Bank Concentration and Its Impact on Financial Inclusion, Efficiency, and Stability: Evidence from Developing Countries

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Abstract

This study investigates the relations between financial stability, financial efficiency, and financial inclusion, which are all measured as index form, and bank concentration via principal component analysis for developing countries. A panel linear autoregressive distributed lag (L-ARDL) model is employed to explore these relations. The results indicate that bank concentration exerts a positive and significant impact on financial stability, financial efficiency, and financial inclusion. To ensure the robustness of the results, panel non-linear (NL-ARDL) and augmented mean group (AMG) models are also applied, with the resultant estimations confirming the consistency of the main results. According to the findings of the study, large banks play a vital role in the banking sector for developing countries due to their diverse financial products, market power, and cost-effectiveness.

Keywords: Bank concentration, financial inclusion, financial stability, financial efficiency, developing countries.
Jel Codes: G10, G15, G20.

1. Introduction

Financial inclusion (FI) encompasses easy, affordable, and fast access to financial services and goods, such as credit, bank deposits, and life insurance. Thorsten Beck, Aslı Demirgüç-Kunt, and Vojislav Maksimovic (2005) assert that many people face financial shortages, including the affordability, availability, and accessibility of financial goods and services, which are key drivers of the industrial structure and competition in developing countries. Financial efficiency (FE) is a significant indicator in both the non-financial and financial sectors, measuring the extent to which the financial system functions (Özlem Olgu, Hasan Dinçer, and Ümit Hacıoğlu, 2014). Financial stability (FS) relates to the reduction of the impact of shocks without disruption to the financial system (William R. Nelson and Roberto Perli, 2007).

Competition theories assert that market concentration (CON), which implies growth in the share of large firms in the banking sector, affects the behaviors of banks regarding offering financial services and goods (Arnoud W. A. Boot and Anjan V. Thakor, 2000). The consolidation of banks and banking regulations in response to the 2008 financial crisis has increased discussions about the effects of CON on the financial sector (Thorsten Beck, Hans Degryse, and Christiane Kneer, 2014), particularly in developing countries, which have concentrated banking markets (Lisa Chauvet and Luc Jacolin, 2017).

The link between FS, FE, FI, and CON is on the agendas of developing countries (Sylwester Kozak and Agata Wierzbowska, 2021), and this study investigates the connection between CON and financial indicators, including FS, FE, and FI, in developing countries, thereby making a significant contribution to the literature. It highlights the impact of CON on financial indicators, given that unemployment is recognized as a phenomenon that affects individuals who have been out of work for an extended period and do not earn a permanent income, particularly in developing countries. Thus, the novelty of this study lies in its coverage of developing countries. The CON level of banks in developing countries is high, meaning that examining the effect of CON on the financial systems in these countries fills an important gap in the literature. FS and FE are fundamental components of financial systems, but they are generally neglected in financial system evaluations due to a lack of data. This study provides valuable findings for the financial literature evaluating FS, FE, and FI in developing countries. Additionally, the identification of FS, FE, and FI as indexes is a key contribution of this study. The primary model, a panel linear autoregressive distributed lag (L-ARDL) model, allows for the separate examination of the long- and short-term effects of CON on FS, FE, and FI. Estimating the panel non-linear autoregressive distributed lag model (NL-ARDL) and the augmented mean group (AMG) model as robustness checks constitutes an original contribution of this study. Conducting robustness checks on results regarding developing countries is vital.

2. Literature Review

The current literature includes some studies on the link between CON, FE, FI, and FI (Ayopo et al., 2020). The traditional market power theory states that the banking sector decreases the cost of financial services, supporting FI (Allen N. Berger and Timothy H. Hannan, 1998). High CON rates provide FE due to the favorable interest rates on credits and deposits (Xiaoqing Fu and Shelagh Heffernan, 2009). Hans Degryse and Steven Ongena (2005) demonstrate a positive link between credit rates and CON, while Claudia Capozza and Angela Stefania Bergantino (2013) explain that managing a banking sector comprised of larger banks is easier for financial authorities. Stijn Claessens (2006) asserts that CON supports different sectors in an economy, while Allen et al. (2016) and Thorsten Beck, Aslı Demirgüç-Kunt, and Vojislav Maksimovic (2004) explain the impact of both CON and competition on the FE and FI of the banking sector. Zuzana Fungáčová, Anastasiya Shamshurb, and Laurent Weill (2017) find that CON ensures no increase in the cost of credit. Claudia Capozza and Angela Stefania Bergantino (2013) argue that high CON may lower interest rates and reduce profits for new enterprises. Ann L. Owen and Javier Pereira (2018) consider that bank competition might not support FI, decrease FE, or overcome asymmetric information, particularly in developing countries. However, Beate Reszat (2005) claims that the CON of a financial institution in one location favors greater liquidity, information flow, centralization, and higher efficiency. Thus, CON leads to scale economies, which are beneficial for providing high-quality services.

The link between FE and CON is explained by three hypotheses, namely, the information generation, efficient structure, and quiet life hypotheses. The quiet life hypothesis suggests that large firms may not operate in strongly competitive conditions due to market power and therefore do not make significant efforts to improve production quality. This situation reduces the efficiency of firms and generates higher CON. The quiet life hypothesis also states that the high CON rate of banks triggers prices and profits in the short term, reducing efficiency. The efficient structure hypothesis posits that when a merger occurs with less effective competitors due to scale, operating costs are reduced, leading to increased profits. However, this process begins with a high CON rate, which enhances the efficiency of firms. The efficient structure hypothesis further holds that larger scale results in lower operating efficiency (Kozak and Wierzbowska, 2021). The information generation hypothesis posits the existence of a negative nexus between CON and FE. When competition is low, banks collect more information about clients, thereby improving efficiency and quality (Fungáčová et al., 2017). Garry J. Schinasi (2004) explores whether FS has important characteristics, such as a stable financial system and well-managed financial risk. There are two approaches to explaining the nexus between FS and CON. The first approach holds that CON rates and banking fragility are negatively related, as CON triggers earnings and increases market power (Franklin Allen and Douglas Gale, 2004). The alternative approach suggests that a high CON level may lead to a high interest rate and increase the risk of bankruptcy (John H. Boyd and Gianni De Nicoló, 2005). André Uhde and Ulrich Heimeshoff (2009) investigate the link between FS and CON when using an aggregate Z-score to determine financial fragility, and their findings indicate that CON is vital for FS due to the higher stock return volatility of larger banks. Fungácová et al. (2017) determine that there are both positive and negative relations between law and competition, while the positive influence is valid for the nexus between competition, GDP, and INF. Armand Fouejieu (2017) finds that rising inflation results in low financial stability in emerging countries. Atilla Çifter (2015) reports the non-existence of a robust relation between FS and CON. Owen and Pereira (2018) note that CON intensifies access to credit. Martin R. Goetz (2018) asserts that a high CON rate on the part of banking systems lowers risk due to large banks' diversification. Désiré Avoma, Chrysost Bangakeb, and Hermann Ndoya (2022) assert that the CON rate of the banking sector promotes FI in African countries. Frank Antwi, Yusheng Kong, and Kofi Nyarko Gyimah (2024) find that the FI of developing countries reduces the level of FS, whereas competition increases FS.

