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Geopolitical Tensions and Financial Market Spillovers

A Time-Varying Connectedness Analysis of Commodity and Equity Markets

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Abstract
This study investigates the spillover effects of geopolitical tensions on commodity and stock markets, focusing on their influence on risk transmission and market stability. By applying a TVP-VAR connectedness framework, it quantifies dynamic interdependencies and higher-order moment risks across financial markets. The research identifies key shock transmitters and receivers, offering insights into crisis-period market behavior. Using daily data from January 2, 2017, to December 21, 2023, the analysis captures time-varying linkages and risk transmissions across commodity and stock markets. The methodology allows for identifying key transmitters and receivers of market shocks during heightened geopolitical tensions. The findings reveal that the Israel-Palestine conflict significantly increases overall spillovers and volatility within financial markets. The TA Allshare index emerges as a primary source of market shocks, reflecting its central role in regional risk transmission. In contrast, the Al-Quds Palestinian index is identified as the most prominent net receiver. These results have important implications for both policymakers and market participants, emphasizing the need to understand and manage geopolitical risk in financial systems.

Keywords
Dynamic Connectedness, Financial Assets, Commodity Markets, Israeli-Palestinian Conflict

1. Introduction
The intensification of global geopolitical tensions, particularly following the events of October 7, 2023, has heightened apprehension among economists about the wider implications of such instability. Growing concerns stem from the possibility of further escalation, which could disrupt global energy markets and compromise vital trade routes. The Middle East, in particular, plays a pivotal role in this context, given its strategic importance as both a major energy provider and a central hub for international commerce. Risks emerging from this region carry substantial economic ramifications that extend well beyond its borders. Adding to the complexity is the backdrop of ongoing economic uncertainty, shaped by lingering effects of the COVID-19 crisis, shifts in monetary policy by major central banks, and continuing geopolitical unrest in other areas, such as the conflict in Ukraine.

The increased integration of global markets and the financialization of commodity markets have led to greater price volatility and trading activity. These factors facilitate the transfer of risk and the propagation of spillovers in both risk and return across various commodity categories. As a result, extensive research has been conducted to explore the causal connections among different commodity markets, highlighting their implications for risk management and asset allocation. Additionally, fluctuations and turbulence in financial and commodity markets are significantly affected by uncertainty shocks. In this study, we conceptualize geopolitical risks quantified through the Geopolitical Risk (GPR) index, as an exogenous factor that independently affects market behavior. This perspective aligns with existing literature, which suggests that the GPR index encapsulates broader political risks that are not directly influenced by market-specific fluctuations.

To substantiate the theoretical rationale for including these variables, we have selected the GPR index based on established research indicating that geopolitical tensions generate uncertainty in financial markets. This uncertainty, in turn, heightens volatility and fosters risk aversion among investors (Abid et al., 2023; Gong and Xu, 2022). Furthermore, commodity prices, namely WTI oil, natural gas, and gold, are historically sensitive to geopolitical events. For instance, oil

prices tend to fluctuate in response to conflicts in key oil-producing regions, while gold is recognized as a haven asset during unstable periods (Cheema et al., 2022; Akhtaruzzaman et al., 2021; Micallef et al., 2023). Additionally, the inclusion of the stock market indices (Al-Quds and TA Allshare) is warranted by their relevance in the context of the Israel-Palestine conflict, as these markets are directly affected by local geopolitical developments (Hassouneh et al., 2018). Recent studies, Khemakhem and Gallas (2025) show that geopolitical tensions, such as the Israel-Palestine conflict, significantly reinforce linkages between commodity and equity markets, increasing volatility and tail risk. A growing body of research confirms that such geopolitical disturbances are major sources of financial market instability, influencing both price dynamics and risk transmission (Su et al., 2019; Sharif et al., 2020; Goyal & Soni, 2024). Events like the Russia-Ukraine war have also triggered sharp movements in energy prices and global equities, illustrating the broader contagion effects of geopolitical shocks (Boubaker et al., 2022; Shaik et al., 2023).

This study investigates the complex dynamics between geopolitical risks and the interconnectedness of commodity and financial markets, focusing on global and regional indices. Specifically, it examines how geopolitical events, such as the Israel-Palestine conflict, affect the dynamic connections between key commodity indices (WTI oil, gold, and natural gas) and stock markets (Al-Quds Palestine index, TA Allshare Israeli index, MSCI Emerging Markets index, and MSCI World index). By covering data from January 2, 2017, to December 21, 2023, the study provides a comprehensive view of market responses to recent and ongoing geopolitical upheavals. The originality of this research is rooted in its use of the Time-Varying Parameter VAR (TVP-VAR) model, which allows for a more responsive and dynamic analysis of market connectedness. Unlike traditional models that rely on fixed window sizes, the TVP-VAR approach captures the evolving nature of risk spillovers in real time, using the Kalman filter to track changes more accurately. This methodology delivers a more nuanced perspective on how geopolitical risks shape market behavior over time. Another key aspect of the study's innovation lies in its focus on relatively underexplored financial markets, particularly the Palestinian and Israeli stock markets. While most previous studies have concentrated on major global indices, this research broadens the scope to include these regional markets, offering new insights into how localized conflicts can reverberate across global financial systems. By doing so, it addresses an important gap in existing research, providing deeper insights into how geopolitical tensions impact financial stability in both developed and emerging markets.

