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The Impact of Financial Inclusion on Financial Stability: Evidence from MENA and African Countries Analyzed Using Hierarchical Multiple Regression

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Abstract: The link between financial inclusion and financial stability is a central concern in public economic policymaking, particularly in emerging countries where access to financial services remains limited. While financial inclusion is widely regarded as a key driver of economic development, its impact on financial stability remains debated. Some studies highlight the stabilizing effect of financial inclusion, whereas others, like emphasize its potential risks. This study empirically investigates the relationship between financial inclusion and financial stability across the years 2011, 2014, 2017, and 2021 in 26 African and MENA countries. The hierarchical multiple regression (HMR) method is employed to assess the independent effect of financial inclusion, controlling for macroeconomic variables. The findings reveal that financial inclusion positively contributes to financial stability through channels such as digital payments and the number of bank branches. Conversely, savings, the number of ATMs, and the money supply exhibit a negative effect on financial stability. These results underscore the need for a regulatory framework that balances financial inclusion with financial stability. In particular, cybersecurity measures must be implemented to support the expansion of digital payments, and supervisory mechanisms should be reinforced to mitigate liquidity risks.

Keywords: banks; ATMs; digital payments; financial inclusion; financial stability; MENA; Africa; hierarchical multiple regression; Z-score

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1. Introduction

Maintaining financial stability has always been one of the main concerns of public policy. However, with the recurrence of financial crises, this concern has become increasingly pressing. The subprime crisis of 2007–2009, in particular, reignited the need to contain systemic risk. Like any episode of financial instability, the financial crisis had serious repercussions for the global economy, exacerbating income inequality and intensifying poverty (OFCE, 2014). In the aftermath of the crisis, governments around the world recognized the importance of not only achieving economic growth but also fostering inclusive economic growth—defined as "growth that not only creates new economic opportunities but also ensures equal access to these opportunities for all segments of society, especially the poor" (Ali & Son, 2007).

In this context, new avenues for economic development have emerged, particularly as policymakers have paid closer attention to the issue of financial inclusion and its implications for economic development. Limited access to financial services is widely recognized as a major obstacle to economic growth for both businesses and households (Demirgüç-Kunt et al., 2022). Consequently, for the first time, the World Bank Group and the Consultative Group to Assist the Poor (CGAP) (2009) launched the *Financial Access* report (2009), providing an overview of financial services in 139 countries. This led to the formulation of a range of actions aimed at improving financial inclusion, considered a powerful tool to reduce inequalities, limit poverty, encourage investment, and manage financial risks (Demirgüç-Kunt et al., 2017).

Yet, despite its recognized importance, a large proportion of the world's population remains financially excluded. According to the Demirgüç-Kunt et al. (2022), 24% of the world's adult population still lacks access to financial services. Kim (2021) identifies four main reasons for this exclusion. First, low-income individuals are often seen as high-risk clients by financial institutions. Second, clients may face discrimination based on social class, religion, or ethnicity. Third, the cost of certain financial services can be a barrier to inclusion. Lastly, limited financial knowledge also contributes to exclusion.

The relationship between financial inclusion and financial stability has attracted considerable academic attention, with mixed findings. Some studies argue that financial inclusion promotes financial stability by diversifying the deposit base and reducing reliance on volatile funding sources (Neaime & Gaysset, 2018). Others, however, warn that extensive financial inclusion may lead to excessive credit growth and systemic risk (Amatus & Alireza, 2015). Most existing studies focus on developed or Asian economies, while regions such as MENA and Africa remain underexplored, despite their financial and economic specificities.

Empirical studies investigating the link between financial inclusion and financial stability have shown divergent results, justifying the need for further analysis. Some authors highlight the stabilizing role of financial inclusion through greater diversification of funding sources (Ahamed & Mallick, 2017), often measured by the number of bank accounts (Neaime & Gaysset, 2018), supporting our first hypothesis. Conversely, other research points to the potential risks linked to increased financial inclusion, particularly through rapid credit expansion (Amatus & Alireza, 2015), in line with our fifth hypothesis.

The literature also presents mixed findings on the role of digital payments. On the one hand, digital payments can enhance the transparency and traceability of financial transactions, reducing risk (Beck et al., 2018). On the other hand, their uncontrolled expansion in the absence of secure regulatory frameworks may become a source of instability (Saluja et al., 2023), supporting our second hypothesis. Moreover, several studies analyze the positive effect of bank branches on financial stability through the reinforcement of depositor confidence and easier access to services (Mbutor & Uba, 2013), which aligns with our sixth hypothesis.

The choice of focusing on the MENA and African regions is based on their specific characteristics. These include a wide range of financial inclusion levels—from advanced financial systems in countries like the United Arab Emirates and South Africa, to underdeveloped systems in countries such as Mali and Sierra Leone (World Bank, 2020). Additionally, these regions are particularly vulnerable to financial and monetary crises, making them ideal for examining the link between the expansion of financial services and financial stability.

This dual context—marked by increasing financial instability and the growing importance of financial inclusion—raises a critical question: Can an inclusive financial system promote or undermine financial stability?

This study seeks to answer the following research question: To what extent does financial inclusion influence financial stability in MENA and African countries?

To address this question, the following hypotheses are proposed:

H1. *Financial stability is positively impacted by the number of accounts.*

H2. *Financial stability is negatively impacted by electronic payments.*

H3. *Financial stability is negatively impacted by savings.*

H4. *Financial stability is positively impacted by having a credit or debit card.*

H5. *Financial stability is negatively impacted by borrowing.*

H6. *Financial stability is positively impacted by the number of bank branches.*

H7. *Financial stability is positively impacted by the number of ATMs.*

H8. *Financial stability is positively impacted by GDP growth.*

H9. *Financial stability is negatively impacted by the inflation rate.*

H10. *Financial stability is negatively impacted by the exchange rate.*

H11. *Financial stability is negatively impacted by the broad money.*

H12. *Financial stability is negatively impacted by the credit/GDP ratio.*

Based on data from 26 countries in the years 2011, 2014, 2017, and 2021, this study finds that digital payments and the number of bank branches have a positive impact on financial stability, while savings, ATMs, and the money supply have a negative impact.

