Portfolio Management in the selected Middle East countries: New evidence of Iran-Israel War

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Abstract:

Middle Eastern countries, due to their natural and financial resources, occupy a strategic position in the global economy. Despite this, portfolio management of their financial markets remains largely unexplored amid political and geopolitical crises. This study investigates return spillovers among eight selected currencies, analyzing total connectedness (TCI), net transmitters and receivers of risk, dynamic optimal weights, hedge effectiveness, cumulative returns, and Sharpe ratios using MVP, MCP, and MCOP approaches. Findings based on Broadstock et al. (2022) approach, show that the UAE and Saudi Arabia currencies are the main risk transmitters, while Lebanon is the primary receiver. The Israeli shekel exhibits the lowest network connection, making it a suitable asset for portfolio diversification. TCI surged to 65% during the Russia-Ukraine war, reducing diversification opportunities, then rose again during the Israel-Hamas conflict and the 12-day Israel-Iran war, ultimately reaching 50% by the study's end. Optimal weights and hedge effectiveness indicate that currency selection depends on market conditions and the applied approach; for example, the Qatari stock market offers significant risk management potential, while the MCP approach achieves the highest cumulative returns and Sharpe ratios. Overall, the study highlights that effective risk management in the Middle East requires attention to geopolitical dynamics and structural market changes, providing practical insights for investors and policymakers to optimize asset allocation and enhance financial stability in high-risk environments.

Key words: Risk spillovers, Portfolio management, Geopolitical risk, Middle East Stock Markets

JEL Classification: G14

1. Introduction:

The Middle Eastern countries, due to their natural and financial resources, are considered strategically important for the global economy. Despite their significance, portfolio management of their stock markets remains largely unexplored amid ongoing crises. The region's high volatility and geopolitical tensions, coupled with the close interconnections among financial markets, make it essential to analyze these dynamics to assist investors and policymakers (Altug et al., 2025; Ahmadian-Yazdi, 2025 a,b; Mensi et al., 2024). Ignoring the deep connections among stock markets amid extreme instability poses considerable challenges for investment and policy decisions. Given the region's geopolitical risk and the sensitivity of stock markets to economic, political, military, and health-related news, constructing and managing a portfolio comprising these markets is highly attractive.

Considering the inherent spillover effects in financial markets, examining the transmission and reception of returns across these stock markets is crucial for policymakers and investors seeking to minimize risk (Lo et al., 2024; Helmi et al., 2025). This study investigates return spillovers among eight selected Middle Eastern countries. It focuses on analyzing total connectedness, identifying net transmitters and receivers of returns, estimating dynamic optimal weights, assessing hedge effectiveness, evaluating cumulative returns, calculating Sharpe ratios, and comparing three portfolio approaches—Minimum Variance Portfolio (MVP), Minimum Correlation Portfolio (MCP), and Minimum Connectedness Portfolio (MCoP)—to identify the optimal portfolio strategy.

The model applied in this study follows Broadstock et al. (2022) approach. This research analyzes optimal portfolio weights under normal and stressed market conditions using MVP, MCP, and MCoP approaches, evaluating time-varying weights and dynamic hedge ratios to provide deep insights into diversification (Ahmadian-Yazdi et al., 2024). Unlike previous studies, which examine MVP, MCP, and MCoP approaches without identifying the optimal one, this study determines which method provides the best risk–return combination.

These approaches cater to different investor profiles: MVP suits risk-averse investors by minimizing portfolio risk, potentially at the cost of lower long-term returns; MCP is ideal for institutional investors and hedge funds seeking diversification, balancing risk–return trade-offs and reducing systemic risk; MCoP targets investors concerned with systemic crises and market contagion, selecting assets with minimal interconnected risk exposure. Investors aim to diversify portfolios under normal and extreme market conditions, optimize asset weights, minimize investment risk, and identify the cheapest hedging strategies according to their investment horizon. Hedge effectiveness (HE) is calculated for univariate and bivariate portfolios, showing the extent to which hedging instruments offset changes in hedged assets (Ahmadian-Yazdi et al., 2024).

This study fills a gap by emphasizing practical portfolio management implications. It explores optimal portfolio weights across market regimes (normal, bearish, bullish) and varying asset positions (short- and long-term). Additionally, it evaluates hedge efficiency across these conditions—a rarely addressed aspect. Performance comparisons using cumulative returns allow investors to select the most suitable strategy and identify optimal asset combinations.

The study provides in-depth insights into relationships among Middle Eastern stock markets, highlighting how extreme events significantly affect connectedness. Static and time-varying return spillovers under different market regimes are analyzed, revealing how high connectedness reduces diversification benefits and increases portfolio risk. Directional spillovers during political and military shocks are investigated, showing dynamic magnitude and sign variations, critical for investment and hedging decisions. Overall, the research suggests innovative investment strategies and portfolio management opportunities under both normal and extreme conditions, offering practical guidance for investors, policymakers, and regulators.

The results reveal significant and dynamic return spillovers among the selected Middle Eastern stock markets. The UAE and Saudi Arabian currencies act as primary risk transmitters, while Lebanon is the main risk receiver, and the Israeli shekel consistently shows the lowest network connection, making it a key asset for portfolio diversification. Total Connectedness Index (TCI) exhibits substantial fluctuations over time, spiking to 65% during the Russia-Ukraine war, which sharply reduced diversification opportunities, rising again during the Israel-Hamas conflict and the 12-day Israel-Iran war before settling around 50% by the end of the study period. Optimal weights and hedge effectiveness vary across market regimes and portfolio approaches: for instance, the Qatari riyal demonstrates strong risk management potential, and MCP consistently delivers the highest cumulative returns and Sharpe ratios. Directional connectedness analysis highlights that geopolitical shocks dramatically alter the role of currencies, with the Israeli shekel shifting from a low-risk asset to a net transmitter during certain periods. Overall, these findings underscore the critical importance of dynamic portfolio strategies and asset selection in volatile geopolitical environments, providing actionable insights for investors and policymakers to optimize risk–return trade-offs and enhance financial stability in the region.

The structure of this paper is as follows. Section 2 presents a review of the literature. Section 3 discusses the methodology used in the study. Section 4 describes the return series' data and presents the descriptive statistics. Section 5 discusses the results and findings. Finally, Section 6 concludes.

2. Literature Review:

Studies conducted over recent decades highlight the critical importance of examining risk spillovers among financial assets and, consequently, portfolio diversification. Understanding how financial asset returns transmit across markets helps explain the inter-asset dynamics within financial systems. Boakye et al. (2025) investigated systemic risk transmission and interconnectedness among commodities, stocks, exchange rates, and bond returns in Africa during the COVID-19 period. Using the TVP-VAR–Diebold–Yilmaz approach, they found that overall systemic risk in the system was low, although foreign exchange market risk was high in southern Africa. Gold and oil acted as the main receivers of system risk. Their results also indicated that inter-asset connectedness intensified significantly during the peak of COVID-19.

Wang et al. (2025) analyzed the connections and risk transmission among green stocks, bonds, carbon markets, and crude oil futures from 2018–2024 using the TVP-VAR-DY combined with wavelet analysis. Their findings revealed pro-cyclical risk transmission in green financial markets during crises and shocks. The green stock market was identified as the strongest risk transmitter, while market sentiment significantly influenced green market spillovers, especially in the long term. Hussain et al. (2024) explored volatility spillovers between stock prices and exchange rates in BRICS countries. Using GARCH models to extract volatilities and the TVP-VAR-DY (2012) framework to examine risk spillovers, they found strong interconnections during COVID-19. The Russian and Indian markets showed close ties, as did Brazil and South Africa, while China exhibited weak linkages with the network.

Zhao and Park (2024) examined risk spillovers among bonds, cryptocurrencies, and traditional financial markets. They found that green bonds were net volatility transmitters in the short term but net receivers in the long term. Bitcoin did not serve as a reliable safe-haven asset since its hedging ability was time-dependent. Moreover, green bonds acted as asymmetric risk transmitters during bull and bear markets, and COVID-19 amplified risk transmission under all market conditions. Meher and Mishra (2024) investigated causality and risk spillovers among stock indices, exchange rates, and 10-year government bond returns across BRICS countries using Granger causality tests and VAR models. They found strong correlations among these variables, with time-varying linkages that should be carefully considered by investors, policymakers, and stakeholders.

Nerantzidis et al. (2024) analyzed time-varying spillovers and interconnectedness between the euro and other EU and non-EU currencies after the sovereign-debt crisis using the QVAR model. Covering January 2016–November 2022, their results showed that the euro was a net transmitter of risk until 2021, after which it became a major receiver, indicating the substantial impact of COVID-19 and the energy crisis on currency network dynamics. Gnagne et al. (2024) studied risk spillovers between sovereign and stock markets using a spatial Durbin model on a panel of 40 countries (2009Q1–2024Q2). They found that increases in sovereign risk lowered both domestic and foreign stock prices through geopolitical, economic, and financial channels. Exchange rates, gross fixed capital formation, and industrial production were key determinants of stock performance. Moreover, spillover effects were stronger in foreign than in domestic markets.

Yahya et al. (2024) examined financial market connectedness within ASEAN-4, regional, and global contexts using multilayer information spillover network topology. They found that risk spillovers surged during the onset of financial crises but declined afterward. ASEAN-4 markets displayed moderate stability, while global markets showed strong and overlapping interconnectedness. Shakeel et al. (2023) analyzed volatility spillovers among exchange rates, gold, and crude oil using DCC-GARCH and BEKK-GARCH models. They found that gold was the primary volatility transmitter to both exchange rates and oil, while crude oil was the main receiver. Their results concluded that volatility is a crucial feature of the commodity derivatives market, influencing transaction profitability, portfolio hedging efficiency, and overall market risk.

Chen et al. (2022) examined how oil price and yuan volatility affect China's stock market index using the upside and downside Conditional Value-at-Risk (CoVaR) approach. They found that the Chinese stock index was more sensitive to oil price fluctuations than to exchange rate movements, although currency uncertainty had notable spillover effects during reform and bear market periods. Hung (2022) empirically analyzed the dynamic relationship and volatility spillovers between exchange rates and stock returns in five Central and Eastern European countries (Hungary, Poland, Czech Republic, Romania, and Croatia) during 2000–2019. Using GARCH-BEKK along with CCC and DCC frameworks, he found significant volatility spillovers, especially during crises, including unidirectional effects from exchange rates to stock indices in Hungary (post-crisis) and Romania (pre-crisis).

Tsan et al. (2021) used a VAR-MGARCH model to study risk spillovers between sovereign bond markets in the US and ASEAN-4 countries. They identified a unidirectional spillover from US bond returns to ASEAN-4, and bidirectional volatility effects across the two regions. Dynamic conditional correlations revealed that ASEAN-4 bond returns increased with emerging market risk, while exchange rates acted as buffers mitigating spillover effects. Zhang et al. (2021) analyzed volatility spillovers among gold spot, gold futures, and the returns of stocks, bonds, and oil in China using VAR-CCC-GARCH and VAR-DCC-GARCH models. They found that neither spot nor futures gold effectively hedged stock, bond, or oil volatility, although gold was suitable for portfolio diversification.

Sahoo et al. (2019) examined volatility spillovers between exchange rates and bond returns in India using a bivariate asymmetric BEKK-GARCH (1,1) model (April 2005–March 2011). Their evidence showed asymmetric volatility transmission between these assets, persisting even during low foreign investment periods. Tiwari et al. (2018) analyzed volatility spillovers among four global asset classes—stocks, sovereign bonds, exchange rates, and credit default swaps (CDS)—from September 2009 to September 2016 using both time- and frequency-domain approaches. Employing Diebold and Yilmaz (2012), they found weak overall network connectivity (5.08%), with stocks and CDS not being primary transmitters. However, at higher frequencies, inter-market connectedness intensified under the TVP-VAR-BK framework. Yip et al. (2017) examined the dynamic relationship between commodities (agriculture, industrial metals, precious metals, energy, and livestock), currencies (euro, pound, yen, Australian dollar, Canadian dollar), and six major stock market indices, specifically during the period of quantitative easing. According to their findings, the stock market is the main transmitter of risk spillovers to the commodity and currency markets. In addition, currencies act as both the main transmitters and receivers of risk spillovers to and from the industrial metals and precious metals markets.

