Financial Inclusion and the Contribution of Fintech in Middle-Income Countries: An Empirical Investigation across a Panel of Countries in Africa and Asia

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ABSTRACT

This paper explores the contribution of financial services to financial inclusion amidst digitization and Fintech growth. It proposes an inclusion index based on African and Asian countries from 2010 to 2019, examining multidimensional characteristics and determinants of financial inclusion. The analysis reveals modest progress, with only eight countries nearing a 0.6 inclusion level, while the rest fall below 0.50. Econometric regression tests highlight a positive relationship between financial inclusion, bank cards, and mobile money, suggesting that digitization of banks has bolstered inclusion. Connectivity and digital payment transactions are also found to be significant factors positively associated with inclusion. Notably, the variable representing Fintech usage stands out as the most significant contributor to financial inclusion.

INTRODUCTION

Financial inclusion, pivotal for economic development and poverty alleviation, ensures accessible, available, and usable financial services. Despite its importance, sub-Saharan Africa lags behind with only 42.6% of adults having bank accounts in 2017, contrasting with 61% in developing nations (Demirgüç-Kunt et al., 2018). Recognizing exclusion as a barrier to development, many countries, including those within the G20, prioritize national financial inclusion strategies (GPFI, 2017). Financial regulators, governments, and the banking sector implement initiatives to foster inclusion, exemplified by the UK's establishment of the "Financial Inclusion Task Force" in 2005.

The emergence of Fintech startups, utilizing AI and IoT, fosters financial inclusion by improving connectivity. However, IoT transactions require robust digital infrastructure and data management skills (Lee I., 2017). Serving as vital connectors, Fintech firms blend finance with digitization to create a more accessible and less risky financial environment. They disrupt traditional banking by offering alternative financing, particularly benefiting consumers and SMEs. Mobile money services enable the unbanked to access financial services through smartphones, offering features like deposits, savings, transfers, and online payments. Fintech innovations like mobile payments hold significant potential for inclusion, providing a pathway to formal banking for the unbanked. Technological advancements in mobile payments play a crucial role in promoting financial inclusion, both locally and globally. However, to ensure Fintech's success in Africa, challenges related to technological infrastructure must be addressed.

The rise of smartphones in Africa and Asia has improved access to financial services, aided by the digital infrastructure of mobile banking. For example, in Kenya, mobile money accounts exceed traditional bank accounts, with 80 mobile subscriptions per 100 inhabitants compared to just 9.27 ATMs per 100,000 adults

in 2016 (World Bank Data).Financial inclusion is now a crucial factor for development in many countries in Africa and Asia, with the potential to boost job creation, reduce poverty, and address inequalities. In the backdrop of Fintech advancements and increased digitization of payment and financing services, this paper investigates the role of financial services in promoting financial inclusion. It also proposes an inclusion index based on a sample of countries in Africa and Asia spanning from 2010 to 2019.

LITERATURE REVIEW

Financial exclusion, as described by Leyshon and Thrift (1995), Conroy (2005), and Mohan (2006), restricts access to financial systems for disadvantaged individuals. Despite high banking rates, Kempson et al. (2004) argue that having a bank account alone does not ensure financial inclusion, underscoring the need to consider additional factors to grasp the full extent of exclusion. Considerations regarding financial inclusion must be reassessed in light of the impact of FinTech. Understanding the extent of digital technology utilization and its effect on financial accessibility is crucial, along with recognizing associated risks. Demirgüç-Kunt (2018) highlights that mobile phones and the internet facilitate financial inclusion only with adequate infrastructure, a challenge in many emerging economies. Addressing infrastructure limitations is essential for successful FinTech deployment, requiring reliable power grids and accessible digital products (Adrien Lauras, 2020).

McCaffrey and Schiff (2017) assert FinTech's role in addressing challenges encountered by the working class with complex daily finances. Ozili (2018) highlights digital financial services' aim to alleviate poverty and enhance inclusion. Meanwhile, banks leverage social networks and digitization to target under banked populations (Gosling P., 2000), overcoming accessibility hurdles. With 38% of the global population lacking bank accounts, FinTech emerges as a key driver of inclusive growth, particularly through mobile financial services. Extensive literature addresses the measurement of financial inclusion, often adopting a multidimensional approach. Sarma (2008) introduced a comprehensive index akin to the Human Development Index (HDI), which assesses accessibility, availability, and usage of banking services on a scale from 0 to 1. A higher index value indicates greater accessibility to financial resources and stronger inclusion. By amalgamating data on these three dimensions, this index offers a more holistic measure of inclusion, surpassing the limitations of individual indicators.