2. Literature Review and Hypothesis Development

2.1. Financial Stability

Given the interconnectedness and complexity of the links between many components of the financial system and the real economy, financial stability is a difficult concept to define or quantify (Gadanecz & Jayaram, 2008).

However, several researchers have tried to understand and diagnose this concept. According to Schinasi (2004), a financial system is said to be stable when not only are the existing imbalances unable to adversely affect economic activity but also when the financial system is able to deal with these imbalances in order to avoid potential shocks. In other words, financial stability is the ability of a financial system to ensure a level of confidence in the functioning of all its institutions and financial markets (Foot, 2003).

On the other hand, Patat (2000) proposes a multidimensional definition of financial stability, which refers not only to the smooth functioning of the components of the financial system but also to the strength of the links between these different components.

Furthermore, banking stability is a key condition for financial stability, insofar as bank failures and the failures of long-term savings and borrowing instruments are responsible for the lack of confidence in financial intermediaries, which acts as a brake on economic growth (Foot, 2003).

2.2. Financial Inclusion

Financial inclusion is a nuanced and complicated concept. Indeed, there is no universal definition of financial inclusion, despite the fact that it is constantly evolving in the academic debate. In the literature, there are two approaches to its definition. Some studies determine what financial inclusion is, while others prefer to define the idea in terms of financial exclusion. The two ideas are strongly linked to each other (Federico et al., 2021).

According to a United Nations (2016) report, financial inclusion represents the provision of financial services at affordable prices over the long term, enabling the poor to participate in the formal economy. Thus, the major objective of financial inclusion is to popularize financial services and make them accessible to a larger population (Sahay et al., 2015).

Although credit is the most crucial element, financial inclusion also includes other financial services provided to individuals who are often excluded from the formal financial system, such as savings, insurances, payments, and money transfers (Dev, 2006). These services need to be offered in a well-regulated environment, in a way that is responsible and safe for the consumer and sustainable for the provider (Demirgüç-Kunt et al., 2017). Expanding the (mostly poor) population's access to these financial services reduces poverty and promotes economic growth (Ozili, 2018).

From another perspective, Conroy (2005) defines financial exclusion as a process whereby poor and disadvantaged socio-economic groups are blocked from accessing the formal financial systems of their countries. The effects can range from indebtedness to disconnection from essential public services and exclusion from other mainstream services such as savings and pension schemes (Goodwin et al., 1999). The most common illustration of financial exclusion is represented by households that are refused credit despite their desire to benefit from it, which is the correct definition of financially excluded people in the context of credit (Dev, 2006).

However, financial inclusion does not necessarily imply that every individual can use the services available or that service providers should ignore the risks and costs involved when they decide to provide their services. Indeed, despite unrestricted access, a household or small business may not be able to use one or more of the services because of voluntary exclusion or unfavorable risk/reward conditions. In this case, there is no need for government intervention. Instead, policy measures should aim to address market imperfections and eradicate non-market barriers to accessing a wide range of financial services (Hannig & Jansen, 2010).

2.3. Literature Review

The relationship between financial inclusion and financial stability is a widely debated subject in the literature.

This relationship is rooted in economic and financial theory. Three main theoretical frameworks support this link: the theory of financial intermediation, Minsky's theory of financial instability, and the theory of financial liberalization. The theory of financial intermediation recognizes the important role of financial institutions in connecting agents with a surplus of funds to those with a deficit, thus promoting access to financial services (Gurley & Shaw, 1960). This idea was further developed by Diamond and Dybvig (1983), who emphasized the role of banks in financing projects, protecting depositors from liquidity risk, and reducing financial instability. These theories support our first hypothesis (H1) and our fourth hypothesis (H4).

Additionally, the theory of financial liberalization states that easing financial restrictions promotes access to financial services but can also weaken the financial system if credit expansion is not properly regulated (McKinnon, 1973; Shaw, 1973). This aligns

with Minsky's theory of financial instability, which highlights the risks of excessive credit growth. These two theories support our fifth hypothesis (H5).

The vast number of studies and the diverse results have led to a lack of consensus on the relationship between financial inclusion and financial stability. This lack of consensus may be due to several factors: the choice of countries studied, which leads to varied results; the use of different research methodologies; and the selection of different indicators or variables, which leads to different conclusions. In this section, the studies are grouped into three categories: those showing a positive effect, those indicating a negative effect, and those finding no significant effect between financial inclusion and financial stability.

Among the studies that empirically support the positive effect of broad access to financial services on financial stability is the work of Neaime and Gaysset (2018). They examined eight MENA countries between 2002 and 2015 using GMM and GLS econometric models. Their findings suggest that the greater the number of ATMs, the more stable the financial system becomes. As the population grows, financial institutions gain more customers, enabling them to expand into new sectors and strengthen their balance sheets. This results in better risk coverage and improved bank resilience.

Using a larger sample of 86 countries and 2600 banks from 2004 to 2012, Ahamed and Mallick (2017) found that financial inclusion helps banks attract low-risk retail deposits, reducing their reliance on the money markets. It also improves pricing power and lowers marginal production costs, which enhances financial stability.

In the West African Economic and Monetary Union (WAEMU), Coulibaly (2023) found that financial inclusion strengthens long-term financial stability.

Similarly, Ozili (2018), focusing on African countries, found that high financial service penetration is associated with more stable financial systems.

In the Indian context, Srivastava et al. (2025) investigated the influence of financial inclusion on financial stability. Their findings revealed a positive relationship between financial inclusion and stability, particularly when financial services are expanded in rural areas, where access to formal finance tends to be limited.

On the corporate side, Morgan and Pontines (2014) studied the impact of financial inclusion variables on financial stability and found that lending to SMEs reduces non-performing loans (NPLs), thus improving bank stability. They suggested that financial inclusion through SME support can help maintain financial stability.

In the Nigerian context, Olusegun et al. (2021) used a DLAP model to study financial stability (measured by the Z-score) and financial inclusion (measured through use, penetration, and availability) from 2014 to 2018. They found a positive effect between financial inclusion and stability. Specifically, the penetration dimension (number of bank accounts) and availability (number of bank branches) had a positive effect on the Z-score. The deposit mobilization enabled by more accounts and branches contributes to the stability and resilience of banks.