In summary, most studies focus on risk transmission among asset classes (stocks, bonds, commodities, energy, and currencies) across various financial markets. However, no study has yet explored risk spillovers among Middle Eastern currencies, despite the region's strategic importance, high volatility, and exposure to geopolitical shocks. Furthermore, this study compares portfolio risk management strategies using both static and dynamic frameworks to identify optimal asset weights, hedge ratios, and performance indicators (e.g., Sharpe ratio and cumulative returns)—an approach not previously applied to Middle Eastern currency markets.

3. Data:

This study utilizes daily data obtained from Investing.com (and for Iran from fipiran.com) covering the period from December 1, 2020, to September 9, 2025. We focus on the stock market indices of eight Middle Eastern countries: the United Arab Emirates (UAE), Turkey (TUR), Saudi Arabia (SAU), Qatar (QAT), Lebanon (LEB), Kuwait (KUW), Iran (IRN), and Israel (ISR). The indices are computed as continuously compounded returns, using the formula Ln(Pt/Pt-1)*100, and are employed throughout this study.

Stock markets in the Middle East serve as a key channel for financial risk transmission. Unlike assets such as gold or foreign currency, stocks reflect both macroeconomic outlooks and sensitivity to political, financial, and geopolitical risks. This is particularly relevant in the Middle East, where high dependence on oil, political instability, and external shocks prevail. Return spillovers in stock indices provide a comprehensive picture of financial dynamics and the vulnerability of these countries' financial systems (Kirkulak Uludag & Khurshid, 2019). Furthermore, focusing on equities clarifies the role of capital markets as mechanisms for absorbing or transmitting shocks, without interference from alternative assets such as gold or currency, which could obscure this picture.

Table 1 presents the descriptive statistics and results of statistical tests for the exchange rate returns of selected Middle Eastern countries. Turkey (0.477) and Iran (0.355) exhibit the highest mean exchange rate changes, indicating greater volatility in these markets. Additionally, Turkey's exchange rate variance (234.5) is substantially higher than that of other countries, reflecting pronounced market instability. Iran's exchange rate returns display significant positive skewness (1.801), suggesting a distribution tilted toward higher values, whereas Turkey, Saudi Arabia, Kuwait, and, to some extent, other countries exhibit negative skewness, indicating dominance of downward shocks.

All countries except Qatar show significant positive kurtosis, signaling distributions more peaked than normal with heavy tails. Iran, in particular, has very high kurtosis (20.249), highlighting the likelihood of extreme exchange rate shocks. The Jarque-Bera test results are significant for all countries ($p = 0.000$), rejecting the hypothesis of normally distributed returns. ERS unit root tests indicate that most exchange rate return series are stationary, though the degree of stationarity varies across countries (e.g., Lebanon shows a strongly negative value, reflecting high stationarity). Overall, these results suggest that Middle Eastern exchange rate markets are highly non-normal, heavy-tailed, and volatile. Iran and Turkey experience the greatest fluctuations, while Iran's exchange rate shows relatively low connectivity with other countries. These findings underscore the importance of studying risk spillovers, as currency shocks may easily transmit in some countries (e.g., UAE, Qatar, Israel) but less so in others (e.g., Iran).

Table 1. Descriptive statistics

	UAE	TUR	SAU	QAT	LEB	KUW	IRN	ISR
Mean	0.224	0.477	0.085	0.088	0.201	0.129	0.355**	0.167
Variance	36.797	234.525	34.148	17.397	111.283	24.054	10.682	38.022
Skewness	-0.153	-0.421***	-0.955***	-0.086	-0.018	-0.687***	1.801***	-0.149
Ex.Kurtosis	4.564***	7.054***	5.819***	2.543***	5.497***	5.580***	20.249***	4.231***
JB	483.028***	1165.077***	865.753***	149.912***	697.611***	762.269***	9763.809***	415.208***
Prob.	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ERS	-4.187	-2.100	-2.289	-3.474	-16.306	-3.562	-4.682	-2.269
Prob.	(0.000)	(0.036)	(0.022)	(0.000)	(0.000)	(0.000)	(0.000)	(0.024)

Note: The symbols ** and *** denote significance at the 5% and 1% levels, respectively. "EX.Kurtosis," "JB," and "ERS" stand for excess kurtosis, Jarque-Bera test for normality, and Elliot, Rothenberg, and Stock for unit-root test, respectively.

The Kendall correlation coefficients among the exchange rate returns of the studied countries are reported in Table 2. As shown, the strongest positive correlations are observed between the UAE and Qatar (0.402), Kuwait and Israel (0.364), and Qatar and Israel (0.339). Iran's exchange rate returns exhibit virtually no significant correlation with those of other countries, indicating that the Iranian stock market behaves relatively independently compared to the rest of the region. Turkey shows only weak positive correlations with the UAE and Israel, and even a weak negative correlation with Saudi Arabia.

Overall, these results highlight a clear heterogeneity in exchange rate dynamics across the Middle Eastern countries. While some currencies, such as the UAE, Qatar, and Israel, are closely interconnected, providing potential channels for risk transmission, others, notably Iran, remain largely isolated from regional movements. This divergence implies that currency shocks can propagate quickly among highly correlated markets, increasing systemic risk, whereas isolated currencies may act as relative safe havens during periods of regional turmoil. The weak correlations of Turkey further suggest that even partially connected markets can exhibit mixed risk transmission patterns depending on geopolitical and economic conditions. Collectively, these findings emphasize the necessity of dynamic portfolio strategies that account for varying degrees of interdependence and country-specific vulnerabilities, enabling investors and policymakers to better manage risk and optimize asset allocation in the volatile Middle Eastern financial landscape.

Table (2): Kendal Correlation Matrix

kendall	UAE	TUR	SAU	QAT	LEB	KUW	IRN	ISR
UAE	1.000***	0.223***	0.291***	0.402***	0.106***	0.321***	0.035	0.335***
TUR	0.223***	1.000***	-0.059**	0.047	0.007	0.021	-0.016	0.062**
SAU	0.291***	-0.059**	1.000***	0.337***	0.149***	0.267***	0.030	0.254***
QAT	0.402***	0.047	0.337***	1.000***	0.049	0.352***	0.055	0.339***
LEB	0.106***	0.007	0.149***	0.049	1.000***	0.040	0.047	-0.029
KUW	0.321***	0.021	0.267***	0.352***	0.040	1.000***	-0.016	0.364***
IRN	0.035	-0.016	0.030	0.055	0.047	-0.016	1.000***	0.048
ISR	0.335***	0.062**	0.254***	0.339***	-0.029	0.364***	0.048	1.000***

Source: Estimated by authors.

The exchange rate return dynamics of the studied countries are illustrated in Figure 1. Throughout the period, Turkey (TUR) and Lebanon (LEB) experienced the highest exchange rate volatility. In Lebanon, this volatility was particularly pronounced during 2021 and 2022, before slightly stabilizing afterward. Iran displayed severe fluctuations in late 2020 and early 2021, but the magnitude of volatility noticeably decreased from 2022 onward, likely reflecting policy interventions and currency restrictions. The UAE, Qatar (QAT), and Kuwait (KUW) exhibited relatively stable exchange rate patterns over the period, with lower fluctuations compared to Turkey and Lebanon. Similarly, Saudi Arabia's exchange rate showed only minor variations, consistent with its currency stabilization policies. Israel displayed moderate volatility, neither as extreme as Turkey and Lebanon nor as stable as Saudi Arabia or recent Iranian trends. Overall, the figures reveal clear volatility clustering, where periods of intense fluctuations follow calmer phases, a hallmark feature of financial markets that underscores the suitability of time-varying network models for analyzing risk spillovers. In summary, during December 2020 to September 2025, Middle Eastern exchange rate markets displayed heterogeneous behavior: Turkey and Lebanon were the most volatile, Iran experienced a gradual reduction in volatility, and the Gulf countries (UAE, QAT, KUW, SAU) exhibited the most stable patterns. This heterogeneity suggests that risk spillovers may differ significantly across the region.

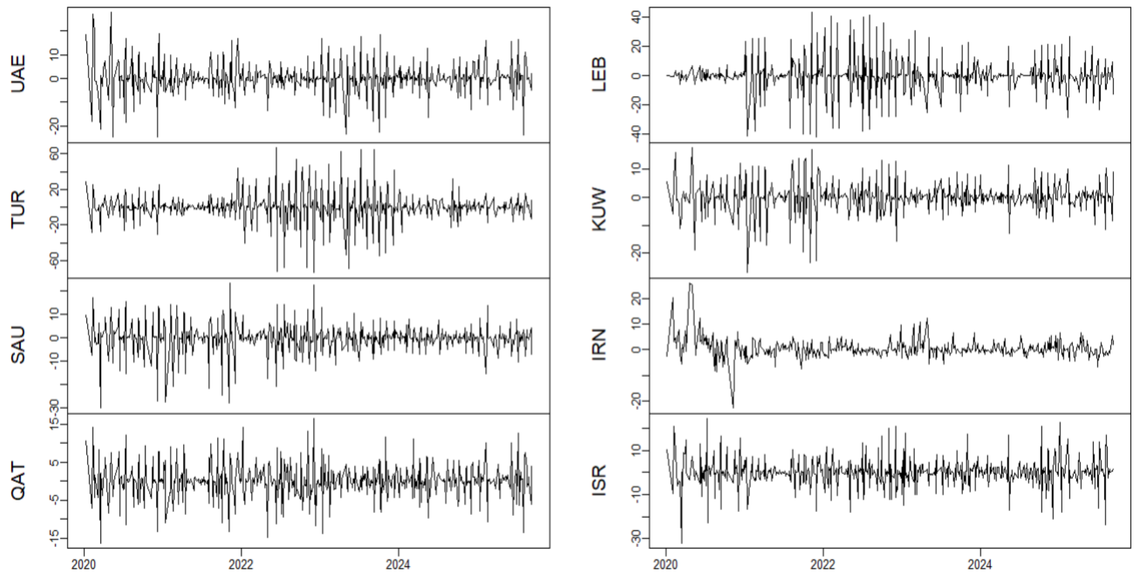

Figure 1. Plot of the selected countries' exchange rate returns

4. Methodology:

We employ several portfolio construction techniques based on Broadstock et al. (2022) approach, incorporating both traditional and well-established approaches. It is important to emphasize that the discussion here offers only a concise overview of the applied methodologies. The portfolios are developed based on the covariance matrix derived from the time-varying variance-covariance estimates of the TVP-VAR model, following Antonakakis et al. (2020).

4.1.Minimum Variance Portfolio (MVP)

The Minimum Variance Portfolio (MVP) is one of the most widely used techniques for portfolio design. Rooted in Markowitz's (1959) multi-asset theory, it seeks to construct a portfolio with the lowest possible level of volatility. The weights are computed as follows:

$$\omega_t = \frac{H_t^{-1} I}{I\, H_t^{-1} I}, \quad (1)$$

where ω_t represents an $m \times 1$ portfolio weight vector, I is an m-dimensional vector of ones, and H_t is an $m \times m$ conditional variance-covariance matrix at time t.