FINANCIAL INCLUSION INDEX

3.1. Traditional indicators of financial inclusion

Existing literature has proposed various methods to measure the degree of inclusivity of any financial system (Park and Mercado, 2015). Financial inclusion has traditionally been measured using density indicators such as the number of bank branches and the number of ATMs (per 100,000 inhabitants). The most commonly used indicator is the number of bank accounts per 1000 adults (Park and Mercado, 2015).

The degree of financial inclusion in an economy was measured through single indicators, evaluating either the types of banking services provided or the proportion of adults with access to these services through a bank account. Thus, new variables were designed to capture deposits, loans, and payments in addition to savings and borrowing. These indicators are grouped under two dimensions: access and usage of formal financial services (Beck et al., 2007; Demirguc-Kunt and Klapper, 2012; Demirguc-Kunt et al., 2018).

Financial inclusion, a multifaceted concept, cannot be accurately captured by single indicators like bank accounts, ATMs, credits, and deposits (Sarma, 2016; Nguyen, 2020; Camara and Tuesta, 2014). Relying solely on traditional indicators may provide incomplete insights into a country's financial inclusiveness.

Hence, various studies aim to develop comprehensive measures that integrate multiple dimensions of financial inclusion into a single figure. Such measures facilitate meaningful comparisons between economies.

3.2. A novel measure of financial sector inclusivity

Academic works addressing the issue of financial inclusion acknowledge the complexity of the phenomenon as they delve into an unexplored research domain encompassing multiple dimensions. Consequently, effectively assessing the degree of financial inclusion based on a single indicator would be challenging. Sarma (2008) introduced a comprehensive multidimensional index of financial inclusion, which assesses accessibility, availability, and usage of banking services. This index, ranging from 0 to 1, consolidates information on banking penetration, availability of financial services, and usage of the banking system into a single measure. Higher values indicate stronger accessibility and inclusion. Inspired by the Human Development Index (HDI), Sarma's index offers a more holistic measure of financial inclusion compared to individual indicators. Accessibility, the first dimension, is measured by the number of bank accounts per 1000 inhabitants. Availability, the second dimension, encompasses indicators such as the number of branches of commercial banks and ATMs per 100,000 inhabitants. The usage dimension evaluates the demand for financial services, considering the volume of credits and deposits as a percentage of GDP.

EXPLORATORY STUDY OF FINANCIAL INCLUSION IN MIDDLE-INCOME COUNTRIES

4.1. Multidimensional Financial Inclusion Index

The Financial Inclusion Index assesses the inclusivity of a country's financial sector, taking into account multiple dimensions such as banking penetration, service availability, and system usage. Ranging from 0 to 1, where 0 signifies total exclusion and 1 denotes complete inclusion, this index integrates information on various inclusion aspects into a single measure. Sarma (2008) developed this index based on three core dimensions: accessibility, availability, and banking service usage. We constructed our financial inclusion indicator by referring to the methodology of Sarma and Pais (2011). We included four measures based on the work of Park and Mercado (2015): depositors with commercial banks per 1,000 adults, borrowers from commercial banks per 1,000 adults, the number of accounts with financial institutions as a percentage of the population over 15 years old, and the number of branches of microfinance institutions per 100,000 inhabitants. The first three measures relate to the access dimension of financial inclusion, while the last measure relates to the availability dimension of financial inclusion. Drawing from the research of Park and Mercado (2015), we incorporated these measures into the financial inclusion index calculation to expand our sample size. Limiting our variables to those utilized by Sarma (2008) would decrease our sample size. By integrating these measures, our indicator becomes more precise, leveraging all accessible information.