3. Data

This study explores the link between CON and index forms of FS, FE, and FI. These indexes encompass various dimensions for 28 developing countries for which data are available for the period from 2005 to 2017. Recep Yorulmaz (2018) and Thai-Ha Le, Tu Chuc Anh, and Farhad Taghizadeh-Hesary (2019) are followed regarding the indicator choices for the three indexes. CON is the assets of the three largest commercial banks for each country. Additionally, this study incorporates country-level variables, such as the gross domestic product (GDP) per capita, rule of law (LAW), and inflation rates (INF), as control variables, aligning with the approach of David Dollar and Aart Kray (2002) and Fungácová et al. (2017). Table 1 summarizes the data used in the analysis and in calculating indexes.

Table 1. Summary of Variables

Data	Data Source
Financial Inclusion Index (FII)	
Mobile money account (Metric 1)	WBGFDD
Number of ATMs* (Metric 2)	
Number of commercial bank branches** (Metric 3)	
Made or received a digital payment (Metric 4)	
Number of commercial bank branches* (Metric 5)	
Number of insurance corporations* (Metric 6)	
Financial Stability Index (FSI)	
Liquid assets/deposits and short-term funding (Metric 7)	WBGFDD
Bank credit/bank deposits (Metric 8)	
Bank Z-score (Metric 9)	
Financial Efficiency Index (FEI)	
Return on equity of bank (Metric 10)	WBGFDD
Net interest margin of the bank (Metric 11)	
Return on assets of a bank (Metric 12)	
Main Independent Variable	
Bank Concentration (CON)	WBGFDD
Control Variables	
Inflation (INF)	WB
GDP per capita (GDP)	
Rule of Law (LAW)	

Note: WBGFDD (World Bank's Global Financial Development Database) and WD (World Bank), * is the per 100,000 adults, and ** is the per 1,000 km^2.

4. Method

This study first measures the FSI, FEI, and FII by performing a principal component analysis (PCA), a method widely used in the literature (Ian Jolliffe, 2011; Yorulmaz, 2018). The data are then standardized according to the approach of Yorulmaz (2018) and Le et al. (2019). Appendix 1 shows the correlation matrices of the variables and the initial tests of the PCA. Panels A, B, and C in Appendix 1 demonstrate that there are sufficient correlations between the indicators used to construct the indexes. Moreover, this study employs Bartlett's and Kaiser–Meyer–Olkin (KMO) tests to assess the data's sustainability. Bartlett's test determines whether the correlation matrix exhibits an identity feature in the PCA (Hair et al., 2006), while the KMO test assesses the sampling adequacy of the data (Naoyuki Yoshino and Farhad Taghizadeh-Hesary, 2015). The results of the Bartlett's and KMO tests are reported in Panels D, E, and F in Appendix 1. The KMO values are greater than 0.5 for all the panels, and the Bartlett's test findings confirm that the variables used in the PCA are correlated with each other. Appendix 2 reports the PCA findings when measuring the indexes. Panel A in Appendix 2 reveals that Metric 8 is the most important indicator and Metric 7 is the second most important indicator when measuring FSI. The least important indicator for FSI is Metric 9. However, Metric 12 and Metric 10 are the most important indicators when constructing the FEI in Panel B in Appendix 2. Additionally, Metric 11 is a second most important factor when constructing the FEI. Panel C in Appendix 2 indicates that the first important indicator when constructing the FII is Metric 3, followed by Metric 6. Moreover, the third most important factor for FII is Metric 2. Furthermore, the least important factor is Metric 1. Table 2 demonstrates that the first two components explain 79% of the total variance of FSI, the first two components explain more than 89% of the total variance of FEI, and the first three components explain 90% of the total variance of FII. After constructing three indexes, this study employs the panel data analysis method because it offers several advantages, including higher degrees of freedom, reduced collinearity, and greater efficiency. The cross-sectional dependency test is crucial in empirical panel data analyses of developing and transition countries (Md Qamruzzaman and Wei Jianguo, 2020), and this study first explores whether there is cross-sectional dependency within the panel data. There are four tests used in the literature to investigate this issue. One of them is the Lagrange multiplier (LM) test proposed by Trevor S. Breusch and Adrian Pagan (1980), and its statistic is given below:

$$y_{it} = \alpha_{it} + \beta_{it}x_{it} + u_{it} \qquad i = 1 \ldots\ldots. N, t = 1 \ldots\ldots. T \tag{1}$$

In Equation (1), t and i are the period and cross-section, y_{it} and x_{it} are the dependent and independent variables, and α_i and β_i are the intercepts and slopes. This study computes the LM test statistics with the following equation:

$$LM = T\sum_{t}^{N-1}\sum_{j=i+1}^{N}\hat{p}_{IJ} \rightarrow dX^2\, N(N+1)/2 \tag{2}$$

In Equation (2), $\hat{p}_{IJ}$ is the residual pairwise correlation. The LM test is not suitable if there is a large cross-section; therefore, M. Hashem Peseran (2004) suggests the following Lagrange multiplier CD_{lm}:

$$CD_{lm} = \sqrt{\frac{N}{N(N-1)}}\sum_{I=1}^{N-1}\sum_{j=i+1}^{N} T(\hat{p}_{IJ} - 1) \tag{3}$$

M. Hashem Peseran (2006) proposes the following CD test, as CD alternative least squares estimation is associated with the size dimension:

$$CD_{lm} = \sqrt{\frac{2T}{N(N-1)}}\sum_{I=1}^{N-1}\sum_{J=i+1}^{N}\hat{p}_{ij} \tag{4}$$

M. Hashem Peseran's (2006) CD test might estimate distorted information in some situations, so the bias-adjusted LM test is suggested for this purpose (M. Hashem Peseran, 2008). The following equation presents the bias-adjusted LM statistics:

$$CD_{lm} = \sqrt{\frac{2T}{N(N-1)}}\sum_{I=1}^{N-1}\sum_{J=i+1}^{N}\frac{(T-K)\hat{p}_{ij}{}^2 - u_{Tij}}{v_{Tij}^2}\ \vec{d}(N,0) \tag{5}$$

