Revisiting the measurement of financial inclusion of rural smallholder farmers in Nigeria

Olayinka O. Adegbite*
Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria, South Africa
Charles L. Machethe
Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria, South Africa
C. Leigh Anderson
Daniel J Evans School of Public Policy and Governance, University of Washington, Seattle, Washington, USA

*Corresponding author: Olayinka O. Adegbite can be contacted at: olayinkadegbite@gmail.com

Abstract

Purpose: This study aims to develop and apply a multidimensional measure of financial inclusion (FI) to address measurement issues and determine the level of FI of rural smallholder farmers and the contribution of domain indicators to the level of FI in Nigeria.

Design/methodology/approach: The paper adapts the Alkire–Foster method to develop a multidimensional FI index (MFII). A stratified two-stage sampling procedure is used to select 2,300 rural respondents from the 2016 Consultative Group to Assist the Poor (CGAP) Smallholder Household Survey.

Findings: Results indicate that 78% of rural smallholder farmers in Nigeria are financially excluded. In addition, owning a formal account is significantly different ($p < 0.00$) from being financially adequate. The financial capability domain contributes the least (29.66%) to the multidimensional FI (MFI) of rural smallholder farmers relative to financial participation and financial well-being. Financial literacy, consumer protection, overcoming barriers such as high transaction costs and financial planning indicators contribute the least to FI relative to formal access.

Practical implications: Results of the study lead to policy recommendations for increasing the FI of rural smallholder farmers in Nigeria, which may be applicable to other countries.

Social implications: Achieving sustainable FI requires that interventions increase the FI of rural smallholder farmers by strengthening financial capability, participation and well-being and not only focus on formal account owners.

Originality/value: The study provides a new methodological and empirical contribution to the FI literature on rural smallholder farmers.

Keywords: Rural farmers; Financial inclusion; Alkire-Foster method; Smallholder agriculture; Nigeria

1. Introduction

Financial inclusion (FI) is key to unlocking the socioeconomic potential of excluded populations for inclusive development (Alliance for Financial Inclusion, 2019a). Access to and use of affordable financial services in a regulated economy are essential for consumption smoothening, savings and capital accumulation, risk mitigation and investment in economic opportunities (Demirguc-Kunt and Klapper, 2013; World Bank, 2017). In Nigeria, Africa's most populated country, over 60% of people live rurally, most of whom rely on smallholder agriculture for their livelihood (Adelaja *et al.*, 2019; World Bank, 2014). Therefore, Nigeria's goal of increasing the FI rate to 80% by 2020 (Central Bank of Nigeria, 2018) relies on ensuring the sustainable FI of rural smallholder farming populations.

Smallholder farmer's FI matters for more reasons than meeting an inclusion rate goal. Financing smallholder agriculture is fundamental to achieving Sustainable Development Goal 2 (SDG 2) which aims to "*end hunger*, *achieve food security*, *improved nutrition and promote sustainable agriculture*" (HLPE, 2013). Likewise, efforts directed at attaining SDG 2 would help to fast-track the attainment of other related outcomes like transforming agriculture and ending poverty (FAO, 2017; Fan *et al.*, 2013). As most recently evidenced, in uncertain situations like those created by coronavirus disease 2019 (COVID-19), food security in Nigeria is essential for public health measures such as staying at home to curb the spread of the virus (Akinwotu, 2020). Despite the fundamental importance of smallholder farmers to Nigeria's food supply, 73% are poor and unable to meet both current and impending financial needs (Mgbenka and Mbah, 2016; Anderson *et al.*, 2017; Cuevas and Anderson, 2016).

For smallholder agriculture to make a meaningful contribution to achieving SDG 2, rural smallholder farmers need to be financially included. Yet, existing methods of measuring FI often fail to recognize the multidimensional nature of FI. Despite an array of indicators that reflect de facto FI, such as financial literacy, it is often simply measured as the proportion of adult populations owning a formal account (Demirguc-Kunt *et al.*, 2018). However, from a rural smallholder farmer's perspective, it is unclear that simply owning a formal account guarantees the farmer is financially better off than a counterpart outside a regulated financial system. Recent debates indicate the need to shift from measuring FI based on headline indicators like access to incorporating indicators that could better inform policy goals for sustainable FI of consumers toward attaining their livelihood potential (World Economic Forum, 2018). The terms financial participation, financial capability and financial well-being are important to integrate into the concept of FI, especially for rural clients (OECD, 2018; Centre for Financial Inclusion, 2013; Bolaji-Adio *et al.*, 2013).

Most previous multidimensional approaches to measuring FI have used the distance-based approach (Sarma, 2008, 2015; Gupte *et al.*, 2012), axiomatic approach (Chakravarty and Pal, 2010) or the two-step principal component analysis (Camara and Tuesta, 2014; Yorulmaz, 2018). In addition, Park and Rogelio (2018) integrated the distance-based and two-step principal component analysis techniques to measure FI. While these measures are important developments, the distance-based approach is considered less appropriate in informing policy decisions due to the nondecomposability property of the index (Chakravarty and Pal, 2010). Moreover, most analyses of FI have been done at the macro

level, using supply data which may not adequately reflect the true state of inclusion for the poor. Although Camara and Tuesta (2014) integrated both demand- and supply-side data in their two-stage principal component analysis, Sarma (2015) argued that principal component analysis approaches may not adequately account for the important properties desirable in a development index such as monotonicity. In Nigeria, Okpara (2013) used an average of ratio index to compute a chi-wins FI index from bank indicators covering 1985, 1988 and 2003 at the country level. Kalu *et al.* (2018) computed the adequacy gap and timeliness gap indices to examine how financial institutions have been able to meet the credit needs of farmers. The approach provided insights on credit rationing by bank institutions but narrows the interpretations of FI.