Table 1: Financial Inclusion Indicators

Dimension	Indicator
Accessibility	Depositors with commercial banks per 1,000 adults
	Borrowers from commercial banks per 1,000 adults
	Number of accounts with financial institutions as a percentage of the population over 15

	years old
Availability	Number of commercial bank branches per 100,000 inhabitants
	Number of microfinance institution branches per 100,000 inhabitants
	Number of ATMs per 100,000 inhabitants
Usage	Volume of credits as a percentage of GDP
	Volume of deposits as a percentage of GDP

Source: Park and Mercado (2015)

All indicators are drawn from the Global Findex database, established by the World Bank, and the Financial Access Survey (FAS) conducted by the IMF. For each of these dimensions, an index is calculated using the formula developed by Sarma and Pais (2011)

$$d_i = \frac{A_i - m_i}{M_{i-m_i}}$$

With:

$A_i$the actual value of dimension i

$m_i$the lower limit of dimension i

$M_i$the upper limit of dimension i

To precisely define the 'availability' dimension, Sarma and Pais (2011) emphasize the significance of differentiating between two distinct indices: the count of commercial bank branches and the count of ATMs. It is essential to allocate weights of 2/3 and 1/3 to each sub-index, respectively.

Subsequently, after calculating the indices for the dimensions, Sarma and Pais (2011) specify in their work that it is essential to combine the three dimensions of accessibility, availability, and usage of banking services with respective weights of 1, 0.5, and 0.5. The underweighting of the last two dimensions is attributed to insufficient data on specific indicators within these dimensions. For instance, in terms of banking services availability, many countries have transitioned to online banking, diminishing the significance of physical bank branches and offering an incomplete assessment of service availability. Similarly, concerning the utilization of loan and deposit data, they only partially capture the dimension of financial system usage. Finally, the financial inclusion index is calculated as follows:

$$\text{IFI}= 1- \sqrt{\frac{(1-p_i)^2+ (0.5-a_i)^2+(0.5-u_i)^2}{1.5}}$$

Where:

$p_i$the index of the accessibility dimension

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$a_i$the index of the availability dimension

$u_i$the index of the usage dimension

According to Sarma (2008), the value of the financial inclusion index is always between 0 and 1.

If $0{,}5 \leq IFI \leq 1$ then the country has a high level of financial inclusion.

If $0{,}3 \leq IFI < 0{,}5$then the country has a moderate level of financial inclusion.

If $0 \leq IFI < 0{,}3$then the country has a low level of financial inclusion.

4.2. Sample of the empirical investigation:

The calculation of the financial inclusion index is an exercise that often encounters challenges related to data availability, completeness, and reliability, especially in low-income countries. To overcome this difficulty, it was necessary, in the context of this paper, to choose a panel of countries from Africa and Asia, where most countries are of intermediate income, and to limit the number of low-income countries. The selected sample consists of 25 countries, including 15 from Africa and 10 from Asia. The observation period spans from 2010 to 2019. The selected countries are as follows:

Table 2: List of Countries in the Sample

African countries	Asian countries
Tunisia	Afghanistan
Egypt	Malaysia
Morocco	Pakistan
Kenya	Thailand
Ivory Coast	Tajikistan
Botswana	Uzbekistan
Senegal	Indonesia
Cameroon	India
Ghana	Bangladesh
Republic of Congo	Mongolia

Algeria	
Gabon	
Mauritania	
Nigeria	
Zambia	

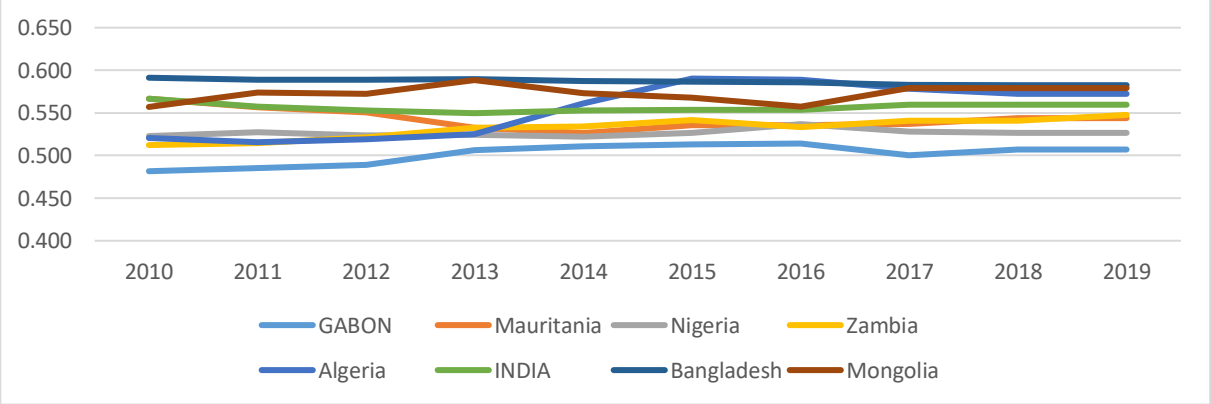
Source: Author's work

The method adopted to achieve our research objective involved exploring data from the World Bank (Global FINDEX) and the Financial Access Survey (FAS, 2019). The work of Demirguc-Kunt and Klapper (2020) provided the first public database of indicators to measure the financial inclusion rate

