

## Exchange Rate Volatility and Financial Market Activity in the MENA Region: New Evidence Using a Dynamic Panel Threshold Regression

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### Abstract

This study examines the impact of exchange rate volatility on financial market activity using a sample of 20 MENA countries from 1990Q1 to 2022Q4. An exchange rate volatility index was derived for each country based on the conditional variance estimated using ARCH/ GARCH models. The main findings using a dynamic panel threshold estimation technique revealed a threshold effect in the relationship between the exchange rate volatility and financial market activity. In oil-exporting countries, exchange rate volatility negatively effects on stock returns at lower or upper threshold levels in a different regime. In non-oil-exporting countries, the adverse effect intensifies when transitioning to the

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high-threshold regime, indicating greater sensitivity to exchange rate instability. Thus, policymakers in the MENA should formulate foreign exchange policy strategies that support exchange rate stability and assist financial market participants in improving risk management, expand the use of hedging instruments, and diversifying portfolios to withstand heightened volatility.

**Keywords:** exchange rate volatility; financial market activity; dynamic panel threshold regression; oil-exporting vs. non-oil economies; MENA region.

**JEL Classification:** F31; G15; C23; O53.

## Introduction

Exchange rate volatility has long been recognised as a central issue in international finance, influencing trade flows, investment decisions, monetary transmission, and macroeconomic stability. In regions where external shocks are recurrent and structural vulnerabilities are pronounced, exchange rate dynamics often become a major determinant of financial and economic performance (Obstfeld & Rogoff, 1995; Krugman et al., 2021). Over recent decades, globalisation and financial integration have intensified the exposure of developing regions to currency fluctuations, particularly where economies rely heavily on external markets (International Monetary Fund, 2023; World Bank, 2024).

The Middle East and North Africa (MENA) region provides a compelling context for analysing exchange rate volatility due to its mix of oil-exporting and non-oil economies, diverse exchange rate regimes, and varying institutional quality. Structural dependencies, including heavy reliance on hydrocarbon revenues and persistent geopolitical risks, heighten the region's sensitivity to external shocks (Baumeister & Kilian, 2016). Moreover, political transitions, regional conflicts, and differing monetary frameworks contribute to pronounced macro-financial instability (Trabelsi & Bahloul, 2022).

In addition to macroeconomic implications, exchange rate fluctuations exert significant influence on financial market activity across emerging economies. Exchange rate movements affect equity prices, bond markets, capital flows, and investor expectations, creating spillovers into broader financial systems (Hajilee & Nasser, 2014). In relatively less diversified markets, such as those in the MENA region, currency instability can magnify financial fragility and hinder market depth (Basher & Sadorsky, 2016).

Despite this importance, a critical problem persists in the empirical literature concerning the MENA region. Existing studies tend to analyse exchange rate volatility or financial market activity separately, rely on linear modelling frameworks, or focus on single-country analyses that cannot explain regional heterogeneity. Moreover, few studies examine whether the relationship between exchange rate volatility and financial market performance changes once certain macroeconomic or financial thresholds are crossed (Hansen, 2000; Kremer et al., 2013). This limited scope creates an important gap in understanding the non-linear and regime-dependent nature of volatility effects within a region characterised by deep structural asymmetries and frequent shocks (Turk-Ariss, 2009).

Accordingly, the main objective of this research is to analyse the non-linear relationship between exchange rate volatility and financial market activity in 20 MENA countries over the period Q1 1990 to Q4 2022, employing the threshold estimation technique. The study aims to determine whether financial market responses to exchange rate movements differ across regimes defined by structural or financial indicators, and to identify the threshold levels at which these changes occur. By doing so, the research provides a more nuanced and empirically

grounded understanding of the mechanisms linking currency instability to financial market performance.

This study contributes to empirical literature in several ways. First, it applies a non-linear (non-monotonic relationship) using a dynamic panel threshold regression proposed by Kremer et al. (2013). Second, it provides region-wide evidence using a long panel dataset (1990–2022) that covers important historical events affecting MENA economies, including global financial crises, oil price collapses, and geopolitical shocks (Baumeister & Kilian, 2016).

Third, this research significantly contributes to experimental studies by expanding and refining previous research in several key areas. By including all 20 MENA countries, this study offers a comprehensive analysis that addresses regional heterogeneity. The classification of countries into oil-exporting and non-oil-exporting categories allows for a nuanced understanding of how exchange rate volatility affects different economies within the region, recognizing that these groups face distinct economic dynamics and challenges. This differentiation is crucial as oil-exporting countries might experience different volatility patterns and impacts due to their reliance on oil revenues compared to non-oil-exporting countries.

Finally, the findings carry important implications for policymakers in the MENA region. Understanding when and how exchange rate volatility influences financial markets can improve monetary policy design and macroprudential regulation (International Monetary Fund, 2023). Recognising threshold conditions under which volatility becomes more disruptive enables central banks and regulators to strengthen market resilience, manage capital flow pressures, and safeguard financial stability (World Bank, 2024). Similarly, financial market participants can leverage the findings to optimize investment strategies, risk management strategies, and navigate the region's volatile economic environment more effectively, ultimately contributing to a more stable and efficient financial system.

This paper has organized as follows: Section 2 provides the theoretical background and literature review on the relationship between the exchange rate volatility and financial market activity. Section 3 describes the data, the empirical model, and the econometric method. Section 4 discusses the empirical findings. Section 5 presents the robustness checks. Finally, Section 6 provides a summary and conclusions.

## 1. Theoretical Background

Starting with Sharpe (1964) and Lintner (1965), the CAPM has evolved and become dominant in the literature particularly on asset pricing (due to this, Sharpe was awarded the Nobel Prize in 1990). CAPM is widely used in many applications such as cost of capital estimation, portfolio construction and performance evaluation. The attraction of the CAPM is that it offers a powerful and intuitively pleasing prediction about how to measure risk and the relation between expected return and risk (Fama & French 2004). However, due to many simplified assumptions and difficulties to implement valid tests of the model, many empirical studies found that the model works poorly. One of the controversial assumptions of CAPM is time-invariant coefficient of the model (Abdul Karim & Abdul Karim 2017). Thus, in this study, we use the international Capital Asset Pricing Model (ICAPM) as an alternative to the linear CAPM.

The International Capital Asset Pricing Model (ICAPM) was developed by economists such as Robert Merton in the 1970s, expanding on the Capital Asset Pricing Model (CAPM) to account for global factors. Merton's work laid the foundation for the ICAPM by introducing a multi-period version of the CAPM that incorporates risks across time and borders, addressing

the limitations of a purely domestic model. While the CAPM assumes that investors only hold domestic assets and are concerned with local market risks, the ICAPM considers the fact that in an increasingly interconnected world, investors diversify internationally and are exposed to a range of global risks, such as exchange rate fluctuations, inflation differences, and diverse interest rates. The model suggests that international asset prices should reflect not only domestic risks but also these global risk factors (Ahmad Hakim & Mohamad, 2016).

The ICAPM modifies the standard CAPM equation by introducing an additional risk premium for global market risks. It suggests that the expected return of a security is influenced by both domestic and international factors, and the risk premium demanded by investors includes compensation for the risk of holding foreign assets. Therefore, the ICAPM helps investors understand how global economic forces impact asset pricing and portfolio selection in an international context. It is particularly useful in guiding multinational corporations and investors as they weigh decisions in global capital markets, allowing for a more comprehensive analysis of risks that go beyond borders. The main equation of the ICAPM is similar to the CAPM but includes additional risk premiums for global factors. The equation can be expressed as (Ahmad Hakim & Mohamad 2016):

$$R_t - R_{F,t} = \alpha \beta (R_{W,t} - R_{F,t}) + \varepsilon_t \quad t = 1, 2, 3, \dots, n \quad \dots(1)$$

where:  $R_t$ ,  $R_{F,t}$  and  $R_{W,t}$  refer to the market portfolio return, world portfolio returns and international risk-free rate respectively, while  $t$  and  $n$  are time period and sample size and  $\varepsilon$  is the white noise residual.

