Financial Inclusion and Financial Stability in Selected MENA Countries: An Analysis of the Long-Run Relationship Using the Panel ARDL Approach

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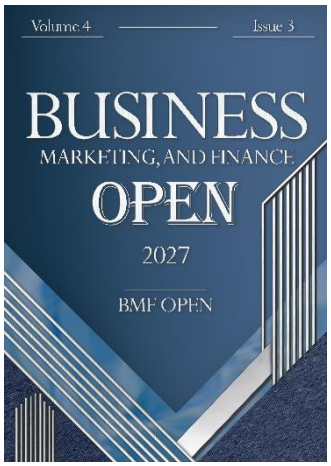

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Abstract: This study was conducted with the aim of examining the effect of financial inclusion on financial stability in selected countries of the Middle East and North Africa (MENA) region during the period 2005–2024. For this purpose, panel data from 12 selected countries and the Pooled Mean Group (PMG) estimation method within the framework of the ARDL model were employed. The composite Financial Stability Index (FSI) was defined as the dependent variable, while the Financial Inclusion Index (FI) was considered the main explanatory variable of the study. In addition, the control variables included economic growth (GRO), population growth (POP), and financial development (FD). The results of the panel unit root tests indicated that all variables were stationary at the I(0) level. The Kao and Pedroni cointegration tests also confirmed the existence of a stable long-run equilibrium relationship among the variables. The estimation results of the baseline model revealed a positive and statistically significant effect of financial inclusion on financial stability (coefficient = 3.152, significant at the 1% level). The inclusion of the nonlinear term (FI^2) demonstrated that there was no evidence of either an inverted U-shaped or a U-shaped relationship between financial inclusion and financial stability (FI^2 coefficient = 1.865, statistically insignificant). The error correction coefficient in both models was approximately -0.50 and significant at the 1% level, indicating a rapid adjustment speed toward long-run equilibrium (approximately 50% per year). Diagnostic tests, including normality, serial correlation, heteroskedasticity, and the Hausman test, all confirmed the validity and robustness of the estimated models. The findings suggest that policymakers in the MENA region can enhance financial sector stability by promoting financial inclusion, while the absence of a nonlinear relationship indicates the persistence of this positive effect across different levels of financial inclusion.

Keywords: Financial inclusion, financial stability, MENA region, PMG-ARDL model, nonlinear relationship, panel analysis, financial development

1. Introduction

Financial inclusion has become a central policy priority in contemporary financial systems because it links access to formal financial services with broader objectives of economic development, social welfare, and financial-sector resilience. In its broadest sense, financial inclusion refers to the availability, accessibility, and effective use of formal financial products and services by individuals, households, and firms. It includes access to bank accounts, payment systems, credit, savings, insurance, and digital financial services, and it is increasingly understood not merely as a

social-development objective but also as a macro-financial condition shaping the stability and efficiency of financial systems. In developing and emerging economies, where large segments of the population and small firms remain underserved by formal finance, financial inclusion can expand the deposit base, diversify credit portfolios, improve savings mobilization, and reduce reliance on informal financial channels. These mechanisms may strengthen financial intermediation and contribute to financial stability by broadening participation in the regulated financial system [1, 2]. However, the relationship is not necessarily linear or universally beneficial; rapid credit expansion, weak supervision, and excessive risk-taking may transform inclusion into a source of fragility if access is expanded without institutional depth and prudential safeguards [3, 4].

Financial stability is generally understood as the capacity of the financial system to absorb shocks, allocate resources efficiently, manage risks, and continue performing its core functions even under conditions of uncertainty. It involves the resilience of banks, financial markets, and payment systems, as well as the ability of monetary and regulatory authorities to prevent instability from escalating into systemic crises. Financial stability is therefore closely associated with bank solvency, liquidity, asset quality, and risk management. Recent studies have emphasized that financial stability is shaped not only by internal banking indicators but also by macroeconomic uncertainty, monetary policy, exchange-rate volatility, and governance quality [5, 6]. From a macro-financial perspective, monetary policy and financial stability are highly interdependent because interest-rate decisions, credit conditions, and liquidity management influence risk-taking behavior in the banking sector [7]. In economies exposed to policy instability, weak institutions, and external shocks, financial stability becomes even more sensitive to the quality of financial-sector development and regulatory coordination [8].

The theoretical relationship between financial inclusion and financial stability can be explained through several channels. First, greater inclusion may increase deposit mobilization and reduce banks' dependence on volatile wholesale funding, thereby improving liquidity stability. Second, broader access to financial services can diversify banks' customer bases and reduce concentration risk. Third, access to formal credit may support entrepreneurship, household consumption smoothing, and private-sector development, thereby improving macroeconomic resilience. Fourth, digital and institutional expansion of finance can improve transaction transparency and reduce the role of informal financial markets. Evidence from multidimensional indexing approaches indicates that financial inclusion can improve financial efficiency and stability when access, usage, and institutional capacity develop together [9]. Similarly, causal analyses suggest that financial inclusion and economic growth may reinforce one another over time, especially when formal financial access enhances savings, investment, and productive activity [10]. These arguments support the expectation that financial inclusion may positively affect financial stability in countries where financial systems remain unevenly developed.