4.2.Minimum Correlation Portfolio (MCP)

An alternative method, developed by Christoffersen et al. (2014), determines portfolio weights based on the conditional correlation matrix rather than the covariance matrix. Before constructing the portfolio, conditional correlations are computed as:

$$R_t = diag(H_t)^{-0.5} H_t diag(H_t)^{-0.5} \quad (2)$$

where R_t is an $m \times m$ matrix. The MCP weights are calculated using the following formula:

$$\omega_t = \frac{R_t^{-1} I}{I\, R_t^{-1} I} \quad (3)$$

4.3.Minimum Connectedness Portfolio (MCoP)

Extending the above methods, the Minimum Connectedness Portfolio (MCoP) is constructed using pairwise connectedness indices instead of variance or correlation matrices. This approach minimizes interdependencies and risk spillovers between assets, yielding a portfolio that is more resistant to systemic shocks or network disruptions. Accordingly, assets that exhibit weak influence on others—or are less affected by them—receive higher weights. The weighting scheme is expressed as:

$$\omega_t = \frac{PCI_t^{-1} I}{I PCI_t^{-1} I'}, \quad (4)$$

where PCI_t represented the matrix of pairwise connectedness indices.

4.4. Hedging Effectiveness (HE)

To evaluate portfolio performance, we compute the hedge effectiveness score as proposed by Ederington (1979):

$$HE = 1 - \frac{Var(y_p)}{Var(y_{unhedged})} \quad (5)$$

where $Var(y_p)$ is the variance of the hedged portfolio returns and $Var(y_{unhedged})$ is the variance of the unhedged asset returns. The *HE* value represents the proportionate reduction in variance achieved through hedging—higher values indicate better risk mitigation, while lower values reflect weaker hedging performance (Broadstock et al., 2022). Finally, it is worth noting that in this study, portfolio performance is evaluated based on both returns and the Sharpe ratio.

The Sharpe ratio, originally proposed by Sharpe (1966) as a measure of reward-to-volatility, is calculated as:

$$SR = \frac{\overline{r_p}}{\sqrt{Var(r_p)}} \quad (6)$$

where r_p denotes the portfolio return. Higher Sharpe ratio (SR) values indicate greater returns relative to the portfolio's risk. In the current research, policy recommendations are derived from the approach that delivers the highest returns and Sharpe ratio.

5. Empirical Results:

The foreign exchange markets of Middle Eastern countries exhibit a high degree of interconnectedness and mutual risk transmission. Analysis of risk spillovers among currency returns shows that a substantial portion of exchange rate volatility in this region arises from external shocks and network interactions among countries. Among them, the UAE, Saudi Arabia, and Kuwait are identified as the main net risk transmitters; their high spillover shares (over 58–61%) indicate their central role in propagating currency shocks to other regional economies. However, these same countries are also major risk receivers, reflecting their two-sided vulnerability and strong sensitivity to external developments.

In contrast, Lebanon and Turkey act as net risk receivers—particularly Lebanon (–10.5) and Turkey (–7.88)—suggesting that their currencies are more affected by regional shocks and have limited power to transmit risk. Israel experiences a relatively balanced position, being both a transmitter and receiver of shocks. Yet, the results show that it has the weakest network connectivity, indicating that the Israeli currency may serve as a low-risk asset for portfolio diversification. This implies that Israel's exchange rate is structurally less exposed to intra-regional co-movements and spillovers, being more influenced by external and extra-regional factors.

This relative independence can be attributed to Israel's diversified, technology-driven economic structure, which is less dependent on oil and energy shocks (Ollivaud et al., 2015)—the usual sources of currency spillovers in the Middle East. Additionally, Israel's stronger financial and trade ties with advanced economies outside the region, along with more independent monetary and exchange rate policies, have reduced its synchronization with regional currency cycles. Therefore, Israel occupies a peripheral position in the regional currency network—neither a central shock transmitter nor a highly vulnerable receiver. These findings highlight that Israel's currency dynamics are shaped more by global financial developments than by regional interlinkages, which is also menthioned by Rosenberg (2018).

Iran's position in this network reveals that its currency returns are net recipients of volatility. This indicates that the Iranian exchange rate is more affected by external fluctuations than a source of spillovers to others. Such a pattern stems from Iran's closed currency market structure, extensive government intervention and controls, and severe international trade and financial restrictions, which have limited external connections while increasing internal sensitivity. Consequently, Iran's exchange rate movements largely reflect external pressures transmitted through the network, while its influence on other regional currencies remains marginal.

Overall, the total connectedness index (TCI = 46.25) suggests that nearly half of the variations in currency returns are driven by cross-country spillovers. These results emphasize that the Middle Eastern forex market operates as a networked system in which Gulf countries play a central role in shock propagation, whereas countries such as Lebanon and Turkey exhibit the highest dependence and vulnerability to these spillover effects.

Table (3). Average connectedness across exchange rates in the selected countries

	UAE	TUR	SAU	QAT	LEB	KUW	IRN	ISR	FROM
UAE	41.54	11.13	11.84	11.34	3.56	10.56	0.51	9.54	58.46
TUR	15.60	64.43	3.00	3.18	5.33	3.08	0.53	4.86	35.57
SAU	11.26	2.37	41.52	16.02	5.40	13.20	0.45	9.77	58.48
QAT	11.54	2.36	16.84	40.25	2.65	13.74	0.44	12.17	59.75
LEB	5.51	5.28	8.00	4.77	66.95	5.30	0.40	3.79	33.05
KUW	10.48	2.18	14.01	14.06	3.02	38.81	0.47	16.97	61.19
IRN	1.22	1.00	0.65	0.78	0.53	1.45	93.80	0.57	6.20
ISR	10.27	3.38	11.00	12.35	2.05	17.78	0.44	42.72	57.28
TO	65.88	27.69	65.35	62.49	22.55	65.12	3.23	57.66	369.97
NET	7.42	-7.88	6.87	2.74	-10.50	3.93	-2.97	0.38	TCI=46.25

Note: The connectedness estimations are based on a VAR model with a lag length order of 1 (BIC) and a 10-step-ahead generalized forecast error variance decomposition.

The Total Connectedness Index (TCI), reflecting the degree of interlinkages and risk spillovers among Middle Eastern exchange rates, has shown significant fluctuations during the period from December 1, 2020, to September 9, 2025 (Figure 2). At the beginning of the period, the index stood at around 50 points but quickly entered an upward trend, reaching a historical peak of nearly 70 points throughout 2021 and early 2022. This surge indicates a sharp rise in co-movements and risk transmission intensity within the regional currency network, likely driven by pressures from the global COVID-19 crisis, energy market instability, and heightened global inflation uncertainty.

After this phase, the index entered a steady downward trajectory, declining substantially during 2022 and 2023 to around 40 points. This drop suggests reduced interdependence among currencies and a weakening of risk spillover mechanisms—possibly due to energy market adjustments and the partial restoration of global trade stability. From late 2023 to early 2025, the TCI stabilized within a relatively narrow range of 40–45 points, indicating a period of relative stability and diminished intensity of shared regional shocks. During this time, exchange rates became more reflective of domestic conditions, with minimal cross-country network effects.

However, from mid-2025, the index began to rise sharply again, surpassing 50 points. This sudden increase signals the emergence of new economic or geopolitical tensions—or other external shocks—across the region, leading to renewed currency interdependence and intensified risk transmission. Overall, the TCI dynamics over the observed period reveal cyclical transitions between high-connectivity phases—associated with common crises and shocks—and low-connectivity phases—reflecting relative stability and greater currency independence. The peaks observed in 2021–2022 and the renewed surge in 2025 highlight the critical role of global and regional shocks in shaping currency dynamics, while the marked decline between 2022 and 2024 underscores that, in the absence of such shocks, exchange rate movements are primarily driven by country-specific factors.

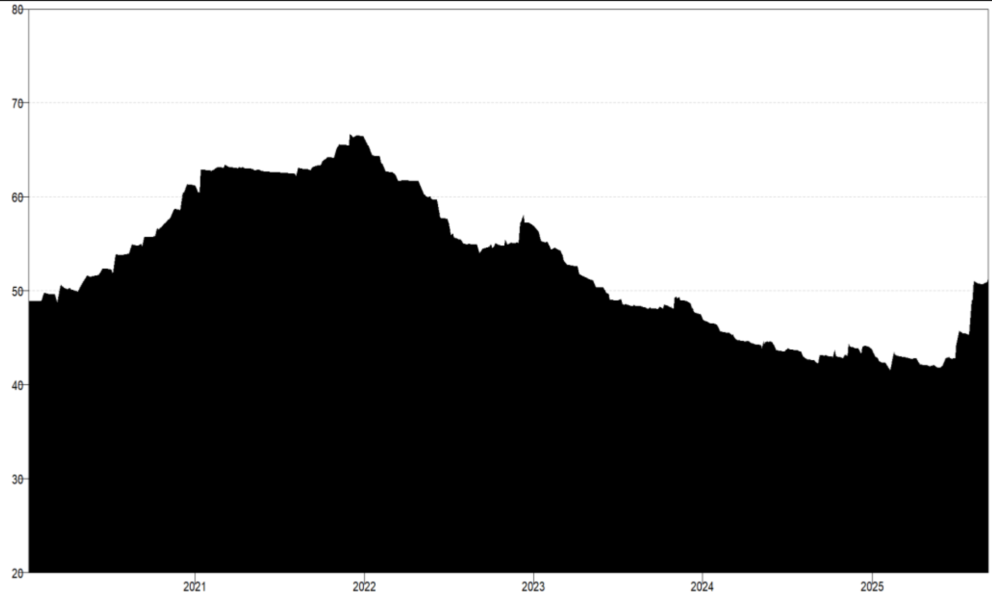

Figure 2. Dynamic Total Connectedness Index (TCI)

Note: The results are based on a TVP-VAR model with a lag length order of 1 (BIC) and a 10-step-ahead generalized forecast error variance decomposition.

Figure (3) illustrates the exchange rate returns of selected Middle Eastern countries from December 2020 to September 2025. The figure shows that the region's risk spillover patterns are highly dynamic. Analysis of the net spillover index reveals that Saudi Arabia acted as a net risk transmitter at the beginning of the period but gradually shifted to being a net risk receiver from late 2023 onward. Turkey's exchange rate exhibited one of the most volatile trends among the countries. The results show that from the start of the sample until mid-2023, Turkey's currency was a net receiver of volatility, then became a transmitter for about a year, and afterward reverted to being a net receiver again. The findings also indicate that the military conflict between Hamas and Israel since late 2023 had a significant impact on the spillover effects between the exchange rate returns of Turkey and Saudi Arabia.

In the case of Kuwait, the connection between its currency returns and those of other countries declined sharply. Between mid-2023 and mid-2024, Kuwait's currency contributed to reducing overall spillover intensity within the regional currency network. As for Qatar, its currency acted as a major net transmitter of risk before 2023, but its connectedness with other assets dropped significantly afterward, turning it into a relatively safe asset by the end of the period.

The results concerning Israel's currency suggest that it was mainly influenced by the Russia–Ukraine war, becoming a strong net receiver of risk until the end of 2022. However, from 2023 onward, Israel's currency turned into a net transmitter of risk, with regional military tensions making it one of the main risk senders in the regional network. This shift reflects Israel's growing role in financial markets and technology-driven investments (Bouri et al., 2014).

Regarding Iran, the net spillover index remains relatively stable and close to zero, indicating that Iran's currency is a weak net receiver of shocks. This reflects the relative independence of its financial market from regional cycles and its weak linkage with other Middle Eastern currencies. Such findings are consistent with the effects of sanctions and international financial isolation (Roudari et al., 2023). Lebanon consistently appears as a net risk receiver, consistent with its deep financial and political crises (World Bank, 2021).

The time-varying spillover cycles also align with major global and regional shocks. Peaks in spillovers are observed during crises such as the COVID-19 pandemic, the Russia–Ukraine war, the 2022 energy crisis, and the escalation of Middle Eastern geopolitical tensions in 2023–2024. These findings are consistent with Zhou et al. (2025), who show that crises and geopolitical tensions amplify risk transmission in emerging markets.

Overall, the results indicate that financial interdependence across the Middle East is highly dynamic. Some countries, particularly the UAE and Saudi Arabia, act as key hubs for risk transmission, while others, like Turkey and Lebanon, are more exposed to risk absorption. These insights are crucial for policymakers and financial regulators in developing regional risk management frameworks and strengthening financial stability.