4.3. Statistical Analysis of the Evolution of the Financial Inclusion Index:

We initially computed the financial inclusion index for 25 countries, comprising 15 African countries and 10 Asian countries, over a span of 9 years. Our calculation incorporated the three dimensions of accessibility, availability, and usage. Consequently, we categorized the countries based on their level of inclusion. The following figures illustrate the evolution of this index over the chosen period

Figure 1:Evolution of the Financial Inclusion Index in countries experiencing a consistently high level of financial inclusion on average



Source: author's own calculation

This figure includes countries with an average high level of inclusion ranging between 0.5 and 0.6. Surprisingly, Mauritania, Algeria, Zambia, and Nigeria consistently exhibit high financial inclusion indices, hovering around 0.6 throughout the sample period, categorizing them as highly inclusive. This unexpected outcome stems from the multidimensional nature of the index, particularly influenced by the accessibility dimension's variable, "number of deposit accounts with commercial banks per 1000 adults." In Algeria and Nigeria, where adults possess more than 1000 deposit accounts, this anomaly arises as individuals can hold

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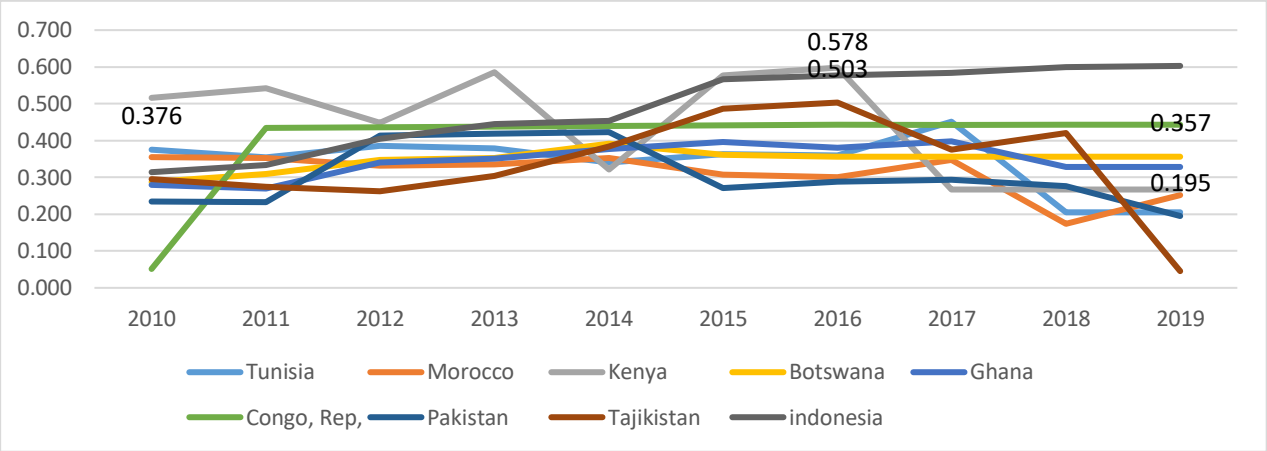
multiple accounts. Similarly, Bangladesh, Mongolia, and India also maintain high inclusion indices around 0.6, indicating significant financial inclusion levels.