Nevertheless, the inclusion–stability nexus is complex. Expanding financial access may increase systemic resilience, but if it is driven by aggressive lending, weak credit screening, or insufficient regulation, it may raise non-performing loans and weaken bank balance sheets. Cross-country studies have therefore produced mixed findings. Some evidence shows that financial inclusion improves stability by strengthening the formal financial base and reducing vulnerability to informal credit risks [11, 12]. Other studies suggest that the effect depends on income level, institutional quality, and the maturity of financial systems [3]. In Asian economies, financial inclusion has been found to support financial stability, but the strength of the effect varies across countries depending on banking structure, regulatory capacity, and macroeconomic conditions [4]. These findings imply that financial inclusion should not be treated as a uniformly stabilizing factor; rather, its impact should be examined within specific regional and institutional contexts.

The Middle East and North Africa (MENA) region provides a particularly important context for examining this issue. MENA countries differ substantially in income levels, oil dependence, governance structures, financial-sector depth, banking concentration, and exposure to geopolitical shocks. Some countries have highly capitalized banking systems and high levels of financial development, whereas others face institutional fragility, limited banking access, weak financial infrastructure, and macroeconomic volatility. Prior research on MENA has shown that financial inclusion can reduce poverty and inequality while also contributing to financial stability, but the effect depends on the depth and inclusiveness of the financial system [13]. Studies focusing on selected MENA countries have also emphasized that the effect of financial inclusion on stability may be nonlinear, suggesting that inclusion may enhance stability up to a certain threshold but may generate risks if expansion occurs without adequate supervision [14]. Moreover, governance quality has been shown to influence banking-sector financial inclusion in selected MENA economies, indicating that institutional environments shape the effectiveness of inclusion policies [15]. Therefore, a regional panel analysis of selected MENA countries is necessary to clarify whether financial inclusion acts as a stabilizing force and whether this effect remains consistent across different levels of inclusion.

The importance of banking competition further complicates the relationship between inclusion and stability. Competition may improve efficiency, reduce costs, expand service delivery, and encourage innovation, thereby supporting financial inclusion. However, excessive competition may also reduce bank margins and encourage risk-taking, potentially undermining stability. The competition–stability debate has therefore produced two competing perspectives: the competition-fragility view and the competition-stability view. The first argues that stronger competition reduces franchise value and encourages riskier behavior, while the second argues that competition lowers borrowing costs and reduces default risk. Empirical research has increasingly treated banking competition as a key condition in the inclusion–stability relationship [16, 17]. Recent evidence from developing economies shows that financial inclusion, banking competition, and financial stability are interconnected, and that competition may mediate or moderate the stabilizing effect of inclusion [18]. In the MENA region, bank competition, ownership structure, and financial stability have also been found to interact significantly, demonstrating the need to incorporate banking-competition indicators into models of financial stability [19]. Although high-frequency trading competition concerns financial markets rather than banking systems, it similarly illustrates that competition can influence market quality and stability through liquidity, speed, and strategic behavior [20].

Financial development is another major factor in this relationship. Financial development can strengthen financial stability by improving intermediation, risk diversification, and institutional capacity. However, financial deepening may also intensify leverage and systemic exposure if credit growth outpaces supervisory capacity. In Iraq, financial development and financial inclusion have been found to matter for economic growth, suggesting that the expansion of formal finance can support broader macroeconomic performance [21]. Research on Iraq also indicates that financial inclusion contributes to sustainable economic development by increasing access to financial services and supporting productive participation in the formal economy [22]. At the same time, financial inclusion in Iraq has been directly associated with efforts to enhance financial stability, especially through greater use of formal banking services during the period 2004–2018 [23]. Other Iraq-focused research has confirmed a meaningful relationship between financial inclusion and financial stability, reinforcing the need to investigate this relationship in countries with bank-centered financial systems and uneven access to formal services [24].

Digital financial development has added a new dimension to the inclusion–stability debate. Digital finance can reduce transaction costs, expand access in underserved areas, improve payment efficiency, and generate data that supports credit assessment. At the same time, digital expansion may introduce cybersecurity, operational, and

regulatory risks. Recent evidence indicates that digital financial development may affect commercial bank stability by changing banks' funding structures, customer relationships, and competitive pressures [25]. In emerging and developing economies, these changes are particularly relevant because digital channels often serve as the fastest route to inclusion. Nevertheless, digital inclusion must be supported by regulation, consumer protection, and financial literacy to avoid excessive borrowing, fraud, or instability. This is especially relevant for MENA economies, where digital transformation is uneven and where traditional banking institutions still dominate financial intermediation.