Despite increasing demand for inclusive financing, most studies (Sarma, 2008, 2015; Camara and Tuesta, 2014) have reported global and country FI rankings with limited evidence on the extent of FI of specific target groups who are more likely to be marginalized. This study revisits the measurement of FI of smallholder farmers by developing and applying a new measure of FI. In this study, the Alkire–Foster method is adapted to develop a multidimensional FI index (MFII) for rural smallholder farmers in Nigeria. The method has been used in developing the Multidimensional Poverty Index in previous studies (Alkire and Foster, 2011; Alkire and Santos, 2010) and adapted to develop the Women's Empowerment in Agriculture Index (Alkire *et al.*, 2013). The MFII developed in this study is survey based and satisfies the properties of a development index such as decomposability and monotonicity (Alkire and Foster, 2011). The decomposability property enables targeting a socioeconomic group or indicators for policy interventions. Likewise, the monotonicity property makes the MFII adaptable to various contexts as the dimensions and indicators constituting the index could be changed. In this study, the method is developed and applied to determine the level of FI of rural smallholder farmers in Nigeria. The contribution of FI domains and indicators to the level of FI of rural smallholder farmers is also determined to identify areas for policy interventions. The rest of the paper is structured as follows: section two describes the methods and procedures. Section three discusses the results. Section four presents the conclusions and policy implications.

2. Methods and procedures

2.1 Data description

The study utilizes nationally representative secondary data from the Consultative Group to Assist the Poor (CGAP) Smallholder Household Survey conducted in Nigeria in 2016 (Anderson, 2016). The survey used a stratified multistage sampling procedure to select smallholder households independently from states across the six geopolitical zones proportionate to the number of agricultural enumeration areas (AEAs) in the country. In the survey, smallholder households are defined as households having ≤ five hectares of land or <50 heads of cattle or <100 goats, pigs or sheep or <1,000 chickens and farming contributes significantly to their livelihood or consumption. The significance of farming was not quantified but assessed based on the perception of household members on whether farming was viewed as a meaningful contributor to the household's livelihood, income and/or consumption (Anderson *et al.*, 2017). Data were collected from November 11, 2016,

to December 9, 2016, using three types of structured questionnaires: individual, multiple and household to interview a total of 2,773, 5,128 and 3,026 respondents, respectively. The household questionnaire was administered to the household head, spouse or knowledgeable adult member of the household. The single-respondent questionnaire was administered to a randomly selected member of the household. The multiple-respondent questionnaire was used to interview all adult members of the selected households (Anderson *et al.*, 2017).

The target group in this study are rural smallholder farmers in Nigeria. Therefore, a stratified two-stage sampling procedure is used to select respondents from the CGAP survey data. The first stage involves the stratification of respondents into rural and urban across the three data sets corresponding to questionnaire types. The second stage involves the selection of all sampled rural respondents across the three data sets. However, to have the complete information of rural smallholder farmers for analysis, the three rural data sets are merged based on the unique member and household identification. This results in a total of 2,300 rural respondents whose information is utilized in the study.

2.2 Development of domains and indicators for the multidimensional financial inclusion index

The MFII is constructed based on the financial participation, financial capability and financial well-being domains. The three domains of FI cover nine indicators.

2.2.1 Indicators of the financial participation domain

The financial participation domain reflects the extent of access to and usage of quality financial services and products at affordable cost, which also suggests the need to overcome barriers like high transaction costs and physical distance (Camara and Tuesta, 2014). In this study, the access indicator reflects the extent of formal account penetration, that is, a situation where a rural smallholder farmer owns a personal formal account to access finance from a financial institution (Demirguc-Kunt *et al.*, 2018). Therefore, the access indicator is constructed from survey questions on whether a respondent has a personal formal account with a bank financial institution, a nonbank financial institution or mobile money service provider. Similarly, the usage indicator is constructed from survey questions on whether the respondent has used a personal or someone else's bank account, nonbank account or mobile money account to perform at least one financial activity up to 90 days to account for regular usage. The “no barrier” indicator includes high transaction cost/ registration fees, physical distance, lack of formal identification and lack of information on formal account opening or use common to rural smallholders (Anderson *et al.*, 2017). Therefore, the “no barrier indicator is constructed from the survey question ‘What is the main reason you do not own or use a formal account?’”

2.2.2 Indicators of the financial capability domain

The financial capability domain reflects people's ability to effectively participate in a formal financial system through prudent financial decisions and plans (Abor *et al.*, 2018). The Central Bank of Nigeria (2018) also identified financial literacy and consumer protection as

key targets in enhancing the financial capability of consumers. The financial literacy indicator is constructed from three survey questions: does the respondent know at least one of the financial services offered by the formal institution used? For what types of financial activities can a respondent use mobile money? Can a respondent at least recall one name of any mobile money provider without aid? The justification for the survey questions is that, although formal education is often used as a proxy for financial literacy and considered to increase the likelihood of FI, recent studies have found that the levels of formal education of smallholder farmers in Nigeria are generally low (Abdu *et al.*, 2015). Rather than suggesting that additional formal education of rural smallholder farmers is necessary for FI, the study proposes that knowledge of financial products and services could be increased through training and awareness programs. This view is supported by Nigeria's national FI strategy (CBN, 2018), which indicates the need to achieve 50% consumer awareness of financial products.