In the MENA region, Hakimi et al. (2021) studied the period from 2004 to 2017 using GMM and concluded that strengthening financial inclusion improves the resilience of the banking sector.

In Jordan, Al-Smadi (2018) examined the effect of financial inclusion (measured by Jordan's financial inclusion index) on financial stability (measured by the Central Bank's financial stability index) from 2006 to 2017 using the fully modified least squares technique. The study found a small but positive effect, possibly limited by risks stemming from financial innovation and low-income customer participation.

Covering 47 countries in the Organization of Islamic Cooperation, Abdulkarim and Ali (2019) used the Z-score to measure financial stability and found that ATMs and bank

branches positively impact stability. ATMs increase competitiveness among banks, while branches help mobilize foreign capital and liberalize markets.

More recently, Abdelkhalek Ganna et al. (2024) found that an increase in mobile accounts per 1000 adults in Egypt had a positive impact on financial stability.

In their study of 26 countries covering the period from 2004 to 2020, Sebai et al. (2025) empirically demonstrated a non-linear relationship between financial inclusion and financial stability. Specifically, financial inclusion has a positive impact on stability up to a certain threshold, beyond which further increases in inclusion become detrimental to financial stability.

In contrast, other studies highlight the risks associated with financial inclusion.

In 35 African countries from 2004 to 2011, Amatus and Alireza (2015) found that outstanding deposits negatively affect financial stability due to the risk of mass withdrawals in times of crisis. However, outstanding loans had a positive effect, as banks used loan income to support operations.

In Olusegun et al.'s (2021) study, while some financial inclusion dimensions had positive effects, the use dimension (measured by savings, electronic payments, and credit) had a negative effect. This is explained by the tendency of banks to channel credit into high-risk sectors like oil and gas.

Similarly, Sahay et al. (2015), using IMF data, found that the uncontrolled expansion of credit increases financial risk, particularly in countries with weak regulation. Outside of credit, they found no significant impact of financial service access on financial stability.

Yu et al. (2022) showed that while digital financial services promote inclusion, they may also lead to excessive borrowing and increase systemic financial risk.

Mehrotra and Yetman (2015) argued that financial inclusion can help households manage consumption and build reserves, promoting price stability. However, they also warned that increased credit access may lead to significant financial risks if poorly managed.

In Abdulkarim and Ali's (2019) study, although ATMs and branches had a positive effect, deposit accounts were found to harm financial stability due to speculative activities in the banking sector.

Other studies conclude that there is no significant link or an inconclusive link between financial inclusion and financial stability.

Ardic et al. (2013) found no connection between financial inclusion (measured by deposit account penetration) and financial stability, possibly due to an indirect relationship.

A similar conclusion was reached by Abbad and Touati (2022).

In its report "*Financial Inclusion and Stability: A Balancing Act*", the CGAP (2023) stated that empirical evidence on the relationship between financial access (account penetration) and financial stability is mixed and inconclusive. A previous analysis by the CGAP and the IFC also found no statistically significant relationship.

Demirgüç-Kunt et al. (2022) argued that merely owning a bank account does not lead to stability if financial services are not actively used.

Even in the study by Al-Smadi (2018), where a small positive effect was observed, the author suggested the possibility of an indirect relationship between financial inclusion and financial stability.

The impact of financial inclusion on systemic risk has been examined by Ben Naceur et al. (2024), who demonstrated that, through the credit channel, bank risk tends to be lower as a result of greater diversification in loan portfolios. Moreover, while financial inclusion via deposits contributes to reducing the individual bank risk, its effect on systemic financial instability remains limited. In contrast, the expansion of digital banks appears to intensify risk, primarily due to increased competition in credit markets.

More recently, a study by Antwi et al. (2024) examined the impact of competition and financial inclusion on financial stability in 60 developing countries over the period from 2002 to 2019. The study revealed several key findings. Firstly, financial inclusion was found to have a detrimental effect on financial stability. However, investment and financial development appear to be factors that can moderate this relationship, allowing financial inclusion to positively influence financial stability up to a certain threshold.

This literature review confirms that there are few studies specifically addressing the impact of financial inclusion on financial stability, particularly in the MENA region (Neaime & Gaysset, 2018; Hakimi et al., 2021). This paper therefore seeks to fill this gap by empirically examining the effect of financial inclusion on financial system stability in MENA countries.

3. Research Methodology

This section describes the empirical study.

3.1. Sample Population

In order to study the impact of financial inclusion on financial stability, this study included a sample of 26 countries, 10 of which are in the MENA region, namely the United Arab Emirates, Saudi Arabia, Jordan, Kuwait, Tunisia, Egypt, Morocco, Algeria, Iraq, and Lebanon, as well as 16 countries from Southern, Eastern, Western, and Central Africa, namely South Africa, Malawi, Benin, Burkina Faso, Guinea, Ghana, Mali, Nigeria, Senegal, Sierra Leone, Togo, Cameroon, Gabon, Kenya, Mauritius, and Tanzania.

The study period covered the years 2011, 2014, 2017, and 2021. The choice of these years depended on the availability of indicators measuring financial inclusion. The data for this study were obtained from the International Monetary Fund (2024) and World Bank databases.

We chose to work on a sample of 26 countries in the MENA and African regions for several reasons. Firstly, data availability was an important selection criterion, as we selected countries with available data on both financial inclusion and financial stability in the World Bank and IMF databases. Secondly, the choice of region was also based on the diversity of financial structures, as the sample includes countries with developed financial systems, such as the United Arab Emirates, and others where the informal sector dominates, such as Mali. This implies that some countries have initiated the development of a financial inclusion framework, while others are still lagging behind. Therefore, the choice of this region enabled a more comprehensive analysis of the effects of inclusion on financial stability. Thirdly, the selection of countries was also based on their experience with episodes of financial instability, which allowed us to examine the role of financial inclusion in either worsening or mitigating these episodes.

By including these criteria, we expected the sample to support a robust analysis.