Empirically, the study reveals significant volatility transmission between commodities and equity markets during times of geopolitical crisis. Our results indicate that the Israeli-Palestinian conflict has significantly intensified volatility transmission between commodity and equity markets, particularly through higher-order moment risks. This underscores the critical role of geopolitical events in shaping cross-market dynamics. By revealing strong interconnectedness during the crisis, the study highlights the need for investors and policymakers to integrate geopolitical risk into their strategies and adopt robust risk management frameworks to mitigate market instability. The study's practical contributions are equally important. It underscores the need for proactive risk management strategies that may reduce the effects of geopolitical tensions on market volatility and commodity prices. By providing actionable recommendations for financial professionals, this research not only advances academic understanding but also has direct implications for policy and investment strategies, making it a valuable addition to the existing body of knowledge.

The structure of the paper is as follows: Section 2 outlines the data sources and the methodological framework. Section 3 details the empirical findings along with a discussion of the results. Section 4 provides concluding insights and implications.

2. Data Collection and Econometric Approach

2.1 Data

To evaluate the effect of geopolitical risk on both commodities and the financial market, we collected the daily settlement prices of West Texas Intermediate (WTI) crude oil futures, natural gas, and gold futures, with gold considered a potential secure asset. For the stock market, we incorporated the Al-Quds and TA Allshare indices for the Palestinian and Israeli stock markets, respectively, along with the MSCI World index and MSCI Emerging Market index. The data of all these variables was sourced from the Datastream platform. Additionally, the daily index of GPR was introduced by Caldara and Iacoviello (2022). The daily data of the GPR is available at the following link: https:// www. Matteoiacoviello.com. The time covered ranges from January 2, 2017, to December 21, 2023, containing a total of 1683 daily observations. Notably, the initiation of the sample period was established based on the presence of distinct geopolitical risks, including the COVID-19 outbreak, the Russia-Ukraine military conflict, and the tensions between Israel and Palestine. We use the following equation to define each series' data return: Rt equals the natural logarithm of (Pt divided by Pt-1), where Pt denotes the index price at time t, while Pt-1 indicates the price of the index at time t-1, and Rt represents the index return at time t.

Fig. 1 illustrates the time series of daily data. The GPR shows strong fluctuations, peaking in 2021 during the COVID-19 crisis. Financial assets also show major price shifts. WTI dropped sharply before turning negative in April 2020, then surged during the Russia-Ukraine war (March 2022) and the Israel-Palestine conflict (October–November 2023). Natural gas prices declined in 2022, rising again in late 2023. Gold fluctuated due to COVID-19, the 2022 war, and late-2023 tensions. Stock indices declined gradually across all three major events.