In Equation (5), k is the number of regressors, and u_{Tij} and v_{Tij}^2 are the mean and variance $(T-K)\hat{p}_{ij}{}^2$, respectively. This study employs the panel L-ARDL model developed by M. Hashem Pesaran, Yongcheol Shin, and Ron P. Smith (1999) and presents the results of examining the symmetrical relations. The panel L-ARDL model identifies cross-sectional dependency and can be employed to test the stationarity of variables at the [I(1)] level, including the lagged values of the variables in the models, as a means of eliminating possible problems due to internality and autocorrelation. In addition to the panel L-ARDL model estimation, this study also runs the panel NL-ARDL model, which can determine the long-term linear relations in a non-linear case (Ömer Yalçınkaya and Esra Kadanalı, 2020). The panel NL-ARDL model highlights the asymmetrical and symmetrical relations (Jeffrey Kouton, 2019) and is given below:

$$\Delta FII_{it} = a_{1t} + \sum_{n=0}^{k}\beta_{1\,2it}\Delta CON_{it-n} + \sum_{n=0}^{k}\beta_{1\,3it}\Delta INF_{it-n} + \sum_{n=0}^{k}\beta_{1\,4it}\Delta LAW_{it-n} + \sum_{n=0}^{k}\beta_{1\,5it}\Delta GDP_{it-n} + \delta_{2\,1it}FII_{it-1} + \delta_{2\,2it}CON_{it-1} + \delta_{2\,3it}INF_{it-1} + \delta_{2\,4it}LAW_{it-1} + \delta_{2\,5it}GDP_{it-1} + \varepsilon_{1it} \tag{6}$$

$$\Delta FEI_{it} = a_{1t} + \sum_{n=0}^{k}\beta_{1\,2it}\Delta CON_{it-n} + \sum_{n=0}^{k}\beta_{1\,3it}\Delta INF_{it-n} + \sum_{n=0}^{k}\beta_{1\,4it}\Delta LAW_{it-n} + \sum_{n=0}^{k}\beta_{1\,5it}\Delta GDP_{it-n} + \delta_{2\,1it}FEI_{it-1} + \delta_{2\,2it}CON_{it-1} + \delta_{2\,3it}INF_{it-1} + \delta_{2\,4it}LAW_{it-1} + \delta_{2\,5it}GDP_{it-1} + \varepsilon_{1it} \tag{7}$$

$$\Delta FSI_{it} = a_{1t} + \sum_{n=0}^{k}\beta_{1\,2it}\Delta CON_{it-n} + \sum_{n=0}^{k}\beta_{1\,3it}\Delta INF_{it-n} + \sum_{n=0}^{k}\beta_{1\,4it}\Delta LAW_{it-n} + \sum_{n=0}^{k}\beta_{1\,5it}\Delta GDP_{it-n} + \delta_{2\,1it}FSI_{it-1} + \delta_{2\,2it}CON_{it-1} + \delta_{2\,3it}INF_{it-1} + \delta_{2\,4it}LAW_{it-1} + \delta_{2\,5it}GDP_{it-1} + \varepsilon_{1it} \tag{8}$$

The NL-ARDL panel models are specified as follows, with k=1,2, e=1…m. Here, Δ denotes the differencing operator. The term $1-\sum_{n=1}^{k}\beta e_{it}$ is a symmetrical error correction term (ECT), a_{1t} is the constant term, and β_{keit} and δ_{keit} are the short- and long-term coefficients, respectively. The panel NL-ARDL models are presented below:

$$\Delta FII_{it} = a_{1t} + \sum_{n=0}^{k} \beta_{1\ 2it}\Delta CON_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 3it}\,\Delta CON_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 4it} LAW_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 5it} LAW_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 6it} INF_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 7it}\, INF_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 8it} GDP_{\ it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 9it}\, GDP_{\ it-n}^{-} + \delta_{1\ 10it} FII_{it-1} + \delta_{1\ 11it} CON_{it}^{-} + \delta_{1\ 12it} CON_{it}^{+} + \delta_{1\ 13it} INF_{it}^{-} + \delta_{1\ 14it} INF_{it}^{+} + \delta_{1\ 15it} GDP_{it}^{+} + \delta_{1\ 16it} GDP_{it}^{-} + \delta_{1\ 17it} LAW_{it}^{+} + \delta_{1\ 18it} LAW_{it}^{-} + \varepsilon_{1it} \quad (9)$$

$$\Delta FEI_{it} = a_{1t} + \sum_{n=0}^{k} \beta_{1\ 2it}\Delta CON_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 3it}\,\Delta CON_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 4it} LAW_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 5it} LAW_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 6it} INF_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 7it}\, INF_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 8it} GDP_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 9it}\, GDP_{it-n}^{-} + \delta_{1\ 10it} FEI_{it-1} + \delta_{1\ 11it} CON_{it}^{-} + \delta_{1\ 12it} CON_{it}^{+} + \delta_{1\ 13it} INF_{it}^{-} + \delta_{1\ 14it} INF_{it}^{+} + \delta_{1\ 15it} GDP_{it}^{+} + \delta_{1\ 16it} GDP_{it}^{-} + \delta_{1\ 17it} LAW_{it}^{+} + \delta_{1\ 18it} LAW_{it}^{-} + \varepsilon_{1it} \quad (10)$$

$$\Delta FSI_{it} = a_{1t} + \sum_{n=0}^{k} \beta_{1\ 2it}\Delta CON_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 3it}\,\Delta CON_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 4it} LAW_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 5it} LAW_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 6it} INF_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 7it}\, INF_{it-n}^{-} + \sum_{n=0}^{k} \beta_{1\ 8it} GDP_{it-n}^{+} + \sum_{n=0}^{k} \beta_{1\ 9it}\, GDP_{it-n}^{-} + \delta_{1\ 10it} FSI_{it-1} + \delta_{1\ 11it} CON_{it}^{-} + \delta_{1\ 12it} CON_{it}^{+} + \delta_{1\ 13it} INF_{it}^{-} + \delta_{1\ 14it} INF_{it}^{+} + \delta_{1\ 15it} GDP_{it}^{+} + \delta_{1\ 16it} GDP_{it}^{-} + \delta_{1\ 17it} LAW_{it}^{+} + \delta_{1\ 18it} LAW_{it}^{-} + \varepsilon_{1it} \quad (11)$$

In Equations (9), (10), and (11), $1-\sum_{n=1}^{k} \beta e_{it}$ is the asymmetric ECT. The symbols (+) and (-) are the positive or negative changes in the variables. The term and long/short coefficients are measured by the mean group (MG) and pooled mean group (PMG) methods, and the Hausman (Chi-squared) test allows for a choice between the MG and PMG models (Pesaran et al., 1999). The stationarities of panel data are problematic since analyses may yield inconsistent results for the t, F, and R^2 test statistics. The stationarity tests for panel data are categorized into two generations, and the second-generation panel unit root tests are employed when there is cross-sectional dependency (M. Hashem Pesaran, 2007).