The ICAPM provides a comprehensive framework for pricing assets in a globally integrated market, where investors must account for both domestic and international risks. By extending the traditional CAPM with additional risk premiums for global factors, the ICAPM reflects the complexities of international investment, including exposure to currency fluctuations, foreign interest rates, and other cross-border economic variables. This model is crucial for investors and institutions operating in multiple countries, as it helps them assess the expected returns of assets while considering the broader risk factors that influence international capital markets. Ultimately, the ICAPM offers a more accurate tool for portfolio optimization in an interconnected world, guiding decisions in global investment and risk management.

The literature on the impact of exchange rate volatility on financial market activity reveals a divergence of results, with some studies indicating a significant influence while others find minimal or no effect, reflecting varying methodologies and contexts. Baranidharan and Alex (2020) examined the volatility spillover of exchange rate on South African stock market for the period 2009-2020. They applied GRACH (Generalized Autoregressive Conditional Heteroskedasticity) model and Cointegration test and Granger Causality test. The outcomes of the analysis have revealed that changes in exchange rate were significant, and negative linkages influenced low on Johannesburg Stock Exchange (JSE). Xie et al. (2020) studied the causal association between the exchange rate and stock market for twenty-six economies, including those of 20 advanced and 6 emerging economies from 1998 to 2019. The findings revealed that there is a bidirectional Granger causality association between the exchange rate volatility and stock market.

In comparison, Tamunowariye & Anaele (2022) empirically examined the impact of exchange rate volatility on stock market performance by adopting quarterly data for Nigeria from the period 1981 - 2019 by utilizing generalized autoregressive conditional heteroskedasticity (GARCH) technique. The outcomes demonstrated that exchange rate volatility was statistically significant with productivity, however, it was revealed that exchange rate volatility is high and that shocks in exchange rate reduce the level of productivity as well as reduces the level of stock market performance. Adekunle (2023) analysed the relationship between foreign exchange rate volatility and the performance of the Nigerian stock market from 1986 to 2015 using the error correction (ECM) model. The results confirmed that foreign exchange rate was highly volatile over the period of study and this has a negative and significant impact on the performance of the Nigerian stock market.

In a major break with the existing macroeconomic literature, Gokmenoglu et al. (2021) evaluated the relationship between exchange rate and stock market returns for selected emerging countries from the 1994–2019. The estimated results revealed that the examined countries' stock market performances are not affected by the exchange rate volatility.

More recently, by using a various GARCH models, including the EGARCH and TGARCH models, Bhargava & Konku (2023) evaluated the relationship between exchange rate fluctuations of a number of major currencies and its impact on the volatility in the US stock market during the 2000 to 2019 period. The empirical findings emphasize that volatility in Australian dollar, Canadian dollar and the euro negatively impact the US stock market. Similarly, Gbadebo (2023) evaluated the impact of exchange rate volatility on the indicators of stock market based on the Nigerian evidence from 1985 to 2020. The scholars used a simple static regression model. The estimated findings indicate that the exchange rate volatility has a negative impact on stock market development.

Moreover, Sreenu (2023) employed the autoregressive distributed lag (ARDL), GARCH and the corresponding Error Correction Model (ECM) examine the impact of the exchange rate on volatility in market returns dynamics in India from January 2000 to June 2020. The estimated findings demonstrated that there is exist a significant relationship in long term between market returns and exchange rate volatility and the short-run term relationship shows the negative effects on the stock market returns. In addition, Tanted and Agarwal (2023) utilized Correlation, Regression analysis and ANOVA model evaluate the impact of exchange rate fluctuations on Indian stock market volatility. The findings confirmed that the exchange rate volatility has no real influence on the stock market.

Recent studies by Prananta & Alexiou (2024) explore the relationship between exchange rates, bond yields, and the stock market in Indonesia, providing nonlinear evidence. Utilizing daily data from 2012 to 2021, the study applies a Nonlinear Autoregressive Distributed Lag (NARDL) model to analyse these dynamics. The results indicate no cointegration between the variables over the entire sample period. However, during the COVID-19 period, evidence of cointegration emerges, suggesting asymmetric effects in both the short and long run.

Because we examine the impact of exchange rate volatility on financial market activity in the MENA region, it is necessary to review previous studies of the region. Empirical studies on the relationship between exchange rate volatility and financial market activity in the MENA region are relatively scarce, despite the significant impact that exchange rate fluctuations can have on financial markets.

Moussa & Delhoumi (2022), using the NARDL model to analyse data from five MENA countries, discovered that exchange rate volatility notably affects market indices, especially in

the short run. Mechrii et al. (2021), employing an ANN model to study Tunisia and Turkey, concluded that exchange rate volatility significantly influences stock market fluctuations. Alenezi et al. (2020) utilized multivariate OLS regression and EGARCH-M models on GCC countries, revealing that stock returns are highly sensitive to exchange rate volatility risk.

Despite these insights, the empirical literature has limitations, including the restricted scope of studies and the short observation periods. The research primarily focuses on a few countries and short-term effects, potentially overlooking long-term implications. Additionally, the methodologies used, while diverse, might not fully capture the complexity of exchange rate dynamics and their broader economic impacts. This calls for more comprehensive studies encompassing a wider range of MENA countries and longer time frames to better understand the nuanced effects of exchange rate volatility.

Moreover, recent studies by Prananta & Alexiou (2024) indicate that traditional linear models often fail to capture the nuanced and asymmetric effects of exchange rate fluctuations, particularly during periods of heightened uncertainty such as the COVID-19 pandemic. Thus, the main innovation of the present study is as follows. First, we employ the dynamic panel threshold regression by Kremer et al. (2013) to detect two-dimension effects, namely time effects and country-specific effects.

This approach allows macroeconomic fluctuations to be captured through the time dimension of the panel data, whereas cross-sectional data only contain a single dimension and therefore cannot reveal dynamic behavioural patterns across countries. Applying this method, the study offers new empirical evidence on how exchange rate volatility influences financial market activity within a panel threshold framework. Second, this estimation technique is particularly suitable for uncovering the nonlinear relationship between exchange rate volatility and financial market activity, while providing the advantage of mitigating multicollinearity issues and effectively accounting for cross-country heterogeneity. Third, we explore whether there exist threshold levels of exchange rate volatility in the relationship between economic structures and financial market activity by splitting the sample according to oil exporting and non-oil-exporting countries. The threshold analysis is necessary to identify the optimal level of exchange rate volatility that has a favourable effect on financial market activity. A moderate level of exchange rate volatility can positively influence financial market activity by reflecting an active investment environment, offering opportunities to profit from price differentials through speculation and hedging, and improving market efficiency via more accurate asset pricing.

## 2. Research Methodology

### 2.1 Data Description

The study employs balanced quarterly panel data covering 20 Middle East and North Africa (MENA) countries over the period 1990–2022 to examine the relationship between exchange rate volatility and financial market activity. The sample comprises both oil-exporting and non-oil-exporting economies based on the World Bank classification. The oil-exporting countries include Saudi Arabia, the United Arab Emirates, Qatar, Kuwait, Oman, Bahrain, Iraq, Algeria, Libya, and Iran, while the non-oil-exporting countries consist of Yemen, Syria, Jordan, Lebanon, Egypt, Morocco, Tunisia, Turkey, Djibouti, and Israel. Stock market returns are obtained from Datastream. The real effective exchange rate, used as the threshold variable, is compiled from the International Monetary Fund's International Financial Statistics (IFS) database.

To enhance the robustness of the findings, several macroeconomic, financial, and institutional variables are incorporated, including return on investment (DataStream), interest rate differential and inflation differential (IFS), oil prices (EIA), institutional quality (WGI), and a dummy variable capturing the Arab Spring crisis. These variables are selected based on theoretical relevance and previous empirical evidence, and they serve to strengthen the validity of the model through appropriate control mechanisms. Table 1 summarizes the variables employed in the investigation and the expected signs of coefficient estimates based on theoretical considerations and previous research.