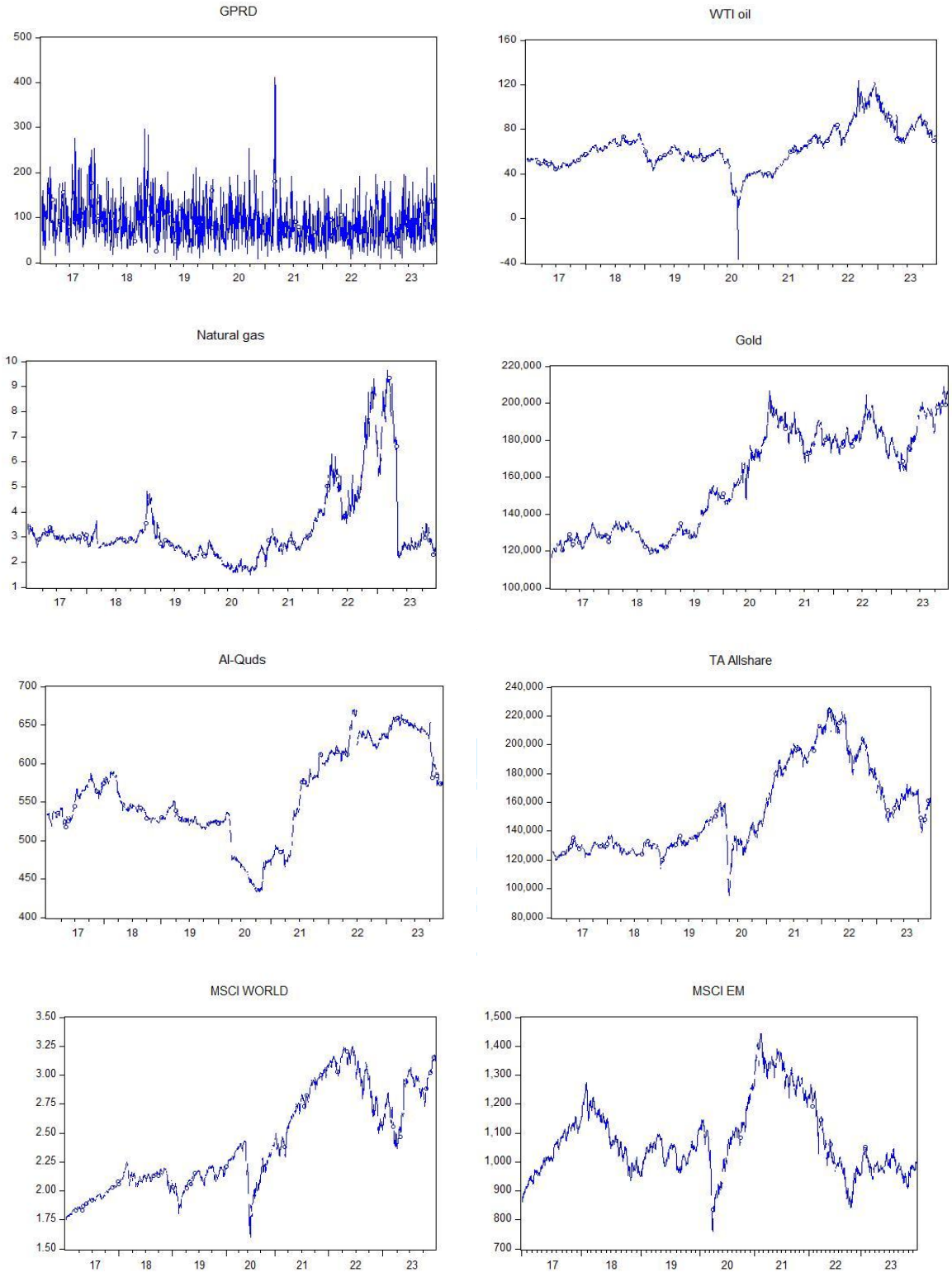


Figure 1. Dynamic time series of daily data
Source: Author's calculations

Table 1. Descriptive statistics

	GPR	WTI oil	Natural gas	Gold	Al-Quds	TA Allshare	MSCI WORLD	MSCI EM
MEAN	0.00012	0.00044	-0.00015	0.00035	0.00005	0.00010	0.00028	0.00006
MEDIAN	-0.00172	0.00217	0.00053	0.00050	-0.00011	0.00070	0.00060	0.00077
MAXIMUM	2.55092	0.31963	0.19798	0.05775	0.02591	0.04716	0.08406	0.09794
MINIMUM	-2.99588	-0.28220	-0.98628	-0.05114	-0.06544	-0.08516	-0.10441	-0.06891
STD.DEV	0.60603	0.03091	0.04245	0.00904	0.00476	0.01070	0.01027	0.01085
SKEWNESS	0.17969	-0.23567	-7.43684	-0.18280	-2.23570	-1.43226	-1.15570	0.18562
KURTOSIS	4.458819	30.70571	176.3243	7.999738	32.90190	12.2102	21.59330	12.83199
JARQUE-BERA	158.2937***	53843.98***	2122161***	1762.314***	64102.46***	6524.018***	24617.62***	6788.507***
ERS	-17.811***	-6.4141***	-6.071***	-15.587***	-6.362***	-10.126***	-15.022***	-9.373***
Q(10)	256.865***	41.396***	41.960***	11.874***	57.977***	60.319***	79.368***	16.618***
Q^2(10)	119.970***	525.855***	136.01***	153.474***	17.288***	562.143***	1125.340***	375.066***

Note: Table 1 indicates the descriptive statistics for the Geopolitical Risk Index (GPR), Commodities (WTI Crude Oil, Gold, and Natural Gas) and the Stock Market (Al-Quds, TA Allshare, MSCI World, and MSCI emergent market) from January 2, 2017 to December 21, 2023. ERS refers to the Elliot-Rothenberg-Stock stationarity test. Q (10) and Q2 (10) are utilized as the Ljung–Box test to assess serial correlation in both the raw series and squared residuals. ***denote significance at the 1% level.
***Source*:** Author's own calculations.

Table 1 presents the summary statistics of the returns. WTI oil, gold, and MSCI World have the highest average returns (0.00044, 0.00035, 0.00028), while natural gas shows the lowest (-0.00015). The GPR index records the highest maximum (2.55092) and standard deviation (0.60603), signaling greater volatility. WTI oil and natural gas also show high risk (0.03091 and 0.04245). Among stock indices, MSCI Emerging Markets and TA Allshare show the highest standard deviations (0.01085, 0.01070), while Al-Quds has the lowest (0.00476). ERS tests confirm stationarity; Jarque-Bera rejects normality; and Ljung-Box tests indicate autocorrelation in returns and squared returns.

2.2 Econometric methodology

The examination of the transmission mechanism among geopolitical risk, commodities, and financial stocks in a time-varying context was conducted utilizing the Time-Varying Parameter Vector Autoregressive (TVP-VAR) interaction methodology developed by Antonakakis et al. (2020). We employ TVP-VAR approach to analyze the dynamic connectedness among commodity and stock markets. This model, the GPR index is treated as an exogenous variable, meaning it drives the system's dynamics without being contemporaneously influenced by the other variables. This treatment is based on the understanding that geopolitical risks typically arise independently of market movements. This method offers advantages compared to the connectedness framework of Diebold and Yilmaz (2014), which utilizes a VAR approach with a rolling window. Unlike the latter, the TVP-VAR model doesn't require choosing a fixed window size, hence eliminating bias. Additionally, it avoids the exclusion of observations by integrating the Kalman filter in estimation, following the methodology outlined by Koop and Korobilis (2014).

3. Findings and Discussion

The connectedness index based on the TVP-VAR model is used to assess the relationship between financial assets and geopolitical risk. We first examine the connection between commodities and stock market indices, then reassess it by including the GPR index. This allows us to evaluate the impact of geopolitical risk, particularly during the Israel-Palestine conflict. The findings highlight the significant role of GPR as an exogenous factor driving volatility in both markets. By treating GPR as exogenous, we isolate its effects, showing that it drives market behavior independently (Caldara and Iacoviello, 2022), emphasizing its relevance in financial market dynamics.

3.1 Static connectedness

Table 2 presents the static connectedness results among three commodities (WTI oil, gas, gold) and four stock indices (Al-Quds, TA Allshare, MSCI World, MSCI EM). Each value in row *i* and column *j* shows risk transmission from variable *i* to *j*. "TO" indicates spillovers sent, "FROM" reflects spillovers received, and "NET" is the difference. If "TO" > "FROM," the variable is classified as "NPT". "TCI" denotes total connectedness. The average TCI is 51.38%, suggesting strong risk spillovers. MSCI EM and TA Allshare indices are the largest transmitters, with 77.21% and 61.57%, respectively. This highlights Israel's market as a major risk source. Natural gas plays a moderate role, transmitting 37.11% of shocks, underlining its relevance in market risk transmission.

