity index investment flows, WTI collapsed by more than 75% within six months as global activity contracted and commodity index investors de-leveraged. The interaction between real demand collapse and financial de-leveraging produced a volatility profile that differs materially from supply-driven geopolitical crises.

Nazlioglu et al. (2015) documented bidirectional volatility transmission between oil prices and financial stress during the GFC period, with causal direction reversing from oil-to-stress before the crisis to stress-to-oil after it. Jebabli et al. (2021) found that energy-stock volatility spillovers during COVID-19 materially exceeded those during the GFC, a finding that anticipates the present study's ranking of COVID-19 as the highest-volatility episode.

2.4 The COVID-19 Pandemic and Unprecedented Oil Market Disruption

The COVID-19 pandemic generated the most extreme demand shock in the recorded history of oil markets, compounded by the simultaneous collapse of OPEC+ supply coordination in March 2020. Together, these forces produced the historic negative WTI price of -$37.63 per barrel on 20 April 2020, an observation outside the support of all conventional oil price models.

Bourghelle et al. (2021) decomposed the pandemic's oil market impact into demand and supply shocks, showing both channels contributed independently to volatility and that investor anxiety amplified fundamental uncertainty as a separate sentiment factor. Le et al. (2021), using an ARDL bounds testing approach with structural breaks on daily data, identified rising COVID-19 case counts, US economic policy uncertainty, and the Russia-Saudi price war as the principal drivers of the WTI collapse, with oil futures speculation playing a supporting role. Gharib et al. (2021) applied log-periodic power law (LPPLS) methods to document the formation of a negative financial bubble in WTI during the outbreak, confirming that crisis-period oil prices can deviate substantially and persistently from fundamental values.

Ma et al. (2021) found, using event study methods, that negative impacts from information leakage during the Saudi-Russia price war were more durable than positive impacts from its eventual resolution - an asymmetry reflected directly in the fat-tailed, negatively skewed return distributions characteristic of the COVID-19 crisis window documented below.

2.5 The Russia-Ukraine War and Energy Market Restructuring

Russia's invasion of Ukraine on 24 February 2022 was the most consequential geopolitically induced energy shock since the 1973 OPEC embargo, given Russia's status as the world's second-largest oil producer and dominant natural gas supplier to Europe. Yagi and Managi (2022), using a monthly input-output model across 56 sectors and 44 countries, estimated global GDP loss from the conflict-induced energy price rise at approximately 2.85% of annual GDP ($2.7 trillion).

Zhang et al. (2024), applying multiresolution causality testing and variational mode decomposition on the October 2021 to August 2022 event window, found that WTI rose by 52.33% and Brent by 56.33%, with the war attributable to approximately 71 to 74% of total price fluctuation. Notably, while this represents the largest price level impact of any crisis in the present study's sample (mean price $105.37 per barrel), the associated return volatility (sigma = 3.54%) fell below that of the GFC, COVID-19, and GeoShock 2026. That result is consistent with the relatively orderly upward price adjustment to a supply shock, as distinct from the chaotic bidirectional volatility generated by demand collapses or chokepoint threats.

Basdekis et al. (2022) documented strong wavelet coherence between Russian and European and US equity markets and crude oil around the invasion date.

3. Methodology

In order to address the research problem, this study adopted a descriptive–quantitative analytical approach, whereby a set of procedures and the following methodological steps were implemented:

3.1 Data collection sources:

This study is based on the daily closing prices of West Texas Intermediate (WTI) crude oil, expressed in US dollars per barrel and downloaded from the Yahoo Finance website. The study period ranges from 01/01/2000 to 05/05/2026. Daily logarithmic returns were computed using the following formula:

$$r_t = \ln \frac{p_t}{p_{t-1}} \times 100$$

3.2 Statistical analysis tools: The Python programming language was used for data loading, cleaning, and conducting the appropriate statistical analyse s, relying on the necessary library.