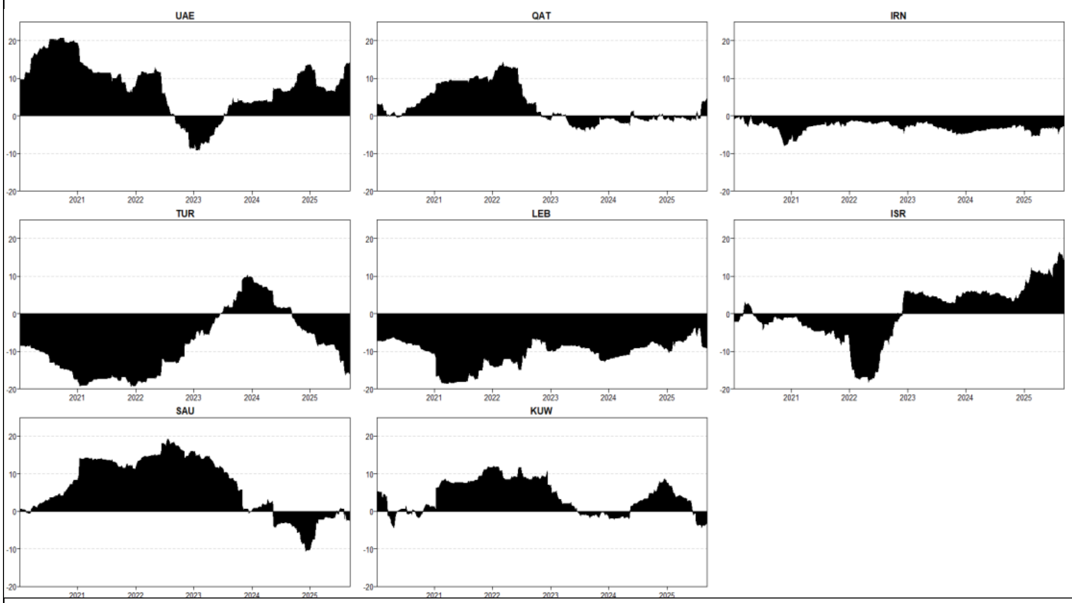

Figure 3. Dynamic net total directional connectedness

Note: In the time intervals when the curve is above (below) the horizontal axis, it means that the asset is the net volatility transmitter (receiver) in the network

The results of the dynamic net risk transmission among currency pairs of selected Middle Eastern countries, illustrated in Figure (4), reveal distinct patterns of each country's role within the regional currency spillover network. The UAE's currency return acts predominantly as a net risk transmitter, exerting a strong influence particularly on the Turkish lira. However, this role shifted notably during the Hamas–Israel conflict (October 2023), when the UAE became a net risk receiver, clearly reflecting how geopolitical shocks can alter spillover dynamics. Throughout the period, the UAE maintained weak linkages with the currencies of Kuwait and Iran, while its influence on the Israeli currency also declined significantly after the onset of the conflict.

On the other hand, Turkey's currency return showed a strong connection with Lebanon's currency only. Initially, Turkey acted as a risk receiver from Lebanon but gradually turned into a net risk transmitter during the 2023 tensions. This finding is particularly relevant given Turkey's economic vulnerability following the February 2023 earthquake and energy crisis pressures, which may have amplified its role in transmitting instability to other regional markets.

Regarding Israel, results indicate that its currency primarily served as a net risk receiver, a role that became more pronounced during the escalation of military conflict with Hamas. Conversely, Saudi Arabia was the main risk transmitter toward Lebanon before the war, but its overall connectedness with other currencies dropped sharply afterward. The relationship between the Saudi riyal and the Israeli shekel also shifted—from risk transmission before late 2023 to risk reception thereafter.

Qatar's currency exhibits a similar pattern, showing generally weak ties with most currencies except Kuwait and Lebanon. It mostly received shocks from Kuwait but transmitted risk to Lebanon. However, since the beginning of the Hamas–Israel conflict, these connections have weakened considerably. A comparable trend is observed for the Kuwaiti and Israeli currencies.

Finally, findings for Iran show that its currency maintained very weak pairwise connectedness with all others throughout the sample period. This is expected given the effects of economic sanctions, restricted financial markets, and limited international trade interactions, reinforcing Iran's marginal position within the regional currency network.

Overall, the analysis suggests that currency spillovers in the Middle East are driven not only by economic relations but also by geopolitical shocks and regional events. These results are consistent with prior research, such as Smales (2021) on financial risk transmission and Ahmed & Sohang (2025) on the impact of political crises on exchange rate dynamics.

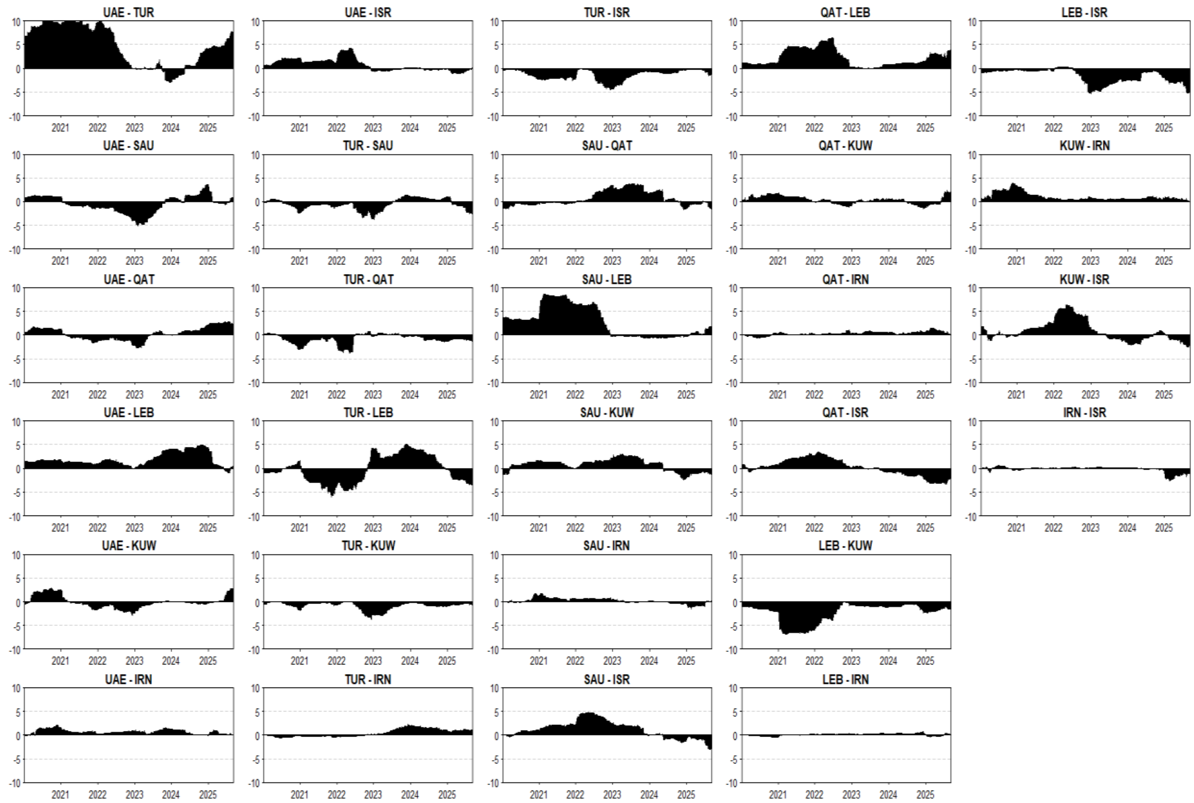

Figure 4. Dynamic net pairwise directional connectedness

Note: In the time intervals when the curve is above (below) the horizontal axis, it means that the asset is the net volatility transmitter (receiver) in the network

The results presented in Table (4), based on the Minimum Variance Portfolio (MVP) approach, provide a clear picture of the optimal weighted pattern of currency assets under different market conditions (normal, bearish, and bullish). According to these findings, the Iranian currency holds the highest optimal weight in all market states, followed by the Qatari currency. This indicates that despite Iran's weak connection within the regional currency network—a key characteristic identified in earlier sections—this very feature reduces its correlation with other currencies, increasing its attractiveness in the optimal portfolio. In contrast, the Emirati currency receives the lowest optimal weight, which aligns with previous findings of its strong linkage with other currencies, as high correlations reduce its diversification benefits. Interestingly, this pattern remains consistent across all three market states (normal, bearish, and bullish).

However, the results regarding the Hedging Effectiveness (HE) index reveal a different pattern. The Turkish currency emerges as the most effective asset for portfolio risk control, achieving a hedging effectiveness of around 97%. This finding is particularly important, as it shows that although the Turkish currency does not hold a high optimal weight in the MCP, its role as a risk management instrument is crucial in reducing portfolio volatility. The Lebanese currency ranks second, with an effectiveness level of about 94%, indicating a solid hedging performance.

In contrast, the Iranian currency—which has the highest optimal weight in the MVP—records the lowest hedging effectiveness, at only about 41%. This suggests that while Iran plays a significant role in portfolio diversification due to its low correlation with other currencies, it is not efficient in risk management. In other words, the Iranian currency serves more as a diversification asset rather than a hedging tool.

These results are consistent with previous literature, which shows that in emerging or restricted financial markets, certain assets may play a strong role in portfolio diversification strategies but have limited hedging effectiveness (Pätäri et al., 2019). Conversely, currencies like those of Turkey and Lebanon—due to their more central roles in spillover networks and higher sensitivity to external shocks—can serve as more effective hedging instruments.

Table 4. Optimal weights based on MVP approach

	Mean	**Std.Dev.**	**5%**	**95%**	**HE**	**p-value**
UAE	0.01	0.02	0.00	0.07	0.83	0.00
TUR	0.04	0.02	0.01	0.06	0.97	0.00
SAU	0.04	0.08	0.00	0.21	0.81	0.00
QAT	0.30	0.14	0.12	0.53	0.64	0.00
LEB	0.02	0.02	0.00	0.05	0.94	0.00
KUW	0.10	0.04	0.03	0.17	0.74	0.00
IRN	0.42	0.10	0.26	0.55	0.41	0.00
ISR	0.06	0.05	0.03	0.14	0.83	0.00

Notes: (1) The table reports average optimal weights based on MVP approach for exchange rates in a multivariate portfolio. It shows the optimal weight of each asset in this portfolio. For example, 0.42 indicates that for a 1$ investment in this basket, the optimal weight of Iran's currency that can manage the portfolio risk is 42 cents. (2) HE indicates the percentage value of Hedging Effectiveness. (2) The 5% volatility shows the bearish market mode, however, the 95% shows the extremely volatile market, namely the bullish market.

The results presented in Table (5), calculated based on the Minimum Correlation Portfolio (MCP) approach, show the optimal weights of currency assets under different market conditions (normal, bearish, and bullish). According to this approach, in the normal market state, the Israeli currency holds the highest optimal weight, followed by the Iranian currency (0.15). The Emirati currency has the lowest optimal weight.

The results differ under bearish and bullish market conditions, where the Turkish currency holds the highest optimal weight in both cases. Furthermore, the Hedging Effectiveness (HE) results indicate that the Turkish currency exhibits the highest positive and significant HE value (0.88). However, for some currencies—specifically Iran, Qatar, and Kuwait—the HE results show negative values, indicating that these assets are risky across all three market conditions.

