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ABSTRACT

This study aims to detect the relationship between financial inclusion and financial performance in the banking sector. Within this scope, firstly, we develop an index for financial inclusion which consists of various dimensions for 85 developing countries in the 2005–2017 time period. Then, we apply static and dynamic panel data analyses. Static panel data analysis findings indicate that financial performance indicators such as bank return on assets, bank return on equity, and bank net interest margin positively affect and bank lending-deposit spread negatively affects financial inclusion, but bank non-interest income to total income has a statistically insignificant coefficient. Also, as a robustness analysis, dynamic panel data analysis provides evidence that financial performance is important for financial inclusion. According to our findings, we can say that the increase in the profitability of the banking sector is one of the triggers of financial inclusion for developing countries.

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Financial performance; financial inclusion; developing countries; banking sector efficiency

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1. Introduction

In a perfect financial market, consumers may straightforwardly access accurate information, but in the real world, there are information asymmetries and power imbalances. Recent reports of The Organisation for Economic Co-operation and Development (OECD), the World Bank, and the Financial Stability Board (FSB) argue for the adoption of a broad range of regulatory and supervisory tools, to improve efficiency, competition, and access to financial markets (Gaganis et al. 2020).

The new phenomenon is financial exclusion, which means that everyone does not access to financial goods and services or has enough financial literacy to use them. The opposite phenomenon of financial exclusion is financial inclusion, which has three dimensions such as the depth, availability, and usage of financial goods and services (World Bank 2013). Financial inclusion is a remarkable topic for academians as well as policymakers and financial market players since it has a potential impact on the financial development of the economy (Demirguc-Kunt, Beck, and Honohan 2008) and it is associated with economic development through community improvement and society (Bose, Podder, and Biswas 2017).

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The financial inclusion indicators may be macro level and micro level (Sarma 2012). The beginning of formal financial inclusion is a deposit at a bank for making and receiving payments in addition to saving money (Demirguc-Kunt, Klapper, and Singer 2017). The United Nations argues that most of the world's population is financially excluded; however, the financial inclusion level is low in developing countries while it is high in developed countries (Consultative Group to Assist the Poorest and World Bank 2010). If financial inclusion is high, this situation provides benefits to the society and eliminates the barriers to the disadvantages of the financial sector (Sarma and Pais 2008).

Financial performance is to fulfill the functions of the financial system and is regarded as one of the most important dimensions of financial development in the banking sector. Efficient financial systems are believed to be less susceptible to banking crises (Olgu, Dinçer, and Hacıoğlu 2014). It is argued that financial inclusion directly contributes to the economic development of a country (Allen et al. 2016) and ensures the efficient allocation of productive resources reducing the cost of capital (Sarma and Pais 2011).

The banking sector fundamental is essential for developing any economic activities. Several central banks of developing and developed countries introduce initiatives through engaging their banking sectors to promote financial inclusion (World Bank 2014). Whether the financial system performs effectively suggests that financial performance may be one of the factors affecting financial inclusion and there may be a relationship between the financial performance of the banking sector and financial inclusion.

This study aims to detect the relationship between financial performance and financial inclusion. Firstly, we develop an index for financial inclusion consisting of various dimensions for 85 developing economy countries in the 2005–2017 time period. And then, we apply static and dynamic panel data analyses. Static panel data analysis findings indicate that financial performance indicators such as bank return on assets, bank return on equity, and bank net interest margin positively affect financial inclusion. But, bank non-interest income to total income has a statistically insignificant coefficient and the bank lending-deposit spread negatively affects the financial inclusion. Also, dynamic panel data analysis for robustness checks provides evidence that financial performance is important for financial inclusion.

The importance of our study is given the following: The first contribution of the study to the literature is to be one of the few studies which measure the relationship between the financial performance of the banking sector and financial inclusion. The second contribution of our study to the literature is the measurement of financial inclusion in a form of an index and making comprehensive research by taking five different financial performance indicators for the banking sector. Again, determining the sample as developing countries is another contribution of the study to the literature since financial inclusion is an important tool in reducing poverty and income inequality in developing countries. And, it is important to identify the triggers of financial inclusion for developing countries thus, the findings obtained in this study are instructive. In addition, we examine the relationship between financial inclusion and financial performance using both static and dynamic panel data analysis and test the robustness of the findings in this study. This situation provides evidence for the robustness of the relationship between financial inclusion and financial performance and can be expressed as the original value of the study. Moreover, in our study, we measure the financial inclusion with two different methods and create two different indexes for financial inclusion. Examining

the financial inclusion with two different indexes is one of the contributions of the study to the literature. Finally, the examination of the relationship between financial inclusion and financial performance of the banking sector ensures valuable insights for policymakers.

This study consists of five sections. The second section includes a summary of the literature, and in the third section, we explain the data and method. The fourth section reports the findings and discussion and the fifth section presents the conclusion.