Classification and identification of the periods of the crises under study: five main geopolitical crises were identified according to the following table :

Table1 : List of Crises, Their Nature, and Time Periods

Crisis	**Type of Crisis**	**Start Date**	**End Date**
Iraq War (Iraq_War)	Geopolitical crisis	03/03/2003	31/12/2003
2008 Financial Crisis (GFC)	Global financial crisis	01/07/2008	31/03/2009
COVID-19 (COVID)	Global health crisis	03/02/2020	30/06/2020
Ukraine War (Ukraine)	Geopolitical crisis	01/02/2022	30/06/2022
Iran War (GeoShock_2026)	Geopolitical crisis	17/02/2026	31/03/2026

Source : Author's own elaboration

3.3 Identification of statistical hypotheses: in view of the research problem and the objectives of the study, four main statistical hypotheses have been : identified that represent the analytical framework of the study

Table 2 : Statistical Hypotheses and Their Objectives of the Study

Statistical Test	**Objectives of the Statistical Test**
Levene's Test	Used to verify the homogeneity of variances across different groups and to determine whether price volatility is homogeneous across crisis periods.

One-Way ANOVA	This test aims to determine whether there are statistically significant differences in the means of shock magnitude across groups.
Kruskal–Wallis Test	Tests whether different crisis-period groups have the same statistical distribution in terms of price volatility levels.
Tukey HSD Test	This post-hoc test allows identifying which crises have the greatest impact on price volatility compared to others.

Source : Author's own elaboration

4.The Empirical Results

4.1 Statistical Results :

Table 3 : Summary Statistics of Oil Prices Across Major Geopolitical

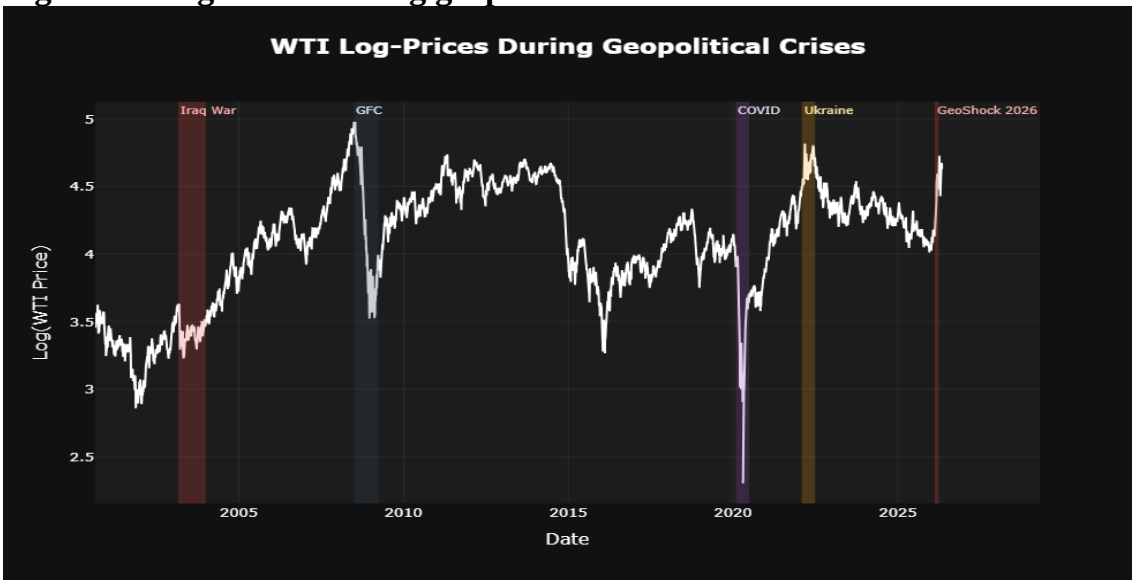
Crisis	Start_Date	End_Date	Min_ Price	Max_ Price	Mean Price	Std_Price
Iraq_War	03/03/2003	31/12/2003	25.24	37.83	36.61	2.275
GFC	01/07/2008	31/03/2009	33.87	145.29	74.01	34.808
COVID	03/02/2020	30/06/2020	18.27	53.78	83.6	34.808
Ukraine	01/02/2022	30/06/2022	88.2	123.7	105.37	9.072
GeoShock_2026	17/02/2026	31/03/2026	62.33	102.88	30.39	13.946

Source: Author's computations using Python

Table (3) presents the statistical characteristics of the price levels of the five crises that have been identified, where we note that there is a clear differentiation in the average prices, where the Ukrainian crisis(2022) recorded the highest average of 105.37 dollars per barrel compared to the Iraq War 2003, in which the average prices reached 30.39 dollars, while the global financial crisis 2008-2009 recorded an average price of 74.01 dollars, and the price changed from the lowest value of 33.87 dollars to the highest price of 145.29 dollars, the health crisis recorded the lowest 18.27 dollars and with

an average price of 83.6 dollars\, with regard to the Iranian crisis 2026, the average price reached 83.60 dollars with a change in prices, the lowest value was 62.33 dollars It changed to the highest price of 102.88 USD, which explains the obvious dynamics within a relatively short time range.