Table 5. Optimal weights based on MCP approach

	Mean	**Std.Dev.**	**5%**	**95%**	**HE**	**p-value**
UAE	0	0.01	0	0	0.21	0.000
TUR	0.3	0.04	0.23	0.35	0.88	0.000
SAU	0.08	0.07	0	0.19	0.15	0.005
QAT	0.07	0.05	0	0.15	-0.66	0.000
LEB	0.14	0.05	0.07	0.24	0.74	0.000
KUW	0.07	0.03	0.02	0.12	-0.21	0.03
IRN	0.15	0.04	0.1	0.21	-0.17	0.000
ISR	0.19	0.06	0.09	0.27	0.24	0.000

Notes: (1) The table reports average optimal weights based on MCP approach for exchange rates in a multivariate portfolio. It shows the optimal weight of each asset in this portfolio. For example, 0.14 indicates that for a 1$ investment in this basket, the optimal weight of Lebanon's currency that can manage the portfolio risk is 42 cents. (2) HE indicates the percentage value of Hedging Effectiveness. (2) The 5% volatility shows the bearish market mode, however, the 95% shows the extremely volatile market, namely the bullish market.

The results of the optimal asset weights based on the Minimum Connectedness Portfolio (MCoP) approach are presented in Table (6). According to these findings, the Iranian currency exhibits a negative Hedging Effectiveness (HE), indicating that it is a high-risk asset and cannot effectively contribute to portfolio risk control. However, the HE values for the other currencies are positive and statistically significant. Under normal and bearish market conditions, the highest optimal weight belongs to the Lebanese pound, while the lowest weights correspond to the UAE dirham and the Saudi riyal. In bullish market conditions, the Turkish lira holds the highest optimal weight. Moreover, the HE results under this approach indicate that the Turkish lira provides the highest hedging effectiveness, approximately 93%.

Table 6. Optimal weights based on MCoP approach

	Mean	Std.Dev.	5%	95%	HE	p-value
UAE	0.05	0.07	0.00	0.18	0.58	0.00
TUR	0.17	0.07	0.02	0.24	0.93	0.00
SAU	0.04	0.06	0.00	0.16	0.55	0.00
QAT	0.11	0.05	0.03	0.18	0.12	0.14
LEB	0.18	0.02	0.16	0.20	0.86	0.00
KUW	0.10	0.04	0.03	0.15	0.36	0.00
IRN	0.22	0.02	0.18	0.25	-0.44	0.00
ISR	0.12	0.06	0.05	0.23	0.60	0.00

Notes: (1) The table reports average optimal weights based on MCoP approach for exchange rates in a multivariate portfolio. It shows the optimal weight of each asset in this portfolio. For example, 0.11 indicates that for a 1$ investment in this basket, the optimal weight of Qatari's currency that can manage the portfolio risk is 42 cents. (2) HE indicates the percentage value of Hedging Effectiveness. (2) The 5% volatility shows the bearish market mode, however, the 95% shows the extremely volatile market, namely the bullish market.

The dynamic optimal weights of each currency based on the MVP approach are presented in Figure (5). As observed, the highest fluctuations over time are associated with the Qatari riyal, Kuwaiti dinar, and Iranian rial. Notably, the optimal weight of the Saudi riyal increased sharply following the outbreak of the Hamas–Israel conflict. In contrast, the optimal weight of the Qatari riyal experienced a significant decline starting in 2022, coinciding with the Russia–Ukraine war. The results also reveal that the optimal weight of the Israeli shekel has dropped substantially since the onset of the military tensions between Israel and Hamas, reaching nearly zero by the end of 2025. The Kuwaiti dinar also showed noticeable fluctuations throughout the sample period; however, its optimal weight never exceeded 20% over time.

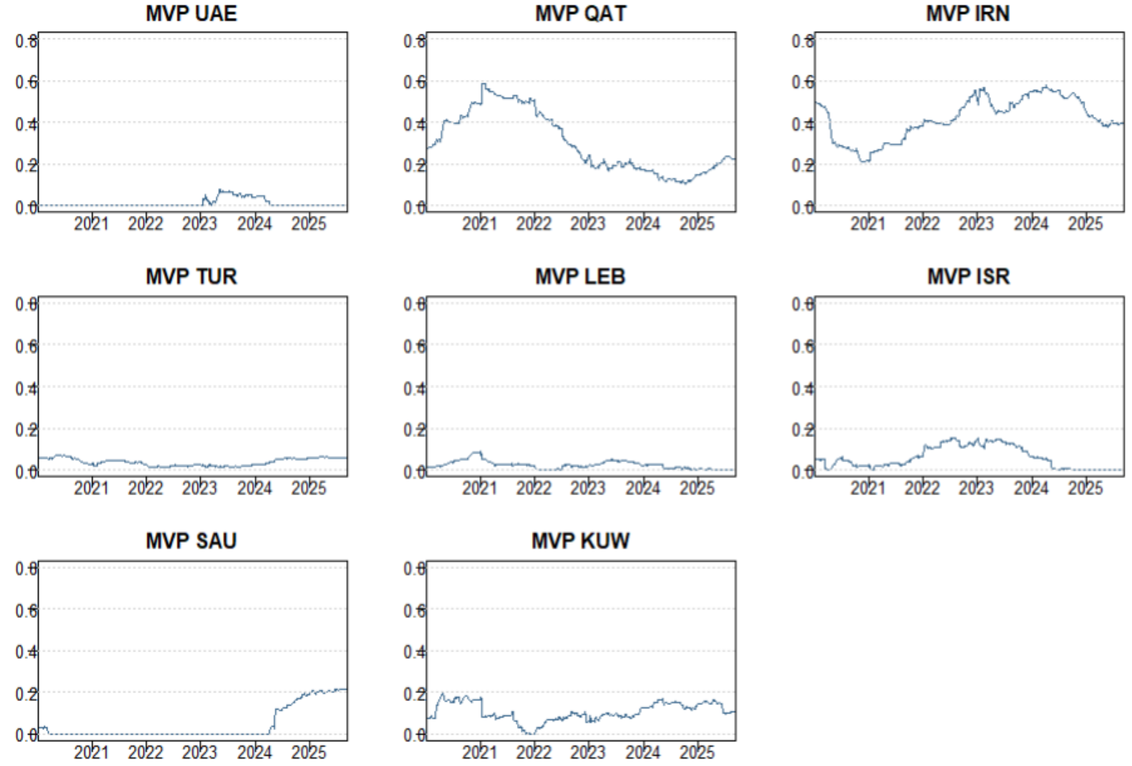

Figure 5. Dynamic portfolio weights using Minimum Variance Portfolio (MVP)

Source: Estimated by authors.

The dynamic optimal weights of each currency based on the MCP approach are illustrated in Figure (5). As evident from the figure, the fluctuations of most currencies over time are considerably higher compared to the MVP results (except for the UAE dirham). The results indicate that the Turkish lira maintains an average optimal weight of around 50%, which is notably higher than that of other currencies. The findings also show that the optimal weights of the Qatari riyal and Saudi riyal increased following the Hamas–Israel conflict, whereas the optimal weights of the Turkish lira, Lebanese pound, and Israeli shekel decreased. The Kuwaiti dinar, despite exhibiting a relatively stable trend after the conflict, experienced a significant decline in its optimal weight toward the end of 2025. The Iranian rial's optimal weight showed a decreasing trend until 2023 but stabilized thereafter, even amid intense regional tensions.

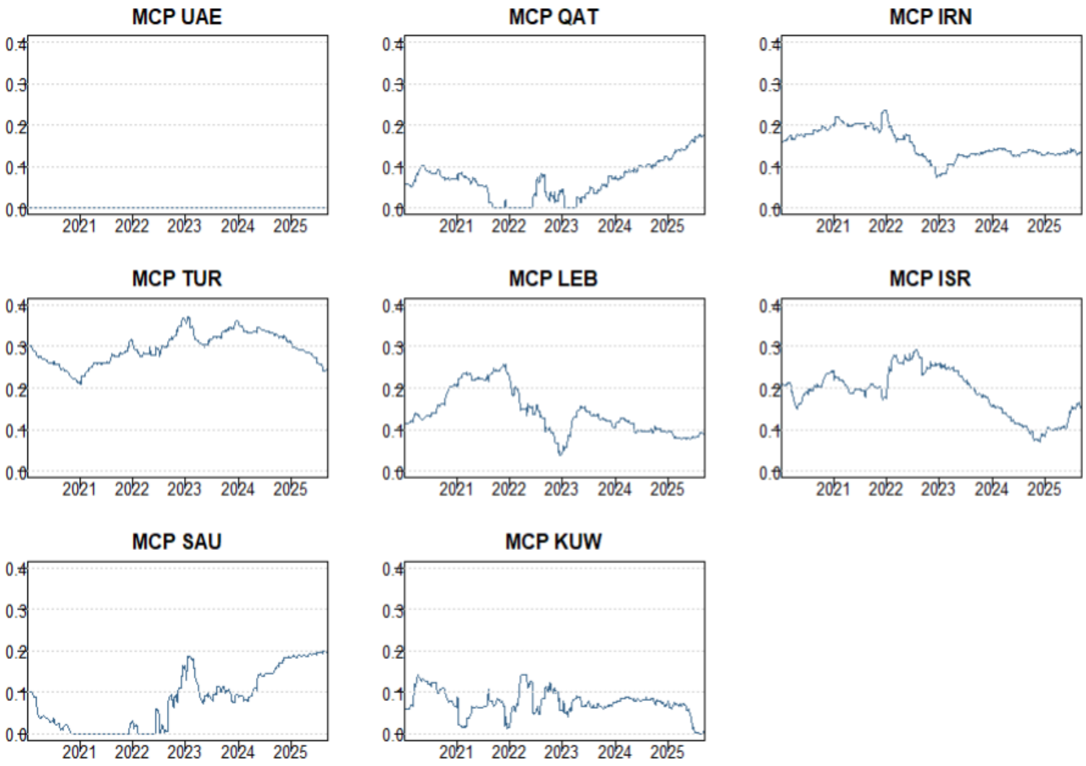

Figure 5. Dynamic portfolio weights using Minimum Correlation Portfolio (MCP)

Source: Estimated by authors.

The dynamic optimal weights of each currency based on the MCoP approach are shown in Figure (6). Compared to the MCP approach, currency fluctuations under MCoP are generally reduced. However, the volatility of the UAE dirham, Turkish lira, Qatari riyal, Israeli shekel, and Kuwaiti dinar is somewhat higher than that of the other currencies. The Hamas–Israel conflict led to a decrease in the optimal weight of the Turkish lira, while the optimal weight of the Saudi riyal increased. The optimal weights of other currencies, particularly the Iranian rial and Lebanese pound, remained relatively stable. Although the UAE dirham exhibited a stable trend before the conflict, its optimal weight surged sharply following the war but returned to a stable and very low level by late 2025. Overall, the MCoP-based results indicate that the Hamas–Israel military tensions had the greatest impact on the optimal weights of the UAE, Turkey, and Saudi Arabia.

