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The impact of digital finance and financial inclusion on banking stability: International evidence

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Keywords: *banking stability; digital finance; financial inclusion; quantile regression; sustainable finance; transmission channel*

Abstract

Research background: Achieving a jointly stable and inclusive financial system represents an important pillar of the call for action among Sustainable Development Goals. Considerable attention from previous research has been given to traditional financial inclusion (FI) and its implications on financial stability and overall development, but the findings are mixed. Furthermore, there is limited evidence related to the implications of digital financial inclusion on banking system stability. Therefore, the present study tends to address two main research questions, as follows: Can traditional financial inclusion protect banking stability? Can digital finance inclusion become a new driving force to promote banking stability?

Purpose of the article: The paper aims to assess the influence of both traditional and digital financial inclusiveness on banking stability, using quantile regression, across a panel of 81 countries. We also examine the potential transmission channels through which financial inclusiveness influences banking stability.
Methods: We construct three different financial inclusion indices, which capture the degree of access and usage of financial services, based on a three-stage Principal Component Analysis. Next, based on quantile analysis, we test the role of these financial inclusion indices in shaping banking stability.
Findings & value added: We provide international evidence on the non-linear relationship between traditional and digital FI and banking stability, respectively. Our empirical findings suggest that FI indices are negatively related to banking stability until a certain threshold, after which, increases in financial inclusiveness have a positive effect on banking stability. The magnitude of the impact is more sizeable for low-range quantiles, meaning that the effect of digital inclusiveness is more pronounced in countries with excessive risk-taking tendencies. We find support for operational efficiency transmission channels and uncover new evidence on the association between digital FI and banking stability.

Introduction

The COVID-19 pandemic has demonstrated the utility and importance of technology in the financial services industry (Xia *et al.*, 2022). Moreover, according to the Sustainable Development Goals Report for 2022, higher-technology industries recovered faster compared to lower-tech industries (United Nations, 2022). Digital finance enhances corporate resilience (Xia *et al.*, 2022), can significantly reduce corporate financial risk (Dai & Zhang, 2022), and could promote household consumption (Li *et al.*, 2020), being recognized as a pathway for economic recovery and growth (Sun & Tang, 2022; Liu *et al.*, 2022). Inclusive finance, via digital financial technologies, can promote the diversification of deposit and loan portfolios, can contribute to the reduction of cost, and can increase the market share (Banna *et al.*, 2021; Vo *et al.*, 2021; Waliszewski *et al.*, 2023). These benefits are more pronounced in countries with a stronger institutional environment (Banna *et al.*, 2021) and require investments in digital infrastructure. On the other hand, banking stability (BS) represents an important driver of sustainable economic development (Jayakumar *et al.*, 2018; Ijaz *et al.*, 2020; Stewart *et al.*, 2021). On the road to achieving the 2030 Agenda, creating a globally sustainable economy will require a stable banking system. Considerable attention from previous research has been given to traditional financial inclusion (FI) and its implications on financial stability and overall development, but the findings are mixed. The dominating empirical perspective is a positive impact of FI on banking stability (among others, Hakimi *et al.*,

2021; Nguyen & Du 2022; Wang & Luo; 2022; Malik *et al.*, 2022), while some studies provide an opposite view (Damrah *et al.*, 2023; Isayev, 2024) or a non-linear approach (Dang & Thi, 2022). Furthermore, there is limited evidence related to the implications of digital FI on banking system stability. A few papers focused on evaluating the link between digital inclusiveness and banking stability (Banna *et al.*, 2020; Danisman & Tarazi, 2020; Banna & Alam, 2021a; Banna & Alam, 2021b; Sodokin *et al.*, 2022; Chinoda & Kapingura, 2023). The analysis is performed on different samples of countries, like European Union countries (Danisman & Tarazi, 2020), Sub-Saharan Africa (Sodokin *et al.*, 2022; Chinoda & Kapingura, 2023) or emerging Asia (Banna & Alam, 2021a; Banna & Alam, 2021b), using, in most of the cases, dynamic panel data estimations-generalized method of moments (GMM). Our objective is to enhance understanding by presenting evidence derived from a larger sample of countries, thereby offering a more comprehensive perspective. Unlike previous studies, this paper deploys a quantile approach to assess the impact of FI on banking stability at different conditional distributions (quantiles) of banking soundness, taking into account recent evidence that less stable banking systems are more exposed to financial inclusion challenges (Isayev, 2024). Therefore, the present study tends to address two main research questions, as follows: Can traditional financial inclusion protect banking stability? Can digital finance inclusion become a new driving force to promote banking stability?

We extend the literature by investigating the impact of both traditional and digital financial inclusion on banking stability, using quantile regression, across a sample of 81 countries (see the list in the Appendix). We hypothesize a non-linear relationship between both types of FI and banking soundness due to the different ways that financial inclusion can influence banking stability. Financial inclusion, defined as greater access to deposits and savings for individuals and businesses, supports banking stability (Han & Melecky, 2013; Feghali *et al.*, 2021). Also, a more diversified lending portfolio can help spread the risks (Yang & Masron, 2024). Here, the major problem could be expanding credit access, without proper supervision and, in this case, inclusion can exert a negative influence on banking stability (Cihak *et al.*, 2016; Feghali *et al.*, 2021; Isayev, 2024), due to asymmetric information and moral hazard issues (Dang & Thi, 2022). Moreover, financial inclusion is expected to promote economic well-being (Feghali *et al.*, 2021) and sustainable economic development is well-recognized as a prerequisite for financial stability (Ozili & Iorember, 2023). Looking at both sides of the

argument, we find support for this view by testing the effect of different FI indices, constructed based on Principal Component Analysis (PCA), by considering both access and usage dimensions of financial services. Looking at the undeniable significance and the future of technology in the financial services industry, a digital financial inclusion index has been developed. Afterwards, the measure of digital FI is combined with the traditional variables of FI and integrated into a comprehensive indicator of FI.

Traditional financial inclusiveness refers to financial services primarily provided by banks to individuals and firms. Regarding banking service penetration in our sample of countries, in 2021, for every 100,000 adults correspond, on average, 17.61 banks and 55.99 ATMs. The usage of services provided by financial institutions registered a significant improvement over the last few years. The share of adults with financial institution accounts increased, on average, from 63% in 2014 to 73% in 2021, while the percentage of individuals who own a debit card increased from 50% to 57% in the same period. The share of adults who make utility payments using a financial institution account also shows an increase from 24% in 2014 to 36% in 2021.

Digital financial inclusion, in both dimensions of access and usage of financial services, focuses on the financial services offered by fintech firms and financial institutions, via the Internet or mobile banking (Khera *et al.*, 2022). The development of technology led to a significant improvement in mobile subscriptions from 54% in 2014 to 94.8% in 2021, on average. The percentage of households with internet access at home also shows a jump from 53.6% in 2014 to 76.5% in 2021. Figures on the usage of digital payments show that, on average, 70% of adults from our sample countries initiated financial transactions based on mobile phones or the Internet in 2021, compared to only 55% in 2014.