Figure 1 : Log- Price During geopolitical crises



Source: Author's computations using Python

The graph shows the logarithmic evolution of oil prices during the various crises between the period 2000-2026, where we observe clear fluctuations in prices, especially in crisis periods, prices show prominent patterns and a rapid response to external shocks, where during the Iraq War prices witnessed a clear upward trend with frequent fluctuations in which prices reached their peak in the period before the global financial crisis, however, prices recorded a sharp collapse during this crisis as a result of the decline in global demand and the economic downturn. Between the period 2010-2014, prices witnessed a gradual increase with obvious fluctuations, but after the period 2014, prices experienced a clear decline with frequent fluctuations and a state of uncertainty, especially between the period 2015 to 2019, which defined this period the beginning of the covid-19 crisis, which is the most extreme crisis, in which prices in 2020 were sharply reduced compared to other crises as a result of the significant decline in global demand for oil caused by closures,

travel restrictions and economic unrest ،as for the Ukrainian crisis, it caused a clear rise in oil prices to follow a low trend after this crisis with obvious fluctuations, but with the beginning of the Iranian crisis in mid-February 2026, prices have known an unprecedented rise as a result of geopolitical turmoil and rising tensions in the Strait of Hormuz, which caused a weakness in global oil supplies.

Table 4 : Volatility Ranking of Crisis Periods Based on WTI Oil Returns

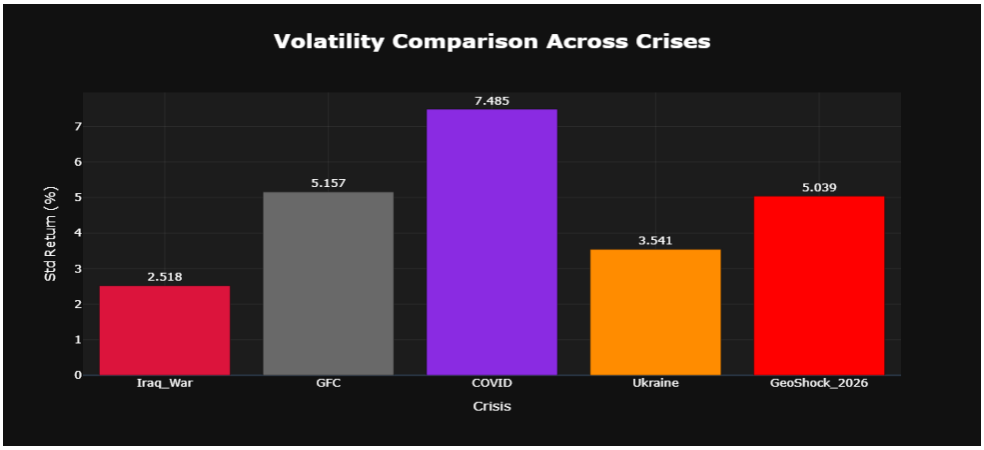
	Min_ Return _%	Max Return_%	Std Return %	Mean Abs Return %	CRISES RANKED BY VOLATILITY
COVID	-11.54	6.3	7.485	4.781	1
GFC	-13.065	16.41	5.157	3.969	2
GeoShock_2026	-28.221	22.048	5.039	3.844	3
Ukraine	-12.927	8.024	3.541	2.68	4
Iraq_War	-12.721	11.519	2.518	1.85	5

Source: Author's computations using Python

We observe from the table of ranking crises according to the fluctuations of price returns, that the corona pandemic ranked first in terms of the severity of volatility, recording a standard deviation of 7.485% and an average absolute value of 4.78%, which explains that this crisis caused significant fluctuations in which the daily returns reached the lowest negative return of about 11.54% against the highest change of 6.3% in this period, while the financial crisis appeared in second place in terms of volatility, in which the standard deviation reached a value of 5.157% compared to the average daily returns in absolute terms which reached 3.969%, also recorded a range of price movement confined between min return -13.065% and max_return-16.41% while the shock Geopolitics 2026 ranked third, in which prices moved by an average absolute value of 5.039% and a standard deviation of 3.844%, this crisis also recorded the highest range of change or movement in the daily returns of prices (from -28.221% to 22.048) . As for the Ukrainian crisis, it ranked fourth, followed by the Iraq crisis of 2003 in the last place with an average daily returns of 2.518 %