Table 1: Variables Description, Expected Sign of Coefficients, and Data Sources

Abbrev.	Variables	Descriptions	Sign	Data Sources
Dependent variable				
SR	Stock returns	Stock market return measured in (%).		Thomson Reuters DataStream
Threshold variable				
REERvol	Real effective exchange rate volatility	Conditional variance of the real effective exchange rate estimated using the GARCH model, capturing time-varying exchange-rate volatility (see a recent GARCH-based ERV application: Makore & Chikutuma (2025)).	(-)	IMF, International Financial Statistics (IFS)
Control variables				
ROI	Return on investment	Earnings After Tax / Total Assets × 100 (%), following Sari et al. (2017)	(+)	Thomson Reuters DataStream
INTD	Interest rate differential	Difference between interest rates in MENA countries and the US Federal interest rate, following Butt et al. (2023).	(+)	IMF, International Financial Statistics (IFS)
INFD	Inflation differential	Difference between inflation rates in MENA countries and the US Federal inflation rate, following Johari et al. (2021).	(+)	IMF, International Financial Statistics (IFS)
OIL	Oil prices	Average spot prices of Brent crude oil (USD per barrel), reflecting the importance of oil revenues in MENA financial markets.	(+)	US Energy Information Administration (EIA)
IQ	Institutions quality index	Composite index based on the Worldwide Governance Indicators (WGI), this index includes six measures: Control of Corruption, Government Effectiveness, Political Stability and Absence of Violence, Rule of Law, Regulatory Quality, and Voice and Accountability. The scores range from -2.5 (weak institutions) to +2.5 (strong institutions), following Lee et al. (2023).	(+)	World Bank, The Worldwide Governance Indicators (WGI)
D	Dummy variable for the Arab Spring crisis	Dummy variable taking the value of 1 during Arab Spring years and 0 otherwise, following Alshammary et al. (2020).	(-)	Author coding (based on event years)

Source: Author's compilation based on Datastream; International Financial Statistics (IFS); US Energy Information Administration (EIA); and World Bank Worldwide Governance Indicators (WGI).

## 2.2 Model Specification and Empirical Strategy

To measure exchange rate volatility, the study first derives the conditional variance of the real effective exchange rate using a standard GARCH framework proposed by Bollerslev (1986). This method is widely used in empirical work because it captures the tendency of financial series to display periods of calm followed by sudden bursts of volatility. After generating the volatility series, the analysis then employs a dynamic panel threshold regression framework to capture potential nonlinearities and regime-specific effects in the data. This approach allows the study to account for both short-run variations and threshold-dependent responses across countries. The model incorporates a set of macroeconomic, financial, and institutional variables, including stock returns, real effective exchange rate volatility, return on investment, interest rate differential, inflation differential, oil prices, an institutions quality index, and a dummy variable for the Arab Spring crisis, providing a comprehensive assessment of the factors driving exchange rate fluctuations in MENA countries. The GARCH model is based on recent empirical studies, including Zhang et al. 2022; Huang and Li 2022; and Kayani et al. (2023), which demonstrate its effectiveness in capturing exchange rate volatility. The general GARCH (1,1) model can be expressed as follows:

$$h_t = \gamma_0 + \delta_1 h_{t-1} + \lambda_1 \mu_{t-1}^2 + \varepsilon_t \quad \dots(2)$$

In equation (1), the value of variance scaling parameter  $h_t$  now depends on both the past value of the shocks, which are captured by the lagged squared residual terms  $\mu_{t-1}^2$  and on the past value of itself, which is captured by lagged  $h_t$  terms  $Y_t$ .

To complement this approach, the study employs a dynamic panel threshold regression model to empirically examine the relationship between exchange rate volatility and financial market activity across oil-exporting and non-oil-exporting countries in the MENA region. Although the primary objective is to analyse the linear relationship between real effective exchange rate volatility and stock market returns, the threshold specification allows the model to detect potential regime-dependent effects where the influence of exchange rate volatility may change once a certain threshold level is reached. The empirical specification follows the determinants of exchange rate volatility widely discussed in the literature. The empirical model used is based on Jorion (1990); Phylaktis & Ravazzolo (2005); and Rai & Garg (2022), in which the empirical linkages between exchange rate volatility and financial market activity are examined using the dynamic panel threshold regression. Accordingly, the relationship is specified through the following dynamic panel threshold equation:

$$SR_{i,t} = \alpha REERV_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \quad \dots(3)$$

where,  $SR_{i,t}$  is stock returns,  $REERV_{i,t}$  is the real effective exchange rate volatility,  $X_{i,t}$  is the vector of control variables that affect financial markets activity, including return on investment (ROI), interest rate differential (INTD), inflation differential (INFD), oil prices (OIL), institutional quality index (IQ), and the dummy variable (D) representing the Arab Spring crisis.  $\varepsilon_{i,t}$  is an error term, and  $i$  represents the country ( $i = 1, 2, \dots, n$ ), and  $t$  represents time ( $1, 2, \dots, n$ ).

This study employs the Dynamic Panel Threshold Regression (DPTR) model proposed by (Kremer et al., 2013; Seo & Shin, 2016; Seo et al., 2019) to examine whether the effect of real effective exchange rate volatility (REERvol) on stock returns (SR) varies across different volatility regimes. The DPTR approach is appropriate because it incorporates the lagged dependent variable into the threshold framework, enabling the model to capture dynamic adjustments in stock returns while allowing the slope coefficients to change endogenously when the threshold variable crosses an estimated value. This specification effectively accounts for nonlinearities, asymmetric responses, and regime-dependent behaviour that are typical in emerging and volatile financial markets. Moreover, the dynamic structure controls for persistence in stock returns, while the fixed effects absorb unobserved country-specific heterogeneity, ensuring that time-invariant structural characteristics, such as institutional settings, market depth, and regulatory frameworks, do not bias the estimated relationships.

Consistent with the objectives of this study, the baseline specification expresses stock returns as a function of REERvol and a set of relevant macroeconomic and institutional control variables, including return on investment (ROI), interest rate differential (INTD), inflation differential (INFD), oil prices (OIL), institutions quality index (IQ), and a dummy variable (D) capturing the effect of the Arab Spring crisis. The threshold mechanism is introduced by allowing the coefficient of REERvol to differ across two distinct regimes depending on whether REERvol is below or above an estimated threshold value,  $\gamma$ . Accordingly, the model can be expressed as follows:

$$SR_{i,t} = u_i + \beta_1 REERV_{i,t} I(REERV_{i,t} \leq \lambda) + \delta_1 I(REERV_{i,t} \leq \lambda) \dots(4) \\ + \beta_2 REERV_{i,t} I(REERV_{i,t} \geq \lambda) + \gamma X_{i,t} + \theta_t + \varepsilon_{it}$$

where  $SR$  denotes stock returns in country  $i$  at time  $t$ ;  $\mu_i$  represents country-specific fixed effects;  $X_{i,t}$  is the vector of control variables ( $ROI, INTD, INFD, OIL, IQ, D$ ); and  $\varepsilon_{it}$  is the error term. The indicators  $1(\cdot)$  partition the sample into low-volatility and high-volatility regimes based on the estimated threshold. The slope coefficients  $\beta_1$  and  $\beta_2$  measure how  $REERV$  influences stock returns under each regime, allowing for the detection of asymmetric effects driven by changes in exchange rate uncertainty.