2. Literature review

The relationship between financial inclusion and banks' profitability is grouped in two approaches. The first one consists of low costs, locations, and small deposits that ensure a high level of profitability (Okun 2012). The second one includes small loans, good interest rates, and high repayment which means a high level of profitability. Financial performance is not only important for policymakers who also ensure the stability of the financial sector, but also it is concerned with overall social welfare. Therefore, the literature suggests that financial performance matters for economic growth (Berger et al. 2004; Hasan, Koetter, and Wedow 2009). Banking sector firms allocate a substantial amount of resources to ensure financial inclusion and communicate this information to various stakeholders including government regulators (European Commission 2001, 2008; Eccles and Serafeim 2013), and it has a direct impact on the firm's market-based performance.

Levine (2005) asserts that the financial sector has a positive impact on the economy through its critical functions. These critical functions are carried out not only by the banks and other financial institutions but also by financial markets. Keeley (1990) argues that profitable banks are more averse to the risk, can increase their core capital, and ensure their viability. Banerjee and Newman (1993), Aghion and Bolton (1997), and Banerjee (2001) argue that access to financial goods and services has a critical role in enabling people to transform their production, employment activities, and fight against poverty. Banks have purposes for penetration to increase the deposit, customers, credit, and other services. New branches ensure the banks invest in technology and equipment and with more branches, banks offer services and ensure more profits. Thus, if the banks' performances are high, banks generate new services to supply customer needs (Shihadeh and Liu 2019).

In recent years, there are studies that examine the relationship between financial inclusion and financial development (De la Torre, Martínez Pería, and Schmukler 2010; Mehrotra and Yetman 2015; García and Jose 2016; Neaime and Gaysset 2018). Also, Beck and Honohan (2009) and Stephen and Sibert (2014) examine the relationship between financial inclusion and firm performance. But, for the developing countries, the studies about the nexus between financial inclusion and performance are still limited in the literature (Zulfiqar, Chaudary, and Aslam 2016; Ahluwalia and Bhatti 2017). Mukherjee and Chakraborty (2012) examine the role and efficiency of commercial banks in promoting financial inclusion. The findings of them show that the banks cannot achieve financial inclusion. Uma and Rupa (2013) try to examine the role of rural banks in financial inclusion and provide evidence that there is a positive relationship between rural banks' activities and financial inclusion.

Joseph and Varghese (2014) analyze the banking sector growth rate, usage of debit cards, and credit cards, and observe that the usage of debit cards increases highly the inclusive banking initiatives. Ravikumar (2012) assesses the role of the banking sector on financial inclusion such as branch and ATM penetrations, population per branch, distribution of banking branches, credits, deposits, and rural banks. Also, Ravikumar (2012) reaches the finding that banking sector performance is an important driver for financial inclusion, but financial exclusion is high in the formal financial system. On the other hand, according to Ravikumar (2012), these findings show higher poverty and inequality of income. Paramasivan and Ganeshkumar (2013) study on financial inclusion in India and show that banking system concentration has a significant impact on financial inclusion.

Martynova, Ratnovski, and Vlahu (2015) provide evidence that more profitable banks give credits and expand their credit volume and this situation generates financial inclusion. Le, Chuc, and Taghizadeh-Hesary (2019) examine the effect of financial inclusion on financial efficiency and sustainability in Asia and find that financial inclusion negatively affects financial efficiency while it positively influences financial sustainability. Harelimana (2016) asserts that financial inclusion triggers financial performance. Mutinda, Jagongo, and Husborn (2017) research the nexus of financial inclusion and financial performance and assert that there is a strong positive relationship between financial inclusion strategies and financial performance. Shihadeh et al. (2018) investigate the relationship between financial inclusion and financial performance for Jordan using annual data from the 2009to 2014 time period and their findings provide evidence that there is a significant effect of financial inclusion on financial performance.

Oranga and Ondabu (2018) determine that financial inclusion indicators such as financial literacy programs, usage of agents and representatives, increasing the number of ATMs, and mobile banking services have a positive and strong impact on the return on equity. Shihadeh and Liu (2019) examine the relationship between financial inclusion and the performance of banks and indicate that financial inclusion indicators can help the banks for earning more returns and decrease the risks.

Al-Chahadah, El Refae, and Qasim (2020) examine the relationship between financial inclusion and financial performance using a simple regression analysis for Jordanian banks. The findings of their study indicate that there is a statistically significant effect of two indicators of financial inclusion, which are financial access and enterprise financing, on bank financial performance. Shihadeh (2021) researches the nexus of financial inclusion and the bank performance in Palestine from the 2006 to 2016 time period and finds that financial inclusion positively affects the financial performance in Palestine. Thus, according to the author, financial inclusion both supports and increases banks' performance and revenues. Bhattacharyya, Wright, and Rahman (2021) study whether expenditure and financial inclusion are associated with better financial performance for Indian banks in the 2015–2017 time period. Their findings demonstrate that degree of financial inclusion is not associated with banks' financial performance.