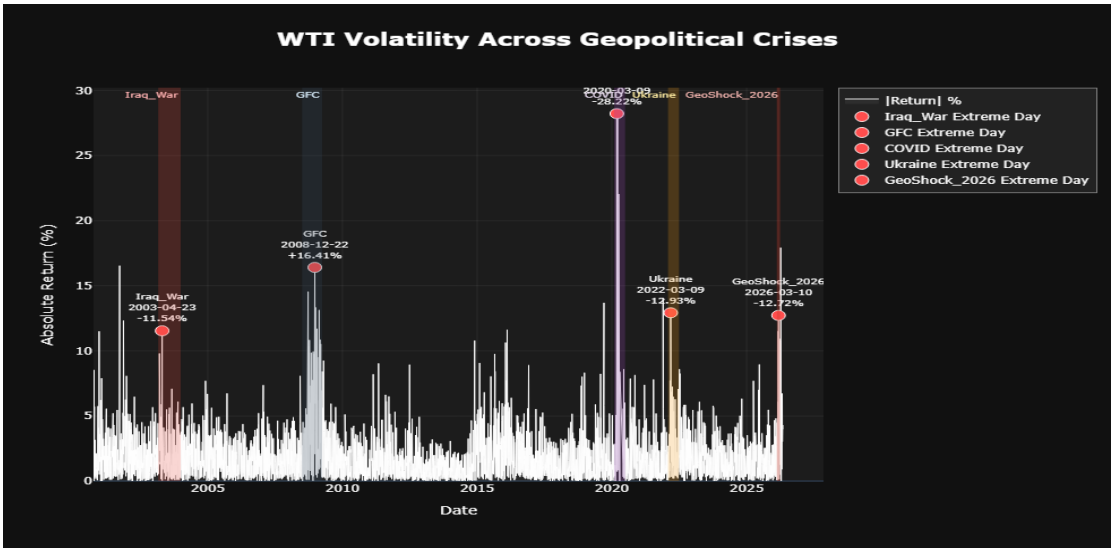
The following charts also summarize the ranking of crises according to the percentage of standard deviation of oil price returns between 2000 and 2026

Figure 2 :Volatility comparison Across crises



Source: Author's computations using Python

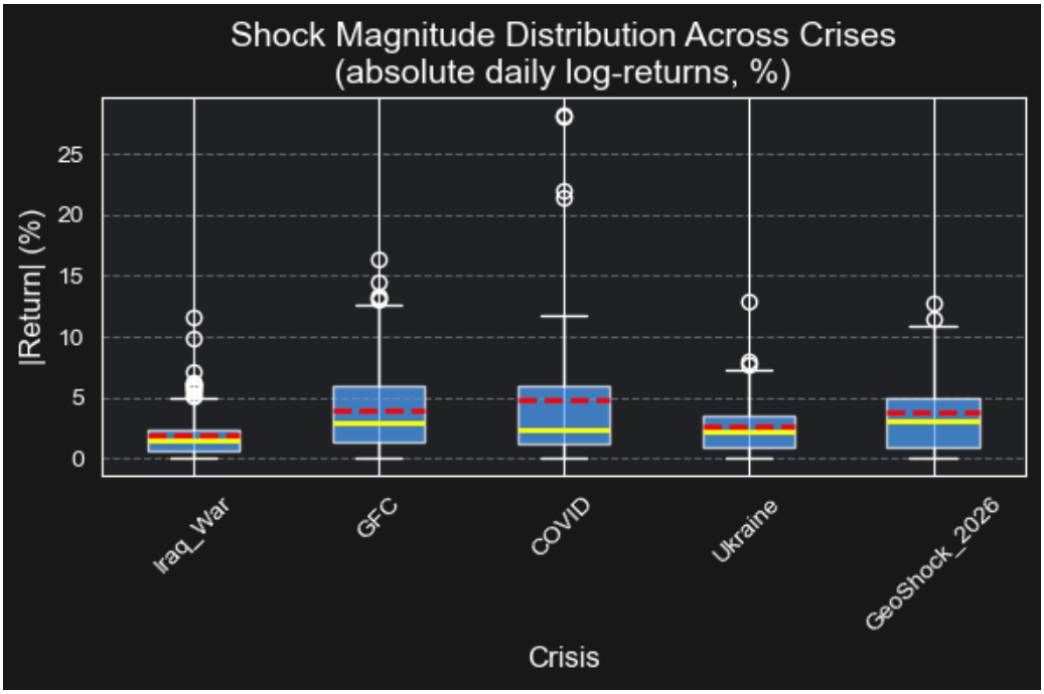
Figure 3 : WTI Volatility Across Geopolitical crises