### 3. Results and Discussions

#### Descriptive Statistics and Correlation

From Table 2, the average Stock Return (2.63%) indicates modest equity performance, occurring alongside exceptionally high Real Effective Exchange Rate Volatility (6806.914), which reflects severe and persistent currency instability. The mean Return on Investment (5.86%) suggests a reasonably productive economy, while the Interest Rate Differential (6.19%) and the high Inflation Differential (15.94%) point to inflationary pressure and reliance on higher domestic interest rates to stabilise prices and the currency. The average Oil Price of \$51.22 reflects a period of moderate external conditions. Meanwhile, the negative mean Institutions Quality Index (-0.43) highlights systemic weaknesses in governance and political stability across the sample. Overall, the descriptive statistics portray economies characterised by moderate returns but exposed to high macroeconomic risk, driven by extreme exchange rate volatility, elevated inflation, and weak institutional structures.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Stock returns	2,640	2.628136	7.317651	-10	15
Real effective exchange rate volatility	2,640	6806.914	47469.03	49.49371	449739.2
Return on investment	2,640	5.863417	2.535198	.45	12.59
Interest rate differential	2,640	6.194386	12.34809	-7.25	347.03
Inflation differential	2,640	15.94404	120.0169	-69.83617	2157.988
Oil prices	2,640	51.21924	32.99083	9.82	132.32
Institutions quality index	2,640	-.4319882	.69091	-2.02185	.79734

Note: Summary statistics for the balanced panel dataset of 20 MENA countries covering 1990–2022.

Source: Author's calculations based on Datastream, IMF (IFS), EIA, and WGI databases.

Table 3 presents the correlation matrix, showing the linear relationships among the key variables and providing early indications of multicollinearity. The strongest association is the positive correlation between Inflation Differential (INFD) and Oil Prices (OIL) at 0.3734\*, implying that rising oil prices coincide with higher domestic–foreign inflation gaps. Oil Prices also exhibit a significant negative correlation with Real Effective Exchange Rate Volatility (REERvol) (-0.3145\*), suggesting that higher oil prices support greater currency stability. The Institutions Quality Index (IQ) shows notable linkages, with negative correlations with Interest Rate Differential (INTD) (-0.3319\*) and INFD (-0.1696\*), indicating that better governance is associated with more stable monetary conditions. Stock Returns (SR), however, display very low and insignificant correlations with all variables, implying that stock market behaviour is not linearly driven by any single macroeconomic factor and reinforcing the need for threshold-based modelling to capture potential non-linear effects.

Table 3: Correlation Test

Variable	SR	REERvol	ROI	INTD	INFD	OIL	IQ
Stock returns	1.0000						
Real effective exchange rate volatility	0.0145	1.0000					
Return on investment	-0.0280	0.0349	1.0000				
Interest rate differential	0.0011	-0.1342*	0.0030	1.0000			
Inflation differential	-0.0088	-0.0833*	0.0065	-0.0761*	1.0000		
Oil prices	0.0018	-0.3145*	0.0141	-0.0266	0.3734*	1.0000	
Institutions quality index	-0.0082	0.1774*	0.1259*	-0.3319*	-0.1696*	-0.0867*	1.0000

Source: Author's estimations.

### 3.1. Preliminary Tests

#### Cross Sectional Dependence Tests

Table 4 reports the Pesaran's CD, Breusch–Pagan LM, and Friedman tests for the 20 MENA countries (1990–2022), showing strong cross-sectional dependence for nearly all variables. Real Effective Exchange Rate Volatility, Return on Investment, Interest Rate Differential, Inflation Differential, Oil Prices, and the Institutions Quality Index all record highly significant statistics at the 1% level, indicating that shocks to these variables spill across countries. Stock Returns are the only exception, where Pesaran's CD test is insignificant ( $p =$

0.4588), although the LM and Friedman tests remain significant. These results confirm that the panel is exposed to common regional shocks, justifying the use of econometric techniques, such as the Panel Threshold Regression, that account for cross-sectional dependence.

Table 4: Cross-sectional Dependency Test for 20 MENA Countries, 1990-2022

Variable	Pesaran's CD Test	Breush-Pagan (LM) Test	Friedman Test
Stock returns	-0.741 (0.4588)	152.961*** (0.9775)	119.426*** (0.0000)
Real effective exchange rate volatility	31.003*** (0.0000)	6069.877*** (0.0000)	659.404*** (0.0000)
Return on investment	151.281*** (0.0000)	22899.546*** (0.0000)	2493.639*** (0.0000)
Interest rate differential	31.072*** (0.0000)	4154.050*** (0.0000)	669.331*** (0.0000)
Inflation differential	39.819*** (0.0000)	9298.616*** (0.0000)	882.801*** (0.0000)
Oil prices	158.367*** (0.0000)	25080.000*** (0.0000)	2620.000*** (0.0000)
Institutions quality index	4.181*** (0.0000)	5906.452*** (0.0000)	256.845*** (0.0000)

Source: Author's estimations.

Table 5 disaggregates the cross-sectional dependence tests for oil-producing and non-oil-producing MENA countries, revealing that most macroeconomic variables show strong and significant dependence across both groups. Real Effective Exchange Rate Volatility, Return on Investment, Interest Rate Differential, Inflation Differential, and Oil Prices remain highly significant across all three tests, confirming broad regional spillovers. Stock Returns show insignificant Pesaran CD results for both groups, while the Institutions Quality Index differs: it is insignificant for oil producers but highly significant for non-oil producers. This suggests that institutional dynamics are more interconnected among non-oil countries, whereas oil producers display more distinct institutional patterns. Overall, the pervasive cross-dependence validates the use of the dynamic panel threshold regression that account for such interconnections to avoid biased estimates. From a policy perspective, the results confirm that the MENA region functions as a highly interconnected bloc, meaning that no country operates in isolation.

Table 5: Cross-sectional Dependency Test (1990-2022)

Variable	Oil Producing Countries			Non-Oil Producing Countries		
	Pesaran's CD Test	Breush-Pagan test	Friedman test	Pesaran's CD Test	Breush-Pagan (LM) test	Friedman test
Stock returns	-0.046 (0.9632)	59.613*** (0.0710)	128.302*** (0.0000)	-1.103*** (0.2700)	27.618*** (0.0000)	113.817*** (0.0000)
Real effective exchange rate volatility	23.428*** (0.0000)	1671.893*** (0.0000)	504.592*** (0.0000)	13.051*** (0.0000)	1487.511*** (0.0000)	332.570*** (0.0000)
Return on investment	73.271*** (0.0000)	5371.883*** (0.0000)	1246.820*** (0.0000)	73.600*** (0.0000)	5419.150*** (0.0000)	1246.820*** (0.0000)

Variable	Oil Producing Countries			Non-Oil Producing Countries		
	Pesaran's CD Test	Breush-Pagan test	Friedman test	Pesaran's CD Test	Breush-Pagan (LM) test	Friedman test
Interest rate differential	16.389*** (0.0000)	764.886*** (0.0000)	391.818*** (0.0000)	11.152*** (0.0000)	1119.266*** (0.0000)	330.008*** (0.0000)
Inflation differential	18.621*** (0.0000)	1831.022*** (0.0000)	505.281*** (0.0000)	22.802*** (0.0000)	2819.022*** (0.0000)	572.694*** (0.0000)
Oil prices	77.071*** (0.0000)	5940.000*** (0.0000)	1310.000*** (0.0000)	77.071*** (0.0000)	5940.000*** (0.0000)	1310.000*** (0.0000)
Institutions quality index	-0.854*** (0.3931)	1934.504*** (0.0000)	133.059*** (0.0000)	7.182*** (0.0000)	1187.712*** (0.0000)	323.242*** (0.0000)

Note: Test is for 20 MENA Countries (oil producer and non-oil producer),

Source: Author's estimations.

### Panel Unit Root Tests

Table 6 presents the results of the Im, Pesaran, and Shin (IPS) panel unit root tests for the non-oil MENA countries sample, showing a mixed order of integration. Stock Returns, Return on Investment, Interest Rate Differential, Inflation Differential ( $\Delta$ ), Oil Prices ( $\Delta$ ), Institutions Quality Index, and the first differences of all variables record highly significant statistics at the 1% level under both trend specifications, confirming stationarity. In contrast, Oil Prices in levels show non-stationarity, and the level of Inflation Differential ( $\approx -0.61$ ) shows weak evidence of stationarity but becomes clearly stationary after differencing, indicating I(1) behaviour. These results imply that non-stationary variables must be used in their differenced form to avoid spurious inference and to ensure that the Panel Threshold Regression captures genuine relationships rather than common stochastic trends.