The empirical literature has increasingly examined the inclusion–stability relationship using panel data, composite indices, and dynamic econometric methods. Studies across income groups have shown that the impact of financial inclusion on financial stability varies according to economic structure and institutional development [3]. Evidence from Asian countries suggests that inclusion can enhance stability, but the magnitude of the effect is shaped by macroeconomic and banking-sector conditions [4]. In ASEAN economies, financial inclusion has been linked to financial-system stability, supporting the view that broader formal financial participation can strengthen the resilience of banking systems [11]. Cross-country evidence on financial inclusion, competition, concentration, and financial stability also suggests that inclusion cannot be isolated from the broader structure of the financial system [17]. Review-based studies further show that international evidence remains mixed and that additional research is needed to identify the conditions under which inclusion strengthens or weakens financial stability [1, 2].

Despite growing research, several gaps remain. First, many studies examine financial inclusion and stability in broad cross-country samples, while fewer focus specifically on selected MENA economies with comparable regional vulnerabilities. Second, previous studies often emphasize either the linear effect of inclusion or the role of financial development, while fewer simultaneously examine nonlinear effects and interaction terms. Third, the MENA region has experienced major shocks during 2005–2024, including the 2008 global financial crisis, the Arab Spring, oil price fluctuations, banking-sector reforms, sanctions in some economies, and accelerated digitalization. These conditions make the region an appropriate setting for investigating both short-run adjustment and long-run equilibrium. Fourth, earlier research in Iran and selected Islamic countries has shown that financial inclusion affects financial stability, but the long-run regional dynamics require further investigation using panel methods [26]. Similarly, studies of MENA countries have linked financial inclusion to economic growth and the shadow economy, indicating that informal economic structures may influence the effectiveness of inclusion policies [27]. Therefore, a dynamic panel approach can provide stronger evidence on the long-run relationship between inclusion and stability in the region.

Methodologically, the use of a panel ARDL framework with the Pooled Mean Group estimator is appropriate because it allows the analysis to distinguish between long-run homogeneous effects and short-run country-specific dynamics. This is important in MENA countries, where long-run structural relationships may be similar due to shared regional characteristics, while short-run adjustment processes may differ because of country-level shocks, policy regimes, and institutional conditions. By using composite indicators for financial stability and financial inclusion, the study can capture multidimensional constructs more effectively than single proxies. The inclusion of financial development, economic growth, population growth, and banking competition also allows the analysis to account for key macro-financial channels emphasized in prior studies [18, 19]. In addition, testing the squared term of financial inclusion helps determine whether the relationship is linear or whether excessive expansion of inclusion creates diminishing or destabilizing effects, as suggested in nonlinear studies of selected MENA countries [14].

Overall, the literature suggests that financial inclusion has the potential to enhance financial stability by expanding formal participation, strengthening deposit mobilization, improving credit access, and reducing reliance on informal finance. However, the stabilizing effect depends on regulatory quality, financial development, banking competition, macroeconomic stability, and institutional capacity. In the MENA region, where financial systems are heterogeneous and exposed to multiple structural shocks, the relationship requires careful empirical investigation using dynamic panel techniques. Accordingly, the aim of this study is to examine the long-run effect of financial inclusion on financial stability in selected MENA countries during 2005–2024 using the PMG-ARDL panel approach, while also testing the possible nonlinear relationship between financial inclusion and financial stability.

2. Methodology

The statistical population of this study consists of all countries in the Middle East and North Africa (MENA) region during the period 2005–2024. Based on the definitions provided by the World Bank and the International Monetary Fund, MENA countries include Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, the United Arab Emirates, and Yemen.

Due to limitations in access to complete and reliable data for the indicators of financial inclusion, financial stability, and banking competition (particularly the Boone indicator and PCA-based data), the sample was restricted to 12 selected countries: Iran, Bahrain, Algeria, Qatar, Saudi Arabia, Jordan, Oman, Morocco, Kuwait, Tunisia, the United Arab Emirates, and Lebanon. These countries were selected because of the relatively comprehensive coverage of data provided by the World Bank, the International Monetary Fund, and reputable banking databases, and they represent economic diversity within the MENA region, including oil-exporting, non-oil-exporting, developing, and high-income economies. The study period spans 20 years (2005–2024), enabling the examination of both long-run and short-run effects, including the impacts of the 2008 global financial crisis, the Arab Spring, and oil price shocks. The total number of observations is 240 (12 countries × 20 years).