This study uses a cross-sectional augmented Dickey–Fuller (CADF) panel unit root test, given the presence of cross-sectional dependency. Another test used for model estimation concerns whether the model is homogeneous or heterogeneous. In this study, homogeneity is tested using the delta and delta-adjusted tests developed by M. Hashem Pesaran and Takashi Yamagata (2008). The homogeneity tests determine whether changes in one country impact changes in other countries and the respective economic structures.

5. Empirical Findings

This study explores the cross-sectional dependency in Table 2, employing the CADF panel unit root test (Ferda Yerdelen Tatoğlu, 2013).

Table 2. Cross-Sectional Dependency Test Findings

Variables	LM_{BP}	LM_{PS}	CD_{PS}	LM_{adj}
FII	2822.87 [0.00]	88.92[0.00]	87.84 [0.00]	7.95 [0.00]
FSI	998.43 [0.00]	22.56 [0.00]	21.48 [0.00]	1.82 [0.00]
FEI	804.56 [0.00]	15.51 [0.00]	14.444 [0.00]	5.39 [0.00]
CON	1295.16 [0.00]	33.37 [0.00]	32.28 [0.00]	12.74 [0.00]
INF	1033.46 [0.00]	24.82 [0.00]	18.786 [0.00]	16.43 [0.00]
LAW	2079.86 [0.00]	60.88 [0.00]	23.63 [0.00]	59.09[0.00]
GDP	3920.47 [0.00]	127.82 [0.00]	23.49 [0.00]	53.46 [0.00]

Note: [] indicates probability value.

Table 3 reveals that the variables are stationary at the first difference, while Table 4 presents the results of the homogeneity test for all the models.

Table 3. CADF Panel Unit Root Test Findings

Variables	Whole Panel (CIPS) Test Statistics	Order of Integration	Leg Lengths
FII	-1.32	I(1)	1
ΔFII	-3.26*		1
FSI	-1.86	I(1)	3
ΔFSI	-3.09*		1
FEI	-2.06	I(1)	2
ΔFEI	-3.65*		2
CON	-2.03	I(1)	1
ΔCON	-3.68*		1
INF	1.35	I(1)	2
ΔINF	-2.55*		1
LAW	-1.95	I(1)	1
ΔLAW	-2.5*		1
GDP	-1.08	I(1)	1
Δ GDP	-2.65*		1
Critical Values of the CADF Panel Unit Root Test	%1: -2.45, %5: -2.25, and %10:-2.14		

Note: * indicates the significance at a 1% significance level. The CIPS test statistics are obtained from critical table values in the T and N conditions of Pesaran (2007) and are determined to be optimal lag lengths in line with the Schwarz information criteria.

Table 4. Homogeneity Test Findings

Tests	FII Model	FEI Model	FSI Model
Delta	5.03*	3.88*	6.99*
Delta adjustment	7.15*	5.16*	8.24*

Note: * indicates significance at 1 % level.

According to the delta test and delta-adjusted test results in Table 4, the models are heterogeneous at the 1% significance level. Therefore, a shock occurring in one country may not affect other countries. There are also some differences regarding the effects of CON, INF, LAW, and GDP on FSI, FEI, and FII. After running the homogeneity tests, this study performs panel regression estimation, as shown in Table 5. In the long run, the coefficients of CON are positive in the estimation, as expected. A one-unit increase in CON causes a rise of 0.15, 0.23, and 0.39 in FEI, FII, and FSI, respectively. The coefficients of the long-run model and the short-run model are similar, except for FEI. The coefficient of FEI is negative in the short run. The results in Table 5 indicate that a linear increase in CON has a positive impact on FSI, FEI, and FII, while the ECT coefficients are negative at a 1% significance level. Table 5 provides evidence that the effects of short-term shocks dissipate over time, suggesting that there are co-integration relations between the variables in all the models.

Table 5. Panel L-ARDL Model Findings

Independent Variable	Dependent Variables		
	FII	FEI	FSI
Long-run			
CON	0.15**	0.23*	0.39**
INF	-0.01*	-0.03*	-0.07*
LAW	0.04	0.02	0.01*
GDP	0.03***	1.3**	0.4*
Constant	-0.01*	0.01*	-0.33***
ECT	-0.27*	-0.31*	-0.15*
Short-run			
D(CON)	0.12**	-0.25*	0.30*
D(INF)	-0.03*	0.01	0.04
D(LAW)	0.02	0.02	0.03**
D(GDP)	0.01	0.03**	-0.01
Hausman Chi^2	0.16	1.34	1.6

Note: *, **, and *** show statistical significance at 1%, 5%, and 10% levels.

The Hausman test (Chi^2) results indicate that the PMG approach is an efficient estimator in Table 5. The long-run estimations shown in Table 5 suggest that the significant effects of CON on FSI, FEI, and FII continue to be valid even if the long-term relations between CON and the indexes are not linear. Additionally, INF has a negative impact on FSI, FEI, and FII in the long term, and this negative nexus persists in the short term for FII. GDP has a positive effect on FSI, FEI, and FII in the long term, but this positive nexus is only valid for FE in the short term. LAW is an effective variable in terms of FSI for the long and short term.

The positive link between CON, FS, FE, and FI may be explained by the increase in the depth of bank assets, the efficient use of resources, and the reduced asset riskiness in highly concentrated conditions in the banking sector (Peter Morgan and Victor Pontines, 2014; González et al., 2017). Therefore, if CON increases, FS, FE, and FI may also increase, and this ensures cost efficiency and risk reduction while accelerating access to and usage of financial goods and services. However, Beck et al. (2004) find that greater CON is an obstacle to growth in developing countries. Cetorelli and Gambera (2001) assert that sectors' external finance needs may grow rapidly, and high CON rates reduce firm size in European Union member countries when compared with non-member countries. Rattia et al. (2008) report that highly concentrated levels alleviate financial constraints in financial markets due to improved accounting standards, reduced risk, more efficient systems, and enhanced creditor rights. Owen and Pereira (2018) demonstrate that CON increases the FI level, which may lead to an increase in FE and FS.