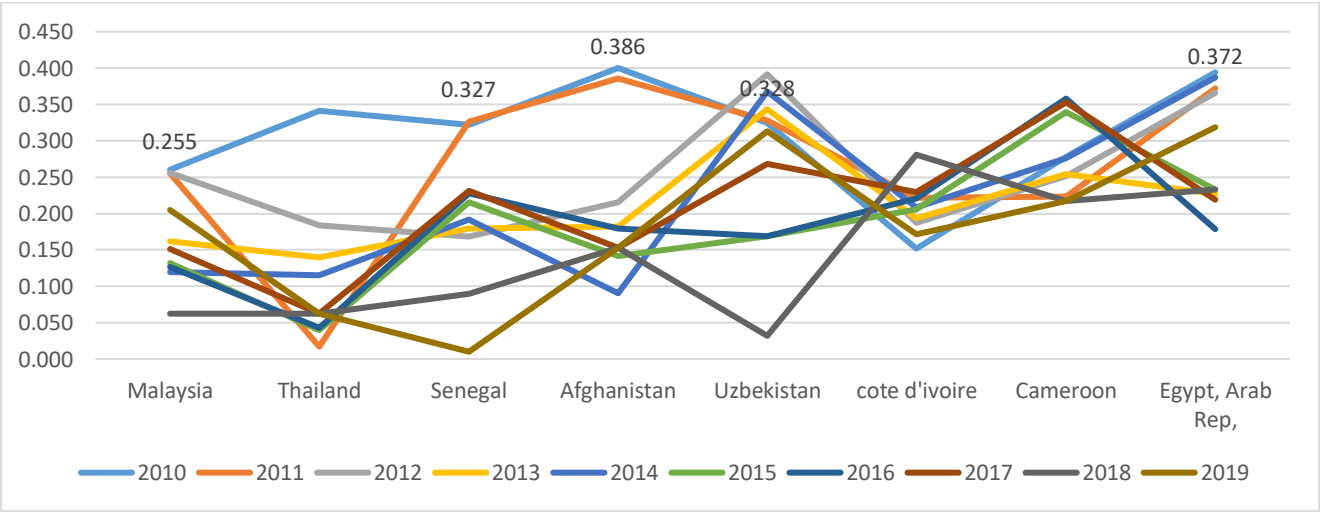
Figure 2: Evolution of the inclusion index in countries benefiting on average from a medium level of financial inclusion



Source: author's own calculation

This chart illustrates the progression of the financial inclusion index from 2010 to 2019 for countries with a moderate level of inclusion. Among these, Tunisia, Morocco, the Republic of the Congo, Botswana, and Ghana are characterized by a moderate level of financial inclusion, with indices not surpassing 0.4. In contrast, Tajikistan and Kenya exhibit a more pronounced level of inclusion, boasting relatively high indices of 0.5 and 0.6 in 2016, respectively. Additionally, Indonesia's financial inclusion index has shown steady development over time, positioning the country as financially inclusive. These findings, although unexpected, can be attributed to the weight of the variable 'the number of deposit accounts with commercial banks per 1000 adults.' In these nations, the number of deposit accounts exceeds 1000 per 1000 adults, indicating that adults hold multiple deposit accounts. Consequently, these countries are classified as having a moderate level of financial inclusion.

Figure 3: Evolution of the financial inclusion index in countries averaging a low level of financial inclusion



Source: author's own calculation

This figure reflects the evolution of the inclusion index for countries with a threshold not exceeding 0.4. We observe that in Senegal, Cameroon, and Ivory Coast, their inclusion indices are quite low. These countries, therefore, have a low level of financial inclusion. The analysis of the evolution of the index allows us to state that Afghanistan, Malaysia, and Thailand have a relatively low inclusion index. Consequently, these results classify these countries as having a low level of financial inclusion. We then ranked the various countries in our sample in descending order based on their degree of inclusion.

Table 3: Average inclusion rates of countries over the period 2010-2019

Rank	Countrie	2010	2014	2019	2010-2019
1	Bangladesh	0,591	0,587	0,583	0,587
2	Mongolia	0,557	0,573	0,579	0,573
3	India	0,567	0,553	0,560	0,557
4	Algeria	0,521	0,561	0,573	0,554
5	Mauritania	0,567	0,526	0,544	0,543
6	Zambia	0,512	0,534	0,548	0,532
7	Nigeria	0,523	0,522	0,527	0,526
8	Gabon	0,482	0,511	0,507	0,501
9	Indonesia	0,314	0,454	0,603	0,488
10	Kenya	0,515	0,321	0,267	0,439
11	Republic of Congo	0,051	0,440	0,442	0,401
12	Botswana	0,288	0,391	0,357	0,348
13	Ghana	0,279	0,378	0,329	0,345
14	Tunisia	0,376	0,340	0,205	0,342
15	Tadjikistan	0,295	0,384	0,045	0,335
16	Maroc	0,355	0,352	0,251	0,311
17	Pakistan	0,235	0,423	0,195	0,305
18	Egypt, Arab Rep,	0,394	0,387	0,319	0,293