Dependent Variable: Composite Financial Stability Index (FSI)

Financial stability was measured using a multidimensional composite index covering three major dimensions of the banking system: capital adequacy, credit risk, and liquidity. Principal Component Analysis (PCA) was employed to construct the index in order to assign optimal and objective weights to the components and reduce multicollinearity.

Capital adequacy includes the banking Z-score and the ratio of capital to total assets. The banking Z-score is calculated as:

$$Z\text{-}score = \frac{ROA + (Equity/Assets)}{\sigma ROA}$$

Credit risk includes the ratio of non-performing loans (NPLs) to total loans and the ratio of loan loss provisions (LLP) to total loans. Liquidity includes the ratio of liquid assets to deposits and short-term liabilities, as well as the loans-to-deposits ratio.

After standardizing the variables, PCA was applied, and the first principal component, which explains the largest proportion of variance, was extracted as the final Financial Stability Index (FSI). Higher values of FSI indicate higher levels of financial stability.

Main Independent Variable: Financial Inclusion Index (FI)

Financial inclusion was measured using a three-dimensional approach consisting of penetration, access, and usage, combined through PCA.

Financial penetration includes the number of bank accounts per 1,000 adults and the number of automated teller machines (ATMs) per 100,000 people. Access is measured by the number of bank branches per 100,000 people. Usage includes the ratio of private sector credit to GDP and the ratio of bank deposits to GDP.

The input variables were standardized and converted into a single composite index using PCA. Higher values of FI indicate higher levels of financial inclusion.

Control Variables

Financial development (FD) was measured as the ratio of domestic credit provided to the private sector by banks to GDP (source: World Bank). Economic growth (GRO) was measured by the annual growth rate of real GDP (source: World Bank). Population growth (POP) was measured by the annual population growth rate (source: World Bank).

Research Models

Following the studies of Antwi and colleagues (2024), three main models were defined. In this article, the focus is placed on the baseline model and the nonlinear model.

Baseline Model (Model 1)

$$FSI_{it} = \beta_0 FSI_{it-1} + \beta_1 FI_{it} + \beta_2 COM_{it} + \beta_3 Z_{it} + \varepsilon_{it}$$

where Z_{it}includes GRO_{it}, POP_{it}, and FD_{it}.

Nonlinear Model (Model 3)

$$FSI_{it} = \beta_0 FSI_{it-1} + \beta_1 FI_{it} + \varphi_1 FI_{it}^2 + \beta_2 COM_{it} + \beta_3 Z_{it} + (\beta_4 FD_{it} \times FI_{it}) + (\beta_5 FD_{it} \times COM_{it}) + \varepsilon_{it}$$

where FI^2represents the square of the financial inclusion index. Specifically, the relationship between FI and FSI is nonlinear if the elasticity coefficients $\beta_1$and $\varphi_1$have opposite signs and are statistically significant. An inverted U-shaped relationship exists if $\beta_1 > 0$and $\varphi_1 < 0$. Conversely, a U-shaped relationship exists if $\beta_1 < 0$and $\varphi_1 > 0$.

Estimation Method: Pooled Mean Group (PMG) within the Panel ARDL Framework

The Pooled Mean Group (PMG) estimator, developed by Pesaran and colleagues (1999), was selected for estimating the dynamic panel models with a relatively large time dimension. The main reasons for this selection are as follows:

The method allows simultaneous estimation of homogeneous long-run coefficients and heterogeneous short-run coefficients across cross-sectional units. It is flexible in handling mixed integration orders $(I(0)$ or $I(1))$without requiring mandatory differencing. It also incorporates an error correction term (ECT), which measures the speed of adjustment toward long-run equilibrium.

The Hausman test (probability = 0.5073) confirmed the superiority of the PMG estimator over the Mean Group (MG) estimator. The LLC, IPS, ADF-Fisher, and PP-Fisher panel unit root tests indicated stationarity of all variables at the $I(0)$level. The Kao and Pedroni cointegration tests confirmed the existence of a long-run equilibrium relationship among the variables. Lag lengths were selected automatically based on the Akaike Information Criterion (AIC), with a maximum of one lag for the dependent variable. All estimations were performed using EViews version 10.

3. Findings and Results

Table 1 presents the descriptive statistics of the study variables. The Financial Stability Index (FSI) has a mean of 1.707 and a standard deviation of 1.552, indicating substantial variation in financial stability levels across the selected countries during the period 2005–2024. The Financial Inclusion Index (FI) has a mean of 0.355 and a standard deviation of 0.136, suggesting a moderate but heterogeneous level of financial inclusion within the sample. Banking competition (COM) has a negative mean (-0.059), which is consistent with the interpretation of the Boone indicator, where more negative values indicate higher competition. Financial development (FD) averages 45.614% of GDP, with higher levels observed in oil-exporting economies and lower levels in some other countries.

Table 1. Descriptive Statistics of Research Variables

Variable	Observations	Minimum	Maximum	Mean	Standard Deviation
FSI	240	-2.729	4.826	1.707	1.552
FI	240	0.072	0.727	0.355	0.136
COM	240	-2.118	1.764	-0.059	0.241
GRO	240	-14.186	32.029	3.048	4.009
POP	240	1.119	80.211	19.538	7.049
FD	240	3.097	172.892	45.614	18.311

Table 2 presents the correlation matrix. A positive and statistically significant correlation between financial inclusion and financial stability (0.067) is observed, supporting the main hypothesis of the study. Banking competition (COM) shows a weak positive correlation (0.011) with financial stability; however, this relationship becomes negative in multivariate estimations. Financial development (FD) exhibits a negative correlation (-0.087) with financial stability, which may reflect increased risk-taking behavior in more financially developed systems. No significant multicollinearity was detected, as no correlation exceeded 0.70 except between FD and some variables, which were controlled for in the model.

Table 2. Correlation Matrix of Variables

Variables	FSI	FI	COM	GRO	POP	FD
FSI	1					
FI	0.067*	1				
COM	0.011	0.029	1			
GRO	-0.004	-0.078*	-0.088*	1		
POP	-0.229**	0.164*	-0.021	-0.057	1	
FD	-0.087*	0.681**	0.052	-0.044	0.311**	1

* Significant at the 5% level; ** Significant at the 1% level.

Table 3 presents the results of the panel unit root tests. All variables are stationary at the level form under individual effects according to the LLC, IPS, ADF-Fisher, and PP-Fisher tests (probabilities below 0.05 in most cases). Therefore, all variables are integrated of order $I(0)$, and none are integrated of order $I(1)$or higher. The squared financial inclusion term (FI^2) was not tested separately due to perfect collinearity with FI, but its stationarity at level is assumed.

Table 3. Results of Panel Unit Root Tests

Variable	LLC (t*)	Prob.	IPS (W-stat)	Prob.	ADF-Fisher	Prob.	PP-Fisher	Prob.	Result
FSI	-4.23678	0.0000	-4.01662	0.0000	58.3721	0.0001	69.3694	0.0000	I(0)
FI	-2.80621	0.0025	-4.90513	0.0000	68.2660	0.0000	131.1895	0.0000	I(0)
COM	-2.07703	0.0189	-4.98135	0.0000	67.1368	0.0000	159.4130	0.0000	I(0)

GRO	-4.52260	0.0000	-6.68460	0.0000	89.9460	0.0000	165.1210	0.0000	I(0)
POP	-5.71701	0.0000	-6.51765	0.0000	90.4067	0.0000	144.0260	0.0000	I(0)
FD	-7.90968	0.0000	-6.94125	0.0000	93.36748	0.0000	208.4980	0.0000	I(0)

Table 4 reports the results of the Kao and Pedroni cointegration tests. The Kao test, with an ADF statistic of $-8.477264$and a probability value of 0.0000, rejects the null hypothesis of no cointegration. In the Pedroni test, most statistics, including Panel PP, Panel ADF, Weighted PP, Weighted ADF, Group PP, and Group ADF, are significant at the 1% or 5% levels. Therefore, the existence of at least one stable long-run equilibrium relationship among the variables is confirmed.

Table 4. Results of Kao and Pedroni Panel Cointegration Tests

Test	Alternative Hypothesis	Statistic	Statistic Value	Prob.
Kao Residual Test	–	ADF	-8.477264	0.0000
Pedroni Residual Test (Within-dimension)	Common AR coefficients	Panel v-Statistic	-1.786300	0.9630
		Panel rho-Statistic	1.279224	0.8996
		Panel PP-Statistic	-2.214748	0.0134
		Panel ADF-Statistic	-2.457496	0.0070
		Weighted Panel PP	-2.857190	0.0021
		Weighted Panel ADF	-2.983096	0.0014
Pedroni Residual Test (Between-dimension)	Individual AR coefficients	Group rho-Statistic	2.610549	0.9955
		Group PP-Statistic	-2.750334	0.0030
		Group ADF-Statistic	-2.909640	0.0018

Table 5 presents the estimation results of the baseline PMG-ARDL model. The coefficient of financial inclusion (FI) is 3.152256 and statistically significant at the 1% level, indicating a positive and strong long-run effect of financial inclusion on financial stability. The coefficient of economic growth (GRO) is positive and significant (0.405533), while the coefficient of population growth (POP) is negative and significant (-0.023712). The error correction term (ECT) is -0.498628 and significant at the 1% level, indicating an adjustment speed of approximately 50% per year toward long-run equilibrium.

Table 5. Results of Baseline PMG-ARDL Estimation

Variable	Long-Run Coefficient	Standard Error	t-Statistic	Prob.
FI	3.152256	0.515310	6.117202	0.0000
COM	-1.225128	0.227201	-5.392270	0.0000
FD	0.602375	0.002601	231.5907	0.0000
POP	-0.023712	0.007636	-3.105285	0.0023
GRO	0.405533	0.013636	29.73985	0.0000
ECT (COINTEQ01)	-0.498628	0.002698	-184.8392	0.0000

Table 6 presents the results of the nonlinear model. The coefficient of FI is 2.24685 and statistically significant at the 5% level, whereas the coefficient of $FI^2$is 1.865210 and statistically insignificant (probability = 0.3578). This finding indicates that there is no evidence of a nonlinear (U-shaped or inverted U-shaped) relationship between financial inclusion and financial stability, and the relationship remains linearly positive. The moderating effect of $FD \times FI$is negative but statistically insignificant. The ECT coefficient remains approximately -0.498 and statistically significant.

Table 6. Results of Nonlinear PMG-ARDL Estimation

Variable	Long-Run Coefficient	Standard Error	t-Statistic	Prob.
FI	2.246850	1.005452	2.013705	0.0462
FI^2	1.865210	2.020649	0.923074	0.3578
COM	-0.229026	0.325432	-0.703761	0.4829
FD	0.607819	0.005535	109.8189	0.0000
POP	-0.011362	0.006412	-1.772056	0.0788
GRO	0.415367	0.011389	36.47249	0.0000
$FD \times FI$	-0.014357	0.014123	-1.016537	0.3114
$FD \times COM$	-0.019479	0.006194	-3.144644	0.0021
ECT	-0.497874	0.002888	-172.3670	0.0000

The diagnostic tests confirm that the key assumptions of the modeling procedure are satisfied. The residuals of the nonlinear model follow a normal distribution and are free from serial autocorrelation. In addition, the error variances were found to be homoscedastic. The Hausman test also confirmed the superiority of the PMG estimator over the MG estimator. To examine the robustness of the findings, several complementary analyses were conducted. First, re-estimation using an alternative estimator, Fully Modified Ordinary Least Squares (FMOLS), demonstrated that the direction and significance of the key relationships were consistent with the initial results. Second, excluding countries with exceptional economic and political conditions from the sample did not substantially alter the overall pattern of results, and the principal findings remained robust. Third, the panel Granger causality test confirmed the existence of a unidirectional causal relationship running from financial inclusion to financial stability, whereas the reverse relationship was not statistically significant. Overall, these complementary analyses indicate the robustness and high validity of the study findings.

4. Discussion and Conclusion

The present study examined the long-run relationship between financial inclusion and financial stability in selected MENA countries during the period 2005–2024 using the PMG-ARDL panel approach. The findings demonstrated that financial inclusion exerts a positive and statistically significant effect on financial stability in the long run. The estimated coefficient of the financial inclusion index in the baseline model indicates that greater access to and usage of formal financial services contribute to improving the resilience and stability of the financial system in the selected MENA economies. This result supports the theoretical argument that expanding financial inclusion broadens the deposit base, increases financial intermediation efficiency, reduces dependence on informal financial mechanisms, and strengthens banking-sector liquidity and resilience. The positive relationship identified in this study is consistent with the findings of [18], who reported that financial inclusion positively affects financial stability in developing economies through enhanced financial-sector participation and diversification of banking activities. Similarly, the findings align with the conclusions of [1], who emphasized that financial inclusion can strengthen the stability of financial systems when supported by adequate regulatory and institutional frameworks. The findings are also consistent with the empirical evidence reported by [11] for ASEAN economies and by [4] for Asian countries, both of which found that broader access to financial services contributes to banking-system stability and macro-financial resilience.

The positive effect of financial inclusion on financial stability can also be interpreted within the structural characteristics of MENA economies. Many countries in the region continue to experience uneven financial access, relatively high dependence on cash transactions, and limited banking penetration in some population groups.

Under such conditions, expanding access to formal financial services may increase the volume of regulated financial transactions and strengthen the supervisory capacity of banking institutions. Financial inclusion may also improve risk diversification by enlarging the customer base of banks and reducing concentration risk. These mechanisms are particularly important in economies vulnerable to oil-price fluctuations, geopolitical uncertainty, and external shocks. The findings of the present study therefore reinforce the argument that financial inclusion functions not only as a social-development instrument but also as a macroprudential policy tool. This interpretation is consistent with the findings of [13], who demonstrated that financial inclusion in MENA countries contributes to reducing economic vulnerability and improving financial-system resilience through lower inequality and broader formal participation. Likewise, the results are compatible with the conclusions of [26], who found that financial inclusion improves financial stability in Iran and selected Islamic countries by enhancing formal financial participation and institutional efficiency.

Another important finding of the study is the absence of a statistically significant nonlinear relationship between financial inclusion and financial stability. The coefficient of the squared financial inclusion term (FI^2) was positive but statistically insignificant, indicating that no evidence of either a U-shaped or an inverted U-shaped relationship exists in the selected sample. This result implies that the effect of financial inclusion on financial stability remains positively linear across different levels of inclusion in the examined MENA countries. In practical terms, the findings suggest that increasing financial inclusion does not appear to generate destabilizing effects within the observed range of financial development and institutional conditions. This outcome differs partially from the nonlinear findings reported by [14], who identified threshold effects of financial inclusion on financial stability in selected MENA countries. One possible explanation for this difference is the broader sample period and the inclusion of additional macro-financial control variables in the present study, which may have captured structural adjustments and regulatory improvements implemented after major financial and geopolitical shocks in the region. Furthermore, the selected countries may still be operating below the level at which excessive credit expansion or over-financialization would generate destabilizing pressures.

The findings also revealed that financial development positively and significantly affects financial stability. This result indicates that deeper financial systems characterized by greater domestic credit provision and stronger banking-sector activity can improve long-run financial resilience in the MENA region. Financial development may strengthen the efficiency of financial intermediation, improve liquidity allocation, and increase the capacity of banks to absorb shocks. This finding is consistent with the results reported by [21], who found that financial development and financial inclusion contribute positively to economic performance and financial-sector functioning in Iraq. The positive role of financial development also supports the broader theoretical literature emphasizing that well-developed financial systems facilitate risk diversification and institutional strengthening. However, the results should also be interpreted cautiously because excessive financial expansion without adequate supervision may increase systemic vulnerabilities. In this context, the positive effect identified in the present study likely reflects the combined influence of financial deepening and institutional adaptation over the study period.

Economic growth was also found to have a positive and statistically significant relationship with financial stability. This finding suggests that stronger macroeconomic performance contributes to healthier banking conditions, lower default risk, and improved financial-system resilience. Higher economic growth generally improves household income, corporate profitability, and repayment capacity, thereby strengthening banking-sector balance sheets and reducing financial fragility. This interpretation is consistent with the findings of [27], who showed that financial-sector expansion and formalization contribute to broader economic growth processes in

MENA countries. The result is also aligned with the arguments presented by [2], who emphasized the mutually reinforcing relationship between financial inclusion, financial-sector development, and macroeconomic stability. Furthermore, stronger economic performance may create more favorable conditions for expanding formal financial services and improving institutional trust, which in turn support financial stability.

By contrast, population growth exhibited a negative relationship with financial stability. This finding may reflect the pressure that rapid population growth places on labor markets, public infrastructure, financial-service provision, and banking resources in some MENA economies. In developing economies where financial infrastructure expansion does not keep pace with demographic growth, rapid increases in population may intensify unemployment, informal economic activity, and financial exclusion, thereby weakening financial-system resilience. This result is particularly relevant for several MENA countries characterized by youth-dominated demographic structures and uneven employment opportunities. The negative relationship may also indicate that financial systems in some countries remain insufficiently prepared to accommodate rapidly increasing demand for formal financial services.

The negative coefficient of banking competition in the baseline model suggests that stronger competition may weaken financial stability under certain institutional conditions. This finding supports the competition-fragility hypothesis, according to which intense competition reduces banks' profit margins and encourages excessive risk-taking behavior. In highly competitive banking environments, banks may lower lending standards or increase leverage to maintain profitability, thereby increasing financial vulnerability. The result is consistent with the findings of [19], who reported that banking competition and ownership structure significantly affect financial stability in MENA countries. Similarly, [16] argued that financial competition may create systemic risks if regulatory oversight is insufficient. The findings also align partially with the cross-country evidence provided by [17], who demonstrated that the interaction among financial inclusion, competition, and concentration shapes financial stability outcomes. However, the competition coefficient became statistically insignificant in the nonlinear specification, suggesting that the destabilizing effect of competition may weaken once interaction terms and nonlinear structures are incorporated into the model.

The interaction term between financial development and financial inclusion ($FD \times FI$) was negative but statistically insignificant. This result implies that financial development does not significantly moderate the effect of financial inclusion on financial stability in the selected MENA economies. One possible explanation is that financial inclusion exerts an independent stabilizing effect regardless of the overall level of financial development. Alternatively, the quality of institutions and governance may play a more decisive moderating role than financial depth alone. This interpretation is supported by [15], who emphasized the importance of governance quality in shaping financial inclusion outcomes within the banking sectors of MENA countries. Similarly, the findings of [8] indicate that macroeconomic instability and institutional quality substantially influence financial-system behavior and financial reporting conditions.

The significant and negative coefficient of the interaction between financial development and competition ($FD \times COM$) suggests that the destabilizing effect of competition intensifies in more financially developed systems. As financial markets deepen and banking activities expand, stronger competition may encourage higher leverage, speculative activities, and aggressive lending behavior. This finding is theoretically consistent with studies emphasizing that financial liberalization and market expansion may increase systemic risk when competition rises faster than supervisory capacity. Although much of the literature emphasizes the efficiency benefits of competition, the present findings suggest that in developing and emerging financial systems, rapid competitive expansion may

undermine long-run stability if prudential regulation remains insufficient. This interpretation is compatible with the broader arguments advanced by [20], who demonstrated that competitive dynamics can influence market quality and systemic outcomes through strategic interactions among financial actors.

An important contribution of the present study is the confirmation of a stable long-run equilibrium relationship among the variables through the Kao and Pedroni cointegration tests. The significant and negative error-correction coefficients in both models indicate that deviations from long-run equilibrium are corrected relatively quickly, with approximately 50% of disequilibrium adjusted within one year. This result demonstrates the dynamic stability of the estimated relationships and supports the suitability of the PMG-ARDL framework for analyzing financial-sector dynamics in MENA countries. The rapid adjustment speed may reflect the increasing responsiveness of banking systems and financial authorities in the region following major shocks such as the 2008 global financial crisis, oil-price collapses, and post-Arab Spring reforms. The finding also supports the argument of [7] that financial stability and macroeconomic policy frameworks are closely interconnected and that institutional adaptation plays a critical role in maintaining financial resilience.

The robustness analyses further strengthened the validity of the findings. Re-estimation using FMOLS confirmed the direction and significance of the principal relationships, indicating that the results are not sensitive to the choice of estimator. Likewise, excluding countries with exceptional political or economic conditions did not materially alter the results, suggesting that the identified relationships are not driven by outlier economies. The panel Granger causality analysis also confirmed a unidirectional causal relationship running from financial inclusion to financial stability, while the reverse relationship was not statistically significant. This finding implies that improvements in financial inclusion precede and contribute to financial stability rather than merely resulting from stable financial systems. The result is consistent with the arguments presented by [12], who emphasized that financial inclusion can improve broader economic and financial outcomes in Asian economies. The findings are also compatible with the evidence reported by [24], [23], and [22], all of whom highlighted the stabilizing and developmental role of financial inclusion in Iraq and similar bank-centered economies.

One important contextual interpretation of the results concerns the role of digital financial transformation. Although the study did not directly incorporate digital finance variables, the study period coincided with rapid growth in digital payment systems, mobile banking, and fintech services across many MENA economies. These developments likely contributed indirectly to the positive relationship between financial inclusion and financial stability by increasing accessibility, transaction efficiency, and formal financial participation. This interpretation is consistent with the findings of [25], who showed that digital financial development significantly influences commercial bank stability through changes in financial intermediation and banking structures. As digital finance continues to expand in the MENA region, its interaction with financial inclusion and financial stability is likely to become increasingly important for policymakers and financial institutions.

One limitation of the present study is the restricted sample size caused by the limited availability of consistent data on financial inclusion, financial stability, and banking competition indicators for several MENA countries. In addition, the study relied primarily on macro-level panel indicators, which may not fully capture micro-level behavioral differences among households, firms, and financial institutions. The analysis also focused mainly on formal banking indicators and did not directly incorporate fintech development, institutional trust, political instability, or informal financial activities, all of which may influence the inclusion–stability relationship. Furthermore, despite the use of robust estimation techniques, cross-country heterogeneity in regulatory quality, sanctions exposure, and financial-system structure may still affect the generalizability of the results.

Future research could extend the present analysis by incorporating digital financial inclusion indicators such as mobile banking usage, fintech adoption, and digital payment penetration. Additional studies may also examine the moderating role of governance quality, institutional effectiveness, monetary-policy uncertainty, and political risk in shaping the relationship between financial inclusion and financial stability. Comparative analyses between oil-exporting and non-oil-exporting economies or between Islamic and conventional banking systems could provide more nuanced insights into regional financial dynamics. Moreover, future studies could apply threshold regression, quantile regression, or nonlinear dynamic panel models to explore whether the impact of financial inclusion varies under different macroeconomic or institutional conditions.

The findings of this study have several practical implications for policymakers and financial authorities in MENA countries. Expanding access to formal financial services should be considered a strategic instrument not only for economic inclusion but also for strengthening long-run financial stability. Policymakers should therefore support banking accessibility, digital financial infrastructure, financial literacy programs, and inclusive credit policies, especially for underserved populations and small enterprises. At the same time, regulatory authorities must ensure that financial inclusion expansion is accompanied by effective prudential supervision, risk management, and institutional strengthening in order to prevent excessive risk-taking and maintain systemic resilience. Strengthening governance quality, improving regulatory coordination, and enhancing the transparency of banking systems may further reinforce the stabilizing effects of financial inclusion across the region.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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