Table 6: Panel Unit Root Tests Results based on Im, Pesaran and Shin (2003) for the MENA region (Non-oil Sample), 1990-2022

Variable	With Trend		Without Trend	
	Statistics	P-values	Statistics	p-values
Stock returns <sub>it</sub>	-6.397***	0.000	-6.180***	0.000
$\Delta$ Stock returns <sub>it</sub>	-6.420***	0.000	-6.190***	0.000
Real effective exchange rate volatility <sub>it</sub>	-4.401***	0.000	-2.676***	0.000
$\Delta$ Real effective exchange rate volatility <sub>it</sub>	-6.420***	0.000	-6.190***	0.000
Return on investment <sub>it</sub>	-6.420***	0.000	-6.190***	0.000
$\Delta$ Return on investment <sub>it</sub>	-6.420***	0.000	-6.190***	0.000
Interest rate differential <sub>it</sub>	-2.717***	0.000	-2.658***	0.000
$\Delta$ Interest rate differential <sub>it</sub>	-6.413***	0.000	-6.186***	0.000
Inflation differential <sub>it</sub>	-0.612***	0.000	-0.625***	0.000
$\Delta$ Inflation differential <sub>it</sub>	-6.314***	0.000	-6.001***	0.000
Oil prices <sub>it</sub>	1.700***	0.000	2.610***	0.000
$\Delta$ Oil prices <sub>it</sub>	1.700***	0.000	2.610***	0.000
Institutions quality index <sub>it</sub>	-3.087***	0.000	-2.673***	0.000
$\Delta$ Institutions quality index <sub>it</sub>	-6.420***	0.000	-6.190***	0.000

Notes: 1) Automatic lag length selection is based on HQIC. 2) \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Source: Author's estimations.

Table 7 presents the results of the Levin-Lin-Chu (LLC) panel unit root tests for the non-oil MENA countries sample, largely supporting the IPS findings. Most variables, Stock Returns, Return on Investment, Real Effective Exchange Rate Volatility, and Oil Prices, are stationary in levels, as indicated by strongly significant statistics in both trend specifications. The main exception is the Inflation Differential, which is non-stationary in levels ( $p = 1.0000$ ) but becomes stationary after first differencing, confirming it is  $I(1)$ . Interest Rate Differential and Institutions Quality Index show weaker significance in levels but exhibit strong stationarity in first differences ( $\Delta$ ). Overall, the results confirm the need to use differenced forms for non-stationary variables, particularly the Inflation Differential, to ensure valid and reliable estimation in the Panel Threshold Regression.

Table 7: Panel Unit Root Tests Results based on Levin-Lin-Chu for the MENA Region (Non-oil Sample), 1990-2022

Variable	With Trend		Without Trend	
	Statistics	P-values	Statistics	p-values
Stock returns <sub>it</sub>	-34.9666***	0.0000	-34.6530***	0.0000
$\Delta$ Stock returns <sub>it</sub>	-60.3800***	0.0000	-60.3675***	0.0000
Real effective exchange rate volatility <sub>it</sub>	-13.6597***	0.0000	-8.1227***	0.0005
$\Delta$ Real effective exchange rate volatility <sub>it</sub>	-39.9031***	0.0000	-39.2627***	0.0000
Return on investment <sub>it</sub>	-79.3731***	0.0000	-79.3662***	0.0000
$\Delta$ Return on investment <sub>it</sub>	-68.6092***	0.0000	-68.6231***	0.0000
Interest rate differential <sub>it</sub>	-12.4421**	0.0387	-10.9632***	0.0010
$\Delta$ Interest rate differential <sub>it</sub>	-29.8413***	0.0000	-29.4019***	0.0000
Inflation differential <sub>it</sub>	2.4824	1.0000	5.8955	1.0000
$\Delta$ Inflation differential <sub>it</sub>	-21.6454***	0.0000	-18.4838***	0.0000
Oil prices <sub>it</sub>	-14.0050***	0.0000	-10.0628***	0.0000
$\Delta$ Oil prices <sub>it</sub>	-43.9257***	0.0000	-43.8919***	0.0000
Institutions quality index <sub>it</sub>	-10.6891**	0.0029	-6.6545**	0.0217
$\Delta$ Institutions quality index <sub>it</sub>	-39.0610***	0.0000	-38.9160***	0.0000

Notes: 1) Automatic lag length selection is based on HQIC. 2) \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Source: Author's estimations.

### Panel Cointegration Test

Table 8 presents the Pedroni panel cointegration results for the MENA region (1990–2022), encompassing both oil and non-oil producers. Out of the seven statistics, six, including Panel PP, Panel ADF, Group PP, and Group ADF, are highly significant at the 1% level ( $p = 0.0000$ ), allowing rejection of the null hypothesis of no cointegration. Only the Panel  $v$ -Statistic is insignificant. Overall, the results indicate a strong long-run equilibrium relationship among the variables, despite some being non-stationary in levels. This confirms that stock returns, exchange rate volatility, oil prices, and institutional quality move together over time, supporting the use of models that incorporate long-run dynamics, such as an Error Correction framework.

Table 8: Pedroni Panel Cointegration Test for the MENA Region (oil producer and non-oil producer countries), 1990-2022

Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	-1.04361	0.851667	-3.16744	0.9992
Panel rho-Statistic	-39.1877***	0	-37.5692***	0.0000
Panel PP-Statistic	-43.2111***	0	-43.4967***	0.0000
Panel ADF-Statistic	-23.487***	2.77E-122	-23.4761***	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	-41.1598***	0.0000		
Group PP-Statistic	-51.1755***	0.0000		
Group ADF-Statistic	-26.5912***	0.0000		

Notes: 1) Automatic lag length selection is based on HQIC criterion. 2) \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. 3) Trend assumption: No deterministic trend.

Source: Author’s estimations.

Table 9 presents the Kao cointegration test for the non-oil MENA countries. The ADF t-statistic of -14.4902 with a p-value of 0.0000 provides clear evidence to reject the null of no cointegration. This confirms that the variables share a stable long-run relationship in non-oil economies, consistent with the Pedroni results. The presence of cointegration supports the use of an error-correction specification to capture both short-term adjustments and long-run equilibrium behaviour.

Table 9: Kao Panel Cointegration Test for the MENA Region (Non-oil Producer Countries), 1990-2022)

	t-Statistic	Prob.
Augmented Dickey- Fuller (ADF)	-14.4902	0.0000

Source: Author’s estimations.

### 3.2. Results of Dynamic Panel Threshold Regression

#### Results of Dynamic Panel Threshold Regression: Full Sample (MENA, 1990–2022)

Table 10 presents the Dynamic Panel Threshold Regression results for the MENA region (1990–2022), showing a nonlinear relationship where Real Effective Exchange Rate Volatility (REERvol) acts as the threshold variable. The lagged stock return coefficient (L1.SR = 0.034\*, 0.020) confirms return persistence, while the threshold effects reveal that below the threshold, REERvol significantly raises stock returns with a coefficient of 0.422\*\* (0.214), but above the threshold, the effect becomes insignificant at 0.009 (0.081). The linear REER Volatility (REERvol) term remains marginally significant at 6.75e-06\* (3.84e-06), and the constant is strongly significant at 2.333\*\*\* (0.577). These results indicate that moderate exchange rate volatility supports stock performance, while high volatility weakens the relationship, consistent with the uncertainty transmission hypothesis (Bahmani-Oskooee & Saha 2015).

Table 10: Dynamic Panel Threshold Model Results (REER Volatility, MENA 1990–2022)

Variable	Coefficient	
L.SR	0.034*	(0.020)
Below Threshold (REER Volatility)	0.422**	(0.214)
Above Threshold (REER Volatility)	0.009	(0.081)
REER Volatility (REERvol)	$6.75 \times 10^{-6}$ *	$(3.84 \times 10^{-6})$
Constant	2.333***	(0.577)

Note: The standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significant at 1%, 5% and 10% levels, respectively. Source: Author’s estimations.