Al-Hamad, Jebreel, and Aldweiri (2021) indicate the role of financial inclusion on the financial performance of commercial Jordanian banks. Their study emphasizes that to increase financial inclusion, there is a need to use modern and innovative technologies such as mobile phones and financial wallets since financial inclusion decreases the cost and increases the profit. Also, Zhang et al. (2022) assert that financial inclusion indicators

such as green finance support the energy policy and economic performance for the 2010–2017 time period in China. Al-Eitan, Al-Own, and Bani-Khalid (2022) provide evidence on whether financial inclusion is significant for 13 Jordanian banks' data from 2009 to 2019 using a panel data regression model. The findings of Al-Eitan, Al-Own, and Bani-Khalid (2022) show that financial inclusion negatively and significantly affects the profitability of the commercial banks in Jordan.

3. Data and method

In our study, we develop a financial inclusion index (FII) consisting of various dimensions by taking into account the literature for 85 developing countries of the 2005–2017 time period and try to determine the relationship between banking sector financial performance and financial inclusion. Developing countries spread over a wide area and have some troubles such as inflation, unemployment, and cost of living, current deficit, etc. with economic downturn since most of them do not catch enough development speed. A large part of the population in the developing countries live by agriculture and per national income level is low as well as low savings and high external depth rate. In recent years, it is observed a high growth rate in some developing countries and per national income is speedily increasing in them. On the other hand, despite of high growth rates, there is poverty and income inequality (Bilge 2001). We include developing countries in the study since the studies on financial inclusion for developing countries are limited and determining explanatory indicators of financial inclusion is important for making policies in reducing poverty and income inequality in developing countries. Therefore, the findings obtained within the scope of the study can be a guide for policy determination in developing countries. We obtain the developing country list from the report of the Development Policy and Analysis Division of the Department of Economic and Social Affairs of the United Nations Secretariat (https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf).

Following World Bank's Global Financial Development Database and literature (Uadiale and Fagbemi 2012; Torugsa, O'Donohue, and Hecker 2012; Iqbal et al. 2012; Cavaco and Crifo 2014; Zhou, Pan, and Wang 2015; Nobanee and Ellili 2016; Le, Chuc, and Taghizadeh-Hesary 2019; Ramzan, Amin, and Abbas 2021), we use indicators of banking sector financial performance for developing countries such as bank lending-deposit spread, bank non-interest income to total income, bank return on assets (after-tax), bank return on equity (after-tax), and bank net interest margin. On the other hand, we include gross domestic income (GDP) per capita as a control variable in logarithmic form for developing countries. Moreover, our study has some limitations. The first one of these limitations is the shortage of data on financial inclusion and financial performance for developing countries. In fact, financial performance and financial inclusion are important keys for financial systems and are neglected in the financial development comparisons, as there is not enough data for cross-countries. The other limitation is that the time interval is narrow. And finally, our findings cannot be generalized to the whole world since data belongs to developing countries.

For constructing FII, we use The World Bank's 'World Development Indicators' in obtaining the country-specific factors to determine the explanatory powers of the proxies of financial inclusion in this study. Thus, we obtain data from the World

Bank's Global Financial Development Database. Our country sample includes 85 developing countries and the countries included in this study are listed below: Afghanistan, Algeria, Angola, Argentina, Bahamas, Bahrain, Bangladesh, Barbados, Belize, Benin, Botswana, Brunei Darussalam, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Chile, China, Colombia, Congo, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Ghana, Guatemala, Guyana, Haiti, Honduras, Hong Kong SARc, India, Indonesia, Iraq, Israel, Jamaica, Jordan, Kenya, Kiribati, Kuwait, Lebanon, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Panama, Paraguay, Peru, Philippines, Qatar, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, South Africa, Sri Lanka, Syrian Arab Republic, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Arab Emirates, Uruguay, Venezuela, Zambia, and Zimbabwe.

Sarma (2008) explores that FII has three dimensions such as depth, usage, and access. Within this scope, we use nine different indicators for three dimensions of FII. On the other hand, our indicators choices are based on the World Bank's Global Financial Development Database and the literature (Gupte, Venkataramani, and Gupta 2012; Yorulmaz 2018; Le, Chuc, and Taghizadeh-Hesary 2019). Indicators for instructing FII are the number of bank accounts per 1,000 adults, the number of ATMs per 100,000 adults, the number of commercial bank branches per 100,000 adults, the deposit income ratio, the life insurance premium volume to GDP (%), the credit income ratio, and the bank cost to income ratio (%).