The consumer protection indicator is constructed from survey questions on the extent to which rural smallholder farmers trust the following formal service providers: banks, bank agents, savings groups, microfinance institutions, mobile money agents and mobile money providers. While consumer protection refers to the institutional settings that guarantee the safety of consumers in financial market participation and inclusion, developing consumer's trust in formal financial systems is key in consumer protection (Randall *et al.*, 2017; OECD, 2018).

Lastly, financial planning reflects the process of making financial management plans to meet financial needs (Agarwal *et al.*, 2015) and the outcome of having a plan. Therefore, this study constructs the financial planning indicator from two survey questions: does a respondent have at least a savings plan, investment plan, living will, retirement plan or an insurance plan? Does a respondent presently have a credit plan for school fees, a goal savings or contractual savings plan for school fees or a savings or payment plan for agricultural inputs like seeds, fertilizers or pesticides?

2.2.3 Indicators of the financial well-being domain

Often used interchangeably in the literature with financial health, financial well-being can refer to the extent of financial resilience, having control over finance or freedom to make financial decisions, financial security or one's financial situation (Kempson *et al.*, 2017; Burggen *et al.*, 2017; Ladha *et al.*, 2017). Successful FI is assumed to rely on individuals being financially better off in a regulated system and able to meet financial needs both now and in the future. This study adopts having control over finance, financial resilience and financial situation indicators as the metrics of the financial well-being domain. The control over finance indicator reflects the extent of control or decision-making ability an individual has in meeting financial needs or being able to pay bills on time (Kempson *et al.*, 2017; Centre for Economic and Business Research, 2018). The control over finance indicator is constructed from two survey questions: does a respondent make sole, joint or no decisions regarding daily expenses? How often does a respondent pay bills on time?

The financial resilience indicator reflects the ability to mitigate risks, absorb shocks or meet emergencies that affect one's financial health (Ladha *et al.*, 2017). This study develops the

indicator from two subindicators: can a respondent come up with 100,000 naira if there is an emergency need requiring payment? [1] Does a respondent have emergency funds to meet unplanned expenses? Finally, the financial situation indicator is developed from the self-assessment of a respondent's current household *financial* situation regarding whether he or she belongs to a household without enough money for food, having enough money for food and clothes only or having enough money for food and clothes and could save a bit or could afford to buy certain luxurious goods.

2.3 Constructing the multidimensional financial inclusion index

This study adapts the Alkire–Foster method (Alkire *et al.*, 2013) to construct the MFII. The first approach involves coding rural smallholder farmers as 1 if adequate in each FI indicator and 0 if otherwise (Table 1). To ensure policy efforts avoid substituting success in one domain with failures in another, the study applies an equal weighting across the domains and corresponding indicators such that the weights sum up to 1 ($\sum_{i=1}^{n} w_i = 1$). The adequacy score α_i therefore is the weighted sum of adequate achievements across the nine FI indicators for each rural smallholder farmer represented as

$$a_i = w_1 X_1 + w_2 X_2 + w_3 X_3 + \ldots + w_9 X_9$$

Where X_i and w_i represent the *i*th indicator and weight of *i*th indicator, respectively; $\alpha_i = 1$ if a respondent is adequate in all nine indicators and 0 if otherwise.

The financial adequacy threshold (f_k) is the share of weighted adequacies a respondent must have across all nine indicators with or without a formal account. The adequacy threshold employed in this study is guided by Nigeria's target to increase the FI rate from 53.7% in 2010 to 80% by 2020 (Central Bank of Nigeria, 2018). These figures are used to establish a lower and upper bound adequacy threshold for the sensitivity analysis. The study also considered the year of survey data collection (Anderson, 2016) and the financial characteristics of rural smallholder farmers. Setting a high (f_k) would imply few respondents would be categorized as financially adequate. Conversely, a low would imply it is not challenging for most rural smallholder farmers to achieve financial adequacy. A rural smallholder farmer is considered financially adequate if he or she has achieved an adequacy score greater than or equal to two-thirds of the weighted domains of FI $(a_i \geq f_k)$.

To censor the headcount of the financially adequate, this study classifies respondents with $a_i \geq f_k$ as = $a_i\,(k) = a_i$, while those with $a_i < f_k$ are classified as $a_i\,(k)$ = 0 (Akire and Foster, 2011). However, a rural smallholder farmer is considered financially included if he or she has an adequacy score greater than or equal to the financial adequacy cut off with adequacy within the access indicator ($a_i \geq fi_k$) such that respondents with ($a_i \geq fi_k$) are classified as $a_i\,(k) = a_i$ but those with $a_i < fi_k$ are classified as $a_i\,(k)$ = 0. Therefore, we define FI as having adequate achievements in at least two-thirds of the three domains of FI with adequacy in formal access. The MFII which measures the level of FI therefore reflects the incidence (Ch_{FI}) and intensity (A_{FI}) of multidimensional FI (MFI) of rural smallholder farmers.