The analysis shows that MSCI Emerging Markets and Israeli indices act as spillover transmitters, contributing 32.97% and 4.28%, respectively. MSCI EM is the largest net shock transmitter. Conversely, WTI oil, natural gas, gold, Al-Quds, and MSCI World are net receivers, with gold as the primary recipient of spillovers.

Expanding the analysis by including GPR in Table 3 reveals increased risk spillovers among stock indices, commodities, and GPR, rising to 74.25% from the previous level in Table 2. This indicates that geopolitical risk

significantly affects overall market connectedness, consistent with findings from Cui and Maghyereh (2024), Gong and Xu (2022), Abid et al. (2023), Shaik et al. (2023), and Yousfi and Bouzgarrou (2023).

In terms of net directional connectedness, the Al-Quds index's net receivership increased sharply from –6.35% (Table 2) to –36.89% (Table 3), reflecting its sensitivity to regional conflicts, as noted by Hassouneh et al. (2018). Crude oil and natural gas shifted from net receivers to net transmitters, consistent with studies emphasizing energy markets' influence during geopolitical uncertainty (Cheng et al., 2022; Su et al., 2019). The TA Allshare index remains the primary shock source (29.47%), corroborating its role as a key risk driver during conflicts (Abid et al., 2023). TA Allshare, natural gas, and GPR emerge as main risk transmitters, while Al-Quds is the largest net receiver (Cui and Maghyereh, 2024).

Table 2 shows the MSCI World index as the main shock source for MSCI Emerging Markets (10.35%), consistent with research on developed markets' influence during crises (Boubaker et al., 2022; Shahzad et al., 2023). WTI oil moderately impacts Al-Quds and TA Allshare (10.06% and 10.66%). Bidirectional spillovers involving GPR show a slight reduction in Table 3, echoing Shaik et al. (2023), who highlight contextual variations in geopolitical risk impacts. Natural gas initially transmitted more shocks than gold (17.46%). GPR notably affected Al-Quds (15.70%) and WTI oil (15.04%), reflecting energy markets' sensitivity to geopolitical tensions (Wang et al., 2022). TA Allshare also transmitted shocks to MSCI Emerging Markets at 13.31%.

Table 2. Return connectedness table between commodities, and stocks markets

	WTI oil	Natural gas	Gold	Al-Quds	TA Allshare	MSCI WORLD	MSCI EM	FROM
WTI oil	45.50	7.48	7.27	7.89	14.12	8.22	9.52	54.50
Natural gas	9.96	51.92	6.66	7.25	9.66	6.52	8.03	48.08
Gold	8.44	5.57	45.50	7.06	10.45	6.98	16.00	54.50
Al-Quds	10.06	7.14	6.72	51.37	9.59	6.78	8.34	48.63
TA Allshare	10.33	6.02	7.61	7.00	42.71	7.56	18.79	57.29
MSCI WORLD	8.00	5.73	6.82	7.18	8.14	47.57	16.55	52.43
MSCI EM	6.62	5.16	6.61	5.90	9.60	10.35	55.76	44.24
TO	53.40	37.11	41.70	42.28	61.57	46.40	77.21	TCI
NET	-1.10	-10.97	-12.80	-6.35	4.28	-6.03	32.97	**51.38%**
NPT	3.00	0.00	1.00	3.00	5.00	3.00	6.00	

Note: The variance decomposition among commodities and stocks markets based on the calculated TVP-VAR (1) and 10-step ahead forecasts.
***Source*:** Author's calculations.

Table 3. Return connectedness table between GPR, commodities and stocks markets

	GPR	WTI oil	Natural gas	Gold	Al-Quds	TA Allshare	MSCI WORLD	MSCI EM	FROM
GPR	18.94	13.99	20.3	11.04	5.83	14.4	5.64	9.88	81.06
WTI oil	15.04	18.32	15.39	8.69	6.56	17.89	6.68	11.42	81.68
Natural gas	14.92	12.59	27.0	8.89	6.18	13.31	5.84	11.27	73.0
Gold	12.32	11.95	14.48	20.16	6.99	13.71	6.84	13.55	79.84
Al-Quds	15.7	11.91	17.46	11.47	15.3	12.34	5.99	9.83	84.7
TA Allshare	9.59	6.55	11.41	10.76	7.71	34.33	6.91	12.74	65.67
MSCI WORLD	9.31	10.5	9.45	6.72	6.69	10.19	39.31	7.82	60.69
MSCI EM	8.63	8.06	9.47	11.54	7.83	13.31	8.54	32.63	67.37
TO	85.51	75.55	97.96	69.1	47.81	95.14	46.44	76.5	594.0
NET	4.45	-6.13	24.97	-10.74	-36.89	29.47	-14.25	9.13	**74.25%**
NPT	4.0	3.0	5.0	1.0	1.0	7.0	2.0	5.0	

Note: The variance decomposition among GPR, commodities, and stocks markets based on the calculated TVP-VAR (1) and 10-step ahead forecasts.
***Source*:** Author's calculations.