Firstly, we measure FII in our study. For constructing FII, we employ principal component analysis (PCA) which is a standard approach for simplifying data (Le, Chuc, and Taghizadeh-Hesary 2019) and is widely run in the literature (Jolliffe 2011). When we look at the existing literature, we can see that currently, some authors use PCA for constructing FII such as Yorulmaz (2018) and Le, Chuc, and Taghizadeh-Hesary (2019). We follow the existing literature and construct FII using PCA and normalize our data since PCA attempts to maximize variance as suggested by Yorulmaz (2018) and Le, Chuc, and Taghizadeh-Hesary (2019). In this study, we use the min–max normalization method in line with Gupte, Venkataramani, and Gupta (2012), Le, Chuc, and Taghizadeh-Hesary (2019), and Yorulmaz (2018) in normalizing data.

Bartlett's test and the Kaiser–Meyer–Olkin (KMO) method are the first stage in PCA and use to compare the degrees of correlation coefficients and the partial correlation coefficients. Bartlett's test shows whether the correlation matrix in the PCA is an identity matrix. It should be significant at 5% level for factor analysis to be suitable (Hair et al. 2006; Tabachnick, Fidell, and Ullman 2007). Meanwhile, the KMO test measures the sampling adequacy and provides evidence of the proportion of common variance that might be caused by underlying factors (Yoshino and Taghizadeh-Hesary 2015). On the other hand, when we construct the FII, we check the correlation structure, identificate the latent factors, rotate the factors, and construct the weights from a matrix of factor loadings, respectively. Finally, we find the statistical importance of the indicators and assign the weights using factor analysis.

Table 1 shows PCA beginning tests correlation matrices for the individual indicator used for measuring FII. When we look at Table 1, we can see that there are high correlations between variables used for constructing FII. Thus, the indicators meet an

important requirement which between correlations of two or more indicators should contain a correlation of 0.30 or greater for PCA (Yorulmaz 2018). Similar to Yorulmaz's (2018) findings, all indicators are positively correlated with each other except for the bank cost to income ratio. Commercial bank branches per 100,000 adults and bank accounts per 1,000 adults have the highest correlation in Table 1. On the other hand, commercial bank branches per 100,000 adults and ATMs per 100,000 adults have the second high correlation according to the findings in Table 1.

We perform Bartlett's test and KMO test at the beginning of the PCA to examine the suitability of the data in Table 1. KMO value is greater than 0.5 and it is 0.6. 0.6 value of the KMO test provides evidence that the variables are suitable for the PCA estimations. Bartlett's test shows that H_0 can be rejected and the variables used in the PCA are correlated. Table 2 reports PCA findings in measuring FII.

Table 2 presents that the deposit income ratio, credit income ratio, and commercial bank branches per 100,000 adults indicators are primarily important for measuring FII. On the other hand, ATMs per 100,000 adults, bank accounts per 1,000 adults, and life insurance premium volume to GDP are secondary important indicators in measuring FII with PCA. But, the bank cost to income ratio is the less important indicator for FII. On the other hand, Table 2 proves that the first three components explain more than 71% of the total variance of FII. After we measure the quality of the individual indicators of FII with PCA, we construct FII.

In this study, we try to determine the relationship between financial performance and financial inclusion. For this purpose, we use static panel data analysis. Unobservable differences for time and country dimensions in a panel dataset should be taken into account through fixed-effect and random-effect and the case of specific effects availability

Table 1. Correlations between the indicators used for measuring FII.

Indicators	ATMs per 100,000 adults	Bank accounts per 1,000 adults	Commercial bank branches per 100,000 adults	Bank cost to income ratio	Deposit income ratio	Credit income ratio	Life insurance premium volume to GDP
ATMs per 100,000 adults	1						
Bank accounts per 1,000 adults	0.51	1					
Commercial bank branches per 100,000 adults	0.53	0.60	1				
Bank cost to income ratio	−0.34	0.29	−0.19	1			
Deposit income ratio	0.35	0.19	0.17	−0.01	1		
Credit income ratio	0.41	0.23	0.32	0.37	0.08	1	
Life insurance premium volume to GDP	0.18	0.14	0.11	0.05	0.35	0.15	1
The Bartlett's test: 4076*, degrees of freedom: 3							
Kaiser–Meyer–Olkin (KMO) test: 0.6							

*Indicates at 5% significance level.

Table 2. PCA findings for measuring FII.

	Components						
Variable	1	2	3	4	5	6	7
ATMs per 100,000 adults	0.25	0.54	0.14	0.16	0.37	−0.22	0.75
Bank accounts per 1,000 adults	0.19	0.49	−0.10	0.52	0.30	0.37	0.23
Commercial bank branches per 100,000 adults	0.55	0.17	−0.32	0.12	0.27	0.34	0.06
Bank cost to income ratio	−0.28	−0.58	−0.09	0.36	−0.30	0.57	−0.17
Deposit income ratio	0.64	0.14	0.14	0.06	−0.76	−0.10	0.28
Credit income ratio	0.57	−0.29	0.44	0.22	0.30	−0.51	−0.41
Life insurance premium volume to GDP	0.09	0.44	0.13	0.10	0.27	−0.12	−0.04