Table 1. Financial inclusion domain indicators, adequacy and weighting

Indicator	Adequacy	Weight
Access	Adequate if a rural smallholder has a personal formal account with at least one formal service provider	1/9
Usage	Adequate if a rural smallholder has used a formal account with at least one of the formal service providers up to 90 days	1/9
No barrier	Adequate if a rural smallholder reported no barrier among the investigated barriers	1/9
Financial literacy	Adequate if a rural smallholder is able to indicate at least one of the financial services offered by the formal institution used or indicate at least one type of financial activity he or she can use mobile money for or at least recall one name of any mobile money provider without aid	1/9
Financial planning	Adequate if a rural smallholder has at least a savings plan; investment; living will; retirement plan, insurance plan or currently has at least a credit plan, a goal or contractual savings plan for school fees, a savings or payment plan for agricultural inputs	1/9
Consumer protection	Adequate if a rural smallholder fully trusts or somewhat trust at least one formal financial source	1/9
Control over finance	Adequate if a rural smallholder makes either sole or joint decision regarding daily expenses or is able to always or sometimes pay bills	1/9
Financial resilience	Adequate if it is very possible or somewhat possible for a rural smallholder to come up with 100,000 naira to pay for emergency within the next month or always or sometimes have emergency fund to cover for unplanned expenses	1/9
Financial situation	Adequate if a respondent belongs to a household with at least enough money for food and cloth only	1/9

$$Ch_{FI} = \frac{FI}{n}$$

Where Ch_{FI} is the censored head count ratio of the financially included (incidence); *FI* is the number of financially included rural smallholder farmers and *n* is the total sample size.

$$A_{FI} = \frac{\sum_{i=1}^{n} fi\,(k)}{FI}$$

Where A_{FI} is the average adequacy score (intensity) of financially included rural smallholder farmers and $fi\,(k)$ represents the censored adequacy score of the *i*th financially included rural smallholder farmer. The MFII is therefore represented as

$$\mathrm{MFII} = Ch_{FI} \times A_{FI}$$

Where (1-($Ch_{FI} \times A_{FI}$) represents the index of multidimensional financial exclusion. This index contains elements, beyond the share of adults with a formal account, potentially necessary to consider toward achieving Nigeria's policy goal of sustainable FI (Central Bank of Nigeria, 2018; Demirguc-Kunt *et al.*, 2018). Accordingly, this study tests whether just owning formal accounts to access finance – the common metric – is equivalent to financial adequacy and hence, the FI of rural smallholder farmers using the Pearson chi-square test.

The contribution of each *i*th indicator to the level of MFI is represented as $((w_i ChX_i/\mathrm{MFII}) * 100)$; where $w_i \quad \left(\sum_{i=1}^{d} w_i \quad = 1\right)$ and ChX_i represent the weight

and censored headcount ratio of indicator *i*, respectively. Finally, the sensitivity of the estimates to alterations in adequacy threshold at $f_k \geq 0.55$ (lower bound) and $f_k \geq 0.77$ (upper bound) is determined using Kendall's tau rank correlation analysis denoted as

$$R^{\tau} = (CP - DP) / (n(n-1)/2)$$

Where *CP* is the number of concordant pairs, *DP* represents the number of discordant pairs and *n* is the number of compared pairwise observations. A positive rank coefficient indicates *CP* > *DP* and the closer to 1, the higher the robustness of estimates (Alkire *et al.*, 2015).

3. Results

3.1 Adequacy of rural smallholder farmers

Results (Table 2) show that 27.07% of rural smallholder farmers in Nigeria are adequate in the access indicator but only 25.43% frequently use formal financial services. Likewise, less than one-third (30.93%) reported not having barriers like high transaction costs, lack of identification and distance in financial participation. Nigeria has adopted various innovations like the three-tiered know-your-customer regulations, biometric bank verification number and national identification number to ease the challenges faced in formal financial participation (Alliance for Financial Inclusion, 2019b). However, it is still difficult to enroll rural populations and farmers due to distance and poor infrastructures, which increases the cost of linking up the country's innovative programs with agricultural operations (ITU, 2016). In the financial capability domain, results indicate that 26% of rural smallholder farmers are adequate in financial literacy and 39.33% in financial planning. However, a higher proportion (66.80%) is adequate in the consumer protection indicator. This may be because Nigeria prioritizes consumer protection as an essential component of FI since the launch of the country's national FI strategy in 2012 and the consumer protection framework in 2016. Although a financial literacy framework was earlier established in 2013 (Central Bank of Nigeria, 2015a), evidence suggests that financial literacy programs in Nigeria are yet to adequately reach rural smallholder farmers. Moreover, a low level of knowledge and management skills to make informed financial decisions could be detrimental to the financial capability and participation of rural smallholder farmers in formal financial systems despite consumer protection. Results of the financial well-being domain indicate that a majority (92.06%) are adequate in control over finance, 72.27% in financial resilience and 85.74% in financial situation. In general, findings indicate that rural smallholder farmers in Nigeria have the highest uncensored headcount ratio in control over finance and the least in financial literacy and use of formal financial services.

Table 2. Adequacy of rural smallholder farmers

Domain	Indicator	Frequency	Percent
Financial participation	Access	621	27.07
	Usage	585	25.43
	No barrier	711	30.93
Financial capability	Financial literacy	598	26.00
	Financial planning	905	39.33
	Consumer protection	1,515	65.80
Financial well-being	Control over finance	2,117	92.06
	Financial resilience	1,662	72.27
	Financial situation	1,972	85.74
Total number of observations		2,300	100.00

3.2 The multidimensional financial inclusion of rural smallholder farmers in Nigeria

Results in Table 3 show that while 27.07% of rural smallholder farmers have formal access to financial services, 29.90% have adequate achievements in at least two-thirds of the domains of FI. This implies that not all who have access to formal services are financially adequate. Findings show that rural smallholder farmers in Nigeria have an incidence (25.65%) and intensity of 85.50% in MFI. This results in an overall MFII of 0.22, which suggests a low level of FI. Anderson *et al.* (2017) reported that 26% of smallholder farmers in Nigeria were financially included as defined by the proportion of those having a personal formal account. However, findings from this study suggest rural smallholder farmers who only own formal accounts to access financial services are significantly different at 1% from those who have achieved financial adequacy in at least two-thirds of the domains of FI with formal access. Therefore, this study establishes that formal access to financial services does not translate to the FI of rural smallholder farmers in Nigeria and validates additional insights possible with an MFII.