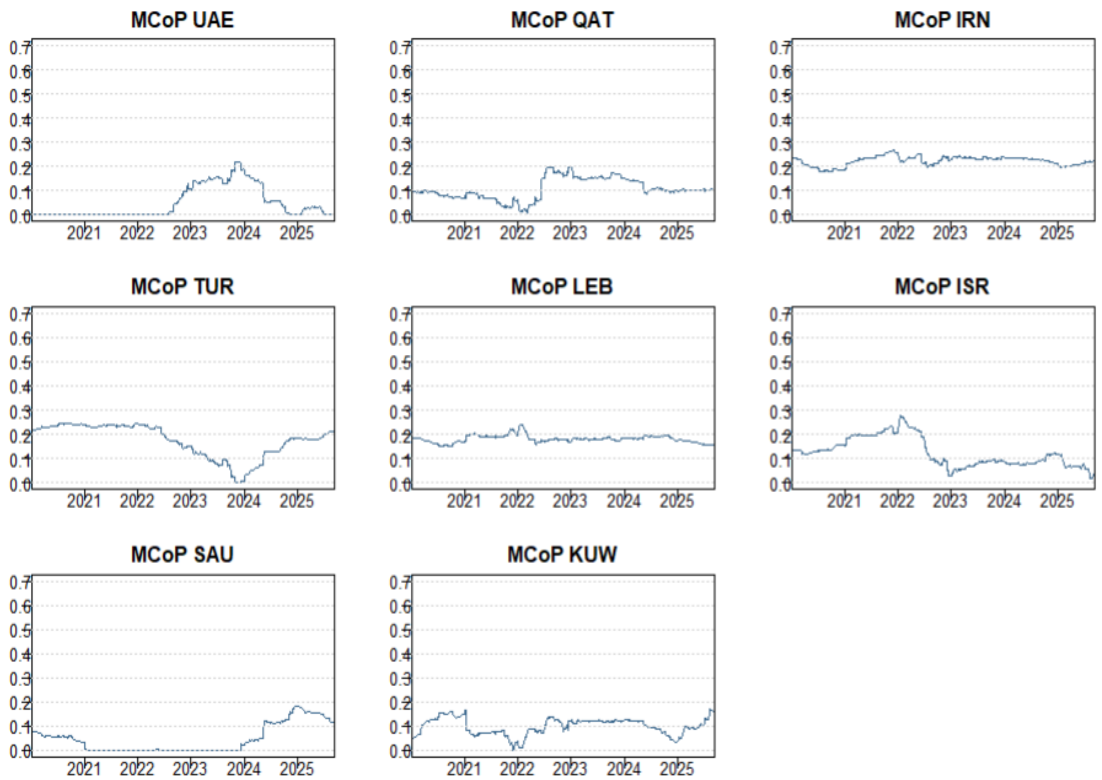

Figure 6. Dynamic portfolio weights using Minimum Connectedness Portfolio (MCoP)

Source: Estimated by authors.

Figure (7) illustrates the cumulative portfolio returns over time based on the MVP, MCP, and MCoP approaches. As shown, prior to early 2023, the cumulative returns under the MVP approach were relatively higher compared to the other two methods. However, following the onset of military tensions and regional conflicts, the results indicate that the MCP approach becomes more suitable, as it delivers higher cumulative portfolio returns than the other two approaches.

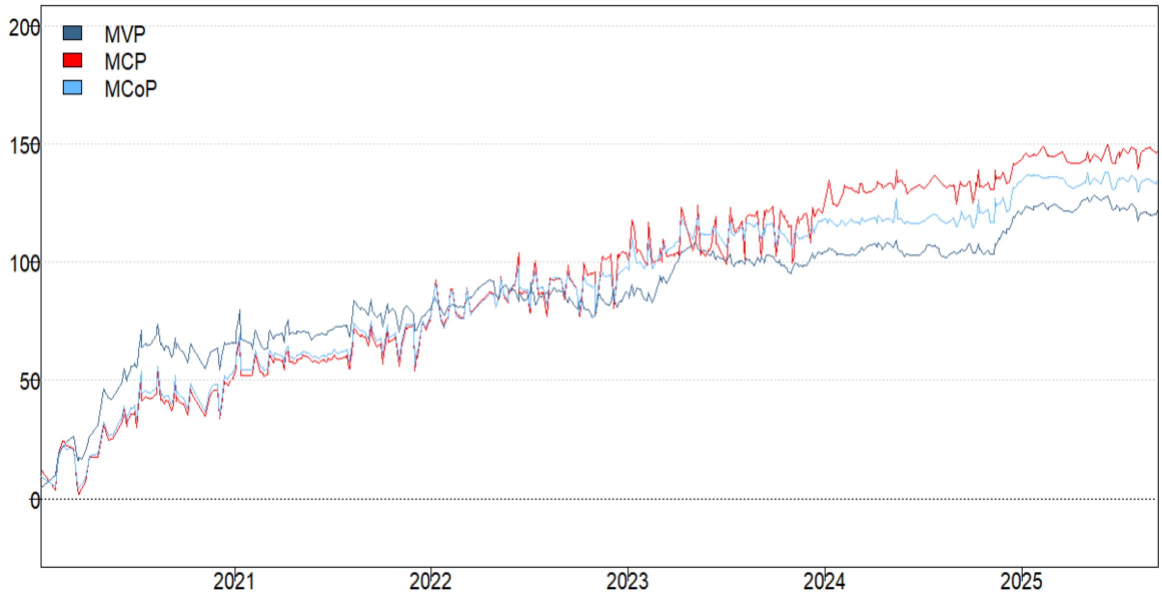

Figure 7. Cumulative return of all series using MVP, MCP and MCoP approaches

Notes: Results are based on the time-varying variance-covariance matrices retrieved from the TVP-VAR (0.99,0.99) with one lag. MVP refers to the minimum variance portfolio, MCP refers to the minimum correlation portfolio, and MCoP to the minimum connectedness portfolio.

Table 7 presents the performance evaluation of different portfolio management approaches, namely MVP, MCP, and MCoP. As shown, the MCP approach exhibits the highest returns and Sharpe ratio compared to the other two methods, making it the optimal choice for portfolio risk management and investment allocation among these assets.

Table 7. Portfolio Performance

	MVP	**MCP**	**MPC**
Return	0.026	0.04	0.02
StdDev	0.22	0.15	0.22
Sharpe Ratio (StdDev)	0.11	0.30	0.09
Sharpe Ratio (VaR)	1.09	2.90	0.93
Sharpe Ratio (CVaR)	0.57	1.57	0.49

Source: Estimated by authors.

Based on the results of Table 7 and Figure 7, the MCP approach was selected as the optimal strategy. Consequently, the optimal weights among the currency pairs examined in this study, under different market conditions (normal, bearish, and bullish), as well as the hedge effectiveness (HE) of the assets, are presented in Table 8.

The results indicate that in a normal market, the highest optimal weight belongs to the UAE/TUR portfolio, which is 0.98. This means that for a $1 investment, $0.98 should be allocated to the UAE currency and the remaining $0.02 to the Turkish currency to minimize portfolio risk. However, since this portfolio exhibits a negligible HE, investing $0.02 in the Turkish currency does not provide meaningful risk hedging for the UAE currency.

The next portfolio with the highest optimal weight in a normal market, while also showing a significant HE, is the QAT/LEB portfolio, with an optimal weight of 0.92. This implies an allocation of $0.92 to the Qatari riyal and $0.08 to the Lebanese pound for a $1 investment. This portfolio has an HE of 0.14, indicating relatively low hedge effectiveness. According to the results, this portfolio also holds the highest optimal weight under both bearish and bullish market conditions.

The results further indicate that the TUR/IRN portfolio has the highest significant HE, at 96%. This implies that if an investor wishes to use the Iranian rial to hedge against fluctuations in the Turkish lira, the share of the Iranian currency in total investment should remain low across all market conditions (normal, bullish, and bearish).

Table (8) Optimal weights in bivariate portfolios based on MCP approach

	Mean	Std.Dev.	5%	95%	HE	p-value
UAE/TUR	0.98	0.03	0.9	1	0.01	0.9
UAE/SAU	0.5	0.23	0.25	0.88	0.36	0.00
UAE/QAT	0.15	0.14	0.00	0.36	0.56	0.00
UAE/LEB	0.81	0.13	0.53	0.94	0.23	0.00
UAE/KUW	0.34	0.22	0.00	0.7	0.46	0.00
UAE/IRN	0.2	0.04	0.14	0.26	0.78	0.00
UAE/ISR	0.48	0.12	0.36	0.72	0.26	0.00
TUR/UAE	0.02	0.03	0.00	0.09	0.84	0.00
TUR/SAU	0.17	0.08	0.08	0.32	0.89	0.00
TUR/QAT	0.07	0.03	0.01	0.1	0.93	0.00
TUR/LEB	0.29	0.15	0.09	0.58	0.68	0.00
TUR/KUW	0.14	0.06	0.08	0.25	0.92	0.00

TUR/IRN	0.06	0.04	0.01	0.11	0.96	0.00
TUR/ISR	0.16	0.03	0.11	0.2	0.87	0.00
SAU/UAE	0.5	0.23	0.12	0.75	0.32	0.00
SAU/TUR	0.83	0.08	0.68	0.92	0.24	0.00
SAU/QAT	0.12	0.18	0.00	0.45	0.58	0.00
SAU/LEB	0.86	0.1	0.66	1	0.1	0.19
SAU/KUW	0.24	0.18	0.00	0.15	0.39	0.00
SAU/IRN	0.22	0.07	0.11	0.33	0.77	0.00
SAU/ISR	0.48	0.19	0.16	0.76	0.31	0.00
QAT/UAE	0.85	0.14	0.46	1	0.08	0.35
QAT/TUR	0.93	0.03	0.9	0.99	0.09	0.25
QAT/SAU	0.88	0.18	0.55	1	0.17	0.03
QAT/LEB	0.92	0.07	0.8	1	0.14	0.02
QAT/KUW	0.75	0.16	0.53	1	0.13	0.1
QAT/IRN	0.35	0.1	0.23	0.55	0.64	0.00
QAT/ISR	0.86	0.12	0.7	1	0.06	0.45
LEB/UAE	0.19	0.13	0.06	0.47	0.75	0.00
LEB/TUR	0.71	0.15	0.42	0.91	0.32	0.00
LEB/SAU	0.14	0.1	0.00	0.34	0.73	0.00
LEB/QAT	0.08	0.07	0.00	0.02	0.87	0.00
LEB/KUW	0.13	0.08	0.00	0.25	0.81	0.00
LEB/IRN	0.09	0.07	0.02	0.22	0.92	0.00
LEB/ISR	0.27	0.09	0.14	0.46	0.8	0.00
KUW/UAE	0.66	0.22	0.3	1	0.18	0.02
KUW/TUR	0.86	0.06	0.75	0.92	0.19	0.01
KUW/SAU	0.76	0.18	0.49	1	0.14	0.08
KUW/QAT	0.25	0.16	0.00	0.47	0.37	0.00
KUW/LEB	0.87	0.08	0.75	1	0.14	0.08
KUW/IRN	0.26	0.08	0.16	0.42	0.7	0.00
KUW/ISR	0.71	0.22	0.32	1	0.13	0.11
IRN/UAE	0.8	0.04	0.74	0.86	0.24	0.00
IRN/TUR	0.94	0.04	0.89	0.99	0.1	0.21
IRN/SAU	0.78	0.07	0.67	0.89	0.26	0.00
IRN/QAT	0.65	0.1	0.45	0.77	0.41	0.00

IRN/LEB	0.91	0.07	0.78	0.98	0.15	0.06
IRN/KUW	0.74	0.08	0.58	0.84	0.32	0.00
IRN/ISR	0.79	0.07	0.7	0.91	0.24	0.00
ISR/UAE	0.52	0.12	0.28	0.64	0.28	0.00
ISR/TUR	0.84	0.03	0.8	0.89	0.19	0.01
ISR/SAU	0.52	0.19	0.24	0.84	0.38	0.00
ISR/QAT	0.14	0.12	0.00	0.3	0.57	0.00
ISR/LEB	0.73	0.09	0.54	0.86	0.4	0.00
ISR/KUW	0.29	0.22	0.00	0.68	0.45	0.00
ISR/IRN	0.21	0.07	0.09	0.3	0.79	0.00

Notes: (1) The table reports average optimal weights for the currencies in bivariate portfolios. It shows the optimal weight of second asset for $1 investment in first asset. For example, 0.25 (in KUW/QAT portfolio) for a 1$ investment indicates that the optimal weight of QAT that can manage the portfolio risk is 75 cents and the remaining 25 cents should be allocated to KUW. (2) HE indicates the percentage value of Hedging Effectiveness.

Figure (8) illustrates the dynamic evolution of optimal weights in two-asset portfolios comprising the Iranian rial and selected regional currencies, as well as the Israeli shekel, over the period 2020–2025. The results indicate that portfolio weights fluctuate considerably over time, although the intensity of these fluctuations is not uniform across all portfolios. Specifically, the IRN/UAE, IRN/TUR, and ISR/IRN portfolios exhibit more stable behavior with smaller weight changes, reflecting better hedging properties compared to other portfolios. In contrast, portfolios such as IRN/KUW, IRN/SAU, and IRN/QAT experience sharp and highly volatile weight adjustments, indicating higher sensitivity to market conditions and regional political and economic shocks.