Total variance explained for components			
Components	Eigenvalues	% of variance	Cumulative variance
1	2.03	0.41	0.41
2	1	0.20	0.61
3	0.5	0.10	0.71
4	0.45	0.09	0.8
5	0.4	0.08	0.88
6	0.35	0.07	0.95
7	0.25	0.05	1

may be shown up through fixed-effect and random-effect. Thus, we employ static panel data analysis in determining the relationship between financial performance and financial inclusion (Nişancı, Karabıyık, and Uçar 2011). Also, the static version of the panel models used in this study is below:

$$\begin{aligned} \mathrm{FII}_{it} = {} & \delta_0 + \delta_1 \text{Bank net interest margin}_{it} + \delta_2 \text{Bank lending} \; - \text{deposit spread}_{it} \\ & + \delta_3 \text{Bank non-interest income to total income}_{it} \\ & + \delta_4 \text{Bank return on assets}_{it} + \delta_5 \text{Bank return on equity}_{it} + \delta_6 \mathrm{GDP}_{it} + \eta_i \\ & + \gamma_t + \varepsilon_{it} \end{aligned} \tag{1}$$

In Equation (1), ε_{it} shows the idiosyncratic error term, and η_i and γ_t indicate time-specific and individual effects.

To determine the cross-section dependency is imperative for panel data of developing countries (Qamruzzaman and Jianguo 2020) and Phillips and Sul (2003) assert that not taking into account the cross-sectional dependence gives ineffective estimations. Thus, before conducting regressions in this study, we examine a cross-section dependency in the panel data. There are four tests of cross-section dependency in the literature as follows: Breusch and Pagan (1980) Lagrange multiplier (LM) test, the Lagrange multiplier $\mathrm{CD}_{\mathrm{lm}}$ test, Pesaran (2006) $\mathrm{CD}_{\mathrm{lm}}$ test, and Pesaran, Ullah, and Yamagata (2008) the bais-adjusted LM test.

Secondly, we examine the stationary for the panels as non-stationary panel data may lead to spurious regression results (Wang et al. 2015). To avoid spurious regression, we test the stationarity of the variables with the panel unit root test. The panel unit root test is generally used in determining the stationarity of panel data.

The unit root tests for panel data are grouped into two categories such as the first- and second-generation panel data analysis. We apply Maddala and Wu (1999) the first-

generation unit root test for panel data. If there is a cross-sectional dependency in the panel data, the second-generation panel unit root tests indicate more reliable results (Hadri and Kurozumi 2012; Pesaran, Smith, and Yamagata 2013). Thus, we employ CADF (cross-sectional augmented Dickey-Fuller) the second-generation panel unit root test in addition to the first-generation panel unit root test. Moreover, we run the generalized method of moments (GMM) technique developed by Arellano and Bover (1995) and Blundell and Bond (1998) for the robustness checks since GMM makes the adjustment of estimation biases as well as the joint endogeneity and assumes that the error terms are not serially correlated (Çevik 2020). Thus, we choose GMM estimation for robustness checks.

4. Empirical findings and discussion

In this study, firstly we measure FII with PCA and then try to determine the relationship between financial performance and financial inclusion. Therefore, we employ static panel data analysis. Firstly, we examine whether there is a multicollinearity problem for independent variables since the multicollinearity problem shows that the independent variables are highly correlated and this situation results in biased estimation. In this study, Table 3 presents Pearson's correlation coefficients and indicates that the correlations between independent variables are not high enough in creating serious multicollinearity problems and we see that no severe multicollinearity exists among the independent variables.

After determining the correlation between the independent variables, we give the cross-section dependency test results in Table 4 to determine whether the cross-section dependency exists in the panel data.

When we look at the findings of Table 4, we can see that the null hypothesis, in which there is a cross-sectional dependence in panel data, cannot be rejected. Thus, the panel data includes cross-sectional dependency. As there is a cross-sectional dependency in the panel, we apply CADF unit root test as a second-generation unit root test in this study and report it in Table 5.

According to the findings of Table 5, all variables included in this study are stationary in level values and the null hypothesis, which the variables are not stationary at level values, can be rejected. On the other hand, to examine the robustness of the results of the panel unit root test, we conduct Maddala and Wu (1999) the first-generation unit root test and it takes place in Table 6.

Table 3. Correlation matrix for independent variables.

Correlations	GDP	Bank return on equity	Bank return on assets	Bank non-interest income to total income	Bank lending-deposit spread	Bank net interest margin
GDP	1					
Bank return on equity	0.21	1				
Bank return on assets	−0.07	0.59	1			
Bank non-interest income to total income	−0.18	0.02	−0.03	1		
Bank lending-deposit spread	−0.12	0.15	0.23	0.14	1	
Bank net interest margin	−0.07	0.24	0.34	0.17	0.19	1

Table 4. Cross-sectional dependency test results.