3.2 Dynamic connectedness

3.2.1 Dynamic total connectedness

This subsection analyzes two figures. The first shows the time-varying total connectedness index (TCI) among commodity and stock markets, while the second adds geopolitical risk as an uncertainty variable within the same set. Fig. 2 displays the TCI for commodities (WTI oil, gold, natural gas) and stock indices (Al-Quds, TA Allshare, MSCI World, MSCI EM). The TCI fluctuates notably between 40% and 85%, reflecting market sensitivity to external shocks. This pattern aligns with prior studies highlighting how global crises increase market interconnectedness (Abid et al., 2023). The peak from 2020 to 2021 corresponds with the WHO's COVID-19 pandemic declaration, consistent with findings by He et al. (2020) and Bouri et al. (2020) on crisis-driven asset correlations.

Following a dip during COVID-19's second wave, the TCI rises again with the Russia–Ukraine conflict in early 2022, supporting observations by Zhang et al. (2020) on market responses to distress. A further peak in October 2023 matches the outbreak of the Israeli-Palestinian conflict, emphasizing the impact of geopolitical events on market linkages.

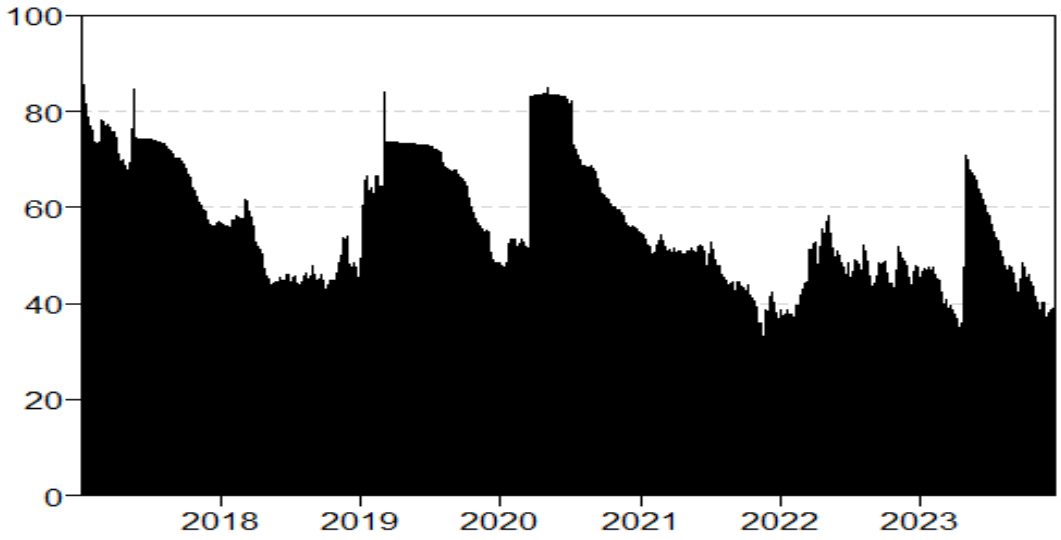


Figure 2. Dynamic total connectedness for commodities and stocks markets
Note: Total dynamic Interaction between commodities and stock markets with TVP-VAR (1) modeling and a 10-step-ahead GFEVD.
Source: Authors estimation.

Fig. 3 illustrates the dynamic Total Connectedness Index for geopolitical risk and financial and commodity markets. In general, our results indicate that the TCI fluctuates throughout our observations, typically falling between 60% and 90%. The TCI reached its highest point during the Corona pandemic and the Israeli-Palestinian war. The observation that the TCI peaked during both the COVID-19 crisis and the Israeli-Palestinian outbreak supports the idea that geopolitical risks can heighten market volatility and interconnectedness. This aligns with insights from research conducted by Shahzad et al. (2023) and Khemakhem and Galllas (2025) emphasizing the significant effect of geopolitical events on market dynamics.

The results demonstrate that dynamic connectedness is shaped by crises and geopolitical events. Geopolitical risk strengthens the interconnection of assets throughout the sample period, especially during periods of turmoil, leading to a substantial increase in connectedness. These results align with the results of Cui and Maghyereh (2024) and Khemakhem and Gallas (2025).