Table 3. Estimates of the multidimensional financial inclusion (MFI) index

Indicators	Estimates
Formal access	27.07%
Financial adequacy	29.90%
Incidence of MFI	25.65%
Intensity of MFI	85.50%
MFII	0.2193
1 – MFII	0.7807
The number of observations	2,300
Pearson X^2 test	*p*-value
H_o: formal access = financial adequacy	0.000
H_o: formal access = financial inclusion	0.000

3.3 Contribution of domains and indicators to multidimensional financial inclusion

Findings show that the financial well-being domain contributes most (35.89%) to the levels of FI of rural smallholder farmers, followed by financial participation (34.45%) and financial capability (29.66%) (Figure 1). This supports the findings of the Central Bank of Nigeria (2015b) that 40% of the Nigerian population in the segment with the lowest financial

capability score participate mostly in smallholder farming. The findings imply that, relative to other domains of FI, rural smallholder farmers in Nigeria are least financially capable to make informed choices about formal services or products which could potentially make them worse off if provided with innovative financial services. According to Bolaji-Adio *et al.* (2013), financial capability is an essential policy strategy in FI because it could influence the extent of an individual's financial participation and/or well-being. However, this study proposes that financial literacy is only one component and should not be substituted with the entire concept of financial capability of rural smallholder farmers in Nigeria when considering interventions.

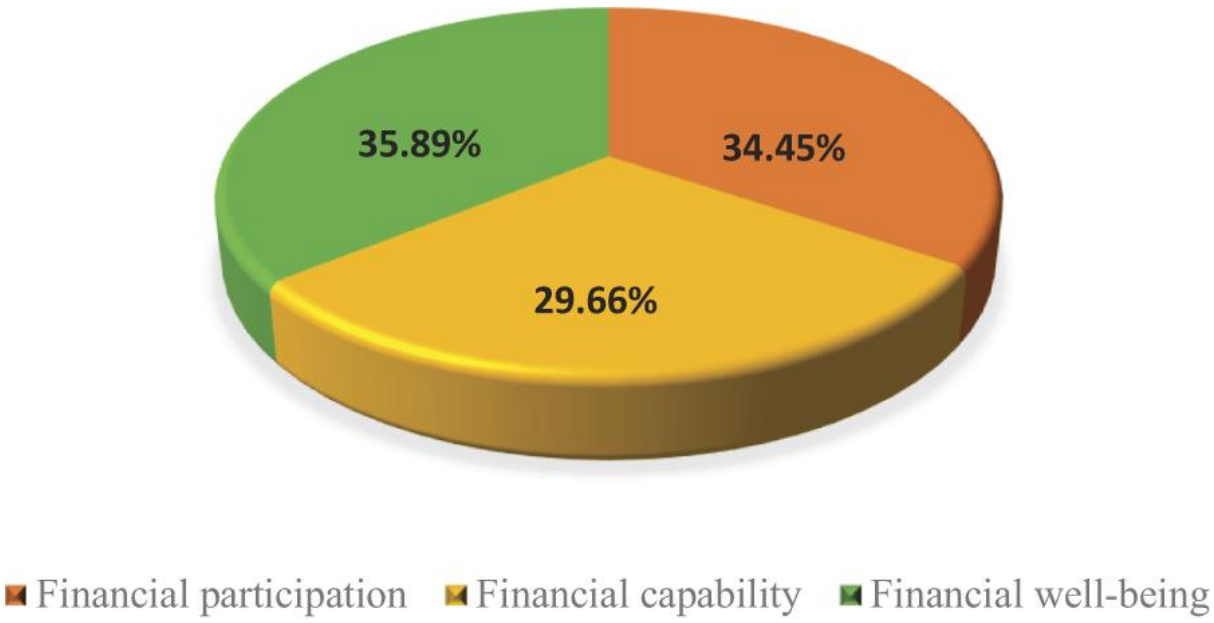

Figure 1. Contribution of domains to multidimensional financial inclusion

Further results on the contributions of domain indicators to the MFI of rural smallholder farmers (Figure 2) show the following order: access (13.00%), control over finance (12.82%), financial situation (12.07%), usage (11.71%), financial resilience (11.00%), financial literacy (10.70%), consumer protection (10.05%), no barrier (9.74%) and financial planning (8.92%). Although this study establishes that rural smallholder farmers in Nigeria generally have a low level of FI, lower censored headcount ratios are observed in financial literacy, consumer protection, no barrier and financial planning indicators relative to formal access.

Table 4. Sensitivity analysis of financial inclusion indicator estimates

Domains of FI	Indicators	Ch_{fj}	$f_k \geq 0.55$ C_MFII	Rank	Ch_{fj}	$f_k \geq 0.66$ C_MFII	Rank	Ch_{fj}	$f_k \geq 0.77$ C_MFII	Rank
Financial participation	1. Access	0.2656	0.0295	1	0.2565	0.0285	1	0.2115	0.0235	1
	2. Usage	0.2364	0.0263	4	0.2311	0.0257	4	0.1981	0.0220	4
	3. No barrier	0.1973	0.0219	8	0.1923	0.0214	8	0.1748	0.0194	7
Financial capability	1. Financial literacy	0.2119	0.0235	6	0.2111	0.0235	6	0.1883	0.0209	5
	2. Financial planning	0.1770	0.0197	9	0.1760	0.0196	9	0.165	0.0183	9
	3. Consumer protection	0.2026	0.0225	7	0.1983	0.0220	7	0.1746	0.0194	7
Financial well-being	1. Control over finance	0.2622	0.0291	2	0.2530	0.0281	2	0.2101	0.0233	2
	2. Financial resilience	0.2212	0.0246	5	0.2171	0.0241	5	0.1825	0.0203	6
	3. Financial situation	0.2453	0.0273	3	0.2383	0.0265	3	0.1989	0.0221	3
	MFII		0.2243			0.2193			0.1893	