The following reasons motivate the relevance of the study. Firstly, the focus of the previous research has been mostly on traditional financial inclusiveness and financial stability, although the recent evidence seems to be inconclusive (Wang & Luo, 2022). Secondly, the undeniable importance and the perspectives of digital financial inclusiveness motivate our research to understand the connection with banking stability. Therefore, the topic is highly important in light of the objectives of the 2030 Agenda.

Our paper contributes to the literature in four ways. Firstly, we advance the knowledge of financial inclusion and banking stability and uncover new evidence on the interaction between digital FI and banking stability.

Secondly, we use unique measures of financial inclusion. Following the methodology proposed by Khera *et al.* (2022), we construct three FI indices, which capture the degree of access and usage of financial services. A three-stage PCA has been employed. In the first stage, the access and utilization sub-indices have been calculated. In the next stage, we have estimated the indices for traditional and digital FI, based on the access and utilization sub-measures from the previous step, as explanatory variables. The third stage estimates a comprehensive financial inclusion index (FII), based on the two indices calculated in stage two, as explanatory variables. Next, based on quantile analysis, we test the influence of these FI indices on BS. Thirdly, we provide international evidence on the non-linear connection between traditional and digital FI and banking stability, respectively. Our empirical findings suggest that financial inclusiveness indices are negatively related to banking stability until a certain threshold, after which, higher financial inclusiveness has a positive effect on stability. The results converge to the idea that financial inclusion development (both traditional and digital) increases banking stability (Banna & Alam, 2021b; Wang & Luo, 2022). For example, above the threshold, an improvement of 1% in the Digital Financial Inclusion Index is related to a 38.27% increase in Z-score for low quantiles at a 5% significance level. The magnitude of the impact is more sizeable for low-range quantiles, meaning that the effect of digital inclusiveness is more pronounced in countries with excessive risk-taking tendencies. The findings show that the effects of FI indices are not uniform across the quantiles of the BS, highlighting the advantages of the quantile regression approach over the dynamic panel estimations. We consider that our empirical findings, based on a panel of 81 countries and taking advantage of recent data available for financial inclusion (Global Findex database), entrenched the value-addition of this paper. Fourthly, we investigate the possible transmission channels through which FI influence bank stability.

The remainder of the paper is organized as follows. Section 2 presents the theoretical background and hypotheses development based on the review of the academic literature. Section 3 describes the data and the methodology employed in the paper. Section 4 presents and discusses the empirical results. Lastly, Section 5 brings the main conclusions and highlights the implications of our findings for policymakers and academics.

Literature review

There are two strands in the literature devoted to the linkages between FI and bank stability. The first strand analyzed the role of traditional FI on banking stability (Hannig & Jansen, 2010; Neaime & Gaysset, 2018; Feghali *et al.*, 2021; Dang & Thi, 2022; Ghosh, 2022; Nguyen & Du, 2022; Wang & Luo, 2022; Malik *et al.*, 2022). The second strand takes into account the recent development in the financial sector and focuses on the impact of digital FI on banking stability (Ahamed & Mallick, 2019; Banna *et al.*, 2020; Danisman & Tarazi, 2020; Banna & Alam, 2021a; Banna & Alam, 2021b; Sodokin *et al.*, 2022; Chinoda & Kapingura, 2023).

Previous research has focused on the impact of traditional FI on the stability of the banking system, focusing on accessibility, availability, and usage of the formal bank system in terms of borrowing, savings or payment accounts. The empirical results are rather mixed.

Financial inclusion can improve financial stability through three channels: the diversification of risks, cost reduction and market power by extending the pool of customers (Morgan & Pontines, 2014; Banna *et al.*, 2021); the decrease in the pro-cyclical exposure of banks by increasing the number of small savers (Hannig & Jansen, 2010) and, respectively, via absorption of inclusion-induced monetary shocks (Ahamed & Mallick, 2019; Danisman & Tarazi, 2020).

Nguyen and Du (2022) document a positive relationship between financial inclusion with bank Z-score for ASEAN countries. A positive association between FI and banking stability has been also found by Ghosh (2022) for a sample of 1,495 banks across 116 countries. Wang and Luo (2022) examined the impact of financial inclusion on bank stability in 36 emerging economies and found a positive nexus, influenced by macro environment factors, such as business cycle, financial circumstances, governmental strength, and policy environment. The authors identify three channels that work for bank soundness: effectiveness of business operations, risk management, and financial resources steadiness. Feghali *et al.* (2021) show that increased access to savings and payment accounts can have a neutral or a positive effect on banking stability. Employing a sample of 3,071 Asian banks, Vo *et al.* (2021) found a positive relationship between traditional FI and banking stability and showed that FI can support banks to increase revenue, curtail costs, and extend their market share. The same positive

connection between FI and bank stability is found by Alvi *et al.* (2021) for the South Asian region.

The above-mentioned evidence generally describes the positive influence of FI on banking stability by increasing the customer's deposit base, therefore reducing the dependence of domestic banks on external financing. Marcelin *et al.* (2022) show better outcomes of Z-scores attributable to inclusion-based deposits, due to cheap funding sources. On this background, businesses have access to finance, transforming domestic savings into investments. The view generally shared indicates that enlarged access to saving products can protect financial stability. The authors acknowledge, however, that adverse implications of FI are possible, if the deponents massively withdraw savings, in bad times. As observed in the literature review on traditional FI, the common empirical approach is to test the implications of financial inclusion indicators, either accessibility or usage, on Z-score outcomes, deploying the GMM methodology. Recent studies also document the role of moderating variables on the nexus between FI and BS, such as bank competition (Feghali *et al.*, 2021), information sharing (Marcelin *et al.*, 2022) or shadow banking (Isayev, 2024).

Financial inclusion can harm financial stability, due to the provision of loans to a riskier pool of borrowers (Cihak *et al.*, 2016), which could worsen the quality of loan portfolios (De la Torre *et al.*, 2013). Also, Feghali *et al.* (2021) highlight that financial inclusion can be linked with higher financial instability. Isayev (2024) documents the negative impact of FI on BS, taking into account the moderating role of shadow banking. In sum, the main idea embraced by these studies is the fact that higher levels of FI, adversely influence BS by increasing credit volumes and the share of non-performing loans, due to capturing previously unbanked, over-indebtedness or vulnerable segments.

There is also a recent paper by Dang and Thi (2022) that shows a non-linear influence of FI on banking stability for ASEAN countries. The authors find that above a certain level of FI, stability increases, while financial inclusion below the threshold will negatively influence stability.