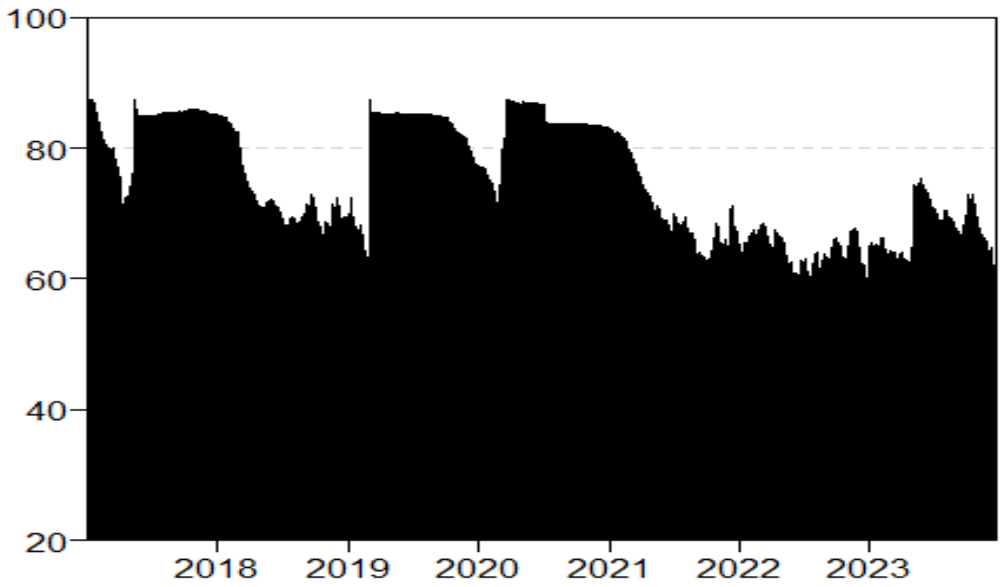
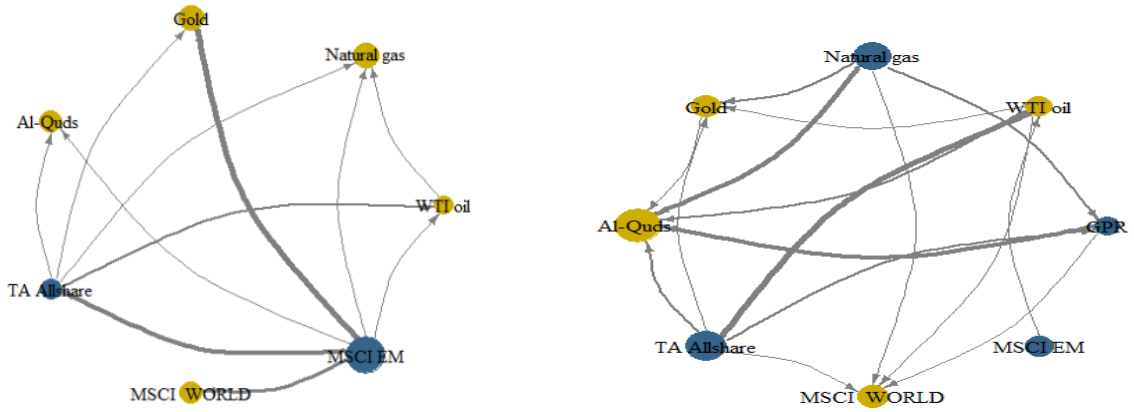


Figure 3. Dynamic total connectedness for the GPR index, commodities, and stocks markets
Note: Total dynamic connectedness between GPR, commodities and stock markets with TVP-VAR (1) model and a 10-step-ahead GFEVD.
Source: Authors estimation.

3.3 Net pairwise directional connectivity network

Fig. 4 depicts the network plot illustrating the dynamics of risk spillover between commodities and stock market indices (on the left), along with the impact of the GPR index on the connectedness measure (on the right). Yellow denotes a net receiver, while blue signifies a net transmitter.



Commodities and stock markets *GBP, commodities and stock markets*

Figure 4. Network plots of connectedness

Note: The left network connectedness (WTI, natural gas, gold markets, Palastine, Israel, MSCI World, MSCI Emergent indices) and the right network connectedness (GPR, WTI, natural gas, gold markets, Palastine, Israel, MSCI World, MSCI Emergent indices). A 10-step-ahead GFEVD and the TVP-VAR (1) model serve as the foundation for both network plots.

Source: Authors estimation.

The network plots further support the average connectedness results shown in Tables 2 and 3. The first plot highlights MSCI EM and TA Allshare as primary shock transmitters, while WTI oil, gold, natural gas, and MSCI World mainly receive shocks. MSCI EM leads in spillover transmission, with gold as the main net receiver, consistent with Lin et al. (2024) and Ghorbel et al. (2022). Strong linkages are evident between MSCI EM and gold, MSCI EM and TA Allshare, as well as between TA Allshare and WTI oil, and MSCI World and Emerging Markets. The second plot incorporates geopolitical risk, showing GPR, natural gas, TA Allshare, and MSCI EM as net transmitters of shocks, aligning with findings by Abid et al. (2023) and Shaik et al. (2023). Conversely, WTI oil, gold, Al-Quds, and MSCI World are net receivers. TA Allshare emerges as the most significant shock transmitter, while Al-Quds is the largest receiver, confirming observations by Hassouneh et al. (2018).

Notably, the network reveals strong connections among GPR and TA Allshare, GPR and Al-Quds, WTI and TA Allshare, and natural gas and Al-Quds. This underscores the substantial interdependence and risk transmission between geopolitical risk, commodities, and specific stock markets, reinforcing insights from Khemakhem and Gallas (2025) and Yousfi and Bouzgarrou (2023).

3.4 Robustness tests

To validate our findings, we performed a robustness analysis by adjusting the prediction horizon via the TVP-VAR model while maintaining a consistent lag order. Specifically, we set the prediction steps to H = 15 and H = 20, with the results detailed in Tables A1, A2, A3, and A4. Importantly, the results reveal no substantial variations, suggesting that extending the forecast horizon has little to no impact on the estimated outcomes.

4. Conclusion

This study examines the dynamic interactions between commodities, stock indices, and geopolitical risks using the TVP-VAR model on daily data from January 2017 to December 2023. It highlights the impact of the Israel-Palestine conflict on global financial markets. Without including GPR index, strong linkages are observed among stock indices, WTI oil, natural gas, and gold during major crises such as COVID-19 and the Ukraine war. The MSCI Emerging Markets and TA Allshare indices stand out as key transmitters of shocks, while WTI oil, natural gas, gold, and Al-Quds act mainly as receivers. Incorporating the GPR index amplifies spillovers, with Al-Quds becoming a significant net receiver and energy commodities turning into net transmitters. These results underscore the role of geopolitical risk in increasing market vulnerability and confirm TA Allshare's central position in driving market shocks.