Variables	Pesaran CD_{lm} test statistic
Bank lending-deposit spread	10.95 [0.00]
Bank non-interest income to total income	11.12 [0.00]
Bank return on assets	6.07 [0.00]
Bank return on equity	17.23 [0.00]
Bank net interest margin	18.25 [0.00]
GDP	165.88 [0.00]
FII	14.45 [0.00]

[] Indicates probability value.

When we look at the findings of Table 6, we can see that all variables are stationary in the level value and do not have a unit root in the level value. Therefore, the findings in Tables 5 and 6 support each other. Within the scope of the study, to determine the relationship between financial performance and financial inclusion, we estimate the static panel data model. In the panel data model estimation to test fixed-effects and random-effects, we apply the *F* test and LM test. Table 7 shows the *F* test and LM test findings.

The results of the *F* and LM tests in Table 7 indicate that there is a cross-section effect but no period effect. Also, Hausman test results point out that the fixed-effects model can give more consistent results. On the other hand, Table 8 gives autocorrelation and heteroskedasticity test results.

According to the findings of Table 8, we can see that there are autocorrelation and heteroskedasticity problems in the estimated fixed-effect model. Due to the presence of autocorrelation, the cross-sectional dependency, and heteroskedasticity in the estimated fixed-effect model in the panel data, we use the fixed-effects model with standard errors of Driscoll and Kraay since it is a robust estimator against the problems of autocorrelation, the cross-sectional dependency, and heteroskedasticity. Table 9 presents a fixed-effect model (with standard errors of Driscoll and Kraay).

The findings in Table 9 indicate that bank lending-deposit spread, bank return on assets, bank return on equity, and bank net interest margin are explanatory variables for FII. Thus, a one-unit increase in banking sector financial performance indicators except for bank lending-deposit spread causes a one-unit increase in FII. On the other hand, a one-unit increase in bank lending-deposit spread causes a one-unit decrease in FII. Bank interest rates are sticky in that they do not respond immediately to the corresponding reference market rates and loan rate stickiness causes credit rationing of

Table 5. CADF panel unit root test results.

Variables	Whole panel (CIPS-cross-sectionally augmented IPS) test statistics	Order of integration	Lag lengths
Bank lending-deposit spread	−6.86*	I(0)	1
Bank non-interest income to total income	−3.6*	I(0)	0
Bank return on assets	−5.16*	I(0)	0
Bank return on assets	−4.92*	I(0)	0
Bank net interest margin	−5.21*	I(0)	0
GDP	−6.68*	I(0)	1
FII	−4.18*	I(0)	1

*Indicates that variables are stationary at 1% significance level.

Table 6. Maddala and Wu panel unit root test results.

Variables	Test statistics	Order of integration	Lag lengths
Bank lending-deposit spread	331.56*	I(0)	1
Bank non-interest income to total income	383.15*	I(0)	0
Bank return on assets	583.21*	I(0)	0
Bank return on assets	545.55*	I(0)	0
Bank net interest margin	563.56*	I(0)	0
GDP	422.23*	I(0)	1
FII	315.84*	I(0)	1

*Indicates that variables are stationary at 1% significance level.

borrowers due to asymmetric information (Jaffee and Russell 1976; Stiglitz and Weiss 1981; Gropp, Sørensen, and Lichtenberger 2007). Thus, the nexus between bank lending-deposit spread and financial inclusion may be negative.

Bank non-interest income to total income and constant have statistically insignificant coefficients in Table 9. The finding, which bank non-interest income to total income does not affect FII, is consistent with the findings of Abedifar, Molyneu, and Tarazi (2018). Abedifar, Molyneu, and Tarazi (2018) assert that bank non-interest income to total income is associated with the bank size and greater banks do not suffer from economies of joint production in the banking sector. On the other hand, our findings show that increasing bank return on assets, bank return on equity, and bank net interest margin suggests that financial inclusion activities increase. Higher profitability may arise rapidly with loan growth and the number of new financial institutions and instruments in the financial system for the banking sector. This situation causes growth in the financial inclusion.

Chauvet and Jacolin (2017) assert that there is a positive relationship between financial performance and inclusion. But Le, Chuc, and Taghizadeh-Hesary (2019) detect a negative relationship between financial performance and inclusion. The findings of Le, Chuc, and Taghizadeh-Hesary (2019) support that the indicator of financial performance decreases financial inclusion. Therefore, our findings are not in line with the findings of Le, Chuc, and Taghizadeh-Hesary (2019). Gupta (1969) explains that larger firms have more resources and this situation allows cost reduction for the industry. Thus, according to Gupta (1969), banking sector efficiency results in financial inclusion. In line with this view and the findings of Al-Chahadah, El Refae, and Qasim (2020), we suggest that financial performance increases financial inclusion.