The findings regarding the impact of financial inclusion on banking system stability are mixed but in favour of the positive influence of financial inclusiveness on banking soundness. Derived from previous evidence, we assess the following hypothesis:

H_1: There is a non-linear relationship between traditional financial inclusion and banking stability.

Regarding the second stream of research, there are only a few studies that investigate the nexus between digital FI and banking stability. As explained by Danisman and Tarazi (2020), policy designs targeting FI are relatively novel and much remains to be done to understand their long-run implications. Using a large sample of 4,168 European banks over the 2010–2017 period, Danisman and Tarazi (2020) highlight that financial inclusion has a stabilizing effect on the European banking system. Banna and Alam (2021a) documented a positive impact of digital FI on banking stability in the case of ASEAN countries. The same authors also highlight that digital FI enhances banking stability for a sample of 574 banks from the emerging Asian community (Banna & Alam, 2021b). Sodokin *et al.* (2022) highlight that the effects of digital transformation on FI are more pronounced in the banking stability background. A positive relationship between digital financial inclusion and bank stability is also documented by Chinoda and Kapingura (2023) in the case of Sub-Saharan Africa and also by Banna *et al.* (2020) for Islamic banks. These representative studies highlight the opportunities of digital FI for banking stability: higher access to risk-related data, therefore reducing credit risk and information asymmetry. Also, digital inclusiveness is expected to contribute to banking stability via improved quality internal controls (Andronie *et al.*, 2023) and audit functions (Khattak *et al.*, 2023).

On the other hand, the embrace of digital technologies spurs competition and market efficiency, but, at the same time, generates new systemic risks to financial stability such as operational risks (Shkodina *et al.*, 2019). There is recent evidence of the negative impact of digital transformation on bank stability (Khattak *et al.*, 2023), due to excessive spending on technology to capture extra market share. The authors show that, as banks are more diversified in terms of services and products, longer time spent to ensure digital inclusiveness lowers their stability. Despite the view generally shared that digital inclusiveness may favour risk reduction (Ruan & Jiang, 2024), it may take a time lag for the benefits to enhance banking stability. As highlighted by the literature review, this stream of research is new and there is much to be done on whether more digital FI enhances stability in the financial system. We try to fill in this gap and, motivated by these findings in the literature, we formulate the second hypothesis as below:

H_2: There is a non-linear nexus between digital financial inclusion and banking stability.

To the best of the authors' knowledge, there is no study on the combined effect of financial inclusion on banking stability. Considering a comprehensive measure of inclusiveness, both traditional and digital, and based on the evidence from the literature reviewed, we advance the third research hypothesis as follows:

H_3: There is a non-linear relationship between comprehensive financial inclusion and banking stability.

Research methods

Variables and data source

There is no formal consensus on the measures of financial inclusion. Regarding traditional financial inclusion, previous studies propose several indicators capturing various features of FI, such as accessibility, penetration, and use of banking services (Hannig & Jansen, 2010; Han & Melecky, 2013; Neaime & Gaysset, 2018; Feghali *et al.*, 2021). Due to the disadvantages of individual indicators used to evaluate the coverage of financial inclusion, more recent studies propose a comprehensive indicator constructed on different variables to measure the access and the usage of banking products and services by individuals and firms (Ahamed & Mallick, 2019; Vo *et al.*, 2021; Wang & Luo, 2022). The common techniques used for index construction are PCA and common factor analysis. For digital financial inclusion, the empirical work presents several variables for both the availability side (ATMs and, respectively, mobile money agent outlets reported to 100,000 adults and per 1,000 km^2 (Banna & Alam, 2021b)) and, respectively, demand side (mobile money accounts registered for 1,000 adults and the number of online banking operations per 1,000 adults (Banna & Alam, 2021b)). Other variables used as a proxy for digital financial inclusion are the percentage of adults who have a financial account or make use of e-money transactions during the previous year and, respectively, the percentage of adults who initiated or received a payment using e-money, cards, or internet (Danisman & Tarazi, 2020).

Following the methodology proposed by Khera *et al.* (2022), we construct three FI indices, which capture the degree of access and usage of financial services for each country. A three-stage PCA has been employed. In the first stage, the access and utilization sub-measures have been calculated. The second stage estimates the indices for traditional and digital FI, based on the access and utilization features from stage one, as explanatory variables. The third step estimates a comprehensive index of FI, based on the two indices calculated in stage two, as explanatory variables. In line with previous studies (Khera *et al.*, 2022; Wang & Luo, 2022; Dang & Thi, 2022), the index values are normalized between 0 (minimum value) and 1 (maximum value) for all countries in the sample within each category, as follows:

$$X_{normalised} = \frac{X - X_{min}}{X_{max} - X_{min}} \quad (1)$$

where X_{min} and X_{max} represent the lowest and the highest values, respectively.

The FI indices approach proposed by Khera *et al.* (2022) has been subsequently employed in other studies (among others, Wu, 2023; Li *et al.*, 2024). Wu (2023) and Li *et al.* (2024) follow the same calculation approach to construct a digital FI index, as outlined in the paper by Khera *et al.* (2022).

In line with previous studies (Banna & Alam, 2021b; Khera *et al.*, 2022), the data for cross-country analysis is retrieved from the World Bank's Global Financial Inclusion Database, IMF Financial Access Survey and International Telecommunication Union (ITU) database, respectively. The indices cover 81 developed and developing economies, across the world, for which the variables related to financial inclusion are available. Given the availability of Global Findex survey data, the indices are estimated for the years 2014, 2017, and 2021. We have excluded 2011, since the variables related to digital inclusiveness have missing observations. Table 1 presents the variables employed in PCA for indices construction and their data sources.

As the dependent variable, we use Z-score in the estimation models, an indicator generally recognized as the primary indicator for bank stability (Kocisova *et al.*, 2018; Ahamed & Mallick, 2019; Vo *et al.*, 2021; Wang & Luo, 2022; Isayev, 2024). The Z-score highlights the probability of default for the banking system, with a higher value indicating greater soundness. It is calculated by the following well-known formula:

$$Z_{i,t} = \frac{ROA_{i,t} + (Equity/Assets_{i,t})}{Sd(ROA)_{i,t}} \quad (2)$$

where ROA stands for return on assets ratio, while Sd(ROA) represents its standard deviation. According to previous studies (Danisman & Tarazi, 2020), a natural logarithm transformation of the Z-score is used to account for its highly skewed characteristic.