From a practical perspective, these findings provide important guidance for investors, policymakers, and risk managers. Monitoring the sensitivity of commodities and stock markets to geopolitical risks, especially during crises like the Israeli-Palestinian conflict is critical. Given the TA Allshare index's role as a key shock transmitter, investors exposed to Israeli markets should exercise caution. The heightened vulnerability of the Al-Quds index highlights the need for stronger risk management in portfolios linked to Palestinian markets. Theoretically, this study enhances the literature by integrating geopolitical risk as an external driver, deepening understanding of market interconnectedness and spillovers. The TVP-VAR model offers a dynamic view of evolving relationships and higher-order return interactions amid

geopolitical tensions. Investors and analysts should embed geopolitical risk assessments within their strategies. The notable volatility spillovers between commodities and equities confirm that geopolitical events significantly affect asset prices. Thus, robust risk management systems with real-time geopolitical monitoring are essential. Financial institutions and policymakers must also integrate geopolitical risk analysis into decision-making to better manage risks and support market stability. Limitations include the focus on specific conflicts, which may not capture all global risks, and reliance on the TVP-VAR model alone. Future research could validate these results with alternative models and explore longer-term effects of conflicts like Israel-Palestine on market volatility. Developing real-time connectedness monitoring tools would improve responsiveness to emerging risks. Further studies might also examine how various geopolitical events shape connectedness, volatility, and spillovers across global markets.

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References
1. Abid, I., Dhaoui, A., Kaabia, O., & Tarchella, S. (2023). Geopolitical risk on energy, agriculture, livestock, precious and industrial metals: New insights from a Markov Switching model. Resources Policy, 85, 103925.
2. Akhtaruzzaman, M., Boubaker, S., Lucey, B. M., & Sensoy, A. (2021). Is gold a hedge or a safe-haven asset in the COVID–19 crisis?
3. Boubaker, S., Goodell, J. W., Pandey, D. K., & Kumari, V. (2022). Heterogeneous impacts of wars on global equity markets: Evidence from the invasion of Ukraine. Finance Research Letters, 48, 102934.
4. Caldara, D., & Iacoviello, M. (2022). Measuring geopolitical risk. American Economic Review, 112(4), 1194-1225.
5. Cheema, M. A., Faff, R., & Szulczyk, K. R. (2022). The 2008 global financial crisis and COVID-19 pandemic: How safe are the safe haven assets?. International Review of Financial Analysis, 83, 102316.
6. Cheng, S., Zhang, Z., & Cao, Y. (2022). Can precious metals hedge geopolitical risk? Fresh sight using wavelet coherence analysis. Resources Policy, 79, 102972.
7. Cui, J., & Maghyereh, A. (2024). Higher-order moment risk spillovers across various financial and commodity markets: Insights from the Israeli–Palestinian conflict. Finance Research Letters, 59, 104832.
8. Gong, X., & Xu, J. (2022). Geopolitical risk and dynamic connectedness between commodity markets. Energy Economics, 110, 106028.
9. Gong, X., Sun, Y., & Du, Z. (2022). Geopolitical risk and China's oil security. Energy Policy, 163, 112856.
10. Goyal, P., & Soni, P. (2024). Beyond borders: investigating the impact of the 2023 israeli–palestinian conflict on global equity markets. J. Econ. Studies. 10.1108/JES-12- 2023-0729. ahead-of-print.
11. Hassouneh, I., Couleau, A., Serra, T., & Al-Sharif, I. (2018). The effect of conflict on Palestine, Israel, and Jordan stock markets. International Review of Economics & Finance, 56, 258-266.
12. He, Q., Liu, J., Wang, S., & Yu, J. (2020). The impact of COVID-19 on stock markets. Economic and Political Studies, 8(3), 275-288.
13. Khemakhem, I., & Gallas, S. (2025). Geopolitical turbulence and market dynamics: analyzing the impact of the Israeli–Hamas conflict on global market volatility. China Finance Review International.
14. Lin, Z. L., Ouyang, W. P., & Yu, Q. R. (2024). Risk spillover effects of the Israel-Hamas War on global financial and commodity markets: A time-frequency and network analysis. Finance Research Letters, 105618.
15. Micallef, J., Grima, S., Spiteri, J., & Rupeika-Apoga, R. (2023). Assessing the Causality Relationship between the Geopolitical Risk Index and the Agricultural Commodity Markets. Risks, 11(5), 84.
16. Shahzad, U., Mohammed, K. S., Tiwari, S., Nakonieczny, J., & Nesterowicz, R. (2023). Connectedness between geopolitical risk, financial instability indices and precious metals markets: Novel findings from Russia Ukraine conflict perspective. Resources Policy, 80, 103190.
17. Shaik, M., Jamil, S. A., Hawaldar, I. T., Sahabuddin, M., Rabbani, M. R., & Atif, M. (2023). Impact of geo-political risk on stocks, oil, and gold returns during GFC, COVID-19, and Russian–Ukraine War. Cogent Economics & Finance, 11(1), 2190213.
18. Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. International review of financial analysis, 70, 101496.

19. Su, C. W., Wang, X. Q., Tao, R., & Oana-Ramona, L. (2019). Do oil prices drive agricultural commodity prices? Further evidence in a global bio-energy context. Energy, 172, 691-701.
20. Wang, Y., Wei, M., Bashir, U., & Zhou, C. (2022). Geopolitical risk, economic policy uncertainty and global oil price volatility—an empirical study based on quantile causality nonparametric test and wavelet coherence. Energy Strategy Reviews, 41, 100851.
21. Yousfi, M., & Bouzgarrou, H. (2023). Financial contagion among stock markets and portfolio risk during the COVID-19 crisis. International Journal of Monetary Economics and Finance, 16(2), 121-138.
22. Zhang, D., Hu, M., & Ji, Q. (2020). Financial markets under the global pandemic of COVID-19. Finance research letters, 36, 101528.