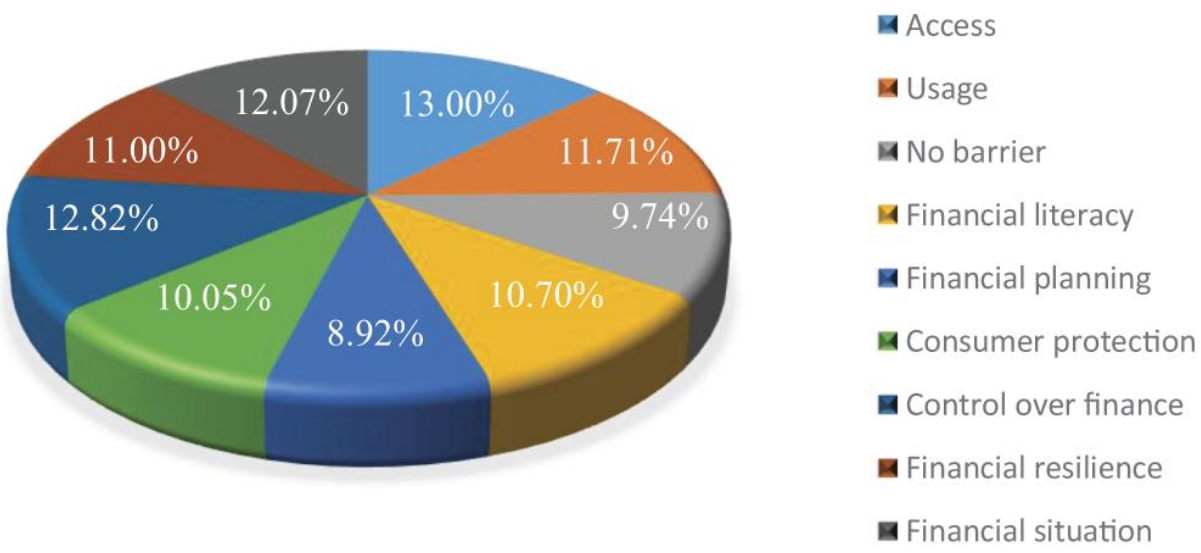

Figure 2. Contribution of indicators to multidimensional financial inclusion

3.4 Sensitivity analysis

Results of the sensitivity analysis (Table 4) show MFII values ranging from 0.19 to 0.22, which imply that rural smallholder farmers in Nigeria persistently have a low FI rate, irrespective of changes in adequacy thresholds. The censored headcount ratio (Ch_{FI}) indicates that having formal access to financial services followed by control over finance contributes a greater proportion to the levels of FI, while financial planning contributes the least. Furthermore, rankings of the contributions of FI indicators (C_MFII) remain unchanged by comparing the lower bound ($f_k \geq 0.55$) with the base threshold ($f_k \geq 0.66$). Results from comparing the base threshold with $f_k \geq 0.77$ indicate that rankings also remain unchanged for most comparisons except the change of position in three indicators. The rank of financial resilience changed from 5th to 6th, that of no barrier changed from 8th to 7th and the rank of financial literacy changed from 6th to 5th. This suggests that financial literacy makes a greater contribution to the FI of rural smallholder farmers at a higher adequacy threshold.

Table 5. Rank robustness check

		Kendall tau-*b* rank coefficient	
Domains of FI	Indicators	$fI_k \geq 0.66$ Vs $fI_k \geq 0.55$	$fI_k \geq 0.66$ Vs $fI_k \geq 0.77$
Financial participation	Access	0.9602	0.8972
	Usage	0.9727	0.9302
	No barrier	0.9774	0.9385
Financial capability	Financial literacy	0.9940	0.9592
	Financial planning	0.9929	0.9568
	Consumer protection	0.9799	0.9073
Financial well-being	Control over finance	0.9596	0.9007
	Financial resilience	0.9806	0.9196
	Financial situation	0.9659	0.9132

Results of the Kendall tau-*b* rank correlation analysis (Table 5) obtained from comparing the base threshold with the lower bound ($f_k \geq 0.66$ vs. $f_k \geq 0.55$) show that rank coefficients range from 0.96–0.99 for the censored head count ratios of all nine FI indicators. However, the coefficients range from 0.90–0.96 when the base threshold is compared with the upper bound ($f_k \geq 0.66$ vs. $f_k \geq 0.77$). Although the results indicate that higher rank coefficients are obtained in the former comparison case than the latter, not less than 0.90 is obtained across alternate thresholds. In line with Alkire *et al.* (2015), a rank coefficient of 1 indicates a perfect positive relationship (100% robust pairwise comparisons) between the ranks obtained at the alternate thresholds. Furthermore, they opined that estimated rank coefficients should be steady enough not to deviate far from the value of 1. Based on the results of the sensitivity analysis, this study concludes that the MFII estimates are robust and steady enough to inform policy interventions in the FI of rural smallholder farmers in Nigeria.

4. Conclusion and policy implications

This study explored the most comprehensive nationally representative data on the financial lives of smallholder farmers in Nigeria to develop a new method for measuring FI and using it to examine the FI status of rural smallholder farmers in the country. The study provides insights into determining whether having just a formal account is adequate for the sustainable FI of rural smallholder farmers.