Hillman and Keim (2001) and Choi and Wang (2009) explore that efficiency in the banking sector may lead to improve financial performance and the banks can lend at lower costs, open more branches, and carry financial goods and services to more customers, then, financial performance promotes the financial inclusion. These findings are in

Table 7. *F* and LM tests results.

Tests	Test statistic
Cross-section *F*	51.72*
Period *F*	1.21
Cross-section/period *F*	44.94*
Hausman test	2.79
Cross-section LM	66.49*
Period LM	1.21
Cross-section/period LM	45.6*

*Indicates statistically significant at 1% level.

Table 8. Autocorrelation and heteroskedasticity tests results for fixed-effect model.

Tests	Statistical value
Heteroskedasticity test	175.85*
Autocorrelation test:	3.2*

*Indicates statistically significant at 1% level.

Table 9. Fixed-effect model (with standard errors of Driscoll and Kraay).

Independent variables	Coefficient	Driscoll/Kraay standard error	*t* statistic
Bank non-interest income to total income	0.60	0.15	0.92
Bank return on assets	1.8	0.15	2.82*
Bank return on equity	2.73	0.12	2.23**
Bank lending-deposit spread	−0.15	0.08	−3.26*
Bank net interest margin	2.25	0.17	4.82*
GDP	0.99	0.8	0.75
Constant	−0.28	0.11	−1.02
F statistic: 8.09*, $R^2 = 0.81$			

* and ** Indicates statistically significant at 1% and 5% levels.

line with our findings in Table 9. On the other hand, Le, Chuc, and Taghizadeh-Hesary (2019) pay attention to the nexus of financial inclusion-performance and show that the positive nexus of financial inclusion-performance disappears when adding financial innovation for developing countries. Also, Bhattacharyya, Wright, and Rahman (2021) assert that there is no relationship between financial inclusion and financial performance and thus, their findings are not in line with our findings since our findings support the existence of a relationship between financial inclusion and financial performance.

De la Torre, Martı´nez Perı´a, and Schmukler (2010) argue that intensive participation in the financial system may lead to high transaction and information costs for low-income clients. In resolving this problem, the number of financial intermediaries should increase financial regulations and supervision should be constructed by the competent authority. If the financial performance indicator has an uptrend, the depth of financial systems will generate synergies for financial inclusion, and the banking system has new users. Also, the depth of financial systems will diversify bank assets, reduce their riskiness, and increase the stability of their deposit base (Morgan and Pontines 2014; Ĉihák, Mare, and Melecky 2016). We support this claim in this study with our findings.

Ramzan, Amin, and Abbas (2021) state that large-sized companies, which take into account corporate social responsibility in the banking sector, have a high financial performance, in this case, they trigger financial inclusion, and the positive relationship between financial inclusion and financial performance occurs. Therefore, our findings are supported by the findings of Ramzan, Amin, and Abbas (2021). On the other hand, we do not determine a significant relationship between GDP and financial inclusion in line with the findings of Smaoui and Salah (2012), Thiagarajan (2018), and Le, Chuc, and Taghizadeh-Hesary (2019).

4.1. Robustness checks

We make robustness checks in this study and try to conduct robustness checks with two different stages. For the robustness checks, on one the hand, we create FII with the equal-

weighted method, on the other hand, we change the estimation method and use dynamic panel data analysis. Most indicators are used to construct the composite index with an equal-weighted method. The equal-weighted method assigns the same weight to all variables. This situation shows that all the dimensions and indicators are equally important in constructing the composite index (Yorulmaz 2018). Firstly, for the robustness checks, we measure equal-weighted FII with indicators of a number of bank accounts per 1,000 adults, number of ATMs per 100,000 adults, number of commercial bank branches per 100,000 adults, deposit income ratio, life insurance premium volume to GDP, credit income ratio, and bank cost to income ratio. Secondly, for the robustness check, we employ GMM by using FII constructed with PCA in our study with Equation (2) below:

$$\begin{aligned} \mathrm{FII}_{it} = {} & \delta_0 \mathrm{FII}_{it}-1 + \delta_1 \text{Bank net interest margin}_{it} + \delta_2 \text{Bank lending} \\ & - \text{deposit spread}_{it} + \delta_3 \text{Bank non-interest income to total income}_{it} \\ & + \delta_4 \text{Bank return on assets}_{it} + \delta_5 \text{Bank return on equity}_{it} + \delta_6 \mathrm{GDP}_{it} + \eta_i \\ & + \gamma_t + \varepsilon_{it} \end{aligned} \tag{2}$$

In Equation (2), lagged dependent variables contain dynamic adjustments in FII to changes in the other variables, ε_{it} is the error term, η_i and γ_t are the time-specific and individual effects. Table 10 presents GMM estimations for robustness checks.