Appendix A. Robustness Test Results

Table A1: Forecast Horizon: 15

	WTI oil	Natural gas	Gold	Al-Quds	TA Allshare	MSCI WORLD	MSCI EM	FROM
WTI oil	45.42	7.44	7.25	7.85	14.09	8.19	9.77	54.58
Natural gas	9.89	51.75	6.65	7.21	9.64	6.49	8.38	48.25
Gold	8.29	5.53	44.92	7.03	10.37	6.89	16.97	55.08
Al-Quds	9.95	7.07	6.69	51.07	9.56	6.71	8.95	48.93
TA Allshare	10.07	5.96	7.55	6.93	42.30	7.44	19.75	57.70
MSCI WORLD	7.91	5.68	6.84	7.13	8.19	47.04	17.22	52.96
MSCI EM	6.59	5.18	6.62	5.95	9.63	10.31	55.73	44.27
TO	52.69	36.85	41.59	42.09	61.48	46.04	81.05	TCI
NET	-1.90	-11.40	-13.49	-6.84	3.78	-6.92	36.77	51.68%
NPT	3.00	0.00	1.00	3.00	5.00	3.00	6.00	

Note: The variance decomposition among commodities and stock markets is analyzed using the TVP-VAR model with a lag length of 1, providing forecasts for 15 steps ahead.

Table A2: Forecast Horizon: 20

	WTI oil	Natural gas	Gold	Al-Quds	TA Allshare	MSCI WORLD	MSCI EM	FROM
WTI oil	45.37	7.41	7.23	7.82	14.06	8.16	9.95	54.63
Natural gas	9.84	51.65	6.64	7.19	9.62	6.47	8.59	48.35
Gold	8.20	5.52	44.59	7.01	10.33	6.85	17.51	55.41
Al-Quds	9.88	7.03	6.67	50.86	9.54	6.68	9.35	49.14
TA Allshare	9.91	5.92	7.52	6.90	42.07	7.37	20.32	57.93
MSCI WORLD	7.85	5.64	6.85	7.10	8.22	46.71	17.63	53.29
MSCI EM	6.57	5.18	6.62	5.97	9.65	10.30	55.71	44.29
TO	52.26	36.71	41.53	41.98	61.40	45.81	83.36	TCI
NET	-2.37	-11.64	-13.89	-7.16	3.47	-7.48	39.07	51.86 %
NPT	3.00	0.00	2.00	3.00	5.00	2.00	6.00	

Note: The variance decomposition among commodities and stock markets is analyzed using the TVP-VAR model with a lag length of 1, providing forecasts for 20 steps ahead.

Table A3: Forecast Horizon: 15

	GPR	WTI oil	Natural gas	Gold	Al-Quds	TA Allshare	MSCI WORLD	MSCI EM	FROM
GPR	18.83	13.94	20.30	11.11	5.84	14.42	5.58	9.98	81.17
WTI oil	15.12	18.15	15.61	8.70	6.57	17.80	6.61	11.44	81.85
Natural gas	15.01	12.58	26.81	8.93	6.18	13.42	5.81	11.25	73.19
Gold	12.43	11.90	14.70	19.97	6.98	13.70	6.83	13.50	80.03
Al-Quds	15.66	11.92	17.63	11.59	14.83	12.50	5.96	9.91	85.17
TA Allshare	9.66	6.62	11.65	10.80	7.70	33.85	6.88	12.84	66.15
MSCI WORLD	9.46	10.46	9.65	6.77	6.69	10.21	38.92	7.84	61.08
MSCI EM	8.67	8.08	9.61	11.59	7.81	13.27	8.56	32.41	67.59
TO	85.99	75.50	99.15	69.49	47.79	95.33	46.24	76.75	TCI
NET	4.82	-6.35	25.96	-10.54	-37.38	29.17	-14.84	9.16	74.53%
NPT	4.00	3.00	5.00	1.00	1.00	7.00	2.00	5.00	

Note: The variance decomposition among GPR, commodities and stock markets is analyzed using the TVP-VAR model with a lag length of 1, providing forecasts for 15 steps ahead.

Table A4: Forecast Horizon: 20

	GPR	WTI oil	Natural gas	Gold	Al-Quds	TA Allshare	MSCI WORLD	MSCI EM	FROM
GPR	18.82	13.93	20.31	11.11	5.85	14.43	5.58	9.98	81.18
WTI oil	15.15	18.08	15.67	8.70	6.57	17.77	6.58	11.48	81.92
Natural gas	15.05	12.59	26.75	8.93	6.17	13.43	5.80	11.27	73.25
Gold	12.45	11.90	14.77	19.88	6.97	13.70	6.82	13.49	80.12
Al-Quds	15.67	11.92	17.70	11.61	14.70	12.53	5.95	9.91	85.30
TA Allshare	9.70	6.65	11.72	10.78	7.70	33.69	6.86	12.89	66.31
MSCI WORLD	9.50	10.45	9.73	6.79	6.67	10.23	38.75	7.88	61.25
MSCI EM	8.70	8.10	9.65	11.60	7.81	13.28	8.55	32.31	67.69
TO	86.23	75.54	99.56	69.52	47.74	95.36	46.16	76.90	TCI
NET	5.05	-6.37	26.31	-10.59	-37.56	29.05	-15.10	9.21	74.63%
NPT	4.00	3.00	5.00	1.00	1.00	7.00	2.00	5.00	

Note: The variance decomposition among GPR, commodities and stock markets is analyzed using the TVP-VAR model with a lag length of 1, providing forecasts for 20 steps ahead.