Table 11 identifies a precise threshold ( $\gamma_1 = 4$ ) for REER volatility that governs the shift in the volatility–stock return relationship. The 95% confidence interval ranges from 2.58 to 9.24, confirming the statistical robustness of the threshold estimate. This value marks the point at which REER volatility transitions from a low-volatility to a high-volatility regime, altering its effect on stock returns across the MENA region.

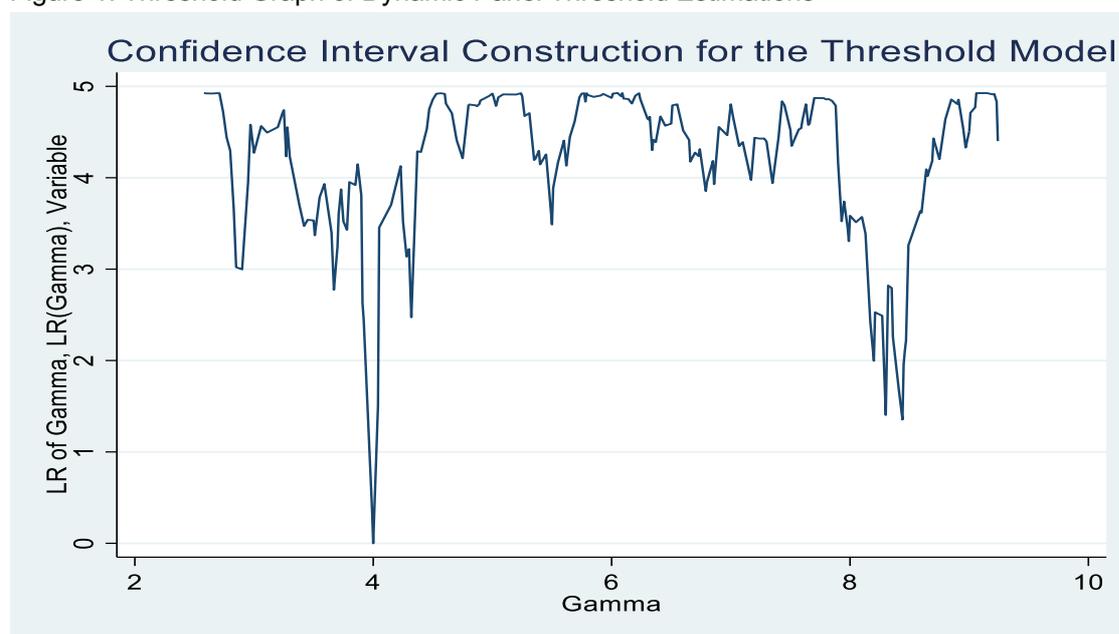
Table 11: Threshold Parameter Estimates: REER Volatility and Stock Returns (MENA, 1990–2022)

Model	Threshold Estimates	95% Confidence Interval	
$\gamma_1$	4	2.58	9.24

Source: Author’s estimations.

Figure 1 presents the threshold graph of the Dynamic Panel Threshold estimation, where the Likelihood Ratio (LR) statistic is plotted against potential threshold values ( $\gamma$ ). The graph displays a distinct trough at the estimated threshold value, indicating the point where the LR statistic reaches its minimum and confirming the optimal ( $\gamma$ ). The confidence interval is visualised by identifying the  $\gamma$ -range where the LR statistic falls below the 95% critical line. The pattern confirms a statistically significant and precise threshold, illustrating the shift from a low-volatility regime, where REER volatility has muted or positive effects, to a high-volatility regime where its impact becomes negative.

Figure 1: Threshold Graph of Dynamic Panel Threshold Estimations



Source: Author’s estimations.

## Results of Dynamic Panel Threshold Regression: Oil-Exporting MENA Countries (1990–2022)

Table 12 reports the results of the dynamic panel threshold regression for oil-exporting MENA countries over the period 1990–2022. The estimates reveal a clear non-linear relationship between stock returns (SR) and real effective exchange rate volatility (REERvol), which acts as the threshold variable. The coefficient of the lagged dependent variable (L.SR = 0.052\*) indicates weak but positive persistence in stock returns. When exchange rate volatility remains below the threshold, stock returns display significant momentum, with a coefficient of 0.370\*\*. However, once volatility exceeds the threshold, the coefficient declines sharply to 0.028 and becomes statistically insignificant, suggesting that high exchange rate volatility reduces return predictability in equity markets. The threshold variable itself (REERvol) shows a positive but economically small effect ( $7.10 \times 10^{-6}$ \*), indicating that although exchange rate volatility is statistically relevant, its marginal economic impact is limited. The constant term (1.930\*\*\*) reflects relatively strong baseline returns in oil-exporting economies, consistent with recent empirical evidence reported by Bouri & Klein (2022) and Mhadhbi & Guelbi (2024).

Table 12: Dynamic Panel Threshold Model Results: Oil-Exporting MENA Countries (1990–2022)

Variable	Coefficient	
L.SR	0.052*	(0.028)
Below Threshold (REER Volatility)	0.370**	(0.150)
Above Threshold (REER Volatility)	0.028	(0.093)
REER Volatility	$7.10 \times 10^{-6}$ *	$(3.84 \times 10^{-6})$
Constant	1.930***	(0.740)

Source: Author's estimations.

Based on Table 13, a key threshold of 7.4 has been identified for the relationship between currency volatility (REER) and stock returns in oil-producing MENA countries. This finding confirms a non-linear tipping point effect (Hansen, 1999). The implication is that when exchange rate volatility exceeds this level, it likely triggers a shift to a negative regime for stock markets. This is critical because, in these oil-dependent economies, currency volatility is closely tied to oil price shocks (Bouri et al., 2022). Therefore, this threshold acts as a crucial risk indicator. Policymakers should use it as an early warning signal to implement stabilising measures, while investors can use it to guide hedging strategies and protect their portfolios from periods of high currency instability (Mhadhbi & Guelbi 2024).

Table 13: REER Volatility and Stock Returns (Non-Oil MENA, 1990–2022)

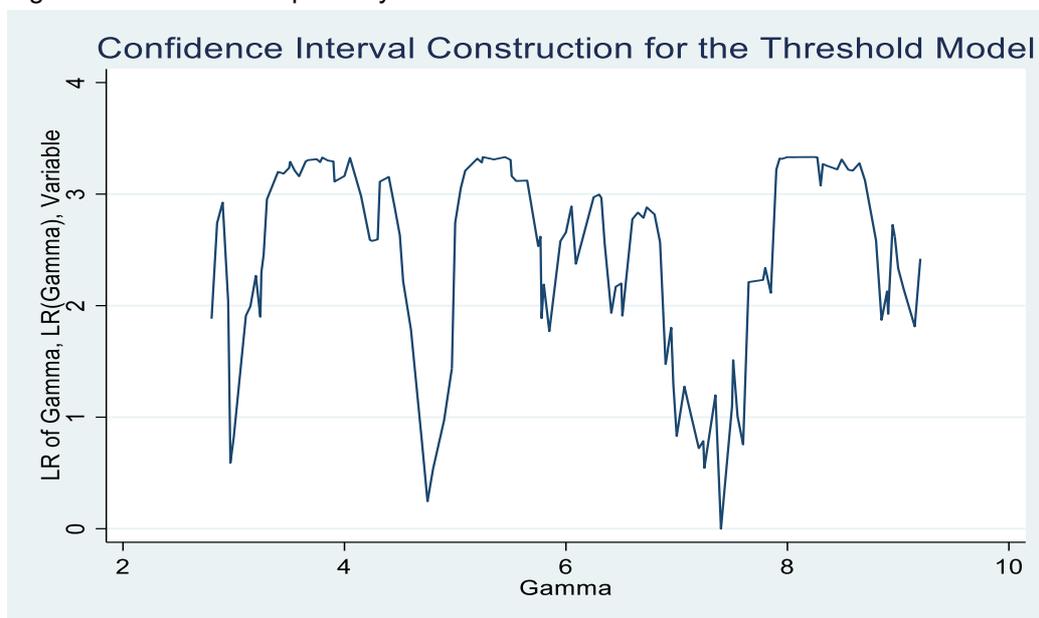
model	Threshold Estimates	95% Confidence Interval	
$\gamma_1$	7.4	2.8	9.2

Source: Author's estimations.