Consistent with the common practice of previous literature, as control variables, we account for several bank characteristics which are recognized as determinants of bank soundness. Bank concentration is employed to control for market structure, with a higher score highlighting efficient market power (Wang & Luo, 2022; Li *et al.*, 2023). Bank concentration represents the assets of the top three commercial banks as a percentage of total banking assets. Bank cost to income ratio is included in the estimation model as a measure of efficiency (Abdelsalam *et al.*, 2022) since empirical evidence highlights an inverse relationship between improvement in efficiency and bank risk-taking. The indicator captures the expenses per unit of income, with a higher number indicating higher transformation inefficiency of input and output (Wang & Luo, 2022). Third, the bank nonperforming loans to gross loans ratio measures the quality of banking assets, with a lower figure indicating stronger stability. Next, bank regulatory capital to risk-weighted assets proxies for bank capitalization, because empirical findings (Banna & Alam, 2021b) show that stronger capitalization may foster BS. The analysis of cross-country data allows us to estimate the impact of traditional and digital financial inclusion on banking stability, conditional on the features of the banking system (Hodula, 2022). In line with Cuadros-Solas *et al.* (2023), using aggregate data, from the banking sector, we attempt to highlight the influence of both traditional and digital financial inclusion on the aggregate stability of the banking industry. Moreover, Cuadros-Solas *et al.* (2023) analyze the impact of digital lending on banking performance, based on cross-country (67 developed and developing countries) and bank-level data. The results are robust in both scenarios, and the empirical findings ascertain an inverse association of banking performance with digital lending. Taking into account the trade-off between bank-level data availability and cross-country sample coverage, we prefer to leverage an extended panel of countries. The lack of bank-level data for many emerging economies would halve the sample of countries and the results would no longer be representative worldwide.

The data for Z-score and bank characteristics were retrieved from the World Bank Global Financial Development database.

Econometric strategy

To estimate the impact of financial inclusion on banking stability the following non-linear model for panel data is developed:

$$Bank\ Z-score_{i,t} = \alpha_{i,j} + \beta_1 FINANCIAL\ INCLUSION_{i,t} + \\ +\beta_2 FINANCIAL\ INCLUSION^2{}_{i,t} + \beta_3 BANKING_{SECTOR_{i,t}} + \varepsilon_{i,t} \quad (3)$$

where: Bank Z-score$_{i,t}$ is a proxy for banking stability; FINANCIAL INCLUSION$_{i,t}$ represents one of the financial inclusion indexes for country *i* over year *t*; FINANCIAL INCLUSION$^2_{i,t}$ represents the square of financial inclusion index introduced in the model to test the non-linear relationship; BANKING_SECTOR$_{i,t}$ refers to banking sector specific variables (e.g., bank concentration, bank cost to income ratio, bank nonperforming loans to gross loans ratio, and bank regulatory capital to risk-weighted assets); β_i represents the coefficients of the variables; *i* indexes the countries; *t* indexes time; $\varepsilon_{i,t}$ represents the error term.

A quantile regression approach is employed in our paper as it provides a complete picture of the relationship between FI and banking stability for countries with very good (poor) performance (in terms of banking stability). Furthermore, QR can overcome some statistical issues, such as outliers (Kizhakethalackal *et al.*, 2013) and non-Gaussian error distribution (Barnes & Hughes, 2002; Coad & Rao, 2008).

Results and discussion

Descriptive statistics and correlation matrix

Table 2 presents the summary statistics for all variables employed in the estimation models. The Z-score's mean value is 17.06 and ranges between 2.13 (for Kazakhstan in 2017) and 55.93 (for Jordan in 2017). We also notice a large cross-country variation in the proxies for FI. The means of Traditional FII and Digital FII are 0.42 and 0.41, respectively. The standard deviations of 0.25 for Traditional FII and 0.21 for Digital FII indicate significant

heterogeneity in the financial inclusiveness level across the sample. The mean of financial inclusiveness indices is higher than the median, as highlighted by Wang and Luo (2022) on the example of 36 emerging economies and indicates that the distribution of financial inclusiveness indices skews to the left. The highest value of Traditional FII was registered by Spain in 2014, while the lowest value was reported by Malawi in 2021. For Digital FII, Mongolia shows the highest value in 2021, while Pakistan is on the opposite side. The distributions of the dependent variable and independent variable of interest raise the efficiency of QR.

Table 3 reports the correlation matrix for the variables employed in the estimations. As the correlation coefficients are below 0.8 (as suggested by econometric studies), we consider that there are no multicollinearity concerns in the estimations.

Univariate analysis

Table 4-6 report the baseline results on the link between financial inclusiveness indices and banking stability. The evidence of the univariate analysis reported in Table 4 highlights a non-linear association between Traditional FII and Z-score. The coefficient of Traditional FII is negative ($\beta_1<0$) and the coefficient of Traditional FII^2 is positive ($\beta_2>0$), both of them being statistically significant for low quantiles (i.e., Q10 to Q25). The impact of Traditional FII on the Z-score is larger for Q25, while for middle-range and high quantiles (i.e., from Q50 to Q90), the coefficient becomes statistically insignificant. The studies converge on the idea that enlarged access to credit can harm stability (Feghali *et al.*, 2021), looking at the determinants of the sub-prime crisis in the United States or the Eurozone crises from Greece and Ireland. Enlarged credit availability augments the risk of bank default. This could be the explanation for the negative influence of traditional FI on stability. However, above a certain threshold, traditional FI improves banking soundness. A higher degree of inclusion can protect stability, because of portfolio diversification benefits (Malik *et al.*, 2022). Also, the increase in the number of domestic savers reduces the procyclicality risk and the dependency of banks on unpredictable external finance, especially in developing economies (Feghali *et al.*, 2021).

Table 5 reports the results of the univariate analysis between the Digital Financial Inclusion Index and banking stability. The findings highlight a non-linear relationship between Digital FII and Z-score. The Digital FII

harms banking stability for low (Q25) and middle-range quantiles (Q75), while Digital FII^2 promotes bank soundness, for the same quantiles. In the first phase, due to increasing the pool of borrowers to those previously unbanked, digital inclusion could enhance financial fragility. Falling lending standards and unchecked credit growth could negatively impact stability (i.e., microfinance crises in India). Also, Yue *et al*. (2022) highlight that digital-based lending to households stimulates consumption and increases the risk of falling into a debt trap. On the other hand, digital FI can adversely influence banking stability, due to high exposure to operational or regulatory risks (Khattak *et al*., 2023). However, above a certain threshold, digital inclusiveness protects stability due to reduced levels of information asymmetry (Yang & Masron, 2024) and the advantages of digital retail payments. With every digital transaction, the historical data of individuals is collected and their lending behaviour can be monitored. Better information processing by reaching previously unbanked individuals could be beneficial for financial stability (Danisman & Tarazi, 2020). Also, Danisman and Tarazi (2020) demonstrate that digital payments reduce bank-specific risks. More specifically, the authors show that a rise of 1% in digital payments is related to a 1.50% decrease in leverage risk and a 0.8% reduction in portfolio risk, respectively. Also, the findings of Kasri *et al.* (2022) confirm that digital payments add value to banking stability.