Source: Author's computations using Python

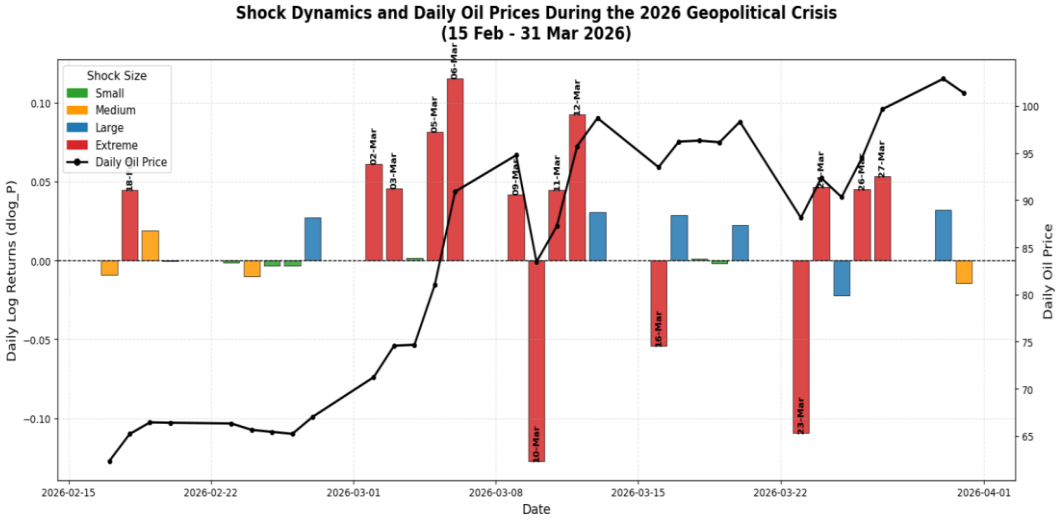
The graph shows the fluctuations of oil price returns (in percentage terms) for various geopolitical and economic shocks, where we observe a clear heterogeneity in volatility patterns with a clear grouping of fluctuations in crisis periods in the form of clusters and occasional spikes followed by lulls after each crisis . The covid-19 crisis is considered the most influential, as it caused a negative relative change in returns of 28.22% on March 09, 2020, while the 2008 financial crisis saw a clear fluctuation in returns of + 16.4% on December 22, 2008, as well as the Ukraine crisis and the Iranian crisis of 2026 caused a change in returns of -12.93% on March 09, 2022 and -12.72% on March 10, 2026, as summarized the following figure shows the distribution of the magnitude of absolute daily shocks in oil revenues (%) across several crises, where the covid-19 crisis represents the highest levels of volatility on record with the spread of outliers.

Figure 4 : shock Magnitude distribution Across Crises



Source: Author's computations using Python

Figure 5 : Shock Dynamics and daily oil prices During the 2026 geopolitical crises



Source: Author's computations using Python

The graph represents the development of daily oil returns(dlog_P) in conjunction with the development of daily prices during the geopolitical crisis of 2026, and the magnitude of shocks was divided into four levels: (small, Medium, large, extreme), 14 cases of severe and extreme shocks were recorded (in red) . Where we note during the beginning of the crisis, i.e. in the last half of February 2026, the returns were relatively stable with small and medium shocks, but with the beginning of March and the increase in geopolitical tensions, prices witnessed a clear rise and increased volatility, as several extreme levels appeared, a series of sharp positive shocks in which prices exceeded the ceiling of 85 dollars, especially in the period between March 02 to March 12, 2026, and during the crisis, negative extreme shocks were recorded on March 10, March 16 and March 24, 2026, indicating the presence of adverse reactions caused by events or news related to the market.