Figure 2 illustrates the threshold graph of the Dynamic Panel Threshold Regression by plotting the Likelihood Ratio (LR) statistic against the range of possible threshold values ( $\gamma$ ) for REER volatility, where the minimum point of the LR curve, typically visualised as a sharp V-shaped trough, marks the most accurate threshold estimate, while the 95% confidence interval is depicted by the portion of the LR curve lying below the critical LR line; this graphical pattern confirms a significant structural shift in the relationship between REER volatility and stock returns for oil-producing MENA countries, indicating that below the threshold volatility exerts

limited influence on returns, but once volatility surpasses the estimated ( $\gamma$ ) the impact becomes strongly negative due to heightened macroeconomic instability, reduced investor confidence, and increased risk premiums, making the threshold an essential early-warning tool for policymakers and a vital risk-management indicator for investors navigating the financial dynamics of oil-dependent economies (Trabelsi & Bahloul 2022).

Figure 2: Threshold Graph of Dynamic Panel Threshold Estimations



Source: Author’s estimations.

### Results of Dynamic Panel Threshold Regression Results: Non-Oil-Exporting MENA Countries (1990–2022)

Table 14 reports the dynamic panel threshold regression results for non-oil-exporting MENA countries over the period 1990–2022. The findings reveal a clear non-linear relationship between stock returns (SR) and real effective exchange rate volatility (REERvol), which acts as the threshold variable. The coefficient of the lagged dependent variable ( $L.SR = 0.049^*$ ) indicates weak but positive return persistence. When exchange rate volatility remains below the threshold, stock returns exhibit strong and statistically significant momentum ( $0.542^{**}$ ). However, once volatility exceeds the threshold, the coefficient decreases substantially and becomes statistically insignificant ( $0.028$ ), suggesting that elevated exchange rate volatility weakens the persistence of stock returns. The threshold variable itself shows a positive and marginally significant coefficient ( $0.042^*$ ), while the constant term ( $2.102^{***}$ ) reflects relatively strong baseline returns across non-oil-exporting MENA markets.

Table 14: Dynamic Panel Threshold Model Results: Non-Oil MENA Countries (1990–2022)

Variable	Coefficient	
L.SR	0.049*	(0.028)
Below Threshold (REER Volatility)	0.542**	(0.273)
Above Threshold (REER Volatility)	0.028	(0.110)
REER Volatility	0.042*	(0.021)
Constant	2.102***	(2.260)

Source: Author’s estimations.

Based on the results from Table 15, the analysis for non-oil producing MENA countries identifies a specific threshold of 4.28 for Real Effective Exchange Rate (REER) volatility, beyond which its impact on stock returns becomes significantly negative. This means that while lower levels of currency volatility are manageable for the stock market, exceeding this critical point triggers a sharp decline in investor confidence and stock performance due to increased uncertainty and risk. The implications are critical for both policymakers and investors. For central banks, the threshold of 4.28 acts as an early-warning signal, indicating when interventions may be needed to stabilize the currency and protect the stock market. For investors, this level serves as a key risk indicator, suggesting that portfolio and hedging strategies should be adjusted when volatility approaches this point to mitigate potential losses. In essence, the finding reveals a precise tipping point, underscoring that exchange rate stability is important for sustaining healthy equity markets in these economies.

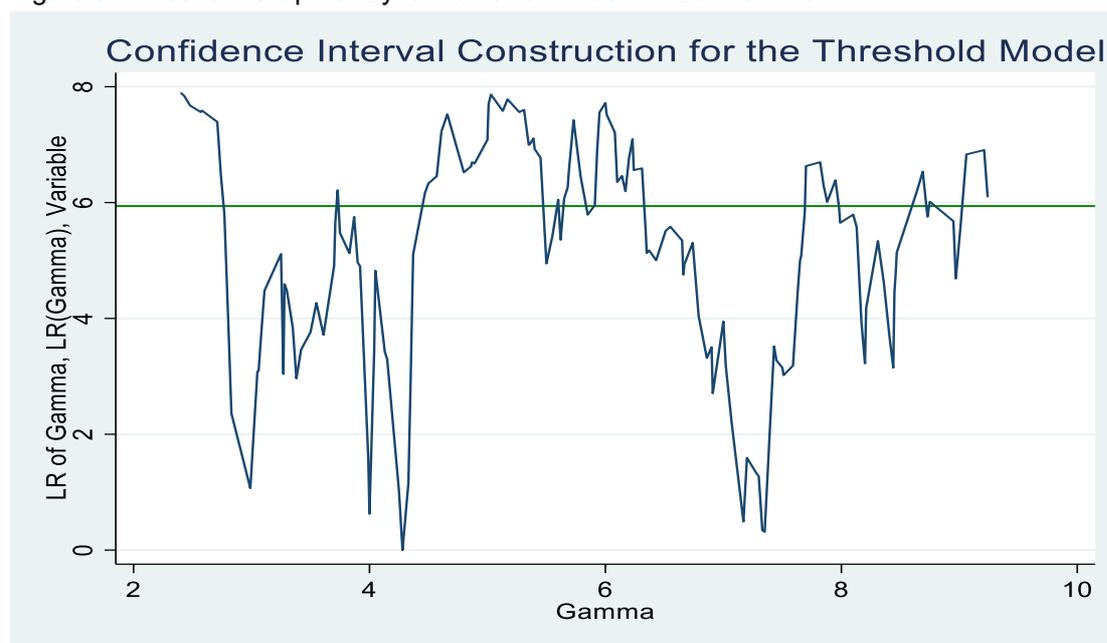
Table 15: Threshold Parameter Estimates: REER Volatility (Non-Oil MENA, 1990–2022)

Model	Threshold Estimates	95% Confidence Interval	
$\gamma_1$	4.28	2.77	9.01

Source: Author’s estimations.

Figure 3 displays the Confidence Interval Construction graph for the dynamic panel threshold estimations, plotting the LR statistic against threshold values ( $\gamma$ ) for REER volatility ranging approximately from 0 to 10, where the true threshold corresponds to the minimum point of the LR curve, and the horizontal critical-value line defines the 95% confidence interval; the sharp V-shaped decline indicates a precise threshold estimate, confirming that the relationship between REER volatility and SR in non-oil-exporting MENA countries (1990–2022) shifts from a low-volatility regime with muted effects to a high-volatility regime where REERvol exerts a strongly negative impact, underscoring that maintaining REER volatility below the threshold is important for preventing capital-flight pressures and preserving stock-market stability.

Figure 3: Threshold Graph of Dynamic Panel Threshold Estimations



Note: Confidence interval construction for REER volatility threshold, non-oil-exporting MENA countries.  
Source: Author’s estimations.

#### 4. Robustness Checks

To ensure the reliability and stability of the empirical findings, this study carried out three different robustness checks, including dividing the full sample into two groups of (oil and non-oil) countries, using additional testing methods, such as difference generalized method of moments (GMM), system GMM.

The one-step Difference GMM results in Table 16 indicate strong overall model significance (Wald  $\chi^2(8) = 5.39e+07$ ,  $p = 0.000$ ), confirming substantial joint explanatory power of the regressors. The Arellano–Bond AR(1) test is significant ( $z = -4.45$ ,  $p = 0.000$ ), which is expected in first differences; however, the AR(2) test is also significant ( $z = 2.13$ ,  $p = 0.033$ ), raising serious concerns regarding moment condition validity and potential inconsistency of the estimates. The lagged dependent variable L1. Stock returns is positive but insignificant (coef. = 0.0098,  $p = 0.622$ ), suggesting weak predictive power of past returns. Among macroeconomic variables, only the inflation differential is statistically significant (coef. = 0.0024,  $p = 0.008$ ) with a positive sign, while real effective exchange rate volatility ( $p = 0.249$ ), interest rate differential ( $p = 0.352$ ), and institutional quality index ( $p = 0.924$ ) are insignificant.