The empirical results of the univariate analysis are reported in Table 6 and ascertain a non-linear interaction between the Comprehensive FII and banking stability. The coefficient of Comprehensive FII is negative ($\beta_1<0$) and while the coefficient of Comprehensive FII^2 is positive ($\beta_2>0$), both of them are statistically significant for low quantiles (Q10 to Q25).

Overall, the results reported in Tables 4-6 show a non-linear association, only for low quantiles. This can be explained by banking sector characteristics. In countries with sound and well-established banking sectors (high quadrants countries), digital inclusion via the lending channel is likely to have less impact on the banking industry (Cuadros-Solas *et al*., 2023). Moreover, less sound banking systems are more likely to experience a negative credit supply shock, when lower-end quality borrowers seek alternative credit, after being denied to traditional lending channels (Hodula, 2022). Since lending is one of the most important business operations of banks, the increase in alternative lending could potentially disrupt the performance and sustenance of the banking industry.

Multivariate analysis

Tables 7–9 report the estimates of the quantile regression results, as well as ordinary least squares regression results, while controlling for bank-specific characteristics. Overall, the multivariate analysis confirms a non-linear connection between financial inclusiveness indices and banking stability, or, in other words, a U-shape association between financial inclusiveness and banking soundness. The results suggest that financial inclusiveness indices are negatively related to banking stability until a certain point, after which, increases in financial inclusiveness have a positive effect on stability. The results converge with the overall view that financial inclusion progress (both traditional and digital) increases banking stability (Banna & Alam, 2021b; Wang & Luo, 2022).

Table 7 shows the empirical results of the quantile regressions, which establish the Z-score as a quadratic function of the Traditional Financial Inclusion Index and its square, while controlling for concentration, cost-to-income ratio, non-performing loans ratio and bank capitalization, respectively. Across specifications, the coefficients of Traditional FII are negative ($\beta_1<0$) while the coefficients of Traditional FII^2 are positive ($\beta_2>0$), confirming the first research hypothesis. The findings suggest that Traditional FII has a significant effect on Z-score only for low quantiles (Q10–Q25). This aligns with Isayev (2024) who finds that countries in the early stages of banking stability are more likely to encounter the challenges associated with FI.

Table 8 presents the empirical results of the quantile regressions, which establish the Z-score as a quadratic function of the Digital Financial Inclusion Index and its square, while controlling for concentration, the cost-to-income ratio, non-performing loans ratio, and bank capitalization. With one exception (Q90), across specifications, Digital FII relates negatively with the Z-score until a certain threshold. Above the threshold, the development of digital inclusiveness enhances bank stability. The results show that, above the threshold, an improvement of 1% in Digital FII is related to a 38.27% increase in Z-score for low quantiles (Q25) at a 5% significance level. The magnitude of the impact is more sizeable for low-range quantiles (Q25), meaning that the effect of digital inclusiveness is more pronounced in countries with excessive risk-taking tendencies (Ruan & Jiang, 2024). For middle and high quantiles (i.e., Q50-Q90), the development of digital inclusiveness is not found to have a statistical effect on Z-score. Our results con-

firm the second research hypothesis and are consistent with those of Dang and Thi (2022). Accordingly, the authors found a non-linear association between FI and banking stability for ASEAN countries.

Table 9 presents the empirical results of the quantile regressions, which establish the Z-score as a quadratic function of the Comprehensive Financial Inclusion Index and its square, while controlling for concentration, cost-to-income ratio, non-performing loans ratio, and regulatory capital to risk-weighted assets ratio. The findings show that the comprehensive FI index harms stability, while its square is not expected to worsen financial stability. The coefficients are statistically significant for low to middle quantiles (Q10-Q50). Comprehensive financial inclusion enhances banking stability once a certain threshold is surpassed since it may take some time for the benefits of FI to become visible, as explained by Yang and Masron (2024).

Overall, across specification, the impact of financial inclusiveness indices is statistically significant for low to middle quantiles (Q25 to Q50), while the effect becomes trivial when the high stability quantiles are considered (Q90). When multiple external predictor variables are considered, our results are in line with previous findings, according to which the impact of financial inclusion on financial stability is less evident under better regulation and supervision (Hua *et al.*, 2023). As long as macro-regulation weakens systemic risks, banking stability is promoted. Therefore, in countries with high-stability banking systems (high quadrants countries), the impact of financial inclusion is less prominent, as previously demonstrated by Isayev (2024).

Regarding the control variables, the results are consistent with previous literature. Although not significant, the concentration of the banking system (less competition) is positively associated with increased Z-score outcomes, for all quantiles except for more stable banks. These results support the competition-fragility hypothesis, as found by Kanga *et al.* (2021). Accordingly, the authors have performed a quantile analysis on bank competition and bank stability and found evidence of competition-fragility for all quantiles except for stable banks. In line with Wang and Luo (2022), our findings show that banking stability is negatively affected if operational inefficiency increases. Moreover, the deterioration of the assets portfolio of banks decreases stability (Xiao *et al.*, 2023). The results show that strong capitalization is good for bank soundness, but only for those more stable. For less sound banking systems (Q10), higher capital adequacy turns into

a disadvantage. The results are in line with Wang and Luo (2022) who document a negative relationship between regulatory capital and stability.

Robustness checks and channel analysis

We test the robustness of our findings by adding three new variables in the models (bank net interest margin, GDP growth, and inflation), in line with previous research to control for macroeconomic variables (Ghosh, 2022; Isayev, 2024), and using panel data models with fixed effects[1]. The results presented in Table 10 support the previous findings providing additional empirical evidence of a non-linear association between FII and bank stability.

We explore several channels (diversification of risks, reduction of NPLs, cost reduction, and increase in market power) through which FI impacts bank stability using a two-step estimation. However, we have found that only the cost reduction is a transmission channel. Following Bilyay-Erdogan *et al.* (2023), a two-step regression approach has been employed. Firstly, we investigate the impact of FII on the bank cost-income ratio (Bank_CIR). In the second step, we used the predicted values of the bank cost-income ratio (Predicted_CIR) to estimate bank stability. The results are presented in Table 11.

Columns (3) and (5) show that digital FII and comprehensive FII negatively and statistically affect cost-income ratios, implying that a higher financial inclusion index reduces cost-income ratios. Our results are in line with those of Vo *et al.* (2021) and Wang and Luo (2022), who found that operational efficiency (measured via the bank cost-income ratio) represents a transmission channel from financial inclusion towards bank soundness. Furthermore, columns (4) and (6) highlight that predicted values of Bank_CIR also negatively and significantly affect bank stability, as previously demonstrated by Yao and Song (2023). Our results represent novel evidence that cost reduction is one of the channels through which digital and comprehensive FII affects bank stability.