3.2. Data and Variables

3.2.1. The Dependent Variable

The Z-score is recognized as one of the most widely used tools for measuring financial stability (Altman, 1968). It is an extension of the "Safety First" thinking developed by Roy (1952). This approach states that an expected return should not fall below a certain "disaster" level. Thus, minimizing the possibility of negative returns allows investors to have a portfolio that maximizes their future returns within a specific level of risk.

The Z-score is therefore a tool for measuring banking stability by assessing the individual banking risk. It also reflects the inverse of the probability of bank failure (Berger et al., 2008).

The Z-score for each bank is calculated using the following formula:

$$\text{Z-Score} = \frac{\text{ROA} + \left(\text{CAR} = \frac{\text{Equity}}{\text{Assets}}\right)}{\text{Standard deviation of ROA}} \quad (1)$$

To assess financial stability, several reports have adopted the Z-score, notably those published by the International Monetary Fund and the World Bank, which were consulted in December 2024. The higher the Z-score, the more stable the bank (Laeven & Levine, 2009).

In the financial literature, the use of the Z-score to measure banking stability goes back to Boyd and Runkle (1993). It has subsequently been widely used in empirical studies of financial stability, particularly to examine the link between financial inclusion and financial stability (Ahamed & Mallick, 2017; Amatus & Alireza, 2015; Morgan & Pontines, 2014; Olusegun et al., 2021; Čihák et al., 2016; Abdulkarim & Ali, 2019).

3.2.2. The Independent Variables

Because of its complexity, the phenomenon of financial inclusion has several dimensions that should be taken into account when measuring it (Chakravarty & Pal, 2013). According to the Global Partnership for Financial Inclusion, financial inclusion can be measured in three dimensions: (1) access to financial services, (2) use of financial services, and (3) quality of products and services (G20, 2012).

The first dimension (access) measures the ability to use financial services. According to the Global Findex database, this dimension is assessed by a number of indicators, including Account (% of people aged 15 and over) and Has a debit or credit card (% of people aged 15 and over).

The second dimension (usage) looks at individuals' use of financial services (Cámara & Tuesta, 2017). According to Global Findex data, there are several indicators of usage, including Borrowed from a formal financial institution (% of people aged 15 and over), Saved in a financial institution (% of people aged 15 and over), and Made or received a digital payment (% of people aged 15 and over).

The third dimension (quality of products and services provided) represents the extent to which financial products and services match customers' needs (World Bank, 2015). There are several indicators of quality, including the score on financial knowledge as well as the sources of emergency funding (G20, 2012).

Based on these dimensions, the independent variables used in this study were selected according to the fundamental aspects of financial inclusion, as defined by the World Bank and the Global Findex. More specifically, they assess the following:

- Access through the number of ATMs (FIN_ATM), the number of bank branches (BK_BRAN), ownership of a debit or credit card (DEB_CRE), and ownership of a bank account (FIN_ACC);
- Usage through digital payments (DIG_PAY), savings (FIN_SAV), and borrowing from financial institutions (FIN_BOR).

In addition, we included macroeconomic variables as control variables to account for the economic context. It should also be noted that these variables are commonly included in the literature addressing the relationship between financial inclusion and financial stability (Ahamed & Mallick, 2017; Sahay et al., 2015; Olusegun et al., 2021).

In addition to financial inclusion indicators, certain economic indicators help to ensure a favorable macroeconomic environment for a stable financial system. We therefore took into consideration the following macroeconomic variables:

- GDP growth
  According to Gadanecz and Jayaram (2008), GDP growth is one of the main indicators for measuring financial stability; it is an indicator of macroeconomic soundness. It is used to describe the real economy because it measures an economy's ability to create wealth. Several studies have analyzed the relationship between the stability of macroeconomic indicators and financial stability. For example, Próchniak and Wasiak (2016) showed that the higher the economic growth, the more stable the financial system.
- Inflation rate
  We introduced the inflation rate in order to take into account the role of monetary policy in maintaining financial stability. The literature highlights that financial instability is generally favored by an inflationary environment. The inflation rate is one of the key indicators of the economic sector. High inflation reflects a weak economic structure and a high level of debt. Such a situation automatically leads to monetary tightening (Gadanecz & Jayaram, 2008).
- Exchange rate
  Due to its importance in the financial system, a more volatile exchange rate decreases investor confidence and may cause an overreaction, leading to financial instability (Ishrakieh et al., 2020).
- The ratio of domestic credit granted by the banking sector as a percentage of GDP (Credit/GDP)
  To account for the credit effect, we introduced the ratio of domestic credit granted by the banking sector as a percentage of GDP. This ratio measures the contribution of banks to the indebtedness of each country. It represents an indicator for measuring stability. An excessively high level of credit threatens the stability of the financial sector as a whole. An increase in credit granted to the private sector relative to GDP leads to a higher probability of financial instability. The literature highlights the important role of excess credit in instability and shows that the latter represents the endogenous result of banks' behavior. Indeed, in periods of economic growth, the volume of credit granted increases. However, this growth can be harmful to financial stability because the volume of credit increases faster than that of GDP. As a result, a high credit-to-GDP ratio reflects excessive risk-taking by banks. The assessment of the vulnerability of the banking sector highlights the level of domestic credit as an indicator of vulnerability (Köhler, 2012).
- Broad money
  We introduced broad money to take into account the effect of monetary policy on financial stability. In this context, the study conducted by Aboulfadl (2014) demonstrated that an increase in the money supply can lead to financial instability. He explained this relationship by the fact that monetary expansion allows interest rates to decrease, thus stimulating investors' willingness to take high risks to maximize their returns, which generates fragility in the financial system. The same result was proven in the Global Financial Stability report published by the IMF in 2024, which shows that rapid growth in broad money is likely to lead to significant risks to financial stability.

Table 1 presents the dependent variable and independent variables.

Table 1. Formulas and descriptions of the variables.