The results suggest not but rather the importance of measures to improve rural smallholder farmer's financial adequacy through increased financial capability, participation and well-being. Though testing for the efficacy of particular interventions is not part of this work, the results suggest financial planning products are important for rural smallholder farmers to strengthen their resilience to economic shocks and confidence to avail themselves of economic opportunities. Affordable digital services could reduce barriers to FI such as high transaction costs and distant location. The role of digital finance is especially apparent during periods of conflict or at times of restricted social mobility, such as due to the COVID-19 pandemic. Importantly, in addition to public interventions, FI policy can seek to strengthen the responsiveness of formal financial institutions to addressing the financial needs and protection of rural smallholder farmers.

Overall, the results suggest that a high rate of financial exclusion among rural smallholder farmers could retard efforts aimed at transforming agriculture to achieve SDG 2. Furthermore, the results suggest that, to achieve inclusive development, it is vital for policy interventions to target and increase the FI of rural smallholder farmers; having a registered formal account is unlikely sufficient to achieve sustainable FI.

Acknowledgements

This research paper was financially supported by the World Bank Robert S. McNamara Fellowship Programme.

Note

[1.] Exchange rate effective at the time of survey December 9, 2016: US$1 = 307.4 naira.

References

Abdu, M., Buba, A., Adamu, I. and Muhammad, T. (2015), "Drivers of financial inclusion and gender gap in Nigeria", The Empirical Econometrics and Quantitative Economics Letters, Vol. 4 No. 4, pp. 186-199.

Abor, J.Y., Issahaku, H., Amidu, M. and Murinde, V. (2018), Financial Inclusion and Economic Growth: What Do We Know?, Working Paper No. 11, Centre for Global Finance, SOAS University of London, London, 2018.

Adelaja, O., Adetunji, O., Ajai, O., Aluko, T., David-West, O., Iheanachor, N., Muritala, O., Nwagwu, I., Ogbu, E., Taiwo, I., Umoh, S. and Umukoro, I. (2019), Digital Financial Services in Nigeria, State of the Market Report 2019, Lagos Business School, Pan-Atlantic University and Sustainable and Inclusive Digital Financial Services.

Agarwal, S., Amromin, G., Itzhak, B., Chomsisengphet, S. and Evanoff, D. (2015), "Financial literacy and financial planning: evidence from India", Journal of Housing Economics, Vol. 27, pp. 4-21.

Akinwotu, E. (2020), "People are more scared of hunger: coronavirus is just one more threat in Nigeria", available at: https://www.theguardian.com/global-development/2020/may/15/people-are-more-scared-of-hunger-coronavirus-is-just-one-more-threat-in-nigeria (accessed 17 May 2020).

Alkire, S. and Foster, J. (2011), "Counting and multidimensional poverty measurement", Journal of Public Economics, Vol. 95, Issues 7-8, pp. 476-487.

Alkire, S. and Santos, M.E. (2010), Acute Multidimensional Poverty: New Index for Developing Countries, OPHI working papers 38, Oxford Poverty and Human Development Initiative, University of Oxford, Oxford, July 2010.

Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A.R., Seymour, G. and Vaz, A. (2013), "The women's empowerment in agriculture index", World Development, Vol. 52, pp. 71-91.

Alkire, S., Foster, J., Seth, S., Santos, M.E., Roche, J.M. and Ballon, P. (2015), Multidimensional Poverty Measurement and Analysis, OPHI working paper No. 84, Oxford Poverty and Human Development Initiative, Oxford University Press, Oxford.

Alliance for Financial Inclusion (2019a), "2019 Maya declaration progress reports: driving impact on the ground", available at: https://www.afiglobal.org/sites/default/files/publications/201910/AFI_Maya_19_AW_digitallow_0.pdf (accessed 12 Jan 2020).

Alliance for Financial Inclusion (2019b), KYC Innovations, Financial Inclusion and Integrity in Selected AFI Member Countries, Digital Financial Services (DFS), working group, guideline note No. 32.

Anderson, J., Anderson, J., Marita, C., Musiime, D. and Thiam, M. (2017), National Survey and Segmentation of Smallholder Households in Nigeria: Understanding Their Demand for Financial, Agricultural and Digital Solution, CGAP working paper, CGAP, Washington, DC, June, 2017.

Anderson, J. (2016), CGAP Smallholder Household Survey in Nigeria, 2016, Building the Evidence Base on the Agricultural and Financial Lives of Smallholder Households, The World Bank, CGAP, Washington, D.C., available at: http://microdata.worldbank.org/index.php/catalog/2922 (accessed 1 April 2018).

Bolaji-Adio, A., Iarossi, G., Perotti, V. and Zottel, S. (2013), Making Sense of Financial Capability Surveys Around the World: A Review of Existing Financial Capability and Literacy Measurement Instruments, report No. 80614, World Bank, Washington DC.

Brüggen, E.C., Hogreve, J., Holmlund, M., Kabadayi, S. and Löfgren, M. (2017), "Financial well- being: a conceptualization and research agenda", Journal of Business Research, Vol. 79, pp. 228-237.

Camara, N. and Tuesta, D. (2014), Measuring Financial Inclusion: A Multidimensional Index, working paper 14/26, BBVA Bank, Economic Research Department, Madrid.

Center for Economic and Business Research (2018), "Financial wellbeing and productivity: a study into the financial wellbeing of UK employees and impact on productivity", available at: https://www.aegon.co.uk/content/dam/ukpaw/documents/financial-wellbeing-and-productivity.pdf (accessed 30 March 2019).