[1] A Hausman test has been employed to determine the exogeneity of the unobserved errors and to choose between fixed-effects and random-effects models.

Conclusions

The paper analyses the cross-country impact of traditional and digital financial inclusion on banking stability, respectively, based on panel quantile regression. We employ unique measures of financial inclusion. Following the methodology proposed by Khera *et al.* (2022), we construct three financial inclusion indices and we test their impact on banking stability. The empirical results confirm a non-linear relationship between financial inclusiveness indices and BS, or, in other words, a U-shaped association between financial inclusiveness and banking soundness. This means that financial inclusiveness harms the Z-score until a certain threshold. Above the threshold, the increase in the level of financial inclusiveness enhances bank stability. Overall, across specification, the impact of financial inclusiveness indices is statistically significant for low to middle quantiles (Q25 to Q50), while the effect becomes trivial when the high quantiles are considered (Q90). We contribute further to this research by analyzing the potential transmission channels through which financial inclusiveness influences financial stability. We find that operational efficiency, measured as cost to income ratio, is one of the channels through which digital and comprehensive FII affects bank stability.

Our findings are useful for risk managers and policymakers. The risk managers should take into account financial inclusiveness figures while evaluating BS. Policymakers should measure and monitor the changes in the level of financial inclusiveness to promote financial stability. Some important policy implications can be drawn from our results. The regulatory authorities should target and anticipate the optimal level of traditional and respectively digital financial inclusion that may strengthen the banking sector stability. To achieve a stable and inclusive financial system, it is relevant to evaluate the trade-off between credit inclusion and stability. The findings highlight the need for cautious extension of financial products, especially in countries with less stable banking systems. As countries with low to medium banking stability are more exposed to FI, policymakers should encourage responsible lending and strengthen the regulatory background. Also, the banking industry in a less stable financial environment should focus on self-supervision (Xi & Wang, 2023) and monitor the risks associated with the rapid development of inclusiveness. It is also necessary to ensure technology infrastructure and required investments to reach a higher level of banking soundness. Moreover, analyzing the transmission

channels of financial inclusiveness offers useful insights to banks to understand practical modalities in which developing financially inclusive products can support their resilience, further reducing costs in favour of clients.

The lack of longitudinal data is the main drawback of our research since the Findex survey is conducted every three years (2011, 2014, 2017, and 2021), but we have excluded 2011, due to missing observations. Therefore, the model is performed for three years per country, but this setting is enough to account for unobserved country heterogeneity, as previously highlighted by Feghali *et al.* (2021).

Our paper seeks to serve as input for further research. Identifying the factors that moderate the cross-country non-linear relationship between FI and banking soundness represents an area for future research. Financial inclusion should not be defined only as a function of the availability and usage of financial products and services (Sant'Anna & Figueiredo, 2024). The goal is to ensure that inclusiveness leads to the financial wellness of previously unbanked segments. Therefore, the implications of financial capabilities on the interrelationship between FI and banking stability could represent an interesting research direction.

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Annex

Table 1. List of variables selected for Inclusion Indices

Overall FI Index					
Traditional FI Index	**Data source**	**Weight**	**Digital FI Index**	**Data source**	**Weight**
Access		0.25	***Access***		0.25
Number of commercial bank branches per 100,000 adults	IMF Financial Access Survey		Active mobile-broadband subscriptions per 100 inhabitants	International Telecommunication Union (ITU)	
Number of ATMs per 100,000 adults			% of the population who has access to the internet		
Usage		0.25	***Usage***		0.25
% of adults with an account opened at a financial institution	World Bank Global Findex Database		% of adults who make use of mobile phones for utility payments	World Bank Global Findex Database	
% of adults who own a debit card			% of adults who receive wages through a mobile phone		
% of adults who save at a financial institution			% of adults who made or received a digital payment		
% of adults who receive wages through a financial institution account					
% of adults who make a utility payment using a financial institution account					

Table 2. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Bank Z-score	243.00	17.06	9.79	2.13	55.93
Traditional FII	243.00	0.42	0.25	0.00	1.00
Digital FII	243.00	0.41	0.21	0.00	1.00
Comprehensive FII	243.00	0.46	0.24	0.00	1.00
Bank_Concentration	240.00	63.82	17.98	17.05	100.00
Bank_CIR	236.00	55.15	11.02	29.94	94.50
Bank_NPL	236.00	37.28	12.68	10.71	77.89
Bank_RK	243.00	4.44	3.03	-7.00	15.34

Table 3. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank Z-score (1)	1.00							
Traditional FII (2)	-0.06	1.00						
Digital FII (3)	-0.01	0.69	1.00					
Comprehensive FII (4)	-0.04	0.92	0.92	1.00				
Bank_Concentration (5)	0.03	0.28	0.36	0.35	1.00			
Bank_CIR (6)	-0.12	0.22	-0.06	0.09	0.11	1.00		
Bank_NPL (7)	-0.17	0.31	0.30	0.33	0.16	0.45	1.00	
Bank_RK (8)	0.01	-0.20	-0.02	-0.12	-0.05	-0.04	-0.04	1.00

Table 4. The relationship between Traditional FII and banking stability

	OLS	**10th quant**	**25th quant**	**50th quant**	**75th quant**	**90th quant**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Traditional FII	-14.6165	-13.7120**	-22.6668***	-18.6630	-8.2168	14.3814
	(8.9166)	(6.8321)	(4.2688)	(11.6422)	(14.4263)	(30.6319)
Traditional FII²	14.1454	16.7362**	23.9424***	18.4359	2.8123	-11.3083
	(9.5859)	(6.7865)	(4.6342)	(11.3935)	(14.9725)	(33.5033)
Constant	19.8266***	9.2454***	13.7503***	18.6939***	24.1501***	26.6678***
	(1.7949)	(1.9415)	(0.9105)	(2.4604)	(2.6232)	(5.6383)
R²* / *Pseudo R²	0.0116	0.0258	0.0453	0.0100	0.0100	0.0018
N. of cases	243	243	243	243	243	243

Notes: Traditional FII is the Traditional Financial Inclusion Index. ***p<0.010, **p<0.05 and *p<0.1.

Table 5. The relationship between Digital FII and banking stability

	OLS	**10th quant**	**25th quant**	**50th quant**	**75th quant**	**90th quant**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Digital FII	-25.6474**	-14.6072	-21.4081**	-15.7047	-33.7173**	-30.3664
	(11.2080)	(11.1818)	(10.7017)	(14.9446)	(15.3063)	(28.5318)
Digital FII²	29.0663**	14.2040	25.9445*	17.4223	41.7166**	36.9607
	(12.6752)	(12.1266)	(13.2082)	(18.4364)	(19.1249)	(33.8643)
Constant	21.3870***	10.5345***	13.1355***	17.8522***	26.3715***	35.1144***
	(2.2025)	(2.4241)	(2.1529)	(2.7281)	(2.7336)	(4.7663)
R²* / *Pseudo R²	0.0218	0.0077	0.0210	0.0093	0.0245	0.0144
N. of cases	243	243	243	243	243	243

Notes: Digital FII is the Digital Financial Inclusion Index. ***p<0.010, **p<0.05 and *p<0.1.