4.2 Statistical Tests and Hypothesis Validation :

Table Test 3 : Levene's test for homogeneity of variances:

F-stat (F)	Prop (P)
17.8101	0.000000

Source: Author's computations using Python

The Levene test shows a statistical value F-stat = 17.81 with a statistical significance less than 0.05, which indicates the rejection of the null hypothesis and confirms the absence of homogeneity in the variations between crises and this explains the existence of differences in volatility levels resulting from shocks and crises .

Table Test 4 : One-way ANOVA:

F-stat (F)	Prop (P)
20.6414	5.327074e-16

Source: Author's computations using Python

The variance analysis test indicates a statistically significant level less than 0.05, which leads to the rejection of the null hypothesis and the acceptance of the alternative hypothesis, which indicates the existence of statistically significant differences in the average magnitude of shocks resulting from the five crises.

Table Test 5 : Kruskal-Wallis test:

F-stat (F)	Prop (P)
H = 67.8272	p = 6.524015e-14

Source: Author's computations using Python

The statistical value of the Kruskal-Wallis test indicates a significance level less than 0.05, which leads to the rejection of the null hypothesis and acceptance of the alternative hypothesis, which states that there are significant differences in the distribution of the magnitude of the shock between the groups (five crises) and also indicates the existence of at least a crisis whose distribution differs from other crises.

Table 6 : Test Tukey HSD pairwise comparisons:

Crisis 1	Crisis 2	Mean Difference	Adjusted p-value	95% CI Lower	95% CI Upper	Significant Difference
COVID	GFC	-1.3897	0.0112	-2.5649	-0.214	**Significant**
COVID	GeoShock_2026	-1.5146	0.2143	-3.4723	0.4432	Non Significant
COVID	Iraq_War	-3.509	0	-4.6635	-2.354	**Significant**
COVID	Ukraine	-2.6783	0	-4.0103	-1.346	**Significant**
GFC	GeoShock_2026	-0.1248	0.9997	-1.9724	1.722	Non Significant
GFC	Iraq_War	-2.1193	0	-3.0752	-1.163	**Significant**
GFC	Ukraine	-1.2886	0.0215	-2.4527	-0.124	**Significant**
GeoShock_2026	Iraq_War	-1.9944	0.0253	-3.829	-0.159	**Significant**
GeoShock_2026	Ukraine	-1.1638	0.4776	-3.1148	0.7873	Non Significant
Iraq_War	Ukraine	0.8307	0.2732	-0.3126	1.9739	Non Significant

Source: Author's computations using Python

Summary of the results of dimensional comparisons (Tukey HSD):

The results of the Tukey HSD test indicate that there are clear differences and differentiation between the various crises, where the differences that had a statistical significance of less than 0.05 were represented by:

- there is a moral differentiation between both the corona pandemic crisis and the following crises : the financial crisis, the Iraq War, and the Ukrainian crisis ;
- There is a moral differentiation between the financial crisis and both the Iraq War and the Ukrainian crisis ;
- There is a moral differentiation between the crises of the 2026 war and the 2003 Iraq War،
- No moral differences were recorded between both the Iraq War and the Ukrainian crisis, as well as between COVID-19 and the shock of 2026 ;

5. Discussion and Interpretation of Results

The results indicate the presence of clear and significant dynamic fluctuations in oil prices through rapid responses in crisis periods. It also turns out that geopolitical crises contribute to higher price levels and volatility compared to the financial crisis and the health crisis, where the latter recorded the lowest price of about 18 dollars per barrel.

The results of the analysis show that the covid-19 pandemic tops the list of crises in terms of volatility, as it recorded the highest standard deviation value of 7.485%, along with an average absolute value of 4.78%, reflecting the severity of price disruptions during this period compared to other crises.

The results also reveal that there is a clear heterogeneity in the patterns of volatility between the five crises, the phenomenon of volatility Clustering is formed, where sharp shocks during crisis periods gather in the form of clusters, followed by periods of relative calm.

On the other hand, there are also prominent extreme values in the distribution of the magnitude of absolute daily shocks to oil revenues across various crises, where the covid-19 crisis represents the highest levels of volatility ever .

The results of the analysis of price dynamics during the period of the geopolitical crisis of 2026 show sharp shocks and unstable prices, and the magnitude of the shock showed the presence of sharp extremes and more positive than negative .