Variables	Measure	Description
Dependent Variables		
Financial stability	Z-SCORE	ROA + CAR/SD of ROA
Independent Variables		
Account (% age 15+)	FIN_ACC	Access
Made or received a digital payment (% age 15+)	DIG_PAY	Usage
Saved at a financial institution (% age 15+)	FIN_SAV	Usage
Owns a debit or credit card (% age 15+)	DEB_CRE	Access
Borrowed from a formal financial institution (% age 15+)	FIN_BOR	Usage
Number of commercial bank branches per 100,000 adults	BK_BRAN	Access
Number of ATMS per 100,000 adults	FIN_ATM	Access
GDP growth	GDP	GDP growth (annual %)
Inflation	INF	Inflation (annual %)
Exchange rate	EXC	
Broad money (% of GDP)	BRM	
The ratio of domestic credits granted by the banking sector as a percentage of GDP	DCB	

FIN_ACC refers to the percentage of the population aged 15 and above who hold an account at a financial institution or with a mobile money service provider. DIG_PAY refers to the percentage of individuals aged 15+ who made or received digital payments. FIN_SAV represents the share of individuals aged 15+ who saved money at a financial institution. DEB_CRE indicates the percentage of the population aged 15+ who own a debit or credit card. FIN_BOR denotes the percentage of individuals aged 15+ who borrowed from a formal financial institution. BK_BRAN stands for the number of commercial bank branches per 100,000 adults. FIN_ATM indicates the number of ATMs per 100,000 adults. GDP corresponds to the annual GDP growth rate. INF represents the annual inflation rate. EXC refers to the official exchange rate. BRM is broad money expressed as a percentage of GDP. DCB denotes the ratio of domestic credit provided by the banking sector to GDP.

3.3. Methodology

We used a hierarchical multiple linear regression (MLR) for our analysis. The first step (Block 1) was carried out using the enter method, including the financial inclusion variables. The second step (Block 2) used the stepwise method, integrating the macroeconomic variables in order to illustrate the different modeling possibilities.

The hierarchical multiple regression (HMR) method was used because it allows the influence of independent variables on financial stability to be analyzed using a stepwise approach. This method ensures that the independent variables are introduced in several stages, making it possible to observe how the addition of new variables improves the explanatory power of the model while considering the changes in the R^2 at each stage (Field, 2018). The HMR method also aims to control the variables by introducing them according to a logical sequence (Petrocelli, 2003). However, a limitation of this method is its inability to correct for endogeneity problems (Cohen et al., 2003).

It is important to emphasize that we did not adopt the generalized method of moments or fixed-effects panel data models, as the data collected are cross-sectional rather than longitudinal (Arellano & Bond, 1991). Consequently, these models are not suitable for our study.

The variables presenting collinearity, with a variance inflation factor (VIF) greater than 10 (FIN_ACC and DCB), were excluded, and the MLR was rerun without those variables. The collinearity analysis was based on the variance inflation factor (VIF), and the results

showed that all the remaining variables had VIFs below 10, which indicates no critical multicollinearity according to Gujarati and Porter (2020). To avoid unpredictable variations in the model coefficients, the FIN_ACC and DCB variables were removed due to their high VIF values.

Although alternative methods, such as principal component analysis (PCA), exist for treating multicollinearity, they were not used in this study in order to preserve the economic interpretation of the results. The PCA method groups correlated variables into components, which makes it difficult to interpret the direct effect of the inclusion of variables on financial stability. Thus, since the remaining variables did not exhibit significant multicollinearity problems, it was considered advantageous to keep the explanatory variables unchanged to ensure robust results.

Regarding endogeneity concerns linked to potential reverse causality between inclusion and financial stability, this study was based primarily on the hypothesis of a relationship running from financial inclusion to financial stability. This assumption justified the use of hierarchical multiple regression. However, we acknowledge that endogeneity may represent a limitation of this study. To mitigate this issue, future research could introduce lagged variables or instrumental variables to reduce the potential bias arising from reverse causality.

Through Table 2, we **notice** that there are some observations with a **Z-score** too far from the mean. Indeed, the extreme values **affect** the **β** coefficients and are poorly predicted by the model, so they are associated with a significant residual value.

Table 2. Diagnosis of observations [a].

Observation Number	Error Residue	Z-Score	Prediction	Residue
23	3.163	55.6678	34.081561	21.5862390
24	3.030	55.5695	34.892137	20.6773634
27	3.014	55.9480	35.378438	20.5695621
28	3.133	56.1393	34.756023	21.3832771
29	3.193	55.9314	34.142839	21.7885614
30	3.123	55.0956	33.783657	21.3119430

Dependent variable: Z-score. SPSS (version 24). The "a" indicates that the results are based on the estimates of successive regression models.

In this case, by observing the diagnostics of the observations, we find that six individuals have Z-score values greater than 55.0956. They significantly deviate from the mean, with a standardized residual value of more than three standard deviations.

Note that these observations correspond to specific countries in the sample: 23, 24, 27, 28, 29, and 30. They represent six out of the eleven observations for Jordan. It would therefore be important to redo the analysis by excluding these values.

Table 3 summarizes the descriptive statistics of the regression model variables for 26 countries in the studied region during the period covering the years 2011, 2014, 2017, and 2021. This table allows us to obtain a sample of 280 after deleting observations 23, 24, 27, 28, 29, and 30.

Table 3. Descriptive statistics.

	Mean	Standard Deviation	N
Z-score	19.095673	9.3843932	280
DIG_PAY	0.362492	0.2258927	280
FIN_SAV	0.145214	0.1030331	280
DEB_CRE	0.255734	0.2309384	280
FIN_BOR	0.107100	0.0854966	280
BK_BRAN	8.226846	6.6681403	280
FIN_ATM	30.218960	40.6176744	280
GDP	3.685845	3.2196501	280
INF	14.865706	52.6365883	280
EXC	961.952168	2047.1950394	280
BRM	23.238189	25.6357821	280

SPSS (version 24).

For the independent variables, we note that the variable relating to the number of ATMs per 100,000 adults (FIN_ATM) has the highest mean value (30.218960), with a maximum value of 185.92 in Lebanon and a minimum value of 0.37 in Sierra Leone. The variable measured by the number of commercial bank branches per 100,000 adults (BK_BRAN) has a mean of 8.226846, with a maximum value of 25.0662 in Lebanon and a minimum value of 1.09 in Malawi. This shows that the studied countries have a relatively high number of ATMs and commercial bank branches.