Moreover, some portfolios, including ISR/KUW and ISR/SAU, display a V-shaped pattern, where optimal weights initially decline but rise again in the later years, suggesting a form of mean-reversion in the weights. The period between 2022 and 2023 shows particularly pronounced volatility, attributable to heightened geopolitical tensions, sanctions, and fluctuations in regional oil and currency markets.

Overall, the observed pattern suggests that, in the long run, the Iranian rial does not dominate portfolio compositions, and its share gradually diminishes. Investors tend to allocate more weight to other regional currencies to better manage portfolio risk. From a policy perspective, these findings imply that the Iranian rial primarily serves as a complementary asset in two-asset portfolios and, due to its low returns and high volatility, cannot play a central role in diversification or hedging strategies.

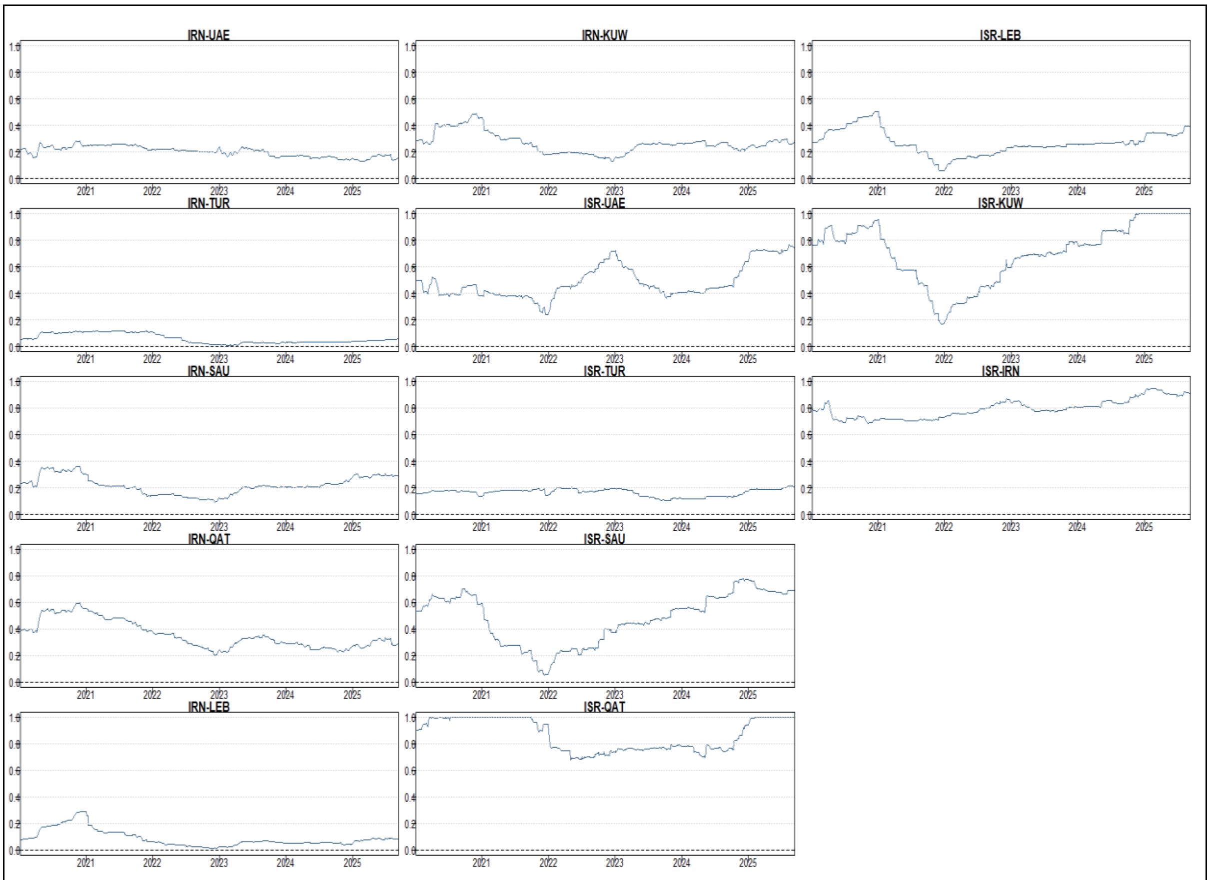

Figure 8. Optimal weights of the bivariate portfolio based on MCP approach

Figure 9 illustrates the dynamic evolution of cumulative returns for two-asset portfolios, focusing on the Iranian rial and the Israeli shekel. Since the primary focus of this study is on military tensions involving Iran and Russia, this section presents cumulative returns of these two currencies in portfolios with other selected currencies.

As shown in the figure, due to the previously identified high risk of the Iranian rial in portfolios, its cumulative returns are substantially high over time, averaging around 150%.

Notably, following the Israel–Hamas conflict and subsequent tensions between Iran and Israel, the cumulative returns of the Iranian rial in portfolios with other currencies further increased.

In contrast, the Israeli shekel exhibits relatively low cumulative returns with other currencies, averaging around 50% over the period. However, following recent regional military tensions, its returns in two-asset portfolios with the Turkish lira and the UAE dirham have risen noticeably. As previously noted, investment risk in the Israeli shekel is relatively low, which aligns with the observed low cumulative returns in the figure.

The combination of the Iranian rial and Israeli shekel presents a different pattern: the cumulative return of this portfolio is significantly high, around 150%, and approaches 200% following military tensions between these two countries.

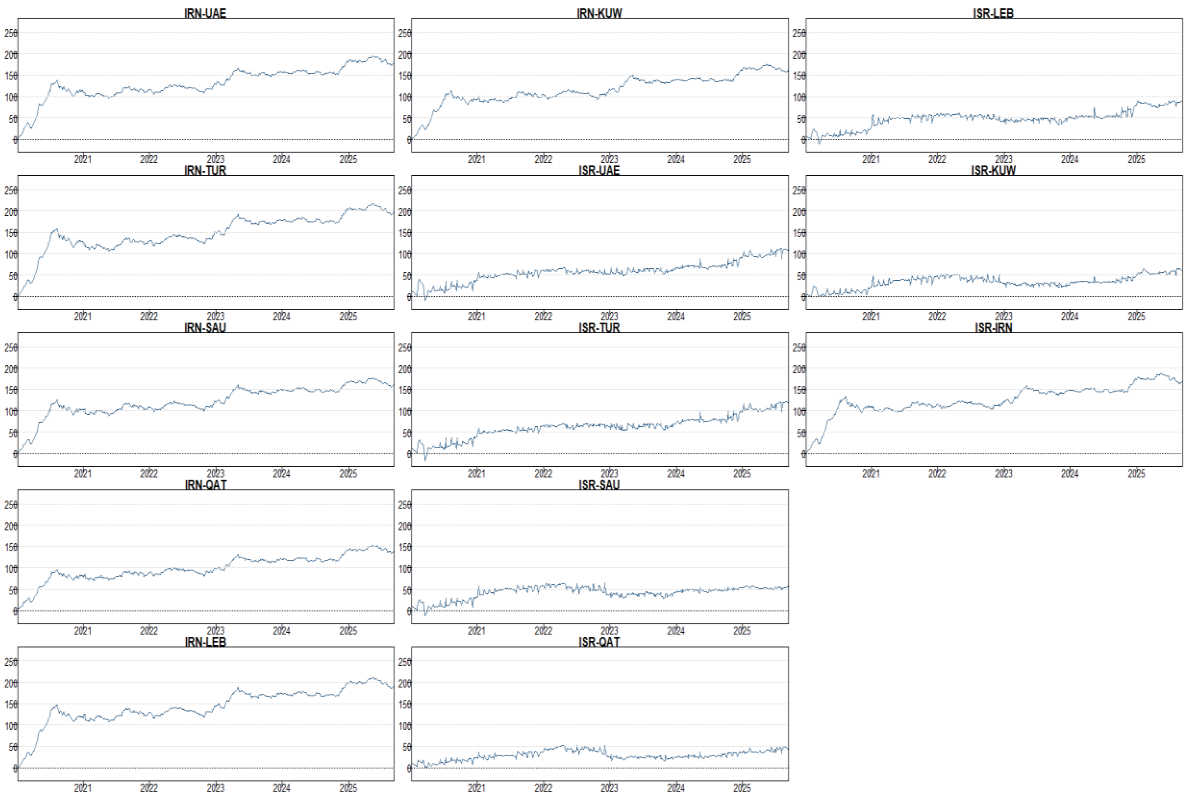

Figure 9. The dynamics of bivariate Cumulative Return in bivariate portfolios

Source: Estimated by authors.

To examine portfolio management strategies, in addition to determining the optimal asset weights in two-asset portfolios and analyzing the dynamics of their cumulative returns, the optimal hedge ratio (HR) for each asset pair under different market conditions (normal, bearish, and bullish) was calculated, and the hedging effectiveness (HE) of each portfolio was also assessed (Table 9).

The results show that, under normal market conditions, the most “expensive” investment strategy corresponds to the SAU/QAT portfolio, with an HR of 0.95. This indicates that for a long-term $1 investment in the Saudi riyal, the investor would need to take a short position of 95 cents in the Qatari riyal to hedge the risk—a substantial amount. In contrast, the “cheapest” strategies involve portfolios where the Iranian rial is the long-term asset, as HRs for all such portfolios are below 0.1. Although most of these portfolios have statistically significant HE (except for combinations with the Turkish lira and Lebanese pound), the HE values remain below 2%, which is extremely low. This implies that despite being “cheap” as long-term investments, portfolios including the Iranian rial offer very limited hedging effectiveness and thus are not suitable for risk-averse investment.

In bearish and bullish market conditions, the cheapest strategies again involve the Iranian rial, but the low hedging effectiveness issue persists. The highest HE is observed for the SAU/QAT portfolio, at approximately 57%, indicating that taking a short position in the Qatari riyal can provide effective risk coverage for a long-term investment in the Saudi riyal.

Table (8) Hedge ratio in bivariate portfolios based on MCP approach

	Mean	Std.Dev.	5%	95%	HE	p-value
UAE/TUR	0.21	0.09	0.07	0.34	0.3	0.21
UAE/SAU	0.52	0.22	-0.03	0.78	0.32	0.00
UAE/QAT	0.76	0.35	0.05	1.19	0.39	0.00
UAE/LEB	0.15	0.07	0.04	0.25	0.07	0.36
UAE/KUW	0.6	0.29	0.12	1.05	0.36	0.00

UAE/IRN	0.08	0.17	-0.23	0.26	0.02	0.89
UAE/ISR	0.48	0.24	0.08	0.8	0.34	0.00
TUR/UAE	1.25	0.48	0.77	2.24	0.28	0.00
TUR/SAU	-0.37	0.51	-1.02	0.47	0.08	0.00
TUR/QAT	-0.3	0.89	-1.8	0.91	0.07	0.00
TUR/LEB	0.29	0.24	-0.1	0.66	0.06	0.36
TUR/KUW	-0.54	0.71	-1.52	0.45	0.08	0.00
TUR/IRN	-0.23	0.45	-1.07	0.42	0.02	0.89
TUR/ISR	-0.45	0.77	-1.6	0.5	0.1	0.00
SAU/UAE	0.54	0.27	-0.02	0.87	0.37	0.00
SAU/TUR	-0.01	0.08	-0.12	0.13	0.08	0.21
SAU/QAT	0.95	0.48	-0.06	1.45	0.57	0.00
SAU/LEB	0.2	0.14	0.05	0.47	0.22	0.36
SAU/KUW	0.7	0.31	0.05	1.02	0.47	0.00
SAU/IRN	0.09	0.12	-0.14	0.24	0.02	0.89
SAU/ISR	0.52	0.26	-0.06	0.83	0.32	0.00
QAT/UAE	0.36	0.18	0.02	0.61	0.41	0.00
QAT/TUR	0.01	0.06	-0.06	0.12	0.07	0.21
QAT/SAU	0.42	0.18	-0.04	0.56	0.48	0.00
QAT/LEB	0.08	0.08	0.00	0.22	0.1	0.36
QAT/KUW	0.5	0.06	0.4	0.57	0.39	0.00
QAT/IRN	0.11	0.06	0.01	0.21	0.01	0.89
QAT/ISR	0.38	0.07	0.29	0.53	0.37	0.00
LEB/UAE	0.46	0.2	0.16	0.76	0.08	0.00
LEB/TUR	0.11	0.11	-0.1	0.3	0.05	0.21
LEB/SAU	0.56	0.3	0.22	1.16	0.2	0.00
LEB/QAT	0.56	0.56	-0.02	1.69	0.12	0.00
LEB/KUW	0.3	0.5	-0.35	1.14	0.12	0.00
LEB/IRN	0.15	0.19	-0.19	0.4	0.01	0.89
LEB/ISR	-0.17	0.4	-0.8	0.47	0.08	0.00
KUW/UAE	0.45	0.24	0.06	0.77	0.39	0.00
KUW/TUR	-0.02	0.06	-0.12	0.08	0.06	0.21
KUW/SAU	0.5	0.21	0.04	0.76	0.45	0.00
KUW/QAT	0.76	0.21	0.51	1.17	0.42	0.00