The results further indicate the heterogeneity of the inter-crisis variations, confirming the existence of fundamental differences in the levels of volatility resulting from the nature of each shock. It was found that there are significant

differences in the average magnitude of shocks between the five crises, in addition to significant differences in the distribution of these shocks across different groups.

Finally, the results of the study show that there are two main patterns of volatility in oil price returns: a high volatility pattern represented by the covid-19 pandemic and the financial crisis, and a medium volatility pattern represented by the Iraq War, the Ukrainian crisis, and the geopolitical crisis (the war on Iran 2026, which indicates a discrepancy in the degree of impact of crises on the dynamics of oil prices and revenues.

6. **CONCLUSION :**

This paper set out to answer a specific question: does the nature of a crisis determine the volatility signature it leaves in crude oil returns, or do all severe disruptions look broadly similar once one controls for scale? The answer, based on five crisis episodes spanning 23 years of daily WTI data, is that crisis type matters considerably.

Three findings stand out. First, the COVID-19 pandemic was the most volatile episode by a wide margin. With a standard deviation of daily returns of 7.49% and 27% of trading days crossing the extreme shock threshold, it sits in a category of its own among the crises examined here. The GLOBAL FINANCIAL CRISIS comes second at 5.16%, and the Geopolitical crisis 2026 follows closely at 5.04% despite covering only 30 trading days. The Russia-Ukraine War, despite generating the largest price level change in the sample, produced moderate return volatility (3.54%), and the Iraq War was the quietest episode of all (1.87%). Levene's test, ANOVA, and Kruskal-Wallis all reject the hypothesis that these five distributions share common parameters at well below the 1% level.

Second, the Geopolitical crisis 2026 result challenges a common prior in the energy economics literature: that geopolitical crises are systematically less volatile than financial or health crises. They generally are. But that generalisation breaks down for chokepoint-type

geopolitical shocks, where the threatened disruption is global rather than regional and credible rather than merely theoretical. The 2026 episode produced daily volatility statistically indistinguishable from the Global Financial crisis in Tukey pairwise comparisons, despite lasting less than two months. The implication is that crisis categorisation should disaggregate geopolitical shocks by mechanism and geography, not treat them as a homogeneous class.

Third, the Tukey HSD results make clear that the pairwise statistical map is not simply a ranking by severity. Three pairs, GLOBAL FINANCIAL CRISIS versus Russia-Ukraine, GLOBAL FINANCIAL CRISIS versus GeoShock 2026, and Russia-Ukraine versus GeoShock 2026, do not differ significantly from each other after family-wise correction, even though individual episode statistics vary. This clustering suggests that the top tier of volatility belongs uniquely to COVID-19, a middle tier covers the GLOBAL FINANCIAL CRISIS and intense chokepoint threats, and a lower tier covers conventional geopolitical conflicts. Understanding which tier a crisis belongs to in real time is, of course, the practical challenge.

Four limitations constrain these conclusions and point to productive extensions. The GeoShock 2026 sub-sample covers only 30 days, which limits the stability of distribution-based estimates. The analysis uses WTI closing prices only; Brent and intraday data would allow cross-benchmark and intraday volatility comparisons. The crisis windows are defined ex-post, introducing selection exposure. And the study does not model spillovers to equity, currency, or fixed income markets, which would be needed to assess the full systemic footprint of each crisis type.

For future research, two directions seem most valuable. One is the development of a real-time crisis typology classifier, combining incoming geopolitical risk index values, demand indicators, and financial stress measures to assign new shocks to the relevant volatility tier as they unfold. The other is a formal test of whether chokepoint-

type geopolitical shocks have a different persistence structure in WTI returns than conventional conflict shocks, using long-memory or regime-switching methods of the kind applied to geopolitical risk by Monge et al. (2023). Both extensions would bring the comparative empirical literature closer to the real-time risk management problems that motivate it.

At a time when the Strait of Hormuz remains a live strategic flashpoint and the structural conditions that generated the COVID-19 volatility spike, including financialised commodity markets and tight OPEC+ coordination, remain in place, the evidence that crisis type is a first-order determinant of oil market volatility is not merely an academic finding. It is a parameter that belongs in every serious risk management and energy security framework.