As shown in Table 4, we can observe that the variable representing the number of bank branches (BK_BRAN) is positively correlated with financial stability (0.530). This demonstrates the stabilizing role of broad access to banking services: the greater the number of branches, the better the financial stability, indicating the key role of banking proximity.

Table 4. Correlations.

	Z-Score	DIG_PAY	fin_sav	deb_cre	fin_bor	bk_bran	fin_atm	GDP	inf	Exc	brm
Z-score	1	0.017	0.106 **	0.170 ***	0.104 **	0.530 ***	−0.008	−0.088 *	−0.065	−0.120 **	−0.409 ***
DIG_PAY		1	0.611 ***	0.797 ***	0.747 ***	0.223 ***	0.351 ***	−0.190 ***	−0.054	−0.288 ***	0.281 ***
fin_sav			1	0.656***	0.638 ***	0.505 ***	0.312 ***	−0.270 ***	0.093 *	−0.334 ***	0.202 ***
deb_cre				1	0.855 ***	0.468 ***	0.524 ***	−0.371 ***	0.028	−0.347 ***	0.134 **
fin_bor					1	0.391 ***	0.545 ***	−0.370 ***	−0.138 **	−0.257 ***	0.071
bk_bran						1	0.526 ***	−0.209 ***	−0.089 *	−0.284 ***	−0.039
fin_atm							1	−0.428 ***	−0.018	−0.171 ***	−0.035
gdp								1	−0.085 *	0.176 ***	0.263 ***
inf									1	−0.014	0.008
exc										1	−0.008
brm											1

SPSS (version 24), N = 280 for all the variables. * Significant, ** Strongly significant, *** Very significant.

In addition, we observe that the relationship between FIN_ATM (ATMs) and the Z-score is weak and negative (−0.008).

The variable representing debit or credit card ownership (DEB_CRE) is weakly and positively correlated with financial stability (Z-Score. This means that increased card ownership is slightly related to better financial stability.

Furthermore, the variable relating to the use of digital payments (DIG_PAY) is weakly and positively correlated (0.017) with financial stability, which could be linked to the level of digital development. This might indicate the limited adoption of digital payments.

Regarding the savings variable (FIN_SAV), it is weakly but positively correlated with the Z-score variable (0.106), meaning that increased savings contribute slightly to financial stability.

As for the variable FIN_BOR, which represents borrowing from a financial institution, it is positively but weakly correlated (0.104), suggesting that an increase in borrowing is slightly correlated with better financial stability.

Regarding the macroeconomic variables, GDP growth is negatively and weakly correlated with the Z-score (−0.088); similarly, inflation is negatively and weakly correlated with the Z-score (−0.065).

For the exchange rate (EXC), it is also weakly and negatively correlated with the Z-score (−0.120). Exchange rate volatility could slightly affect financial stability.

The money supply, represented by the variable (BRM), is negatively correlated with the Z-score (−0.409). This means that an increase in the money supply is associated with lower financial stability.

Among the variables, we note a strong positive correlation between digital payments (DIG_PAY) and debit/credit card ownership (DEB_CRE) (0.797), demonstrating a strong link between these two aspects of financial usage. This suggests that these two forms of financial access are complementary.

We also note a positive correlation (0.611) between DIG_PAY (digital payments) and FIN_SAV (savings in a financial institution). This can be explained by the fact that people who make digital payments also tend to save in financial institutions, reflecting an increased use of formal financial services.

A strong correlation is observed between FIN_SAV (savings) and borrowing from financial institutions (FIN_BOR) (0.638), indicating that individuals who save are also more likely to borrow. This suggests active participation in the formal financial system.

A positive relationship is observed between BK_BRAN (bank branches) and FIN_ATM (automated teller machines) (0.526), indicating that a dense network of bank branches is associated with a greater number of ATMs.

Furthermore, the table shows a negative relationship (−0.371) between economic growth (GDP) and debit/credit card ownership (DEB_CRE), suggesting a lower reliance on debit/credit cards in more advanced economies.

We also note a negative relationship (−0.209) between economic growth (GDP) and the number of bank branches (BK_BRAN), indicating a tendency to reduce the number of bank branches in rapidly growing economies (digitalization effect).

Finally, the table shows a negative relationship (−0.428) between FIN_ATM (ATMs) and GDP, suggesting that a higher number of ATMs is negatively correlated with lower economic growth. This could reflect reverse causality.

The Table 5 shows a correlation coefficient of 0.774, reflecting a positive correlation between the dependent variable and the independent variables, with a coefficient of determination (R-squared) of 0.599, indicating that 59.9% of the variation in the Z-score is explained by the model.

Table 5. Model summary [c].

Model	R	R^2	R^2 Adjusted	Standard Error	Change Statistics					Durbin–Watson
					Variation of R^2	Variation of F	ddl1	ddl2	Sig. Variation of F	
1	0.675 [a]	0.456	0.444	6.9961150	0.456	38.166	6	273	0.000	0.491
2	0.774 [b]	0.599	0.588	6.0209399	0.143	96.594	1	272	0.000	

Model 1 includes the independent variables FIN_ATM, FIN_SAV, DIG_PAY, BK_BRAN, FIN_BOR et DEB_CRE. Model 2 adds the variable BRM to test its additional impact. The "a" indicates that the results are based on the estimates of successive regression models. The "b" indicates the predictors, "c" indicates that Model 2 builds on Model 1 by adding an additional variable. Predicted values: (constants), FIN_ATM, FIN_SAV, DIG_PAY, BK_BRAN, FIN_BOR et DEB_CRE. Predicted values: (constants), FIN_ATM, FIN_SAV, DIG_PAY, BK_BRAN, FIN_BOR et DEB_CRE, BRM. Dependent variable: Z-score. SPSS (version 24).

Table 6 is used to assess the quality of the regression model. This table shows an F-value of 57.968 and a p-value < 0.001, allowing us to conclude that the model is statistically significant.

Table 6. ANOVA [a].