Table 6. The relationship between Comprehensive FII and banking stability

	OLS (1)	10th quant (2)	25th quant (3)	50th quant (4)	75th quant (5)	90th quant (6)
Comprehensive FII	-30.2128***	-20.8222**	-32.9523***	-27.7214	-29.4023	-22.8512
	(11.3779)	(9.1201)	(6.6215)	(17.0882)	(22.5762)	(34.3958)
Comprehensive FII²	31.6084**	22.1590**	34.2264***	29.4720	32.2081	24.4183
	(12.2157)	(10.2386)	(6.1647)	(19.4316)	(27.3236)	(38.0360)
Constant	22.4800***	10.9792***	16.3686***	19.4183***	26.2752***	34.6831***
	(2.2663)	(1.8784)	(1.7308)	(2.8484)	(3.7025)	(6.8425)
R^2 / Pseudo R^2	0.0285	0.0247	0.0508	0.0139	0.0093	0.0134
N. of cases	243	243	243	243	243	243

Notes: Comprehensive FII is the Comprehensive Financial Inclusion Index. ***p<0.010, **p<0.05 and *p<0.1.

Table 7. The non-linear relationship between Traditional FII and banking stability

	OLS (1)	10th quant (2)	25th quant (3)	50th quant (4)	75th quant (5)	90th quant (6)
Traditional FII	-18.0601*	-17.8646**	-25.8284***	-10.2786	9.5127	51.4539
	(9.4410)	(7.2371)	(5.0837)	(12.7871)	(18.4140)	(47.4084)
Traditional FII²	19.1772*	21.5904***	26.8089***	11.4482	-4.0806	-42.0691
	(10.0167)	(7.6306)	(4.7220)	(12.4711)	(19.3546)	(42.9709)
Bank_Concentration	0.0496	0.0320	0.0149	0.0373	0.0189	-0.0393
	(0.0381)	(0.0268)	(0.0257)	(0.0526)	(0.0716)	(0.1235)
Bank_CIR	-0.0735	0.0938	0.0103	-0.0038	-0.1147	-0.1266
	(0.0660)	(0.0614)	(0.0675)	(0.1177)	(0.0899)	(0.1458)
Bank_NPL	-0.1119*	-0.0969*	-0.0627	-0.1052	-0.1512	-0.2911*
	(0.0580)	(0.0518)	(0.0522)	(0.0892)	(0.0943)	(0.1519)
Bank_RK	0.0298	0.0153	-0.0525	0.0851	0.6241	0.6106
	(0.2245)	(0.1503)	(0.1630)	(0.3403)	(0.5010)	(0.6825)
Constant	25.1483***	5.8984	15.3048***	18.8850***	27.2763***	36.5169***
	(4.2503)	(4.0582)	(4.5043)	(6.4589)	(6.1230)	(10.9346)
R^2 / Pseudo R^2	0.0498	0.0430	0.0585	0.0187	0.0435	0.0586
N. of cases	234	234	234	234	234	234

Notes: Traditional FII is the Traditional Financial Inclusion Index. Bank_concentration refers to the 3-bank asset market share. Bank_CIR means Bank cost-to-income ratio. Bank_NPL stands for Bank nonperforming loans to gross loans. Bank_RK means Bank capitalization. ***p<0.010, **p<0.05 and *p<0.1.

Table 8. The non-linear relationship between the Digital FII and banking stability

	OLS (1)	10th quant (2)	25th quant (3)	50th quant (4)	75th quant (5)	90th quant (6)
Digital FII	-22.4458*	-17.9339	-31.1492**	-15.5582	-11.7554	3.5235
	(11.7860)	(11.1645)	(12.6371)	(15.5970)	(18.6436)	(35.4741)
Digital FII²	26.8284**	18.9601	38.2707**	19.0562	23.3085	18.7394
	(13.1204)	(12.7579)	(15.6540)	(18.4500)	(21.8334)	(38.2887)
Bank_Concentration	0.0350	0.0186	0.0004	0.0305	0.0217	-0.0200
	(0.0389)	(0.0252)	(0.0324)	(0.0538)	(0.0658)	(0.1179)
Bank_CIR	-0.0412	0.0763	0.0482	0.0597	-0.0616	-0.0515
	(0.0673)	(0.0586)	(0.0779)	(0.1062)	(0.0877)	(0.1705)
Bank_NPL	-0.1067*	-0.0818*	-0.0528	-0.0746	-0.1545*	-0.3659**
	(0.0605)	(0.0492)	(0.0620)	(0.0833)	(0.0889)	(0.1791)
Bank_RK	0.0167	-0.1319	-0.0931	0.0518	0.5369	0.4824
	(0.2195)	(0.1811)	(0.1899)	(0.3365)	(0.4304)	(0.6096)
Constant	24.6353***	8.7634**	14.1166**	15.1025**	27.8116***	40.7758***
	(4.2195)	(3.8376)	(5.6168)	(6.7382)	(5.3410)	(10.4961)
R^2 / *Pseudo* R^2	0.0517	0.0317	0.0282	0.0188	0.0547	0.0498
N. of cases	234	234	234	234	234	234

Notes: Digital FII is the Digital Financial Inclusion Index. Bank_concentration refers to the 3-bank asset market share. Bank_CIR means Bank cost-to-income ratio. Bank_NPL stands for Bank nonperforming loans to gross loans. Bank_RK means Bank capitalization. ***p<0.010, **p<0.05 and *p<0.1.