KUW/LEB	0.1	0.14	-0.06	0.37	0.16	0.36
KUW/IRN	0.14	0.07	-0.01	0.25	0.02	0.89
KUW/ISR	0.57	0.1	0.44	0.75	0.41	0.00
IRN/UAE	0.03	0.05	-0.04	0.09	0.03	0.00
IRN/TUR	0.00	0.01	-0.02	0.02	0.01	0.21
IRN/SAU	0.02	0.04	-0.05	0.09	0.02	0.00
IRN/QAT	0.06	0.03	0.01	0.11	0.01	0.00
IRN/LEB	0.02	0.02	-0.01	0.05	0.01	0.36
IRN/KUW	0.06	0.06	0.00	0.18	0.02	0.00
IRN/ISR	0.03	0.02	0.00	0.07	0.01	0.00
ISR/UAE	0.47	0.23	0.06	0.72	0.35	0.00
ISR/TUR	-0.01	0.11	-0.17	0.17	0.09	0.21
ISR/SAU	0.46	0.24	-0.14	0.71	0.27	0.00
ISR/QAT	0.81	0.24	0.54	1.19	0.39	0.00
ISR/LEB	-0.03	0.1	-0.16	0.13	0.06	0.36
ISR/KUW	0.8	0.17	0.58	1.17	0.44	0.00
ISR/IRN	0.12	0.13	-0.01	0.42	0.02	0.89

Notes: (1) The table reports average hedge ratio for the currencies in bivariate portfolios. It shows that the hedge ratio for $1 long position in first asset. For example, 0.8 in ISR/KUW, indicates a $1 long position in ISR can be hedged by taking 80 cents short position in KUW. (2) Negative values for each bivariate portfolio indicates a long position for both of assets. (3) HE indicates the percentage value of Hedging Effectiveness.

This study also explores the dynamic behavior of the hedge ratio over time when the investor holds the Iranian rial or Israeli shekel as the long-term asset in two-asset portfolios, alongside the analysis of hedge ratios and hedging effectiveness (HE). The results indicate that when the Israeli shekel is the long-term asset, the hedge ratio exhibits significant fluctuations over time—particularly when the Saudi riyal, Qatari riyal, UAE dirham, or Kuwaiti dinar are used as short-term hedging assets. From a policy perspective, this implies that relying on hedging strategies based on these currencies for long-term investments is costly and inefficient for both investors and financial institutions.

Conversely, in portfolios where the Iranian rial serves as the long-term asset, the hedge ratio remains relatively stable over time, suggesting very low-cost strategies. However, as shown in Table 8, the short-term hedging assets in these portfolios provide limited hedging effectiveness. Therefore, the Iranian rial cannot be considered a reliable or attractive asset for long-term investment purposes.

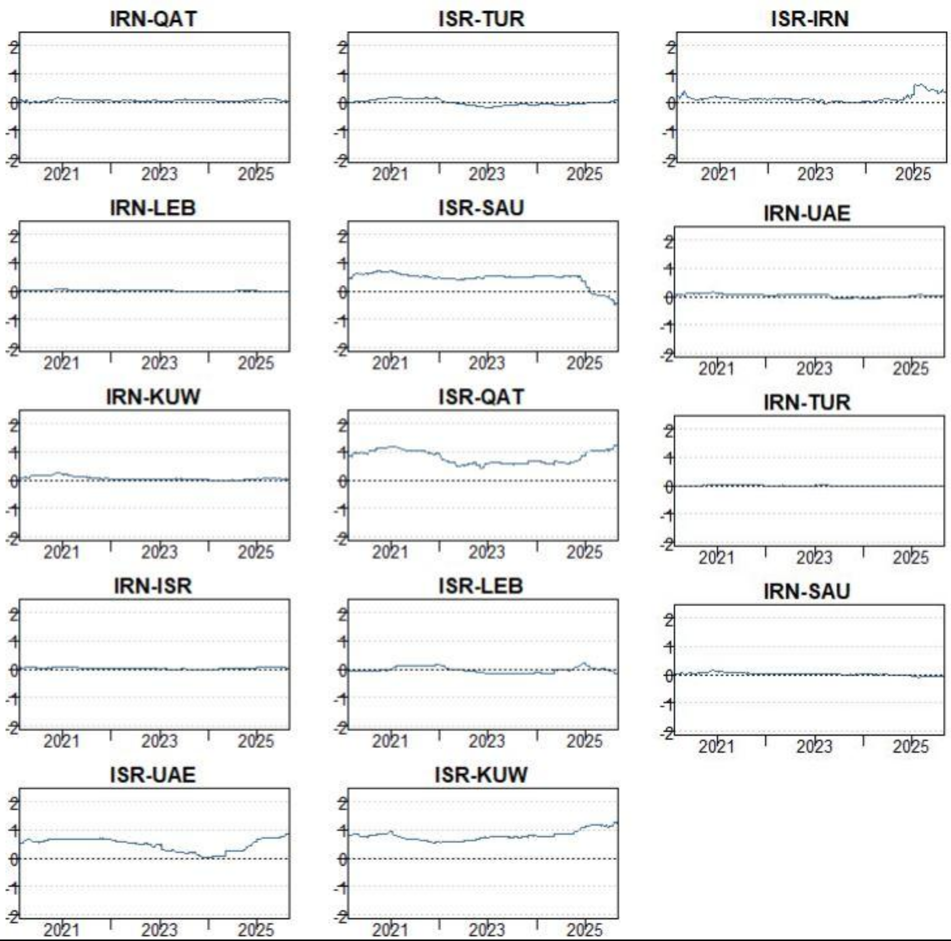

Figure 10. Dynamic bivariate Hedge ratios

Source: Estimated by authors.

6. Conclusion:

Middle Eastern countries hold a strategic position in the global economy due to their abundant natural and, consequently, financial resources. Despite the region's importance, portfolio management of its stock markets amid political and geopolitical crises remains largely unexplored. High volatility, elevated uncertainty, and sensitivity of financial markets to economic, political, military, and even health-related events make analyzing interconnections among these markets crucial for both investors and policymakers. Ignoring these dynamics can expose decision-makers to significant financial and policy risks.

Given the inherently interconnected nature of financial markets and return spillovers, understanding the relationships and return flows among regional stock markets is vital, particularly for designing multi-asset portfolios and managing risk to reduce uncertainty. This study investigates return spillovers among the stock markets of eight selected Middle Eastern countries, focusing on total connectedness index (TCI), identification of return transmitters and receivers, dynamic optimal weights, dynamic hedging, cumulative returns, Sharpe ratios, and comparison of three portfolio approaches—MVP, MCP, and MCoP—to identify the optimal strategy for portfolio management.

Key research questions include:

How did stock market connectedness change during crises such as the COVID-19 pandemic, the Russia–Ukraine war, Hamas's October 7 attack, and the 12-day Iran–Israel conflict?

Which markets act as net return transmitters or receivers?

Which portfolio approaches achieve the highest Sharpe ratios and optimal risk–return combinations?

How do dynamic weighting and hedging patterns evolve under crisis conditions?

Which approach delivers the highest cumulative returns?

The study's theoretical framework is based on Bradstock et al. (2022) and Koka et al. (2024). A major innovation of this research is that, unlike previous studies, it does not merely introduce portfolio approaches but also identifies which approach provides the best risk–return combination. The findings show that the primary risk transmitters in the regional currency network are the UAE and Saudi Arabian currencies, whereas the Lebanese currency is the main risk receiver, indicating its susceptibility to external shocks. In contrast, the Israeli currency exhibits the lowest connectivity, making it suitable for diversification within investor portfolios. TCI among the studied currencies is high and exhibits significant temporal fluctuations. Notably, during the Russia–Ukraine war, TCI rose sharply to around 65%, reducing diversification opportunities. Subsequent to the Israel–Hamas war, overall connectedness increased again and continued to trend upward following the 12-day Israel–Iran conflict, reaching approximately 50% by the end of the study period. These results indicate that geopolitical crises substantially constrain diversification opportunities and highlight the need for dynamic risk management strategies. Lowly connected currencies such as Israel's can serve as protective hedges against risk spillovers. From a policy perspective, the findings suggest that financial market interdependencies in the Middle East can intensify rapidly during crises, threatening regional financial stability. Consequently, designing effective hedging tools and fostering regional cooperation to manage shocks is strategically important.

Net directional connectedness results reveal that currency connections with the network are highly volatile and dependent on political and economic events. For example, the Israeli currency's network exposure surged during the Russia–Ukraine war, diminishing its portfolio risk-reduction advantage. By 2023, however, Israel's currency shifted to become a net risk transmitter. The 2025 Israel–Iran conflict further intensified its network influence. Except for Iran, other currencies experienced substantial temporal fluctuations. Qatar's currency, in particular, showed the lowest connectivity after the Israel–Hamas war and subsequent political tensions, making it a reliable hedge for portfolios during this period. Overall, the Russia–Ukraine conflict significantly affected the network connections of all currencies except Iran.

Optimal weight results based on MVP indicate that the Iranian currency has the highest optimal weight across all market conditions (normal, bearish, and bullish), but its hedging effectiveness (HE) is the lowest compared to other currencies. Qatar's currency also shows high optimal weight along with significant HE, suggesting its suitability for portfolio risk management. According to MCP, Israel's currency has the highest weight in normal markets, while Turkey dominates in bearish and bullish markets, also providing substantial HE. Under MCoP, Lebanon and Turkey achieve the highest optimal weights with positive and significant HE across all market states. These results indicate that currencies with the highest risk management potential vary across approaches, and market conditions influence the choice of optimal currency, except under MCoP.

Dynamic cumulative return analysis shows that from 2022 onward, MCP delivers higher cumulative returns over time, making it the preferred approach in this study for examining optimal weights and hedge ratios. Bivariate hedge ratio results indicate that hedging costs depend on market conditions. For instance, in normal markets, short positions in the UAE currency can provide an inexpensive and significant hedge for long positions in Qatar. Moreover, Qatar's currency provides the highest HE as a short-term hedge for long positions in most currencies, supporting earlier findings. Portfolio performance results further confirm that MCP achieves the highest Sharpe ratio and return compared to the other approaches.

In summary, by combining dynamic connectedness analysis, optimal weighting, and evaluation of different portfolio approaches (MVP, MCP, MCoP), this study demonstrates that effective risk management in the Middle East is impossible without accounting for geopolitical dynamics and structural market changes. The findings assist investors in selecting optimal asset combinations and alert regional and international policymakers that financial stability in the Middle East is closely tied to political and security developments. These insights can guide investors in resource allocation and policymakers in enhancing risk management and financial stability under the region's high-risk conditions.

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