Econometrically, the significant AR(2) result combined with the excessive number of instruments (2333) relative to groups (20) suggests possible instrument proliferation and model misspecification, warranting caution in interpretation and potential instrument reduction. Substantively, the results imply that inflation differentials may positively influence stock returns in this context, whereas exchange rate volatility, interest rate differentials, and institutional quality do not exhibit significant effects. This indicates that other omitted macroeconomic or firm-specific factors may play a more decisive role in explaining stock return dynamics.

Table 16: Dynamic panel-data estimation, one-step Difference GMM

Group variable:	ID	Number of obs. =	2,620
Time variable:	YEAR 1	Number of groups =	20
Number of instruments =	2,333	Obs per group: min =	131
Wald $\chi^2(8) =$	5.39e+07	avg =	131.00
Prob > $\chi^2 =$	0.000	max =	131
<b>Stock returns</b>	<b>Coefficient</b>	<b>std. err.</b>	<b>P&gt; z </b>
L1.	.0098449	.0199588	0.622
Real effective exchange rate volatility	-9.35e-07	8.11e-07	0.249
Return on investment	-.0879991	.0735048	0.231
Interest rate differential	.0080132	.0086176	0.352
Inflation differential	.0024356	.0009192	0.008
Oil prices	-.0010289	.0033452	0.758
Institutions quality index	.0203264	.2143897	0.924
Dummy	-.3947439	.4507449	0.381
_cons	3.123542	.4620052	0.000
Arellano-Bond test for AR (1) in first differences: $z = -4.45$ Pr > $z = 0.000$			
Arellano-Bond test for AR (2) in first differences: $z = 2.13$ Pr > $z = 0.033$			

Note: One-step System GMM estimation used as an additional robustness check.

Source: Author's estimations.

The one-step system GMM estimation, based on 2,620 observations across 20 groups and 131 balanced time periods, shows strong joint significance (Wald chi-square = 4.20e+07,  $p < 0.001$ ). However, the lagged dependent variable L1. Stock returns is positive but insignificant ( $\beta = 0.0049$ ,  $p = 0.825$ ), supporting weak-form efficiency. Among the explanatory variables, only the inflation differential is statistically significant ( $\beta = 0.0025$ ,  $p = 0.007$ ), indicating a positive association with stock returns. In contrast, real effective exchange rate volatility ( $\beta = -1.02e-06$ ,  $p = 0.191$ ), return on investment ( $\beta = -0.0942$ ,  $p = 0.192$ ), interest rate differential ( $\beta = 0.0092$ ,  $p = 0.252$ ), oil prices ( $\beta = -0.0009$ ,  $p = 0.782$ ), institutions quality index ( $\beta = 0.0072$ ,  $p = 0.973$ ), and the dummy variable ( $\beta = -0.4754$ ,  $p = 0.267$ ) are all statistically insignificant, despite some coefficients displaying theoretically consistent signs.

Diagnostic tests raise important specification concerns: AR(1) is significant ( $z = -4.44$ ,  $p < 0.001$ ), as expected, but AR(2) is also significant ( $z = 2.03$ ,  $p = 0.042$ ), indicating potential second-order serial correlation and invalid moment conditions. Combined with the excessive instrument count (2,316 instruments for 20 groups), this suggests instrument proliferation and possible bias. Consequently, while the inflation differential appears robust, the reliability of the overall estimates is questionable, and re-estimation with a reduced instrument set or alternative specifications is necessary for more credible inference.

Table 17: Dynamic Panel-Data Estimation, One-Step System GMM

Group variable:	ID	Number of obs. =	2,620
Time variable:	YEAR 1	Number of groups =	20
Number of instruments =	2,316	Obs per group: min =	131
Wald chi2(8) =	4.20e+07	avg =	131.00
Prob > chi2 =	0.000	max =	131
<b>Stock returns</b>	<b>Coefficient</b>	<b>std. err.</b>	<b>P&gt; z </b>
L1.	.0049464	.0224069	0.825
Real effective exchange rate volatility	-1.02e-06	7.83e-07	0.191
Return on investment	-.0942231	.0721572	0.192
Interest rate differential	.0091583	.0079918	0.252
Inflation differential	.0024623	.0009189	0.007
Oil prices	-.0009223	.0033402	0.782
Institutions quality index	.0071823	.209299	0.973
Dummy	-.4753592	.4284371	0.267
_cons	3.159862	.4591378	0.000
Arellano-Bond test for AR (1) in first differences: $z = -4.44$ Pr > $z = 0.000$			
Arellano-Bond test for AR (2) in first differences: $z = 2.03$ Pr > $z = 0.042$			

Note: One-step System GMM estimation used as an additional robustness test.

Source: Author's estimations.

## Conclusions

This study set out to examine the non-linear relationship between exchange rate volatility and financial market activity in 20 MENA countries over the period 1990–2022, using the dynamic panel threshold regression (PTR) framework. The main objective was to determine whether the impact of real effective exchange rate volatility (REERvol) on stock returns varies across different volatility regimes and whether specific threshold levels exist that

alter the behaviour of financial markets. The use of a long quarterly panel dataset, combined with the threshold estimation technique, allowed the research to capture time effects, cross-country heterogeneity, and potential regime-dependent dynamics that traditional linear models overlook.

The empirical findings confirm the presence of significant non-linearities in the volatility–return nexus. Threshold estimation identified two statistically meaningful volatility thresholds, indicating that stock market responses differ across low-, moderate-, and high-volatility regimes. Below the first threshold, REERvol exerts a significant negative effect on stock returns, suggesting that moderate volatility increases risk premiums and discourages investor participation. However, at extreme volatility levels, the impact becomes statistically insignificant, implying that markets may have already priced in heightened uncertainty or that investor behaviour is dominated by other macroeconomic factors. Additionally, several control variables exhibit consistent and meaningful effects: institutional quality positively supports stock returns, while interest rate and inflation differentials, oil prices, and return on investment also play important roles in shaping financial market performance across the region.

The results offer important implications for policymakers. First, the identification of volatility thresholds provides a practical early-warning mechanism for central banks, indicating the levels of exchange rate instability at which stock markets become particularly vulnerable. Second, the strong and positive influence of institutional quality highlights the need for continuous governance improvements, regulatory strengthening, and enhanced political stability to support financial market resilience. Third, given the high degree of cross-country dependence observed among key macroeconomic variables, coordinated regional policy responses, especially in exchange rate management, monetary policy alignment, and crisis preparedness, are essential to mitigate systemic risks. Finally, the identification of precise volatility thresholds allows financial market participants to refine risk-management practices, improve entry and exit timing, and adjust hedging strategies based on prevailing volatility regimes.

#### Credit Authorship Contribution Statement

Hasan, A.S. conceptualised the research idea, collected the data, conducted the empirical analysis, and drafted the initial manuscript. Karim, Z. A. contributed to the research design, econometric modelling, and methodological development. Azam, A.H. M assisted with data interpretation, literature integration, and manuscript revision. Ghazali, M. F. contributed to the theoretical framing, policy interpretation of results, and final editing of the manuscript. All authors reviewed and approved the final version of the manuscript.

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#### Conflict of Interest Statement

The authors declare that no commercial or financial relationships exist that could be construed as a potential conflict of interest.

#### Data Availability Statement

The data used in this study are obtained from publicly available sources, including Thomson Reuters Datastream, the International Monetary Fund International Financial Statistics (IFS), the US Energy Information Administration (EIA), and the World Bank Worldwide Governance Indicators (WGI).

The compiled dataset used for the empirical analysis is available from the corresponding author upon reasonable request.

#### Ethical Approval Statement

This study does not involve human participants, personal data, or animal subjects. All data used in the analysis are secondary macroeconomic and financial indicators obtained from publicly accessible databases. Therefore, ethical approval was not required.

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