Table 9. The non-linear relationship between the Comprehensive FII and banking stability

	OLS (1)	10th quant (2)	25th quant (3)	50th quant (4)	75th quant (5)	90th quant (6)
Comprehensive FII	-32.0839***	-31.0096***	-36.9818***	-30.6317*	-12.3467	-50.1856
	(11.6528)	(8.2990)	(7.2446)	(17.3655)	(22.0492)	(52.6057)
Comprehensive FII²	34.8688***	33.6809***	37.9579***	32.2113*	22.4568	65.0729
	(12.3199)	(8.6041)	(7.2696)	(19.4366)	(23.8604)	(51.2560)
Bank_Concentration	0.0446	0.0357	0.0089	0.0606	0.0536	0.0361
	(0.0382)	(0.0263)	(0.0258)	(0.0557)	(0.0710)	(0.1104)
Bank_CIRatio	-0.0664	0.0784	-0.0014	-0.0201	-0.1218	-0.0642
	(0.0648)	(0.0584)	(0.0622)	(0.1104)	(0.0833)	(0.1411)
Bank_NPL	-0.1081*	-0.0809	-0.0558	-0.0696	-0.1709*	-0.2851*
	(0.0589)	(0.0501)	(0.0509)	(0.0770)	(0.0956)	(0.1701)
Bank_RK	0.0277	-0.2611	-0.1606	-0.0828	0.4869	0.5926
	(0.2191)	(0.1598)	(0.1735)	(0.3301)	(0.4287)	(0.6599)
Constant	27.3212***	10.1499***	19.0273***	21.3079***	29.7315***	44.5092***
	(4.3412)	(3.6467)	(5.0861)	(6.5931)	(6.7201)	(12.4951)
R^2 / *Pseudo* R^2	0.0671	0.0585	0.0603	0.0247	0.0567	0.0576
N. of cases	234	234	234	234	234	234

Notes: Comprehensive FII is the Comprehensive Financial Inclusion Index. Bank_concentration refers to the 3-bank asset market share. Bank_CIR means Bank cost-to-income ratio. Bank_NPL stands for Bank nonperforming loans to gross loans. Bank_RK means Bank capitalization. ***p<0.010, **p<0.05 and *p<0.1.

Table 10. Robustness check results

	Model 1	Model 2	Model 3
Traditional FII	-25.5496**		
	(9.9605)		
Traditional FII²	23.0105**		
	(9.9840)		
Digital FII		-20.4542**	
		(12.4632)	
Digital FII²		20.9061*	
		(13.6148)	
Comprehensive FII			-29.8072**
			(11.9701)
Comprehensive FII²			28.5577**
			(12.4343)
Bank_Concentration	0.0613	0.0468	0.0570
	(0.0392)	(0.0398)	(0.0396)
Bank_CIR	-0.0667	-0.0596	-0.0704
	(0.0722)	(0.0734)	(0.0710)
Bank_NPL	-0.2325***	-0.2124***	-0.2110***
	(0.0675)	(0.0691)	(0.0680)
Bank_RK	0.1087	0.1366	0.1203
	(0.2242)	(0.2214)	(0.2202)
Bank_NIM	-0.3497	-0.1627	-0.2371
	(0.3887)	(0.3680)	(0.3908)
GDP_growth	-0.0861	-0.0670	-0.0754
	(0.0819)	(0.0827)	(0.0820)
Inflation	0.0198	0.0189	0.0152
	(0.0524)	(0.0538)	(0.0530)
Constant	30.7443***	28.3390***	14.4088***
	(4.8626)	(4.9686)	(2.6599)
R^2	0.3348	0.3402	0.3406
N. of cases	214	214	214

Table 11. Channel analysis: cost reduction

	Bank_CIR (1)	Bank Z-score (2)	Bank_CIR (3)	Bank Z-score (4)	Bank_CIR (5)	Bank Z-score (6)
Traditional FII	-19.5289					
	(19.3646)					
Traditional FII²	4.2704					
	(20.7242)					
Predicted_CIR1		-0.1936				
		(0.1822)				
Digital FII			-28.7318***			
			(10.4774)			
Digital FII²			25.5220**			
			(11.0895)			
Predicted_CIR2				-0.3515***		
				(0.1167)		
Comprehensive FII					-31.3193**	
					(13.3271)	
Comprehensive FII²					23.2012*	
					(13.6464)	
Predicted_CIR3						-0.3788***
						(0.1279)
Bank_Concentration	-0.0103	-0.0270	0.0052	-0.0285	0.0074	-0.0287
	(0.0613)	(0.0201)	(0.0605)	(0.0195)	(0.0609)	(0.0195)
Bank_RK	-0.0824	0.0522	0.0081	0.0337	-0.0417	0.0305
	(0.2018)	(0.0690)	(0.2044)	(0.0652)	(0.2036)	(0.0655)
Bank_NIM	-1.1503*	0.9850***	-1.4251**	0.8164***	-1.4025**	0.7873***
	(0.6067)	(0.2752)	(0.6092)	(0.2263)	(0.6075)	(0.2332)
Bank_NPL	0.1695*	0.0709	0.1851**	0.0994***	0.1824**	0.1043***
	(0.0861)	(0.0430)	(0.0835)	(0.0341)	(0.0837)	(0.0354)
GDP_growth	-0.0281	-0.0688**	-0.0021	-0.0723**	-0.0047	-0.0730**
	(0.0909)	(0.0294)	(0.0886)	(0.0284)	(0.0887)	(0.0285)
Inflation	-0.0614	-0.0056	-0.0551	-0.0158	-0.0406	-0.0176
	(0.0639)	(0.0234)	(0.0679)	(0.0210)	(0.0654)	(0.0213)
Constant	62.9731***	22.9036**	61.0008***	31.6525***	62.4589***	33.1621***
	(7.1663)	(10.2704)	(6.0581)	(6.7233)	(6.3726)	(7.3202)
R-squared	0.1145	0.2563	0.1439	0.2997	0.1353	0.2981
N. of cases	214	214	214	214	214	214

Appendix

Countries included in the empirical analysis (years 2014, 2017 and 2021)

No	Country	No	Country
1	Albania	42	Lebanon
2	Argentina	43	Lithuania
3	Armenia	44	Malawi
4	Australia	45	Malaysia
5	Austria	46	Mali
6	Bangladesh	47	Malta
7	Belgium	48	Moldova
8	Bolivia	49	Mongolia
9	Bosnia and Herzegovina	50	Namibia
10	Brazil	51	Nepal
11	Bulgaria	52	Netherlands
12	Cambodia	53	New Zealand
13	Canada	54	Nicaragua
14	Chile	55	Nigeria
15	Colombia	56	North Macedonia
16	Croatia	57	Norway
17	Cyprus	58	Pakistan
18	Czech Republic	59	Panama
19	Denmark	60	Peru
20	Dominican Republic	61	Philippines
21	Ecuador	62	Poland
22	Egypt, Arab Rep.	63	Portugal
23	El Salvador	64	Romania
24	Estonia	65	Saudi Arabia
25	Finland	66	Senegal
26	France	67	Serbia
27	Georgia	68	Singapore
28	Germany	69	Slovak Republic
29	Greece	70	Slovenia
30	Honduras	71	South Africa
31	Hungary	72	Spain
32	India	73	Sweden
33	Indonesia	74	Switzerland
34	Ireland	75	Thailand
35	Israel	76	Tunisia
36	Italy	77	Türkiye
37	Japan	78	Uganda
38	Jordan	79	United Arab Emirates
39	Kazakhstan	80	Zambia
40	Kenya	81	Zimbabwe
41	Latvia		