7. Bibliography List:

- Antonakakis, N., Gupta, R., Kollias, C., & Papadamou, S. (2017). Geopolitical risks and the oil-stock nexus over 1899-2016. Finance Research Letters, 23, 165-173.
- Basak, S., & Pavlova, A. (2015). A model of financialization of commodities. Journal of Finance, 71(4), 1511-1556.
- Baumeister, C., & Hamilton, J. D. (2019). Structural interpretation of vector autoregressions with incomplete identification: Revisiting the role of oil supply and demand shocks. American Economic Review, 109(5), 1873-1910.
- Bourghelle, D., Jawadi, F., & Rozin, P. (2021). Oil price volatility in the context of Covid-19. International Economics, 167, 39-49.
- Cunado, J., Gupta, R., Lau, C. K. M., & Sheng, X. (2020). Time-varying impact of geopolitical risks on oil prices. Defence and Peace Economics, 31(6), 692-706.
- Echaust, K., & Just, M. (2021). Tail dependence between crude oil volatility index and WTI oil price movements during the COVID-19 pandemic. Energies, 14(14), 4147.
- Gharib, C., Mefteh-Wali, S., Serret, V., & Ben Jabeur, S. (2021). Impact of COVID-19 pandemic on crude oil prices: Evidence from econophysics approach. Resources Policy, 74, 102392.

- Henderson, B. J., Pearson, N. D., & Wang, L. (2015). New evidence on the financialization of commodity markets. Review of Financial Studies, 28(5), 1285-1311.
- Hou, A., & Suardi, S. (2012). A nonparametric GARCH model of crude oil price return volatility. Energy Economics, 34(2), 618-626.
- Jebabli, I., Kouaissah, N., & Arouri, M. (2021). Volatility spillovers between stock and energy markets during crises: A comparative assessment between the 2008 global financial crisis and the Covid-19 pandemic crisis. Finance Research Letters, 46, 102363.
- Kang, W., Ratti, R. A., & Yoon, K. H. (2013). Structural oil price shocks and policy uncertainty. Economic Modelling, 35, 314-319.
- Klein, T., Thu, H. P., & Walther, T. (2016). Oil price volatility forecast with mixture memory GARCH. Energy Economics, 58, 46-58.
- Le, T.-H., Le, H. C., & Awaworyi Churchill, S. (2021). The historic oil price fluctuation during the Covid-19 pandemic: What are the causes? Research in International Business and Finance, 58, 101489.
- Lee, C.-C., Olasehinde-Williams, G., & Iheonu, C. O. (2021). Are geopolitical threats powerful enough to predict global oil price volatility? Environmental Science and Pollution Research, 28, 28720-28731.
- Lyu, Y., Tuo, S., Wei, Y., & Yang, M. (2021). Time-varying effects of global economic policy uncertainty shocks on crude oil price volatility: New evidence. Resources Policy, 70, 101943.
- Monge, M., Gil-Alana, L. A., & Martinez de Gracia, F. (2023). The impact of geopolitical risk on the behavior of oil prices and freight rates. Energy, 269, 126779.
- Nazlioglu, S., Soytas, U., & Gupta, R. (2015). Oil prices and financial stress: A volatility spillover analysis. Energy Policy, 82, 278-288.
- Plakandaras, V., Gupta, R., Gogas, P., & Papadimitriou, T. (2019). Point and density forecasts of oil returns: The role of geopolitical risks. Resources Policy, 62, 580-591.
- Shahzad, U., Alghalith, M., & Muhammed, A. (2023). Connectedness between geopolitical risk, financial instability indices and precious metals markets: Novel findings from Russia Ukraine conflict perspective. Resources Policy, 80, 103249.
- Shepard, J. U., & Pratson, L. F. (2020). Maritime piracy in the Strait of Hormuz and implications of energy export security. Energy Policy, 140, 111379.
- Singleton, K. J. (2014). Investor flows and the 2008 boom/bust in oil prices. Management Science, 60(2), 300-318.
- Talmadge, C. (2008). Closing times: Assessing the Iranian threat to the Strait of Hormuz. International Security, 33(1), 82-117.
- Tang, K., & Xiong, W. (2012). Index investment and the financialization of commodities. Financial Analysts Journal, 68(6), 54-74.

- Yagi, M., & Managi, S. (2022). The spillover effects of rising energy prices following 2022 Russian invasion of Ukraine. Economic Analysis and Policy, 77, 40-54.
- Zhang, Q., Di, P., Farnoosh, A., & Li, J. (2024). The impact of Russia-Ukraine war on crude oil prices: An EMC framework. Humanities and Social Sciences Communications, 11, 386