The panel NL-ARDL model is employed to generate the results in Table 6, which shows that the PMG approach is an efficient estimator for all the models, the ECTs are significant and negative, and the effects of short-term shocks disappear in the long term. The panel NL-ARDL estimation reveals asymmetric effects of CON, LAW, INF, and GDP on FSI, FEI, and FII in both the long and short runs. This study finds that most of the asymmetrical coefficients of the variables are statistically significant, as expected. Moreover, there is a positive effect of positive changes in CON on FSI, FEI, and FII, except for the short-run effect of D. CON_Positive on FEI. A one-unit increase in positive changes in CON causes increases of 0.2, 0.13, and 0.15 in FSI, FEI, and FII for the long term, respectively. A one-unit increase in negative changes in CON causes decreases of -0.07 and -0.01 in FII and FEI for the long run. However, in the short run, the significant effect of positive CON shocks on FEI disappears. Moreover, in the short-run estimations, negative shocks to CON have a substantial impact on FII. Positive changes in GDP are positive determinants of FEI and FII in the long term and of FSI in the short run. Moreover, negative changes in GDP have a long-term negative effect on FII and FSI, and a negative relation exists between negative changes in GDP and FEI in the short term. Positive changes in INF result in negative changes in FII and FEI in the short run, and negative changes in INF increase FEI in the short run. Negative changes in INF positively affect FII, FEI, and FSI in the long term but only have a significant and positive effect in the short run on FII. Finally, positive changes in LAW are the effective variable for FII and FEI in the long term, although only positive changes in LAW affect FII in the short run. Negative changes in LAW have a significant and negative effect on FSI in the long term.

Developing countries exhibit varying levels of financial development, influenced by factors such as human capital, participation in the financial system, institutional quality, and technological advancement (Lola et al., 2018). Furthermore, the financial agencies of developing countries are subject to regulations, given that the cost of credit is high and the levels of competition and credit volume are low (International Monetary Fund, 2023; Tesfamlak Gizaw, Zerihun Getachew, and Malebo Mancha, 2024). Gizaw et al. (2024) argue that competent authorities should focus on the law to develop financial markets and financial institutions, thereby preventing the adverse selections and moral hazards that are prevalent in developing markets. Yusheng Kong and Kofi Nyarko Gyimah (2024) find that CON reduces FSI in developing countries, while FI is a prerequisite for achieving FS. Shehong Hou (2023) reveals the U-shaped nexus between competition and FS, finding that there is an optimal level for competition in China as a developing country. Kong and Gyimah (2024) claim that up to a certain level, high CON or low competition may harm the financial sectors of developing countries. After a certain level, this negative nexus turns positive, since developing countries experience a higher CON rate. Additionally, Kong and Gyimah (2024) note that mergers and acquisitions should be thoroughly analyzed and evaluated.

Antwi et al. (2024) state that developing countries aim to increase FI, and also explore the systemic risk indicators in the formal financial systems of developed countries, finding that these situations may decrease FS and FE. Van et al. (2021) assert the existence of a positive nexus between GDP and FI, which aligns with the findings of this study. Mandira Sarma and Jesim Pais (2011) focus on the determinants of FI and find that there is a close relation between GDP and FI, as mentioned in this study. Susan Feng Lu and Yang Yao (2009) confirm that the legal system is an important factor in determining bank credit size, which is in line with the findings of this study. Fungácová et al. (2017) find that LAW is positively related to the Lerner index and negatively associated with the H-statistic. Fouejieu (2017) concludes that higher INF rates decrease the stability of the financial system. Le et al. (2019) assert that there is no influence of GDP on FS and FE, contrary to the findings of this study. Schinasi (2004) states that if the legal system is robust, FS may be ensured, as determined in this study. Controversial findings are reported for developing countries with regard to the nexus between CON, FS, FE, and FI due to regional and country differences.

Table 6. Panel NL-ARDL Model Findings

Independent Variables	Dependent Variables		
	FII Model	FEI Model	FSI Model
Long-run			
CON_Positive	0.2*	0.13*	0.15*
CON_Negative	-0.07*	-0.01*	-0.19
GDP_Positive	0.5*	1.13	1.38*
GDP_Negative	-0.8*	-0.01	-2.1*
INF_Positive	-0.08***	-0.02*	0.2
INF_Negative	0.04**	0.01*	0.9*
LAW_Positive	0	0.49**	0.02***
LAW_Negative	0.01	0.04	-0.01**
Short-run			
D.CON_Positive	0.03*	-0.02	0.01*
D. CON_Negative	-0.25*	-0.07	-0.03
D. GDP_Positive	2	0.11	0.9**
D. GDP_Negative	1.52	0.07*	1.1
D.INF_Positive	-0.16	-0.04*	0.2
D. INF_Negative	0.03*	0.5	0
D. LAW_Positive	0.04***	0.08	0
D. LAW_Negative	0.03	0.05	-0.02
Constant	0.02*	0.1	0.01
ECT	-0.34*	-0.11**	-0.49*
Hausman $Chi2$	0.97	0.67	1.33

Note: *, **, and *** show statistical significance at 1%, 5%, and 10% levels.

5.1. Robustness Checks

In this study, robustness checks of the findings are conducted, with second-generation cointegration tests being employed due to the presence of cross-sectional dependency. The results of the second-generation cointegration test, as developed by Persyn and Westerlund (2008), are presented in Table 7.

Table 7. Panel Cointegration Test Results

Statistics	FII Model	FEI Model	FSI Model
G_t	-9.9*[0.00]	-3.84*[0.00]	-5.27*[0.00]
G_a	-7.8*[0.00]	-4.85*[0.00]	-4.3*[0.00]
P_t	-5.92*[0.00]	-9.86*[0.00]	-4*[0.00]
P_a	-6.32*[0.00]	-5.1*[0.00]	-6.33*[0.00]

Note: * and [] indicate the statistical significance at 1% level and robust probability values, respectively. Boot failure is based on 400 repetitions, and lag length and lead length are determined according to the Akaike information criteria.

Table 7 reveals that the null hypothesis can be rejected in all the models, indicating a long-run relation between the variables in the models. Additionally, Table 8 provides evidence that a one-unit increase in CON results in increases of 0.4, 0.21, and 0.06 in FSI, FEI, and FII, respectively. Additionally, INF is a negative factor for FII and FEI, while LAW increases FSI and FEI. Finally, GDP is a significant and effective variable for FSI and FII. According to the results in Table 8, the findings of this study are robust to alternative panel data estimations. Therefore, the results in Tables 5, 6, and 8 remain similar, and the results in Table 8 support those in Tables 5 and 6. The influence of the control variables on the AMG estimation is approximately in line with the findings of the panel L-ARDL and panel NL-ARDL models.