Center for Financial Inclusion (2013), "Enabling financial capability along the road to financial inclusion", available at: https://centerforfinancialinclusionblog.files.wordpress.com/2013/10/financialcapability.pdf (accessed 30 March 2019).

Central Bank of Nigeria (2015a), "National financial literacy framework", *Abuja Nigeria*, available at: https://www.cbn.gov.ng/out/2016/cfpd/financialliteracy.pdf (accessed 10 July 2019).

Central Bank of Nigeria (2015b), "National financial literacy baseline survey report", *Abuja Nigeria*, available at: https://www.cbn.gov.ng/out/2016/cfpd/baselinesurvey.pdf (accessed 10 July 2019).

Central Bank of Nigeria (2018), "National financial inclusion strategy (revised)", *Abuja Nigeria*, available at: https://www.cbn.gov.ng/Out/2019/CCD/NATIONALFINANCIALINCLUSIONSTRATEGY.pdf (accessed 10 July 2019).

Chakravarty, S.R. and Pal, R. (2010), Measuring Financial Inclusion: An Axiomatic Approach, working paper 2010-03, Indira Gandhi Institute of Development Research, Mumbai, March.

Cuevas, C.E. and Anderson, J. (2016), Understanding Demand, Driving Innovation Smallholder Households and Financial Services, CGAP Working Paper Smallholder Dairies, Washington, DC, February.

Demirgüç-Kunt, A. and Klapper, L. (2013), "Measuring financial inclusion: explaining variation in use of financial services across and within countries", Brookings Papers on Economic Activity (Spring), Vol. 44, pp. 279-340.

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S. and Hess, J. (2018), The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution, World Bank, Washington, DC.

Fan, S., Brzeska, J., Keyzer, M. and Halsema, A. (2013), From Subsistence to Profit: Transforming Smallholder Farms, food policy report, IFPRI, Washington, DC.

FAO (2017), "Food and agriculture: driving action across the 2030 agenda for development", available at: http://www.fao.org/3/a-i7454e.pdf (accessed 10 April 2020).

Gupte, R., Venkataramani, B. and Gupta, D. (2012), "Computation of financial inclusion index for India", Procedia—Social and Behavioral Sciences, Vol. 37, pp. 133-149.

HLPE (2013), Investing in Smallholder Agriculture for Food Security, a report by the High Level Panel of Experts on Food Security and Nutrition Committee on World Food Security, Rome, available at: http://www.fao.org/3/a-i2953e.pdf (accessed 20 April 2018).

ITU (International Telecommunication Union) (2016), "Review of national identitypPrograms", available at: https://www.itu.int/en/ITUT/focusgroups/dfs/Documents/09_2016/ReviewofNationalIdentityPrograms.pdf (accessed 10 April 2020).

Kalu, I.U., Omeje, A.N. and Mba, A.N. (2018), "Financial inclusion in the agricultural sector in Nigeria: an index of penetration", International Journal of Economics and Financial Issues, Vol. 3 No. 8, pp. 35-44.

Kempson, E., Finney, A. and Poppe, C. (2017), Financial Well-Being: A Conceptual Model and Preliminary Analysis, SIFO Project Note No: 3, Consumption Research, Final edition, Oslo and Akershus University College of Applied Sciences, Norway, July.

Ladha, T., Asrow, K., Parker, S., Rhyne, E. and Kelly, S. (2017), "Beyond financial inclusion: financial health as a global framework", available at: https://www.findevgateway.org/paper/2017/03/beyond-financial-inclusion-financial-health-global-framework (accessed 10 July 2019).

Mgbenka, R.N. and Mbah, E.N. (2016), "A review of smallholder farming in Nigeria: need for transformation", International Journal of Agricultural Extension and Rural Development Studies, Vol. 3 No. 2, pp. 4-54.

OECD (2018), “Financial inclusion and consumer empowerment in Southeast Asia”, available at: http://www.oecd.org/finance/Financial-inclusion-and-consumer-empowerment-in-Southeast-Asia.pdf (accessed 10 April 2020).

Okpara, G.C. (2013), Developing an Index of Financial Inclusion: An Average Ratio Approach, MPRA Paper No. 49505, Munich University Library, Germany.

Park, C.-Y. and Mercado, R.V. Jr (2018), Financial Inclusion: New Measurement and Few Cross- Country Impact Assessment, ADB economics working paper series No. 539, Philippines, March.

Randall, D., Ardic Alper, O.P., Varghese, M.M. and Traversa, M. (2017), Global Financial Inclusion and Consumer Protection Survey: 2017 Report, working paper report No. 122058, World Bank, Washington, DC.

Sarma, M. (2008), Index of Financial Inclusion, working paper 215, Indian Council for Research on International Economic Relations (ICRIER), New Delhi.

Sarma, M. (2015), “Measuring financial inclusion”, Economics Bulletin, Vol. 35, Issue 1, pp. 604-611.

World Bank (2014), Nigeria Agriculture and Rural Poverty: A Policy Note, report no. 78364-NG, World Bank, Washington, DC, available at: https://openknowledge.worldbank.org/handle/10986/19324 (accessed 10 April 2020).

World Bank (2017), “Mobile Technologies and Digitized Data to Promote Access to Finance for Women in Agriculture, working paper report No: 112110, World Bank, Washington, DC.

World Economic Forum (2018), “Advancing financial inclusion metrics: shifting from access to economic empowerment”, available at: http://www3.weforum.org/docs/WEF_White_Paper_Advancing_Financial_Inclusion_Metrics.pdf (accessed 11 April 2020).

Yorulmz, R. (2018), “An analysis of constructing global financial inclusion indices”, Borsa Instabul Review, Vol. 18 No. 3, pp. 248-258.