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19	Cameroun	0,278	0,276	0,217	0,277
20	Uzbekistan	0,324	0,368	0,313	0,271
21	Ivory Coast	0,152	0,209	0,171	0,207
22	Afghanistan	0,400	0,090	0,153	0,205
23	Senegal	0,322	0,192	0,010	0,196
24	Malaysia	0,260	0,120	0,205	0,173
25	Thailand	0,341	0,115	0,062	0,107

Source : Author's work

Table 3 illustrates a moderately varied range of financial inclusion indices among developing countries, spanning from 0.10 to 0.6. Approximately 68% of sampled countries exhibit an inclusion index exceeding 0.30, but the degree of exclusion within this group varies. Notably, eight countries, including Bangladesh, Mongolia, India, Algeria, Mauritania, Zambia, Nigeria, and Gabon, surpass 0.5, constituting 32% of the sample. Conversely, 36% of countries, such as Indonesia, Kenya, and the Republic of the Congo, demonstrate a moderately low level of inclusion. Additionally, 32% of countries have inclusion levels below 0.3, considered mediocre.

Interestingly, the level of inclusion only partially correlates with a country's per capita income. For instance, Botswana exhibits a relatively lower level of inclusion compared to countries with lower per capita income, like Indonesia and Kenya. Similarly, Malaysia and Thailand demonstrate lower inclusion levels despite their higher per capita income within the upper range of middle-income countries. Generally, countries with lower per capita income tend to have lower levels of financial inclusion, as exemplified by Egypt, Uzbekistan, Ivory Coast, and Cameroon, where the inclusion index falls below 0.3. The discrepancies in ranking countries regarding their financial inclusion index may stem from inadequate transnational data, particularly regarding digital banking operations like mobile payments, which are becoming increasingly prevalent in the shift towards digital banking.

4.4. Approach and Methodology of the Study

Numerous factors influence financial inclusion, and the interaction with each of them is complex. In the following, we aim to identify factors associated with a certain degree of importance to the financial inclusion index. Following the approach of Sarma and Pais (2011), we conducted two independent regressions to identify variables associated with a certain degree of importance to the inclusion index.

The first regression seeks to capture the role of banking variables by examining the potential link between the structure of the banking market and the level of financial inclusion. To achieve this, we construct variables reflecting the level of banking development, such as the credit card ownership rate (CD) and the number of mobile money accounts for individuals aged over 15 (MM).

The second regression seeks to examine the influence of Fintech utilization on financial inclusion levels, as well as the correlation between financial strength and financial inclusion levels. To do this, we include the variable "non-performing loans" as a percentage of total bank loans (NPL) to measure financial strength.

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Additionally, we introduce a variable representing the use of smartphones or the internet to access an account (USED) and a variable related to sending or receiving digital payments (digi). This variable encompasses the use of digital services for bill payments, online purchases, and sending or receiving money.

Descriptive Statistics and Correlation

Table 4 :Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Indice	250	0.378	0.159	0.01	0.603
credit card	250	0.089	0.092	0.01	0.4
NPL	250	0.094	0.074	0.007	0.499
MM account	250	0.154	0.164	0	0.73
Mobile/internet Acces	250	0.167	0.175	0.01	0.72
Digital payments	250	0.307	0.19	0.06	0.853

Source: author's own calculation

Table 4 summarizes the descriptive statistics of the various variables used in our study. Several key points can be highlighted from it. On average, our sample has a low level of inclusion at a rate of 37%. Additionally, only 8% of the sample uses a credit card on average; furthermore, there are, on average, only 15.4% mobile money accounts, and 16.7% of the individuals in our sample use a smartphone or the internet to access an account. The analysis of Table 4 also shows that, on average, 30.7% of our sample engages in digital transfers.

Table 5: The correlation matrix of dependent and independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) indice d'inclusion financière	1.000					
(2) Credit card	0.462*	1.000				
(3) MM account	0.306*	0.237*	1.000			
(4) Mobile/internet Acces	-0.071	-0.101	0.560*	1.000		
(5) Digital payments	-0.009	0.247*	0.479*	0.544*	1.000	
(6) NPL	0.106	-0.002	0.103	-0.069	-0.221*	1.000

*** p<0.01, ** p<0.05, * p<0.1

Source: author's own calculation

The correlation matrix indicates that all the variables used in this study are not highly correlated, as the coefficient associated with each of these variables is below 0.8. This suggests that there is no issue of multicollinearity.

4.5. Econometric modeling of factors related to financial inclusion:

The following aims to identify factors associated with a certain degree of importance to the financial inclusion index. To achieve this, we conduct two series of regressions of the inclusion index on two different sets of variables related to the banking system and the Fintech domain, respectively. These sets of variables are independent of each other. The first regression attempts to capture the role of banking variables, and the second aims to assess the impact of Fintech variables on financial inclusion.

The first regression seeks to examine the potential link between the structure of the banking market and the level of financial inclusion. It is represented by the following empirical model:

$$IFI_{it} = \alpha_0 + \beta_1 CD_{it} + \beta_2 MM_{it} + \varepsilon_{it} \qquad (1)$$

More specifically, the goal is to demonstrate whether these banking variables could explain the level of financial inclusion in a given country. To do this, we construct variables that reflect the level of banking development, such as the credit card ownership rate(CD) and the number of mobile money accounts for individuals aged 15 and above(MM)and study their effects on financial inclusion.$CD_{it}$and MM_{it}represent the regression variables$\beta_1 and \beta_2$are the coefficients of the control variables to be estimated, and the constant is represented by$\alpha_0$and finally,$\varepsilon_{it}$is the error term.

The second regression aims to study both the extent to which the use of Fintech explains the level of financial inclusion and the financial strength and level of financial inclusion. It is represented by the following empirical model:

$$IFI_{it} = \alpha_0 + \beta_1 NPL_{it} + \beta_2 used_{it} + \beta_3 digi_{it} + \varepsilon_{it} \qquad (2)$$

To assess financial strength, we incorporate the variable of non-performing loans as a percentage of total bank loans.The lower the NPL rate, the better the asset quality, and the financially stronger the banking sector. Subsequently, the effect of two variables related to Fintech, reflecting the use of digital services, is analyzed to determine if Fintech contributes to financial inclusion by facilitating access to basic financial services for low-income individuals. To do this, a first variable representing the use of smartphones or the internet to access an account (USED) is constructed. This index shows how digital usage affects the financial inclusion situation in a region. The second variable is digital payment send or receive (DIGI). This variable includes the use of digital services to pay bills, make online purchases, and send or receive money.$NPL_{it} + \beta_2 used_{it} + \beta_3 digi_{it}$ represent our regression variables$\beta_1, \beta_2 et\ \beta_3$ sare the coefficients of the control variables to be estimated, and the constant is represented by$\alpha_0$and finally $\varepsilon_{it}$is the error term.

Before selecting the Panel estimation method, we conducted preliminary tests, including the Hausman test to distinguish between the Fixed Effects model and the Random Effects model, along with tests for heteroscedasticity and autocorrelation. Based on the Hausman test results, the Random Effects model is deemed the most appropriate for our dataset; "P Value > 5%" (see Annex 6).
The outcome of the heteroscedasticity test (Wald modified) indicates that our model's data exhibit heteroscedasticity. However, the result of the Wooldridge autocorrelation test indicates the absence of an

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autocorrelation problem. Given this result, the most appropriate technique for our model is the Feasible Generalized Least Squares (FGLS) method.

The following Table 6 presents the results of the regressions of the dependent variable, which is the financial inclusion index, on banking variables on one hand, and on variables from the Fintech domain on the other hand.

Table 6: Regression results of the financial inclusion index

MODEL SPECIFICATION	R.E	R.E
EXOGENOUS VARIABLES	(1)	(2)
Credit card	0.772***	-
	(0.0608)	-
MM account	0.102**	-
	(0.0401)	-
Mobile/internet Access	-	0.320***
	-	(0.0983)
Digital payments	-	0.146**
	-	(0.0568)
NPL	-	-0.148**
		(0.0574)
Constant	0.290***	0.315***
	(0.00860)	(0.0202)
Observations	250	250
Number of countries	25	25
Hausman test(p-value)		
H_0 : random effects (accepted)	0.272	0.875
Wald test (p-value)	0.000	0.001
Heteroscedasticity test (p-value)	0.000	0.000

Autocorrelation test (p-value)	0.058	0.054

Notes: This table represents the result of panel data regression with random effects and error correction (FGLS). The Hausman test is the Hausman test (1978), where the null hypothesis is that there is no systematic difference in coefficients. The Wald test denotes the overall significance of the model. The heteroscedasticity test is the Likelihood-ratio test by Wooldridge (2010). Heteroscedasticity characterizes data that do not have constant variance (null hypothesis). The autocorrelation test is a Wald test (within-individual autocorrelation), where the null hypothesis is the absence of autocorrelation of errors. Standard errors are shown in parentheses. ***, **, and * represent the significance of variables at the 1%, 5%, and 10% level, respectively.

Source: author's calculations.

The number of credit cards in an economy is positively and significantly associated with financial inclusion. This result indicates that credit cards promote access to bank accounts. In many economies, credit cards dominate the digital payment landscape. However, few people possess such cards. On the other hand, many individuals have a mobile phone that allows them to make payments through their smartphones. In India, for instance, there are more adults with a bank account linked to a smartphone than those with a bank account tied to a credit card. Indeed, the digital infrastructure of mobile banking enables reaching various segments of the population more efficiently and directly. This leads us to our next variable, the number of mobile money accounts. The analysis of Table 6 shows a positive and significant relationship between financial inclusion and the variable of mobile money accounts. Therefore, this new digital banking tool, mobile money, significantly improves the rate of financial inclusion.

In the second regression, the non-performing loan rate exhibits a negative and significant impact on financial inclusion. A high non-performing loan rate reflects deteriorating asset quality, compelling banks to maintain higher provisions. Consequently, this strains bank resources and diminishes their ability to provide suitable financing products for vulnerable individuals, thereby exacerbating financial exclusion. Conversely, the use of smartphones or the internet to access accounts is positively and significantly associated with financial inclusion. Connectivity plays a pivotal role in facilitating financial inclusion, aligning with findings by Beck et al. (2007), who highlighted a positive association between connectivity and access to financial services. Additionally, the regression of the second variable, involving sending or receiving digital payments, indicates a positive and significant relationship with financial inclusion. Thus, digital technologies have the potential to surmount barriers to accessing financial services and enhance financial inclusion.

CONCLUSION

Financial inclusion remains a pressing challenge in middle-income countries, leading to various segments of the population being excluded. These nations have adopted strategies leveraging digital technologies to enhance inclusion. Given the multidimensional nature of financial inclusion, we developed a synthetic index considering aspects like banking penetration, service availability, and system usage across a panel of countries in Africa and Asia. The index revealed modest progress, with only eight countries surpassing an inclusion level of 0.50 on average from 2010-2019. For the rest, inclusion rates were below 0.50, indicating the need for more ambitious reform programs.

We conducted econometric tests to identify factors enhancing financial inclusion, finding a positive relationship between inclusion and variables like mobile money and credit cards. Digitization of banks, particularly through mobile money accounts, significantly improved inclusion rates. Connectivity also played a crucial role, positively associated with financial inclusion. Additionally, the variable of digital

payments showed a positive and significant relationship with inclusion. These findings underscore the importance of digital tools in advancing financial inclusion strategies.

Fintech emerges as a pivotal factor for financial inclusion, with digital technologies notably aiding in overcoming barriers to accessing financial services. Econometric tests highlight the significant contribution of Fintech tools to financial inclusion, particularly through smartphone and internet-based account access. Technological advancements in mobile payments play a vital role in enhancing financial inclusion.

Our findings are consistent with previous studies by Sekantsi and Motelle (2016) in Lesotho, Bongomin et al. (2017) in Uganda, and Ouma et al. (2017) across several African countries. However, addressing financial inclusion in academic work acknowledges its complexity, often adopting a multidimensional approach due to its diverse nature. Thus, gauging financial inclusion solely through a single indicator proves challenging, as indicators may evolve differently over time. Introducing the synthetic financial inclusion index represents an innovative approach, providing a holistic understanding of the issue on a scale from 0 to 1.

This study contributes empirically to the understanding of financial inclusion across a panel of African and Asian countries, emphasizing the role of Fintech development and bank digitalization. Nonetheless, data scarcity can hinder calculating the financial inclusion index for some countries, underscoring the importance of robust data collection efforts. Future research should explore the impact of regulatory environments on financial inclusion, guiding policymakers towards more effective initiatives. While opening low-cost bank accounts improves accessibility, enhancing availability and usage requires broader infrastructure enhancements. This analysis can offer valuable insights to policymakers, guiding future interventions to foster financial inclusion. Further research could delve into these aspects for more comprehensive understanding.

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