Greater CON may boost FS, FE, and FI, and larger banks may facilitate portfolio diversification, access to financial goods and services, and efficient use of resources, thereby reducing asset riskiness. Based on this assumption, when an economic crisis occurs, mergers in the banking sector become widespread (González et al., 2017) and the concentration rates of the banking sector may increase due to an expectation of improvement in FS.

Table 8. AMG Panel Cointegration Analysis Results

Variables	FII Model	FEI Model	FSI Model
CON	0.4*	0.21*	0.06*
INF	-0.04**	-0.16*	0.25
LAW	0.93	0.01*	0.41*
GDP	0.03***	1.29	2.1*

Note: *, **, and *** show statistical significance at 1%, 5%, and 10% levels.

6. Conclusion

This study identifies the relations between CON and FS, FE, and FI in developing countries. The panel L-ARDL model is employed to investigate the relations between CON, FS, FE, and FI. The findings reveal a positive correlation between CON and FS, FE, and FI, as well as a negative correlation between GDP and FS, FE, and FI. Conversely, the long-term effect of INF is negative on FS, FE, and FI. The LAW is an effective variable for both long- and short-term financial stability. Additionally, a robustness check analysis yields approximately the same findings as the main estimation results in this study.

The estimation findings indicate that FS, FE, and FI are positively influenced by CON. Thus, higher CON is related to FS, FE, and FI. The positive nexus between the concentration level of banks and FI, FE, and FS may be due to diversification, more efficient resource utilization, reduced risk-taking behavior, and improved financial infrastructure in larger banks. These results bring to the agenda in many developing countries the need to increase concentration rates to an optimal level, thereby improving FS, FE, and FI. Thus, financial growth policies of developing countries should include goals related to enhancing FS, FE, and FI. Policymakers should strengthen the LAW framework by investing in human resources, in addition to strengthening the banking sector's concentration structure. This is because a concentrated market may exhibit less competition in the banking sector. Moreover, mergers and acquisitions may be encouraged by policymakers through monitoring and regulating the banking sector, as a trigger of CON.

References

Allen, Franklin, and Doug las Gale. 2004. "Competition and Financial Stability", *Journal of Money, Credit, and Banking*, 36(3b): 453-480. https://doi.org/10.1353/mcb.2004.0038.

Allen, Franklin, Asli Demirguc-Kunt, Leora Klapper, and Maria Soledad Martinez Peria. 2016. "The Foundations of Financial Inclusion: Understanding Ownership and Use of Formal Accounts." *Journal of Financial Intermediation,* 27(9): 1–30. https://doi.org/10.1016/j.jfi.2015.12.003.

Allen, N. Berger, and Timothy H. Hannan. 1998. "The Efficiency Cost of Market Power in the Banking Industry: A Test of the 'Quiet Life and Related Hypotheses". *The Review of Economics and Statistics*, 80:3, 454–465. https://doi.org/10.1162/003465398557555

Antwi, Frank, Yusheng Kong, and Nyarko Gyimah Kofi. 2024. "Financial Inclusion, Competition, and Financial Stability: New Evidence from Developing Economies". *Heliyon,* 10: e33723. https://doi.org/10.1016/j.heliyon.2024.e33723

Armand, Fouejieu. 2017. "Inflation Targeting and Financial Stability in Emerging Markets". *Economic Modelling,* 60, 51–70. http://dx.doi.org/10.1016/j.econmod.2016.08.020

Babajidea, Abiola Ayopo, Adedoyin Isola Lawal, Lanre Olaolu Amoduc, Olabanji Olukayode Ewetand, Susannash Limunga Esowee, and Tochukwu Chibuzor Okaforf. 2020. "Financial Institutions Concentration and Financial Inclusion Penetration in Nigeria: A Comparative Analysis". *Journal of Contemporary African Studies,* 38(4): 610-626. https://doi.org/10.1080/02589001.2020.1822991

Beck, Thorsten, and Augusto De la Torre. 2006. *The Basic Analysis of Access to Financial Services.* WPS 4026, World Bank. Retrieved from https://doi.org/10.1596/1813-9450-4026

Beck, Thorsten, Aslı Demirgüç-Kunt, and Vojıslav Maksimovic. 2005. "Financial and Legal Constraints to Growth: Does Firm Size Matter?". *The Journal of Finance,* LX(1): 137-177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

Beck, Thorsten, Aslı Demirgüç-Kunt, and Vojislav Maksimovic. 2004. "Bank Competition and Access to Finance: International Evidence". *Journal of Money, Credit and Banking,* 36: 627–648. https://www.jstor.org/stable/pdf/3838958.pdf?refreqid=excelsior%3Ac3fd5b4b5ca0b2f6b907705c97805887

Beck, Thorsten, Hans Degryse, and Christiane Kneer. 2014. "Is more Finance better? Disentangling Intermediation and Size Effects of Financial Systems". *Journal of Financial Stability*, 10, 50–64. https://doi.org/10.1016/j.jfs.2013.03.005

Boot, Arnoud W. A., and Anjan V. Thakor. 2000. "Can Relationship Banking Survive Competition?". *The Journal of Finance,* 55(2): 679-713. https://doi.org/10.1111/0022-1082.00223.

Boyd, John H., and Gianni De Nicoló. 2005. "The Theory of Bank Risk-Taking and Competition Revisited". *The Journal of Finance*, 60(3): 1329-1343. https://doi.org/10.1111/j.1540-6261.2005.00763.x.

Breitung, Jörg. 2001. "*The Local Power of Some Unit Root Tests for Panel Data".* Nonstationary panels, panel cointegration, and dynamic panels. Emerald Group Publishing Limited.