Model		Sum of Squares	ddl	Mean Squares	F	Sig.
1	Regression	11,208.492	6	1868.082	38.166	0.000 [b]
	Residue	13,362.155	273	48.946		
	Total	24,570.647	279			
2	Regression	14,710.180	7	2101.454	57.968	0.000 [c]
	Residue	9860.467	272	36.252		
	Total	24,570.647	279			

Dependent variable: Z-score. The "a" indicates that the results are based on the estimates of successive regression models. Predicted values: (constants), FIN_ATM, FIN_SAV, DIG_PAY, BK_BRAN, FIN_BOR, DEB_CRE. The "b" indicates the predictors. Predicted values: (constants), FIN_ATM, FIN_SAV, DIG_PAY, BK_BRAN, FIN_BOR, DEB_CRE, BRM. SPSS (Version 24). Model 1 includes the independent variables FIN_ATM, FIN_SAV, DIG_PAY, BK_BRAN, FIN_BOR, and DEB_CRE. Model 2 adds the variable BRM to test its additional impact on the dependent variable Z-score. The "c" indicates that Model 2 builds on Model 1 by adding an additional variable.

Table 7 provides insight into the impact of each independent variable on the dependent variable, which is the Z-score. Thus, the regression equation is as follows:

$$\text{Z-score} = 16{,}092 + 6940\ \text{DIG\_PAY} - 24{,}294\ \text{FIN\_SAV} + 1135\ \text{BK\_BRAN} - 0.117\ \text{FIN\_ATM} - 0.149\ \text{BRM}. \quad (2)$$

Table 7. Coefficients [a].

Model		Non-Standardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Intervals of Confidence		Collinearity Statistics	
		A	Standard Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constante)	14.303	0.957		14.940	0.000	12.418	16.188		
	DIG_PAY	−0.558	3.400	−0.013	−0.164	0.870	−7.251	6.135	0.297	3.362
	FIN_SAV	−32.094	6.164	−0.352	−5.207	0.000	−44.228	−19.959	0.435	2.299
	DEB_CRE	5.694	4.262	0.140	1.336	0.183	−2.697	14.086	0.181	5.523
	FIN_BOR	17.702	10.239	0.161	1.729	0.085	−2.456	37.861	0.229	4.369
	BK_BRAN	1.191	0.088	0.846	13.592	0.000	1.018	1.363	0.514	1.946
	FIN_ATM	−0.116	0.014	−0.500	−8.323	0.000	−0.143	−0.088	0.551	1.814
2	(Constante)	16.092	0.844		19.071	0.000	14.431	17.754		
	DIG_PAY	**6.940**	3.024	0.167	2.295	0.022	0.988	12.893	0.279	3.590
	FIN_SAV	**−24.294**	**5.364**	−0.267	−4.529	0.000	−34.853	−13.734	0.425	2.350
	DEB_CRE	5.306	3.668	0.131	1.446	0.149	−1.917	12.528	0.181	5.524
	FIN_BOR	3.073	8.937	0.028	0.344	0.731	−14.522	20.667	0.223	4.493
	BK_BRAN	**1.135**	**0.076**	0.807	15.011	0.000	0.986	1.284	0.511	1.957
	FIN_ATM	**−0.117**	**0.012**	−0.507	−9.790	0.000	−0.141	−0.093	0.551	1.814
	BRM	**−0.149**	**0.015**	−0.408	−9.828	0.000	−0.179	−0.119	0.856	1.169

Dependent variable: Z-score. The bolded values indicate coefficients that are statistically significant at the 5% level ($p < 0.05$). SPSS (version 24). The "a" indicates that the results are based on the estimates of successive regression models.

4. Discussion

The results obtained from the coefficient table show that five variables significantly impact financial stability.

Indeed, the negative impact between savings and financial stability is explained by previous empirical studies that consider that excessive savings not directed toward productive projects lead to systemic risks (Olusegun et al., 2021; Amatus & Alireza, 2015). Similarly, studies by Mian et al. (2017) and Martin and Ventura (2018) show the role of an expansion of household savings in the creation of speculative bubbles in financial markets.

The variable measuring digital payments (DIG_PAY) is positively associated with financial stability. When the level of digital payments increases by one unit, the Z-score increases by 6.940 units. This result leads to the rejection of the second hypothesis (H2).

This result appears to contrast with previous empirical studies, which can be explained by the fact that those studies mainly focused on financial systems characterized by less developed digital infrastructures, which involved risks to financial stability. This is not the case today, thanks to the development of protection strategies against digital risks. Furthermore, our results are consistent with the role that digital payments can play in limiting the informal economy by formalizing transactions, allowing the detection of unauthorized activities, and strengthening the monitoring of financial transactions. This encourages households to deposit their funds, which increases the liquidity of banking institutions and diversifies the sources of finance.

This finding can also be explained by the gradual adoption of digitalization in the financial sector in the studied region. Moreover, it may be attributed to the facilitating role of electronic payments in banking operations, making transactions easier and more transparent. In addition, electronic payments improve liquidity management, which helps reduce the financial instability risks, as highlighted by the Bank for International Settlements. This result contradicts the findings of Olusegun et al. (2021).

The coefficient table shows that the variable FIN_SAV, which measures savings in a financial institution, is negatively associated with financial stability (−24.294). This result confirms the third hypothesis (H3). The negative link between savings and financial stability can be explained by the fact that savings represent a financial behavior that limits consumption and investment, potentially leading to speculative operations, which reduce demand and promote financial instability. This result aligns with the findings of Olusegun et al. (2021) and Amatus and Alireza (2015).

Additionally, the coefficient table shows a positive effect (1.135) between the number of bank branches (BK_BRAN) and financial stability. For every one-unit increase in the number of bank branches per 100,000 adults, financial stability improves by, on average, 1.135 units. This positive relationship can be explained by risk diversification when there are numerous bank branches, resulting in higher competition among banks, which strengthens depositors' confidence and consequently promotes financial stability. This highlights the importance of a strong banking infrastructure in maintaining financial stability. This result confirms the sixth hypothesis (H6) and is consistent with the findings of Olusegun et al. (2021) and Amatus and Alireza (2015).