In this study, GMM estimations as robustness checks of Panel A and Panel B in Table 10 show that the FII variable is significantly affected by its previous values. The previous period values of FII are affected by the current period FII values and this finding proves that the FII is persistent. On the other hand, AR(1) and AR(2) values in Panel A and Panel B of Table 10 provide evidence that there is no first-order and second-order autocorrelation in GMM estimations. Also, the Hensen *J*-test findings prove that the internal instruments used in the dynamic models are valid. Finally, Wald χ^2 test results indicate that each model as a whole is significant in Panel A and Panel B of Table 10.

In the Panel A of Table 10, bank lending-deposit spread and bank non-interest income to total income variables affect the FII variable statistically insignificant, but bank return on assets, bank return on equity, and bank net interest margin affect positively and statistically significant the FII variable. Thus, if bank return on assets, bank return on equity, and bank net interest margin values increase, FII grows. On the other hand, Panel B of Table 10 shows that bank return on assets, bank return on equity, and bank net interest

Table 10. GMM estimations.

Panel A. Dependent variable: equal-weighted FII	FII_{it-1}	Bank lending-deposit spread	Bank non-interest income to total income	Bank return on assets	Bank return on equity	Bank net interest margin	GDP
Coefficients	0.69*	−0.59	−0.1	0.15*	1*	1.33*	0.03*
Hensen *J*-test value: 74.09, AR(1) *p*-value: −1.01, AR(2) *p*-value:−0.75, Wald χ^2: 189.91*							
Panel B. Dependent variable: constructed FII with PCA	FII_{it-1}	Bank lending-deposit spread	Bank non-interest income to total income	Bank return on assets	Bank return on equity	Bank net interest margin	GDP
Coefficients	0.57*	−0.05*	0.09	0.12*	0.18*	1.49*	0.09
Hensen *J*-test value: 82.88, AR(1) *p*-value: −1.4, AR(2) *p*-value: −0.49, Wald χ^2: 220.08*							

*Indicates statistically significant at 1% level.

margin variables are statistically significant and the effects of explanatory variables are positive on FII, but the effect of the bank lending-deposit spread on FII is negative. Finally, GDP does not have explanatory power for FII in Panel A and Panel B of Table 10. In brief, we determine that financial performance indicators are effective in financial inclusion.

The findings in Panel A and Panel B of Table 10 are approximately parallel to each other, and in determining the relationship between financial inclusion and financial performance for developing countries, measuring financial inclusion using a different method or determining a relationship with a different analysis does not actually change the findings. Thus, we determine that our findings are robust to different measurement and analysis methods.

5. Conclusion

In our study, we develop a financial inclusion consisting of various dimensions for 85 developing countries in the 2005–2017 time period and examine the relationship between financial performance, and financial inclusion. For this purpose, we employ static panel data analysis. On the other hand, in determining the robustness checks, we conduct the dynamic panel data analysis and measure a different index for financial inclusion.

Static panel data analysis findings show that financial performance indicators such as bank return on assets, bank return on equity, and bank net interest margin positively affect financial inclusion. But, bank non-interest income to total income and GDP have statistically insignificant coefficients in line with the literature. On the other hand, bank lending-deposit spread negatively affects financial inclusion. Also, dynamic panel data analysis provides evidence that financial performance is important for financial inclusion and measuring financial inclusion using a different method or determining a relationship with a different analysis does not change the findings. Thus, we determine that our findings are robust for different methods and indexes.

The most important implication of the study is that various indicators of financial performance such as bank return on assets, bank return on equity, and bank net interest margin increase financial inclusion. As a matter of fact, according to our findings obtained in the study, we may say that the increase in the profitability of the banking sector is one of the triggers of financial inclusion for developing countries. Another implication of the study is that bank lending-deposit spread negatively affects financial inclusion since the high difference between deposit rates and loan rates may decrease the loan demand of households, and in this case, financial inclusion may decrease.

High financial inclusion brings intensive participation in the financial system and leads to high transaction and information costs. To eliminate this problem, banks work high financial performance and this situation brings a more efficient increase in financial inclusion, which is an important tool for poverty and income inequality. An uptrend financial performance is an increase in the size of the financial sector. The deepening of the financial system means an increase in the number of financial intermediaries such as commercial banks, cooperative credit unions, and financial instruments available in these markets. On the other hand, an increase in the number of ATMs and branch cause fastly and straightforwardly access to financial goods and services.

If sufficient and necessary regulations can be made by the competent authorities in the banking system for the factors which reduce the bank profitability and efficiency, and thus the number of financial intermediaries and instruments may increase and access to loans may become more straightforward. In brief, if the banks with high financial performance are encouraged by the governments for increasing the number of agents and bringing to the banks new clients and new sources of revenues, financial inclusion is promoted by financial performance.

In future studies, the relationship between financial inclusion and financial performance can be examined for countries according to income groups. By using different control variables and estimation models, the relationship between financial inclusion and financial performance for developing countries can be reexamined. In the relationship between financial performance and financial inclusion, financial inclusion can be examined on an indicator basis in addition to index-based analysis.

Disclosure statement

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