Breusch, Trevor, and Andrian Pagan. 1980. "The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics". *The Review of Economic Studies,* 47(1): 239-253. https://www.jstor.org/stable/2297111

Cetorelli, Nicola, and Michele Gambera. 2001. "Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry Data". *Journal of Finance,* 56: 617–648. https://doi.org/10.1111/0022-1082.00339

Chauvet, Lisa, and Luc Jacolin. 2017. "Financial Inclusion, Bank Concentration, and Firm Performance". *World Development,* 97: 1–13. https://doi.org/10.1016/j.worlddev.2017.03.018

Cifter, Atilla. 2015. "Bank Concentration and Non-Performing Loans in Central and Eastern European Countries". *Journal of Business Economics and Management,* 16(1): 117–137. https://doi.org/10.3846/16111699.2012.720590

Claessens, Stijn. 2006. "Access to Financial Services: A Review of the Issues and Public Policy Objectives". *World Bank Research Observer,* 21(2): 207-240. https://doi.org/10.1093/wbro/lkl004

Claudia, Capozza, and Angela Stefania Bergantino. 2013. "*The Effect of Bank Concentration on Entrepreneurship in Central and Eastern European Transition Countries_x0003"*. European Regional Science Association. http://www-sre.wu.ac.at/ersa/ersaconfs/ersa13/ERSA2013_paper_01049.pdf

Degryse, Hans, and Steven Ongena. 2005. "Distance, Lending Relationships, and Competition". *Journal of Finance*, 60, 231-266. http://www.econ.kuleuven.be/ces/discussionpapers/default.htm

Désiré, Avoma Chrysost Bangakeb, and Hermann Ndoya. 2022. "Does Bank Concentration Stem from Financial Inclusion in Africa?". *Applied Economics*, 54(28): 3261–3278. https://doi.org/10.1080/00036846.2021.2006134

Dollar, David, and Aart Kray. 2002. "Growth is Good for the Poor". *Journal of Economic Growth*, 7(3): 195–225. https://link.springer.com/article/10.1023/A:1020139631000#preview

Feng, Susan Lu, and Yang Yao. 2009. "The Effectiveness of Law, Financial Development, and Economic Growth in an Economy of Financial Repression: Evidence from China". *World Development*, 3(74): 763-777. https://doi.org/10.1016/j.worlddev.2008.07.018

Fu, Xiaoqing, and Shelagh Heffernan. 2009. "Market Power and Firm Risk: A Test of the `Quiet Life' Hypothesis". *Journal of Monetary Economics,* 9(1): 73-85. https://doi.org/10.1016/0304-3932(82)90051-4

Fungáčová, Zuzana, Anastasiya Shamshurb, and Laurent Weill. 2017. "Does Bank Competition Reduce Cost of Credit? Cross-Country Evidence from Europe". *Journal of Banking Finance,* 8(3): 104–120. http://dx.doi.org/10.1016/j.jbankfin.2017.06.014

Gizaw, Tesfamlak, Zerihun Getachew, and Malebo Mancha. 2024. "Financial Development and Economic Growth: Evidence from Emerging African and Asian Countries". *Cogent Economics & Finance,* 12(1): 2398213, https://doi.org/10.1080/23322039.2024.2398213

González, Luis Otero, Alaa Razia, Milagros Vivel Búa, and Rubén Lado Sestayo. 2017. "Competition, Concentration and Risk Taking in Banking Sector of MENA Countries". *Research in International Business and Finance,* 42: 591–604. http://dx.doi.org/10.1016/j.ribaf.2017.07.004

Hair, Joseph F., Bill Black, Barry Babin, Rolph E. Anderson, and Ronald L. Tatham. 2006. *Multivariate Data Analysis*. Uppersaddle River. NJ: Pearson Prentice Hall.

International Monetary Fund. 2023. *International financial statistics (database)*. https://data.imf.org/

Jolliffe, Ian. 2011. "Principal Component Analysis". *In International Encyclopedia of Statistical Science* (pp. 1094-1096). Berlin, Heidelberg: Springer.

Kirkpatrick, Colin, Victor Murinde, and Moses Tefula. 2008. "The Measurement and Determinants of X-inefficiency in Commercial Banks in Sub-Saharan Africa". *The European Journal of Finance,* 14(7): 625-639, https://doi.org/10.1080/13518470701705769

Kouton, Jeffrey. 2019. "The Asymmetric Linkage between Energy Use and Economic Growth in Selected African Countries: Evidence from A Nonlinear Panel Autoregressive Distributed Lag Model". *Energy Economics,* 83: 475-490. https://doi.org/10.1016/j.eneco.2019.08.006

Kozak, Sylwester, and Agata Wierzbowska. 2021. "Banking Market Concentration and Bank Efficiency. Evidence from Southern, Eastern and Central Europe". *South East European Journal of Economics and Business*, 16(1): 38-52. https://doi.org/10.2478/jeb-2021-0004

Le, Thai-Ha, Tu Chuc Anh, and Farhad Taghizadeh-Hesary. 2019. "Financial Inclusion and its Impact on Financial Efficiency and Sustainability: Empirical Evidence from Asia." *Borsa Istanbul Review*, 19(4): 310–322. https://doi.org/10.1016/j.bir.2019.07.00

Levin, Andrew, Chien-Fu Lin, and Chia-Shang James Chu. 2002. "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties". *Journal of Economy,* 108: 1-24. https://doi.org/10.1016/S0304-4076(01)00098-7

Leyshon, Andrew, and Nigel Thrift, 1995. "Geographies of Financial Inclusion-Financial Abandonment in Britain and The United States". *Transactions of the Institute of British Geographers,* 20(3): 312–341. http://www.jstor.org/stable/622654.

Martin R., Goetz. 2018. "Competition and Bank Stability". *Journal of Financial Intermediation,* 35(A): 57-69. https://doi.org/10.1016/j.jfi.2017.06.001

Morgan, Peter, and Victor Pontines. 2014. "Financial Stability and Financial Inclusion". ADBI Working Papers 488. *Asian Development Bank Institute*. http://dx.doi.org/10.2139/ssrn.2464018

Nelson, William R., and Roberto Perl. 2007. "Selected Indicators of Financial Stability". *Risk Measurement and Systemic Risk,* 4: 343-372. https://www.ecb.europa.eu/events/pdf/conferences/jcbrconf4/Perli.pdf

Olgu, Özlem, Hasan Dinçer, and Ümit Hacıoğlu. 2014. "*Handbook of Research on Strategic Developments and Regulatory Practice in Global Finance*". IGI Global.

Owen, Ann L., and Javier Pereira. 2018. "Bank Concentration, Competition, and Financial Inclusion". *Review of Development Finance,* 8*:* 1–17. https://doi.org/10.1016/j.rdf.2018.05.001

Persyn, Damiaan, and Joakim Westerlund. 2008. “Error Correction Based Cointegration Tests for Panel Data”. *Stata Journal,* 8(2): 232-241. https://doi.org/10.1177/1536867X0800800205

Pesaran, M. Hashem, and Yamagata Takashi. 2008. “Testing Slope Homogeneity in Large Panels”. *Journal of Econometrics*, 142: 50-93. https://doi.org/10.1016/j.jeconom.2007.05.010

Pesaran, M. Hashem, Yongcheol Shin, and Ron P. Smith. 1999. “Pooled Mean Group Estimation Dynamic Heterogeneous Panels”. *Journal of The American Statistical Association*, 94(446): 621-634. https://www.jstor.org/stable/2670182