Regarding the impact of the number of ATMs, the variable FIN_ATM is negatively associated with financial stability (−0.117). This indicates that an increase in ATMs appears to harm financial stability. This result leads to the rejection of the seventh hypothesis (H7). A possible explanation is the increased need for liquidity to meet depositors' demands, which could lead to massive withdrawals, thereby weakening financial stability. This result aligns with the concept of bank liquidity, as massive withdrawals through ATMs can quickly expose banks to liquidity risk, thereby increasing financial risks. Moreover, the expansion of ATM networks can lead to risks related to fraud and security attacks, which may undermine depositors' confidence in banks, thereby jeopardizing the stability of financial systems. This result contradicts the findings of Neaime and Gaysset (2018) and Abdulkarim and Ali (2019).

With regard to the macroeconomic variables, the money supply, represented by the variable BRM, is negatively associated with financial stability (−0.149). This result confirms the eleventh hypothesis (H11). It can be explained by the negative effects of an excessive circulation of money in the studied economies. This expansion can cause inflation, which encourages risk-taking and, consequently, triggers economic and financial crises. This result aligns with the findings of Aboulfadl (2014).

Contrary to the empirical studies, our results demonstrate that there is no significant effect between the Z-score and the following variables: the number of bank accounts,

possession of a credit or debit card, and borrowing from a formal financial institution. This leads to the rejection of the first, fourth, and fifth hypotheses (H1, H4, and H5).

Contrary to the findings of Olusegun et al. (2021) and Abdelkhalek Ganna et al. (2024), our study demonstrates that no relationship was detected between the number of bank accounts and financial stability. This result can be explained by the fact that merely owning a bank account does not necessarily lead to its active use. Accounts may remain underutilized or inactive due to poor banking service quality or insufficient financial knowledge among account holders. This result highlights the importance of active financial inclusion that encourages the effective use of financial services. The absence of a significant link between having a bank account and financial stability shows that simply opening an account does not enable financial inclusion to impact financial stability, as it may not be effectively utilized.

Moreover, the absence of a significant relationship between credit/debit card ownership and financial stability could be due to the fact that cards are often used for small transactions, limiting their impact on financial stability. It turned out that there is no significant link between credit card ownership and financial stability. This result can be explained by the fact that credit cards are mainly used for day-to-day transactions rather than large-scale operations such as investments, which does not reflect the impact of this variable on financial stability. Moreover, credit card transactions are not recorded on the balance sheet of the financial institution, which reduces their effect on financial stability.

Furthermore, unlike previous studies, our study finds no impact of borrowing from a formal financial institution on financial stability. This result may reflect the role of adequate regulations in loan granting, which limits their effects on financial stability. The absence of a significant effect between borrowing and financial stability can be explained by the fact that banks rigorously assess borrowers' creditworthiness. This role of regulation, along with the appropriate mechanisms in place for granting loans, helps minimize the impact on the risk of financial instability. Moreover, the diversification of banks' portfolios, as well as prudent banking practices such as credit supervision, ensures that borrowing does not have a significant influence on financial stability.

Regarding the macroeconomic variables, the analysis shows that there is no significant relationship between GDP growth, inflation, and financial stability. This result may stem from differences in the financial structures of the countries studied, which create disparities in the macroeconomic impacts and make it difficult to identify a relationship between these variables and financial stability. It is also possible that some omitted variables, such as governance indicators, may explain these results, as they could influence the outcomes.

Additionally, the absence of significant effects of the macroeconomic variables on financial stability suggests that the relationship between financial inclusion and financial stability is primarily explained by the microeconomic variables, which play a more significant role than the macroeconomic factors. This indicates that internal financial mechanisms have a stronger influence on financial stability.

5. Conclusions and Recommendations

This study empirically analyzed the role of financial inclusion in financial stability across 26 countries using the hierarchical multiple linear regression (MLR) method over the years 2011, 2014, 2017, and 2021.

Financial stability was measured using the Z-score, while financial inclusion was represented by several independent variables capturing two main dimensions: access to financial services and use of financial services.

The results demonstrate that the relationship between financial inclusion and financial stability is explained by several variables.

Regarding the variables related to access to financial services, the number of commercial bank branches per 100,000 adults (BK_BRAN) has a positive impact on financial stability, whereas the number of ATMs per 100,000 adults (FIN_ATM) is negatively associated with financial stability.

As for the variables related to the use of financial services, digital payments (DIG_PAY) are positively associated with financial stability, while savings (FIN_SAV) are negatively associated with it.

However, no significant effect was found between most macroeconomic variables and financial stability, with the exception of the money supply variable, which is negatively related to financial stability.

These findings show that financial inclusion is significantly associated with financial stability—positively through digital payments and the number of bank branches, and negatively through savings, the number of ATMs, and the money supply.

It is therefore recommended to promote the use of electronic payments in the study area by increasing public knowledge and awareness of the advantages of technological tools. Regulators must ensure the implementation of digital and financial literacy programs to help the population understand both the benefits and the risks of digital payments. This can be achieved through awareness-raising initiatives.

Furthermore, to ensure trust in electronic financial operations, it is recommended to strengthen infrastructure security through the implementation of audit and security standards in order to attract more users.

Additionally, increasing the number of bank branches in the study area is suggested. Governments should further reinforce their banking infrastructure to develop financial services, particularly in less developed areas.

With regard to savings, it is recommended to promote and encourage the financing of small and medium-sized enterprises (SMEs) to reduce excess savings and redirect funds toward productive projects.

Moreover, the negative relationship between the number of ATMs and financial stability implies that controlling ATM expansion is essential for better management of potential liquidity risks.

Finally, the negative impact of the money supply on financial stability highlights the importance of monetary control policies in regulating inflation.

One of the main limitations of this study is the use of cross-sectional data, which do not allow for the examination of the long-term causal effects between financial inclusion and financial stability. Moreover, our results show that the effect of the macroeconomic variables on financial stability is not significant due to the heterogeneity of the economies studied, which may obscure any indirect relationships between these variables and financial stability.

Therefore, future research should adopt panel data and methodologies such as the generalized method of moments (GMM) to identify the causal relationships between the variables. Furthermore, it would be relevant for future studies to introduce variables measuring the quality of financial services and to account for the specific effects of each country's economy by using fixed- or random-effects models in order to develop country-specific recommendations.

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