Pesaran, M. Hashem. 2006. “Estimation and Inference in Large Heterogeneous Panels with A Multifactor Error Structure”. *Econometrica,* 74(4): 967–1012. https://www.jstor.org/stable/3805914

Pesaran, M. Hashem. 2007. “A Simple Panel Unit Root Test in The Presence of Cross-Section Dependence”. *Journal of Applied Econometrics,* 22(2): 265-312. https://doi.org/10.1002/jae.951

Peseran, M. Hashem. 2004. *General Diagnostic Tests for Cross-Section Dependence in Panels*. IZA Discussion Paper, 1240. Retrieved from http://ftp.iza.orga/dp1240.pdf

Qamruzzaman, Md, and Wei Jianguo. 2020. “The Asymmetric Relationship between Financial Development, Trade Openness, Foreign Capital Flows, and Renewable Energy Consumption: Fresh Evidence from Panel NARDL Investigation”. *Renewable Energy,* 159: 827-842. https://doi.org/10.1016/j.renene.2020.06.069

Rattia, Ronald A., Sunglyong Lee, and Youn Seol. 2008. “Bank Concentration and Financial Constraints on Firm-Level Investment in Europe”. *Journal of Banking & Finance*, 32: 2684–2694. https://doi.org/10.1016/j.jbankfin.2008.07.001

Reszat, Beate. 2005. *European Financial Institution in a Global Economy*. West Sussex, England: John Willey and Sons Ltd

Sarma, Mandira, and Jesim Pais. 2011. “Financial Inclusion and Development”. *Journal of International Development, 23*(5): 613-628. https://doi.org/10.1002/jid.1698

Schinasi, J. Garry. 2004. “*Defining Financial Stability”*. IMF Working Papers 04/87, Washington, DC: International Monetary Fund.

Shehong Hou. 2023. “The Nonlinear Relationship between Banks Competition and Financial Stability in China”. *Applied Economics Letters*, 30:3, 331-335. https://doi.org/10.1080/13504851.2021.1985065.

Uhde, André, and Ulrich Heimeshoff. 2009. “Consolidation in Banking and Financial Stability in Europe: Empirical Evidence”. *Journal of Banking & Finance,* 33(7): 1299–1311. https://doi.org/10.1016/j.jbankfin.2009.01.006

Van, Thi-Hong Loan, Anh The Vo, Nhan Thien Nguyen, and Duc Hong Vo. 2021. “Financial Inclusion and Economic Growth: An International Evidence”. *Emerging Markets Finance and Trade*, 57:1, 239-263, https://doi.org/10.1080/1540496X.2019.1697672

Woetzel Lola, Anu Madgavkar, Jeongmin Seong, James Manyika, and Kevin Sneader. 2018. “*Outperformers: High-Growth Emerging Economies and the Companies that Propel them*”. McKinsey Global Institute.

Yalçınkaya, Ömer, and Esra Kadanalı. 2020. “Effects of Climate Change on Economic Growth: Evidence from the 20 Biggest Economies of The World”. *Romanian Journal of Economic Forecasting*, XXIII(3): 93-118. http://www.rjef.ro/rjef/rjef3_20/rjef3_2020p93-118.pdf

Yerdelen Tatoğlu, Ferda. 2013. *İleri panel veri analizi-Stata uygulamalı.* İstanbul: Beta Yayınları

Yorulmaz, Recep. 2018. “An Analysis of Constructing Global Financial Inclusion Indices”. *Borsa Istanbul Review*, 18(3): 248-258. https://doi.org/10.1016/j.bir.2018.05.001

Yoshino, Naoyuki, and Farhad Taghizadeh-Hesary. 2015. “Analysis of Credit Ratings for Small and Medium-Sized Enterprises: Evidence from Asia”. *Asian Development Review,* 32(2): 18-37. https://doi.org/10.1162/ADEV_a_00050

Appendix 1. Beginning Tests of PCA and Correlations between the Indicators in Constructing Indexes

Panel A. FSI	**Metric7**	**Metric 8**	**Metric 9**			
Metric 7	1					
Metric 8	0.5	1				
Metric 9	-0.4	-0.36	1			
Panel B. FEI	**Metric 11**	**Metric 12**	**Metric 10**			
Metric 11	1					
Merric 12	0.34	1				
Metric 10	0.37	0.68	1			
Panel C. FII	**Metric 5**	**Metric 2**	**Metric 6**	**Metric 3**	**Metric 4**	**Metric 1**
Metric 5	1					
Metric 2	0.57	1				
Metric 6	0.89	0.27	1			
Metric 3	0.45	0.57	0.39	1		
Metric 4	0.01	0.27	0.09	0.11	1	
Metric 1	-0.02	-0.01	-0.02	-0.07	0.3	1
Panel D. FSI The Bartlett's Test: 68.86*, Df[1]: 3 Kaiser- Meyer-Olkin (KMO) Test: 0.53						
Panel E. FEI The Bartlett's Test: 302.45*, Df: 3 KMO Test: 0.61						
Panel F. FII The Bartlett's Test: 391*, Df: 3 KMO Test: 0.51						

* indicates statistical significance at 1% level, and Df is the degrees of freedom

Appendix 2. Findings of PCA

Indexes	**Components**			
Panel A. FSI	**1**	**2**	**3**	**4**
Metric 7	0.33	0.94	-0.12	-
Metric 8	0.68	-0.15	0.72	-
Metric 9	-0.66	0.32	0.69	-
Panel B. FEI	1	2	3	-
Metric 11	0.47	0.88	0.05	-
Metric 12	0.62	-0.37	0.69	-
Metric 10	0.62	-0.29	-0.72	-
Panel C. FII	1	2	3	4
Metric 5	0.39	0.42	-0.39	0.32
Metric 2	0.40	0.51	-0.24	-0.01
Metric 6	0.55	-0.44	0.14	-0.03
Metric 3	0.58	-0.38	0.07	0.07
Metric 4	0.23	0.41	0.51	-0.68
Metric 1	0.02	0.24	0.71	0.66
Total Variance Explained for Components				
Panel D. FSI	**Eigenvalues**		**% of Variance**	**Cumulative Variance**
1	1.41		0.47	0.47
2	0.95		0.32	0.79
3	0.63		0.21	1
Panel E. FEI	**Eigenvalues**		**% of Variance**	**Cumulative Variance**
1	1.94		0.65	0.65
2	0.73		0.24	0.89
3	0.32		0.11	1
Panel F. FII	**Eigenvalues**		**% of Variance**	**Cumulative Variance**
1	2.18		0.36	0.36
2	2		0.33	0.69
3	1.26		0.21	0.9
4	0.61		0.10	1

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization