

Financial inclusion, vulnerability coping strategies and multidimensional poverty: Does conceptualisation of financial inclusion matter?

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Abstract

Policy emphasis on financial inclusion and deepening has shifted away from measures capturing formal financial services only and towards the development of more inclusive financial markets which account for both formal and informal services. This study examines the effect of financial inclusion and vulnerability coping strategies on multidimensional poverty, where the conceptualisation of financial inclusion is based on four perspectives—(i) one that focuses on only the formal financial sector, (ii) another that concentrates on only the informal financial sector, (iii) one that considers only the mobile money sector and (iv) finally, one that combines all financial markets (i.e., formal and informal including mobile money). Findings show that the conceptualisation of financial inclusion does not only matter in identifying the financially included but also has an implication on how financial inclusion influences multidimensional poverty. Financial inclusion measures that use only formal financial products and services understate their potential effects on multidimensional poverty, thus, justifying the need for a financial inclusion measure that considers both formal and informal sectors. Incorporating informal financial products and services in the measure reduces multidimensional

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poverty more for female-headed households and those in rural settings. Households' adoption of vulnerability coping strategies has the potential to reduce the likelihood of being multidimensionally poor.

KEYWORDS

financial inclusion, poverty, vulnerability

JEL CLASSIFICATION

G21, G23, I31, I32

1 | INTRODUCTION

Financial inclusion is recognised among the key poverty reduction tools because of its ability to improve living standards (Abor et al., 2018; Bukari et al., 2020; Koomson et al., 2020; Munyegera & Matsumoto, 2016) and how it facilitates the provision of financial resources needed by households to invest in education (Arora, 2012; Chiapa et al., 2016); health (Akotey & Adjasi, 2016; Jalilian & Kirkpatrick, 2002), protection against idiosyncratic risk and sudden shocks (Duflo et al., 2013; Giordano & Ruiters, 2016; Koomson et al., 2021). Other studies have shown that financial inclusion can aid in the achievement of Sustainable Development Goals, especially Goal 1-Zero poverty (Ahmed et al., 2015). It has been argued that financial inclusion can reduce multidimensional poverty, which is mainly conceptualized as households' deprivation in three dimensions of welfare—education, health, and living standards (Alkire & Foster, 2011a). This notwithstanding, a plethora of extant studies on the link between financial inclusion and poverty have either focused on the poverty dimensions discretely or have used a unidimensional measure of poverty (see Cuesta & Danquah, 2022; Devkota & Upadhyay, 2013; Imai et al., 2010; Mohammed et al., 2017; Swamy, 2014). This suggests that the existing studies have offered less robust empirical evidence on the link between financial inclusion and multidimensional poverty.

Also, previous household-level studies have largely ignored the endogeneity problem often present in the financial inclusion-poverty nexus. One of the endogeneity problems ignored in the financial inclusion-poverty literature is the issue of transaction cost. Transaction costs could be financial (i.e., transportation cost on accessing financial services, interest rates on loans, etc.), in-kind (i.e., opportunity foregone when traveling long distances to banks, etc.) or psychic (i.e., psychological stress of queuing at banking halls and other discomforts experiences with access to financial services) and often result in market failures in financial markets (Kon & Storey, 2003; Stiglitz & Weiss, 1981). This endogeneity when unaccounted for in a model, may bias estimates and by implication, either understate or overstate the potential effect of financial inclusion on poverty. From a policy viewpoint, not accounting for endogeneity often results in wrong conclusions and by extension, misleading policy outcomes. Another serious concern in the literature is a measurement problem that relates to the conceptual measurement of financial inclusion. Previous studies (see Chiapa et al., 2016; Mohammed et al., 2017; Sani Ibrahim et al., 2018; Swamy, 2014; Zins & Weill, 2016) that have measured financial inclusion using only formal financial services despite the growing concerns that financial inclusion is a multi-dimensional concept (Cámara & Tuesta, 2014; Nguyen, 2020; Sarma, 2008, 2016). Relying on only formal financial services as a measure of financial inclusion provides inadequate information about the comprehensiveness of the financial eco-system (Nguyen, 2020), and thus,

severely obscures our understanding of the extent of financial inclusion (Cámara & Tuesta, 2014; Sarma, 2008, 2016). By aggregating both formal and informal dimensions of financial inclusion into a composite index, users are able to substantially smooth out the measurement errors, in addition to overcoming the limitations of unidimensional measures. Thus, in this study, we address the key question of whether the conceptualisation of financial inclusion does matter in identifying the financially included and its implication on how financial inclusion influences multidimensional poverty while addressing the potential endogeneity associated with financial inclusion. We further examine whether a household's adoption of vulnerability coping strategies has the potential to reduce its chances of being multidimensionally poor.

As a result of the possible poverty-reducing effect of financial inclusion, many strategic efforts have been made at the global and national levels to enhance financial inclusion. One such effort is the World Bank's target of achieving universal financial inclusion (UFI) by 2020 as a poverty reduction tool (World Bank, 2018). This effort can partly be linked to the global improvements in the financial inclusion rate from 51% (in 2011) to 69% (in 2017), but gender and locational gaps continue to exist in financial inclusion, especially in developing countries. In developing countries, ownership of an account for males is 79% while females own 59% (Demirguc-Kunt et al., 2018). Along location dimensions, urban communities continue to get more access to finance than the rural population with a differential gap of over 20% in favour of the former (Gueze, 2014). Apart from existing gender and location gaps, the measure of financial inclusion has concentrated on formal finance and less on informal finance. Since such concentration does not adequately represent the financial system in developing countries, it requires the inclusion of the informal sector due to the dualized nature of their financial markets (Zins & Weill, 2016). The 2030 agenda further commits member states to 'leave no one behind' and states that Sustainable Development Goal (SDG) indicators should be disaggregated, where relevant, by income, sex, age, race, ethnicity, migratory status, disability and geographic location (Winkler & Satterthwaite, 2017). Premised on this commitment and evidence of gender and locational gaps in financial inclusion, there is a need to provide gender- and location-based empirical evidence on the effect of financial inclusion on multidimensional poverty. To address this, we disaggregate our analysis and estimate male–female and urban–rural sub-sampled models to identify gender and location-specific effects of financial inclusion on multidimensional poverty. Our goal is to facilitate policy prescriptions that meet their specific gender and location needs.

Apart from country-level policy directions (i.e., the 2015 Maya Declaration) aimed at reducing poverty through financial inclusion (AFI, 2015), households also engage in risk-coping strategies such as savings, micro-insurance, and investment against vulnerability to poverty (Chambers, 2006; Dercon, 2005; Hamid et al., 2011). Based on the widely acknowledged fact that households in developing countries are exposed to many forms of risk such as crop failure, drought, and loss of jobs that have implications on poverty, Dercon et al. (2008) argue that the acquisition of insurance constitutes a comprehensive system of protection for the poor. Apart from insurance, households can access credit and invest to reduce poverty (Dercon, 2005). Nonetheless, the extant literature on the effect of risk-coping strategies on multidimensional poverty remains sparse, to the best of our knowledge. This study investigates the effect of households' adoption of vulnerability coping strategies (i.e., savings, micro-insurance, investment, and earning extra income against vulnerability) on multidimensional poverty.

The case of Ghana is used to provide empirical evidence on the issues raised above. The choice of Ghana is interesting and timely because it was the first among the few countries in sub-Saharan Africa to achieve the MDG1 target of halving extreme poverty (Abane, 2017).

Despite this achievement, extreme poverty was still evident in the five northern regions of the country (Abane, 2017) whilst rural households are poorer compared to urban households (GSS, 2018). Poverty incidence is also higher for male-headed households (25.8%) compared to female-headed ones (17.6%). Similarly, male-headed households, spend more on health, and education and own more assets than female-headed homes (GSS, 2018). On the contrary, women dominate men in business ownership (GSS, 2014; Oduro et al., 2011). Financial inclusion in Ghana exhibits gender and locational differentials. Account ownership among urban-located males is 54% compared to 46% for their female counterparts. For rural males, the proportion of account ownership is 61% compared to 39% for females (GSS, 2018). Ghana is improving in levels of financial inclusion, especially through an improvement in mobile money account ownership by 26% from 2014 to 2017. Comparing the information on Ghana to those provided above, using data from Ghana reflects a typical developing country situation that fits the scope of the study.

Using distance to financial institutions and the number of mobile money agents as instruments to account for the endogeneity inherent in financial inclusion, we find that inclusion significantly reduces household multidimensional poverty by 4.6–19.0 percentage points depending on how financial inclusion is measured. Disaggregating the analysis by gender, we find that the effect of financial inclusion on multidimensional poverty is greater for females than males with a differential magnitude of 1.2–2.1 percentage points depending on how financial inclusion is conceptualised. Along rural–urban dimensions, we find that the effect of financial inclusion on multidimensional poverty is greater for rural dwellers than urban dwellers with a differential magnitude of 2.5–9.2 percentage points and again depending on how financial inclusion is measured. The remaining sections of this paper are as follows: Section 2 reviews the literature on the link between financial inclusion and multidimensional poverty and provides a critique of empirical studies. The methodology discussed in Section 3 includes data sources, measurement of key variables, and estimation technique. The empirical analysis and discussion are done in Section 4 while the conclusion and policy recommendations are presented in Section 5.

2 | LITERATURE REVIEW

2.1 | Formal financial services and poverty

While the search for understanding the financial inclusion-poverty nexus has spawned considerable interest since the late 1990s, the quest for ending poverty in all its form everywhere in recent times has rekindled the debate about the distributional effect of financial inclusion on poverty. Thus, recent studies have been ardent to understand the channels through which financial services affect poverty to engender policy-based debates. Notable studies with this agenda include Demircuc-Kunt and Levine (2008), Chibba (2009), Demircuc-Kunt et al. (2011), Duflo et al. (2013), Park and Mercado (2015), Fungáčová and Weill (2015), Dimova and Adebawale (2018), Wentzel et al. (2016), Krumer-Nevo et al. (2017), Ouma et al. (2017), Rewilak (2017), Owen and Pereira (2018), Sani Ibrahim et al. (2018) and Abor et al. (2018). What appears noncontroversial from these studies is that financial inclusion significantly reduces poverty in diverse ways: increase in incomes through access to credit and savings which increase household per capita food and non-food consumption as well as reduce deprivation. Khaki and Sangmi (2017) observed that

being financially included does not only reduce deprivations in education dimension but across all other dimensions. Yang and Fu (2019) concluded that the development of China's inclusive finance can significantly alleviate the multidimensional poverty in rural China.

At the methodological level, most of these studies share, if not the same, common features such as measuring financial inclusion from a formal point of view that concentrates on only formal finance. For instance, Park and Mercado (2015), Iqbal and Sami (2017), Wentzel et al. (2016) and Sani Ibrahim et al. (2018) measured financial inclusion using access to and use of formal financial products and services. Similarly, Fungáčová and Weill (2015) focused on formal accounts, formal savings, and formal credit as measures of financial inclusion. However, these studies have narrowly conceptualized financial inclusion. The key gap in this methodological approach is that financial inclusion is narrowly measured to mean only formal financial services. It is significant to underscore that such narrow conceptualizations often bias financial inclusion estimates and may limit optimal policy design.

In the Ghanaian context, some progress has been made on the empirical front regarding the link between financial inclusion and poverty. For instance, Bukari et al. (2020) examined how access to joint or bundled financial services reduces household poverty. The authors found that though providing household with financial services (credit, savings, insurance, and remittances) as standalone products significantly reduce their poverty levels, offering those products as a package or bundle (i.e., savings with credit, credit with insurance, or savings with credit and insurance, etc.) reduces household poverty the most. Notwithstanding that Bukari et al.'s (2020) study shed light on how complementary financial services reduce household poverty, some gaps remain. First, Bukari et al.'s (2020) study was limited to only the formal financial sector in that their study did not capture any indicator of financial inclusion from the informal sector. By implication, their study focused on only one aspect of financial inclusion. Financial inclusion is multidimensional encompassing several dimensions of both formal and informal financial services and therefore using standalone indicators does not provide a complete picture of the financial ecosystem and by extension, defeats the overarching goal of multidimensionality. Supporting this view, Sarma (2008) argues that using individual indicators of financial inclusion only provides incomplete information on the inclusiveness of the financial system of an economy and importantly, may lead to a misleading understanding of the extent of financial inclusion (Sarma, 2008). A comprehensive measure of financial inclusion should be able to incorporate information on several aspects or dimensions of inclusion, preferably into a single score (Sarma, 2008, p. 5).

Koomson et al. (2020) attempted to follow the multidimensional approach proposed by Sarma (2008) by constructing an index for financial inclusion to study its effect on poverty and vulnerability to poverty in Ghana. However, Koomson et al.'s (2020) financial inclusion index lacks all-inclusiveness. Their index included limited information from the informal sector as it captured only ownership of mobile money accounts. Their index did not capture the usage of mobile money services. Moreover, information on Ghanaians' ownership and usage of microfinance services, cooperatives, and credit union services and products was totally missing in Koomson et al.'s (2020) financial inclusion index. Our study builds on this existing literature by broadening the scope of financial inclusion to capture several aspects of the informal sector. Precisely, our financial inclusion index incorporates 13 indicators from the informal sector (including 4 indicators from the mobile money sector) in addition to 12 indicators from the formal sector.

2.2 | Informal financial services and poverty

Another relatively significant strand of literature on the financial inclusion-poverty nexus consists of those who consider the role of informal financial services (i.e., microfinance, cooperative unions, village savings and credit unions, and other regulated non-banking institutions) in complementing the role of formal services in poverty reduction. This literature can contextually be divided into two. The first consists of those that have investigated the role of informal financial services in reducing poverty in Ghana (Annim, 2018; Nukpezah & Blankson, 2017; Oteng-Abayie et al., 2022) and the second relates to those that have the same subject in other developing economies (Abdallah Ali et al., 2022; Binaté Fofana et al., 2015; Brannen & Sheehan-Connor, 2016; Chagwiza et al., 2016; Imai et al., 2010; Pagura & Kirsten, 2006; Wossen et al., 2017). Across-the-board, evidence suggests that informal financial services such as microfinance (Abdallah Ali et al., 2022; Annim, 2018; Binaté Fofana et al., 2015; Imai et al., 2010; Khandker, 2005; Oteng-Abayie et al., 2022), cooperative unions (Chagwiza et al., 2016; Getnet & Anullo, 2012; Wossen et al., 2017), and village savings and credit unions (Brannen & Sheehan-Connor, 2016; Ksoll et al., 2016) significantly reduce individuals and households poverty at varying degrees. However, we know of no study that builds a composite index incorporating individuals' or households' consumption of all these informal financial services and their implications on poverty. Again, to the best of our knowledge, no study in the informal finance-poverty literature has considered either multidimensional poverty or building a composite index for poverty.

Given the foregoing notable lacunas, we seek to provide an answer to this question: Is the poverty-reducing effect of financial inclusion enhanced if access to informal financial services is captured in the measurement of financial inclusion? Additionally, previous works did not disaggregate their analyses along the financial inclusion index despite that the SDGs' agenda 2030 emboldens analysts to disaggregate whenever data permits. By implication, the existing literature offers insufficient information in advancing our understanding of how different conceptualisations of financial inclusion impact poverty. By building separate indexes of financial inclusion for the formal sector, informal sector, and mobile money sector, we seek to appreciate how such varied conceptualisations influence multidimensional poverty. This study uniquely contributes to the literature, policy, and practice by exploring whether a redefinition of financial inclusion to capture informal markets (MFI, mobile money banking, Susu, etc.) results in enhanced poverty reduction. We believe this empirical support would engender evidence-based policy debate on how expanding financial inclusion stimulates individuals to access both formal and informal financial services and how they adopt risk/vulnerability coping strategies against risk and sudden shocks.

2.3 | Mobile money and poverty

A burgeoning literature from Ghana and beyond shows that the benefits of owning a mobile phone far outweigh the cost. Analysis of the dynamics of the development and penetration of mobile banking services in Ghana shows that the uptake of these services by individuals is rising rapidly (Adaba & Ayoung, 2017), largely due to its potential benefits. For instance, Abor et al. (2018) using seemingly unrelated probit and IV estimations show that owning a mobile phone significantly reduces the probability of a household becoming poor and also increase the per capita household consumption of food and non-food goods. In furtherance to the impact of

mobile banking, evidence from Kenya are quite promising as a significant proportion of Kenyan households (89%) save through mobile money with most of the poor farmers documenting over 95% success rate (Omwansa et al., 2013). Similarly, Siegel and Fransen (2013) observed that mobile banking goes beyond promoting savings and increasing accessibility of credit. They found that mobile banking provides opportunities for individuals and households to receive and send remittances internally and internationally. Mobile banking provides alternatives for even formal financial institutions to offer innovative financial services (Diniz et al., 2016). Like other commentators, Munyegera and Matsumoto (2016) found that having access to mobile banking services significantly improves welfare compared to non-users owing to the low transaction, transport, and time costs. Additionally, Ouma et al. (2017) showed that being included in mobile banking not only boosts one's savings but also significantly improves the frequency and amount saved as well as convenience. Motivated by their findings, the authors concluded that mobile banking has become an instrument through which the unbanked, who mostly are the poor and vulnerable become integrated into the mainstream financial system.

3 | METHODOLOGY

3.1 | Data source and descriptions

The study employed secondary data sourced from the Intermedia Financial Inclusion Insights Program conducted in December 2014 by the World Bank with the sole objective of exploring the uptake and usage of digital financial services (DFS) in Ghana. The survey covered a broad range of issues: adaptation and use of DFS among specific target groups notably the poor, rural, and the unbanked. The nationally representative survey comprised a sample survey of all the households across the 10 regions of Ghana. The survey employed a two-stage stratified cluster design with the list of all 37,674 Enumeration Areas (EAs) from the 2010 population and Housing Census of Ghana with corresponding data on the number of households. In the first stage, 300 (EAs) (156 urban and 144 rural EAs) were systematically selected with Probability Proportional Size (PPS), the measure of size being the population age 15+. In the second stage, 10 households were selected from each of the 300 EAs to produce an overall sample size of 3002 adults aged 15+. The sampling was done in collaboration with the Ghana Statistical Service (GSS). This study used a sample size of 3002 adults aged 15+. Due to missing observations in some variables, the sample size was reduced to 2983 during the regression analysis.

3.2 | Measurement of variables

3.2.1 | Financial inclusion index (FII)

The multi-dimensional nature of financial inclusion encompasses the use of formal and informal bank accounts, payment behaviour, savings and credit patterns, and insurance decisions by persons aged 15 or more years (Demirgüç-Kunt & Klapper, 2012). Thus, we measure financial inclusion broadly from both a formal perspective (Fungáčová & Weill, 2015; Iqbal & Sami, 2017; Park & Mercado, 2015; Sani Ibrahim et al., 2018; Wentzel et al., 2016) and an

informal perspective (Abor et al., 2018; Munyegeera & Matsumoto, 2016). Specifically, financial inclusion covers three broad dimensions: (1) Formal services—account operation at formal financial institutions, use of formal accounts and other formal financial services (2) Informal services—account operation at informal financial institutions, use of informal accounts and other informal financial services (2) Mobile money services—ownership of Mobile money account and use of mobile account for financial transactions. From these dimensions, we generated a multidimensional measure of financial inclusion from 25 binary indicators using multiple correspondence analysis (see Table 1), which is consistent with recent studies (Aslan et al., 2017; Dungey et al., 2018). Table 1 shows the financial inclusion indices and their indicators.

Table 1 indicates that the majority (33.6%) of the households have savings accounts with banks. However, those with fixed deposit accounts (0.7%) and Ezwich accounts (0.5%) were the least in the sample. In the informal financial markets, Table 1 indicates that the majority (23.2%) of the households have access to MFI loans despite that account ownership with such institutions is low (8.2%). Similarly, notwithstanding that 18.9% of the households have registered mobile money accounts, the proportion of those that withdraw (25.2%) and do other financial transaction using mobile money accounts (30.2) is high. This pattern holds for those in the formal financial markets. For instance, 30.8% and 39.5% of the households withdraw and do other financial transactions respectively using bank accounts. Figure 2 shows the financial inclusion status of Ghanaian households based on formal and informal perspectives.

Multiple correspondence analysis (MCA)

Consistent with recent studies (Aslan et al., 2017; Dungey et al., 2018), using MCA, we construct a multidimensional measure of financial inclusion from 25 binary indicators (see Table 1) for the four perspectives: (i) an index for the formal sector only using 12 binary indicators (ii) an index for the informal sector only using 13 binary indicators (iii) an index for mobile money only using four binary indicators (iv) an index that combines both the formal and informal sectors (i.e., all the 25 indicators). Although other methods such as principal component analysis (PCA) and factor analysis are available (Amidžić et al., 2014; Aslan et al., 2017; Tuesta et al., 2015), they are well-suited for continuous variables whilst MCA is a better approach when generating an index from nominal or ordinal indicators because it is non-parametric and not subject to assumptions of normality and linearity (Aslan et al., 2017; Kolenikov & Angeles, 2009). The MCA, which is a generalization of PCA, has been widely used to generate multidimensional poverty (Asselin & Anh, 2008; Ezzrari & Verme, 2012). It has also been used to create indices from categorical data in other fields of research but has been applied less in the area of finance despite its advantages when compared with PCA in the case of binary variables (Kolenikov & Angeles, 2009; Le Roux & Rouanet, 2004). For each of the four indexes and based on the Burt approach to MCA, we retained the first two dimensions and crucially, the retained dimensions explained at least 73% of the variation in each index (see Table 2). Regarding the FI index for the formal sector, the retained dimension explained 73.83% of the variation in financial inclusion. For the FI index for the informal sector, the retained dimensions explained 80.26% of the variations in financial inclusion. The contribution of the retained dimensions in the FI index for the mobile money sector was 74.62%. The contribution of the retained dimensions in the overall FI index (i.e., one that combines both formal and informal sectors including mobile money) was 80.85%.

TABLE 1 Financial inclusion indicators.

	Mean	SD
<i>Formal financial services</i>		
Current account	0.076	0.264
Savings account	0.336	0.472
Fixed deposit account	0.007	0.083
Insurance account	0.056	0.230
Investment account	0.036	0.185
Other formal accounts	0.019	0.138
Deposit using a bank account	0.299	0.265
Withdraws using a bank account	0.308	0.215
Use a bank account for other financial transactions	0.295	0.456
Use e-banking services	0.221	0.415
Access to bank loan	0.140	0.347
ATM card	0.467	0.499
<i>Informal financial services (excluding Mobile money services)</i>		
MFI account	0.082	0.274
Cooperative account	0.012	0.110
Savings and credit union account	0.032	0.175
Susu account	0.007	0.101
Ezwich account	0.005	0.068
Use MFI services	0.099	0.299
Use cooperative services	0.013	0.115
Use savings and credit union services	0.048	0.213
Access to MFI loan	0.232	0.422
<i>Mobile money services</i>		
Mobile money account	0.189	0.191
Deposits using mobile money account	0.150	0.100
Withdraws using mobile money account	0.252	0.174
Use a mobile money account for other financial transactions	0.302	0.159
<i>N</i>	3002	

Source: Authors' computation based on the InterMedia Consultative Group to Assist the Poor (CGAP) Ghana survey ($N = 3002$, 15+), December 2014–January 2015.

3.2.2 | Measurement of multidimensional poverty

From the perspective of the poor, poverty is multidimensional ranging from poor health, nutrition, lack of adequate sanitation and clean water, social exclusion, low education, bad housing conditions, violence, inadequate food leading to malnutrition, disempowerment, and much more (Alkire & Foster, 2011a, 2011b; Alkire & Santos, 2011). The MPI's key innovation is that it identifies the individuals or households who experience overlapping deprivations. Each

household has its profile of multidimensional poverty in the MPI, which can also be broken down by indicator to show the composition of multidimensional poverty across different regions, ethnic groups, households, or any other population sub-group, with useful implications for policy (Alkire & Santos, 2011; United Nations, 2010). A multidimensional poverty index (MPI) was constructed using Alkire and Foster's (2011a, 2011b) multidimensional poverty indicators. The MPI was constructed using 10 indicators grouped under three equally weighted dimensions—education, health, and standard of living. Each dimension and the indicators under it together with the relative weights assigned to them can be found in Table A1. From the three dimensions, the deprivation score for each household is generated as a weighted sum of the number of deprivations as shown below:

$$d_i = w_1 l_1 + w_2 l_2 + \dots + w_n l_n \quad (1)$$

where d_i is the household deprivation score, l_i is captured as 1 if the household is deprived in indicator i and 0 otherwise. w_i is the weight attached to the indicator i , such that $\sum_{i=1}^d w_i = 1$.

In the context of multidimensionality, a household must be deprived in at least two dimensions hence the multidimensional cut-off is ≥ 0.34 . The generated MPI is represented by a binary random variable that takes the value of 1 if the household is identified as multidimensionally poor and 0 otherwise.

3.3 | Econometric specification and estimation strategy

In the light of the literature under sections one and two, we can specify the link between poverty and financial inclusion as shown in Equation (2)

$$Pov_h = \alpha FI_h + X_h \beta + e_h \quad (2)$$

where Pov_h denotes the poverty status of the household; FI_h refers to financial inclusion; X_h is a vector of control variables identified in previous studies to influence poverty. These variables include age, employment status, household size, gender, location, educational level, and others (Haughton & Khandker, 2009; Imai et al., 2010). α and β are parameters to be estimated and e_h an error term.

We estimated Equation (2) using a Probit model and our choice of a Probit (Maximum Likelihood Estimation) technique is informed by the binary nature of the multidimensional poverty variable. However, an important theoretical issue associated with Equation (2) is the possible endogeneity problem associated with the link between financial inclusion and poverty. We suspect that the source of endogeneity is the omission of transaction costs in Equation (2). From a consumer viewpoint, transaction costs could be financial costs (Stiglitz & Weiss, 1981), and in-kind costs or psychic costs (Kon & Storey, 2003). Financial cost includes transportation costs incurred when accessing financial services including interest rates charged on loans and also the cost incurred to hire someone to expedite your access to financial services (Stiglitz & Weiss, 1981). In-kind cost relates to the opportunity cost of time spent traveling long distances to access financial services and in some cases time spent on bureaucratic and needless documentation at financial institutions (Kon & Storey, 2003). The psychic cost comprises the

TABLE 2 Multiple correspondence analysis (burt/adjusted inertias).

Dimension	Principal inertia	Percent	Cumul. percent
<i>Formal sector only</i>			
Dim 1	0.017662	64.84	64.84
Dim 2	0.002521	8.98	73.82
Dim 3	0.000734	1.51	75.33
Dim 4	0.000165	0.57	75.90
<i>Informal sector only</i>			
Dim 1	0.01103	73.59	73.59
Dim 2	0.006731	6.67	80.26
Dim 3	0.003584	2.94	83.20
Dim 4	0.002012	1.58	84.78
Dim 5	0.00065	0.80	86.59
Dim 6	0.000459	0.27	85.85
Dim 7	0.000174	0.48	86.33
<i>Mobile money sector</i>			
Dim 1	0.014870	65.92	65.92
Dim 2	0.00752	8.70	74.62
Dim 3	0.000014	3.01	77.63
<i>Both formal and informal sectors</i>			
Dim 1	0.005355	71.15	71.15
Dim 2	0.004591	9.70	80.85
Dim 3	0.0015	1.36	82.21
Dim 4	0.001421	0.82	83.03
Dim 5	0.000696	0.08	83.11
Dim 6	0.000302	0.05	83.16
Dim 7	0.000182	0.04	83.20
Dim 8	1.82E-05	0.02	83.22
Dim 9	1.17E-05	0.01	83.23

Source: Authors' computation based on the InterMedia Consultative Group to Assist the Poor (CGAP) Ghana survey ($N = 3002$, 15+), December 2014–January 2015.

psychological stress that individuals undergo when considering the distances of their locations to banks or thinking about the amount of time spent queuing in the banking halls and other discomforts that comes with accessing financial services (Kon & Storey, 2003). Given this, the transaction cost is a cause of market failure in the financial market; thus, not accounting for it would likely bias the estimated effect of financial inclusion on poverty when a simple probit technique is applied (Stiglitz & Weiss, 1981). One may account for transaction cost by including the expenditure of financial transactions but it is difficult to account for other components of transaction cost such as in-kind and psychic costs (Kon & Storey, 2003), and the endogeneity problem is likely to persist.

To resolve the endogeneity problem identified in Equation (2), we implemented IVProbit estimation using two instruments—distance to banks, or an MFI and number of mobile money

agents within the area where an individual lives. Econometrically, for our IVProbit to be feasible, the instruments must satisfy two conditions namely the relevance condition and the validity condition (Cameron & Trivedi, 2010). The relevance condition requires that our instruments are relevant in explaining the variations in financial inclusion (the endogenous variable). As shown from our first-stage result presented in Table 3, the chosen instruments have a statistically significant effect on financial inclusion and hence met the relevance condition. Additionally, the F-statistics from the first stage are all statistically significant at 1% which gives credence to meeting the relevance criterion. The validity condition requires that our chosen instruments should have a direct link with the endogenous variable (financial inclusion) and at the same time not have a direct link with the dependent variable (poverty) (Cameron & Trivedi, 2010). As per the validity condition, these instruments have a direct relationship with financial inclusion but do not have a direct relationship with poverty unless through financial inclusion indicators. Empirical evidence suggests that these instruments are relevant and valid. As an example, notwithstanding that sub-Saharan Africa has made significant strides in financial inclusion, distance to financial institutions remains one of the main barriers to financial inclusion (Demirgüç-Kunt & Klapper, 2012). In their study of how distance to financial institutions affects financial inclusion, Brown et al. (2016) found that households nearest to banks are more likely to use financial services and products relative to households that lived in far locations. Other key studies that have employed these instruments to study the link between financial inclusion and poverty include Koomson et al. (2020), Churchill and Marisetty (2020), and Bukari et al. (2021).

To increase the predictive power of our instruments and further ensure the robustness of our result, we implemented the Lewbel (2012) two-stage least squares (an instrument-free estimator), and also Oster's (2019) bounding analysis to omitted variable bias. The relationship between the instruments and financial inclusion is presented in Equation (4). Given that in most cases, households adopt several coping strategies concurrently to optimize their benefits, we examined the link between the adoption of vulnerability coping strategies and multi-dimensional poverty shown in Equation (5).

The model in Equation (2) is extended and specified as the structural form in Equation (3).

Financial inclusion and poverty

Structural equation (2nd stage)

$$Pov_i = \beta_0 + \beta_1 FII_i + \beta_2 Urban_i + \beta_3 Hhsze_i + \beta_4 Male_i + \beta_5 Emp_i + \beta_6 Edu_i + \beta_7 Age_i + \beta_8 Mstat_i + \epsilon_i \tag{3}$$

Reduced form equation (1st stage)

$$FII_i = \alpha_0 + \alpha_1 DistBAM_i + \alpha_2 Agents_i + \alpha_3 Urban_i + \alpha_4 Hhsze_i + \alpha_5 Male_i + \alpha_6 Emp_i + \alpha_7 Edu_i + \alpha_8 Age_i + \alpha_9 Mstat_i + \delta_i \tag{4}$$

Vulnerability coping strategy and poverty

$$Pov_i = \gamma_0 + \gamma_1 SAV_i + \gamma_2 MIV_i + \gamma_3 LAV_i + \gamma_4 ExtInc_i + \gamma_5 OwnHse_i + \gamma_6 Urban_i + \gamma_7 Hhsze_i + \gamma_8 Male_i + \gamma_9 Emp_i + \gamma_{10} Edu_i + \gamma_{10} Age_i + \gamma_{12} Mstat_i + \varphi_i \tag{5}$$

TABLE 3 First-stage results.

Variables	(1) FII overall ME	(2) FII formal ME	(3) FII informal ME	(4) FII_MoMo ME
Distance to bank (in minutes)	−0.034*** (0.001)	−0.034*** (0.001)		
Distance to MFI (in minutes)	−0.023*** (0.022)		−0.053*** (0.012)	
Number of mobile money agents	0.038*** (0.012)		0.278*** (0.003)	0.258*** (0.003)
Household size	0.009** (0.005)	0.003 (0.005)	0.008** (0.004)	0.004** (0.002)
Male (ref = female)	0.058*** (0.005)	0.032*** (0.000)	0.030*** (0.002)	0.023*** (0.003)
Employed (ref = unemployed)	0.165*** (0.000)	0.137*** (0.000)	0.091*** (0.003)	0.073*** (0.003)
Basic education	0.021** (0.009)	0.079 (0.189)	0.190** (0.090)	0.136* (0.072)
Secondary education	0.252*** (0.008)	0.088*** (0.006)	0.091*** (0.007)	0.195*** (0.009)
Tertiary education	0.346*** (0.006)	0.420*** (0.018)	0.147*** (0.012)	0.111*** (0.018)
Never married	0.107*** (0.008)	0.061*** (0.006)	0.026*** (0.004)	0.031 (0.052)
Married	0.207*** (0.003)	0.163*** (0.001)	0.294*** (0.050)	0.031*** (0.002)
Separated	0.429* (0.245)	0.245 (0.207)	0.152 (0.114)	−0.071 (0.093)
Rural (ref = urban)	−0.218*** (0.023)	−0.227*** (0.014)	0.130** (0.051)	0.089** (0.007)
34–53 years	0.274*** (0.012)	0.233*** (0.017)	0.279** (0.051)	0.271 (0.205)
54–73 years	0.112 (0.126)	0.141 (0.444)	0.197 (0.244)	0.128 (0.129)
74+ years	0.151 (0.527)	0.137 (0.444)	0.110 (0.244)	−0.152 (0.199)
Western region	−0.455* (0.232)	−0.730*** (0.193)	0.430*** (0.108)	0.222** (0.087)
Central region	−0.165 (0.230)	−0.511*** (0.096)	0.327*** (0.108)	0.227** (0.088)

TABLE 3 (Continued)

Variables	(1) FII overall ME	(2) FII formal ME	(3) FII informal ME	(4) FII_MoMo ME
Volta region	−0.482*** (0.140)	−0.648*** (0.101)	−0.101 (0.111)	0.050 (0.091)
Ashanti region	−0.232 (0.188)	−0.279* (0.155)	0.187** (0.087)	0.025 (0.070)
Brong-Ahafo region	−0.409* (0.030)	−0.377* (0.091)	0.064 (0.110)	0.116 (0.082)
Eastern region	0.276 (0.220)	−0.136 (0.180)	0.544*** (0.101)	0.416*** (0.080)
Northern region	−.528*** (0.150)	−0.964*** (0.010)	−0.171 (0.116)	0.073 (0.095)
Upper East region	−0.695*** (0.116)	−0.718*** (0.167)	−0.051 (0.146)	0.048 (0.120)
Upper West region	−0.633*** (0.152)	−0.781** (0.110)	0.125 (0.150)	−0.053 (0.137)
Constant	5.982*** (0.431)	4.161*** (0.369)	1.655*** (0.213)	0.846*** (0.161)
R ²	0.354	0.287	0.315	0.370
F-statistic	67.64***	54.13***	59.12***	78.97***
Observations	2983	2983	2983	2983

Note: FII_overall is an overall financial inclusion index for formal and informal financial services including mobile money services. FII_formal is an index measuring financial inclusion for only formal financial services. FII_informal is an index measuring financial inclusion for only informal services including mobile money services. FII_MoMo is the financial inclusion index for only mobile money services. Instruments for FII_overall are the distance (in minutes) to the nearest bank, MFI, and the number of mobile money agents closest to the individual. Instruments for FII_formal distance (in minutes) to the nearest bank. Instruments for FII_informal are the distance (in minutes) to the nearest MFI and the number of mobile money agents closest to the individual. Instruments for FII_MoMo are the number of mobile money agents closest to the individual. Heads with no formal education are the omitted category for education. Heads below 33 years are the omitted category for age. Heads in other marriage types are the omitted category for marital status. Greater Accra region is the omitted category for the region. ME refers to the average marginal effects. Standard errors in parentheses.

* $p < .1$; ** $p < .05$; *** $p < .01$.

where *Pov* is a binary variable for multidimensional poverty. *FII* is a financial inclusion index that is measured in four viewpoints—(i) one that focuses on only the formal financial sector, (ii) another that concentrates on only the informal financial sector, (iii) one that considers only the mobile money sector, and (iv) finally, one that combines all financial markets (i.e., formal and informal including mobile money). *Urban* is the location (captured as urban = 1, rural = 0); *Hhsiz* is the number of persons living in a household including dependents; *Male* is a binary variable which is captured as 1 for male and 0 for female; *Emp* is a binary variable defined as 1 for employed and 0 otherwise, *Edu* is a categorical variable for no education, primary, secondary and Tertiary, no education is the reference category. *Age* is the age of the individual measured as a categorical variable with below 33 years, 34–53 years, 54–73 years, and 74+ with

those below 33 years as the reference category, *Mstat* is the marital status of the individual categorized into, married, divorced/separated and widowed with never married as the base category. *SAV* refers to whether an individual saves at least once a month against risks, *MIV* is a binary variable captured as 1 if the individual currently has micro-insurance against risk (medical, car, crop, or any other) and 0 otherwise. *IAV* is captured as 1 if the individual has an investment (real estate, stock or shares) against risk and 0 otherwise. *ExtInc* is captured as 1 if the household head earns an extra income and 0 otherwise. *OwnHse* is a dummy variable for household ownership. The summary statistics of all the variables used in this study are provided in Table A2.

3.4 | Descriptive statistics

Figure 1 shows the proportion of Ghanaian adults aged 15+ who have registered accounts with banks, mobile money, and or nonbank financial institutions (informal services). As depicted in Figure 1, about 48% of Ghanaian adults have access to financial accounts, whether formal or informal. From diagram A, most Ghanaian adults have bank accounts (33.81%), followed by those with mobile money accounts (18.87%), and finally those with nonbank accounts (11.87%).

Figure 2 presents the financial inclusion status of Ghanaian adults age 15+ based on both formal and informal perspectives. From a formal perspective (i.e., formal financial services), 43.20% of Ghanaian adults are financially included while the remaining majority (56.80%) are financially excluded (see panel A). On the other hand, when the measurement of financial inclusion concentrates on only informal financial markets, panel B implies that about 46.70% of Ghanaian adults are financially included while the remaining 53.03% are financially excluded. Viewing financial inclusion from only the mobile money perspective, panel C reveals that 30.55% of Ghanaian adults are financially included while the remaining 69.45% are financially excluded. Overall, conditioned that financial inclusion is broadly defined to include both formal

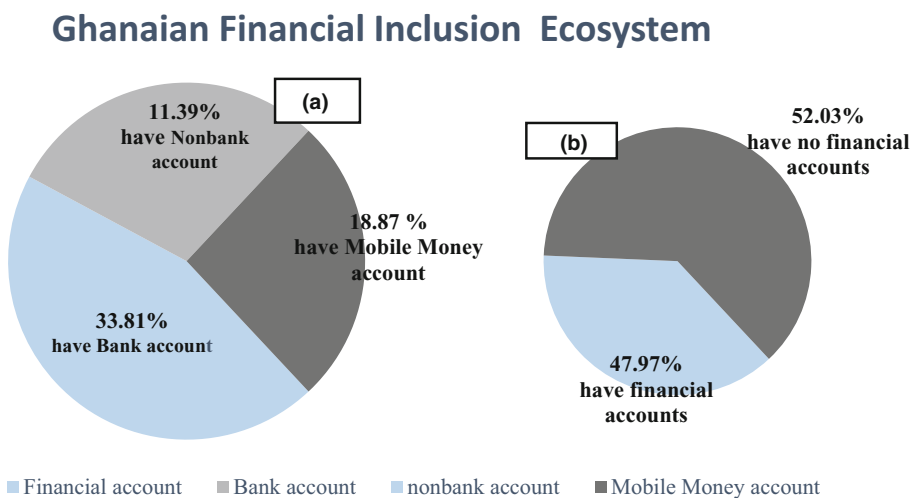


FIGURE 1 Ghanaian financial inclusion ecosystem. *Source:* InterMedia Consultative Group to Assist the Poor (CGAP) Ghana survey ($N = 3002, 15+$), December 2014–January 2015. [Colour figure can be viewed at wileyonlinelibrary.com]

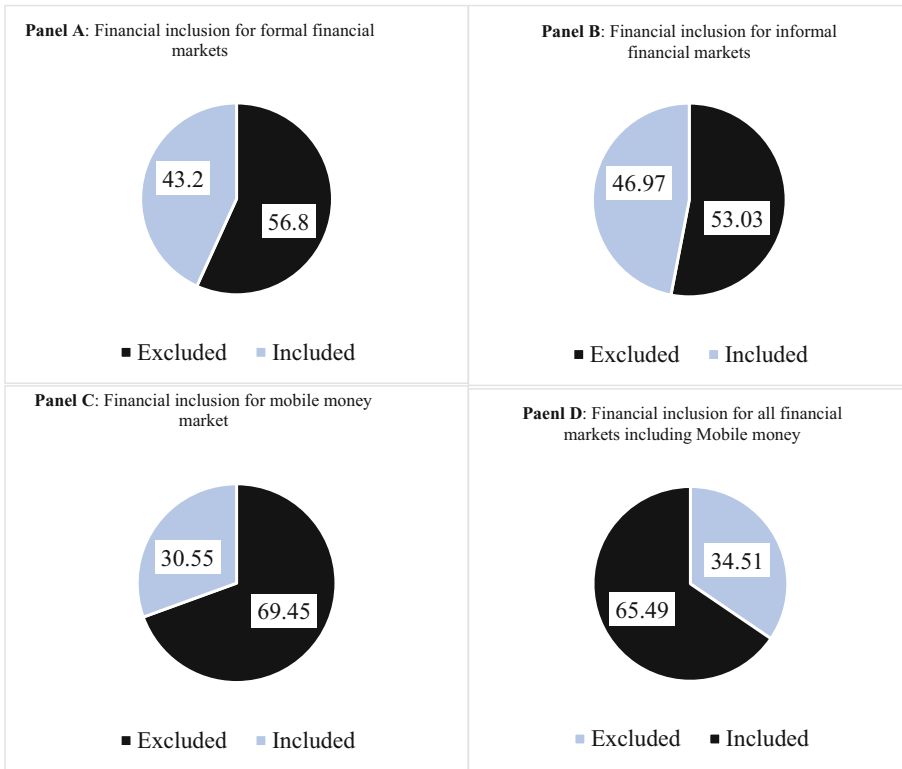


FIGURE 2 Proportion of households financially included. Panel (a): Financial inclusion for formal financial markets. Panel (b): Financial inclusion for informal financial markets. Panel (c): Financial inclusion for mobile money market. Panel (d): Financial inclusion for all financial markets including Mobile money. [Colour figure can be viewed at wileyonlinelibrary.com]

and informal financial services including mobile money, panel D indicates that the majority (65.49%) of Ghanaian adults are financially included while the remaining 34.51% are financially excluded. This observation implies that the conceptualisation of financial inclusion is likely to matter in identifying the financially included or excluded. To determine whether conceptualisation has any implication on how financial inclusion influences multidimensional poverty, we embark on the analysis in four ways—(i) one that focuses on only the formal financial sector, (ii) another that concentrates on only the informal financial sector, (iii) one that considers only the mobile money sector, and (iv) finally, one that combines all financial markets (i.e., formal and informal including mobile money). Table 4 offers results on the effects of financial inclusion from these four perspectives.

4 | RESULTS AND DISCUSSION

4.1 | Effect of FI on multidimensional poverty

Tables 3 and 4 present results for the effect of financial inclusion on multidimensional poverty. Table 3 reports first-stage results from the instrumental probit estimation while Table 4 presents the main results.

TABLE 4 Main results for the effect of FI on multidimensional poverty (IVprobit).

Variables	(1) FII_overall ME	(2) FII_formal ME	(3) FII_informal ME	(4) FII_MoMo ME
Financial inclusion	-0.190** (0.072)	-0.091*** (0.030)	-0.080*** (0.019)	-0.046** (0.018)
Male (ref = female)	0.021*** (0.001)	0.017*** (0.000)	0.021*** (0.001)	0.019*** (0.001)
Household size	-0.012*** (0.000)	-0.011*** (0.001)	-0.011*** (0.000)	-0.011*** (0.001)
Rural (ref = urban)	0.064*** (0.010)	0.058*** (0.011)	0.070*** (0.010)	0.071*** (0.010)
Employed (ref = unemployed)	-0.076*** (0.001)	-0.046*** (0.002)	-0.055*** (0.002)	-0.0522*** (0.001)
Basic education	-0.058** (0.020)	-0.044** (0.020)	-0.051** (0.020)	-0.060** (0.023)
Secondary education	-0.080*** (0.021)	-0.056 (0.030)	-0.100*** (0.021)	-0.102*** (0.021)
Tertiary education	-0.123*** (0.030)	-0.120*** (0.030)	-0.094*** (0.001)	0.092*** (0.001)
Never married	-0.028 (0.027)	-0.013 (0.030)	-0.034 (0.026)	-0.036 (0.026)
Married	-0.046*** (0.016)	-0.034* (0.019)	-0.054*** (0.015)	-0.056*** (0.015)
Separated	0.000 (0.038)	0.016 (0.043)	-0.006 (0.038)	-0.009 (0.038)
53–34 years	-0.004 (0.054)	-0.011 (0.060)	-0.003 (0.053)	-0.007 (0.054)
73–54 years	-0.014 (0.052)	-0.031 (0.058)	-0.010 (0.052)	-0.016 (0.053)
74+ years	-0.008 (0.030)	-0.027 (0.050)	-0.003 (0.050)	-0.008 (0.050)
Western region	0.058** (0.022)	0.037 (0.026)	0.068*** (0.023)	0.062*** (0.022)
Central region	0.091*** (0.025)	0.079*** (0.027)	0.095*** (0.025)	0.094*** (0.025)
Volta region	0.141*** (0.027)	0.120*** (0.031)	0.150*** (0.028)	0.153*** (0.028)
Ashanti region	-0.010 (0.015)	-0.016 (0.017)	-0.007 (0.015)	-0.009 (0.015)

TABLE 4 (Continued)

Variables	(1) FII_overall ME	(2) FII_formal ME	(3) FII_informal ME	(4) FII_MoMo ME
Brong-Ahafo region	0.086*** (0.021)	0.077*** (0.021)	0.088*** (0.020)	0.088*** (0.020)
Eastern region	0.090*** (0.024)	0.083*** (0.025)	0.090*** (0.024)	0.087*** (0.023)
Northern region	0.206*** (0.031)	0.175*** (0.042)	0.224*** (0.032)	0.231*** (0.032)
Upper East region	0.224*** (0.040)	0.200*** (0.039)	0.235*** (0.040)	0.238*** (0.040)
Upper West region	0.239*** (0.038)	0.207*** (0.050)	0.261*** (0.047)	0.258*** (0.050)
First-stage				
Distance to bank (in minutes)	-0.034*** (0.001)	-0.034*** (0.001)		
Distance to MFI (in minutes)			-0.053*** (0.003)	
Number of mobile money agents	0.038*** (0.005)		0.278*** (0.004)	0.258*** (0.004)
F-statistic	67.641***	54.130***	59.120***	78.970***
Sargan p-value	.212		.211	
Wald χ^2	253.530***	239.490***	250.760***	250.430***
Wald test of exogeneity	24.899***	30.177***	34.083***	22.111***
Hausman test	25.760***	31.927***	36.100***	29.340***
Observations	2983	2983	2983	2983

Note: Dependent variable is the multidimensional poverty index (MPI) which is dichotomous and takes a value of 1 if the household is multidimensionally poor and 0 otherwise. FII_overall is an overall financial inclusion index for formal and informal financial services including mobile money services. FII_formal is an index measuring financial inclusion for only formal financial services. FII_informal is an index measuring financial inclusion for only informal services including mobile money services. FII_MoMo is the financial inclusion index for only mobile money services. Instruments for FII_overall are the distance (in minutes) to the nearest bank, MFI, and the number of mobile money agents closest to the individual. The instrument for FII_formal distance (in minutes) to the nearest bank. Instruments for FII_informal are the distance (in minutes) to the nearest MFI and the number of mobile money agents closest to the individual. Instruments for FII_MoMo are the number of mobile money agents closest to the individual. Heads with no formal education are the omitted category for education. Heads below 33 years are the omitted category for age. Heads in other marriage types are the omitted category for marital status. Greater Accra region is the omitted category for the region. ME refers to the average marginal effects. Standard errors in parentheses.

*p < .1; **p < .05; ***p < .01.

4.1.1 | Drivers of financial inclusion: First-stage results

Table 3 presents results for the determinants of financial inclusion. Here, we focus on only the instruments—distance to the nearest bank, distance to MFI, and the number of mobile money

agents in the area where the individual lives. Table 3 indicates that distance to a bank significantly influences financial inclusion negatively. Precisely, an increase in distance to the nearest bank significantly decreases the probability of financial inclusion by 3.4 percentage points. This is statistically significant at 1% and hence indicates that distance to the bank (our instrument) is an important predictor of one's participation in the formal financial markets. Further, Table 3 indicates that a unit increase in distance to the nearest MFI significantly decreases financial inclusion by 2.3 percentage points and it is statistically significant at 1%. Moreover, Table 3 shows that a unit increase in the number of mobile money agents significantly increases financial inclusion by 3.8 percentage points and it is statistically significant at 1%. Finally, the F-statistics are all significant at 1% indicating that these instruments are relevant in explaining variations in financial inclusion. In terms of validation, the Sargan p -values under Table 3 are all not significant, thereby indicating that the over-identification restriction is not a concern and thus the instruments are valid. Our finding that distance to financial institutions and the number of mobile money agents are significant predictors of people's participation in the financial markets is consistent with the extant literature (Bukari et al., 2020; Churchill & Marisetty, 2019; Koomson et al., 2020, 2021).

4.1.2 | Main results for financial inclusion on poverty

Table 4 displays results on the effect of financial inclusion on multidimensional poverty from four perspectives—Formal only, informal only, mobile money, and both formal and informal. It is important to reemphasise that in the context of this study unless otherwise stated, informal financial services include mobile money services. Column (1) present results for the effect of financial inclusion on multidimensional poverty where financial inclusion is measured using both formal and informal financial services and products. Column (2) show the case where financial inclusion is measured using only formal financial services and products. Column (3) presents results for the case where the measurement of financial inclusion concentrates on only informal financial services and products. Column (4) estimates a similar effect but for mobile money services. Under each set of results, we present the marginal effects of IVprobit estimations (see Table A3 for the standard probit estimates). We interpreted (preferred) the IVprobit results in all cases and our motivation stems from the Wald test of the exogeneity of financial inclusion (our endogenous variable). The significant Wald test across all models leads to a rejection of the null hypothesis of no endogeneity at a 1% level of significance. This means that financial inclusion is endogenous and the probit model will produce inconsistent estimates of the link between financial inclusion and multidimensional poverty. Besides, the Hausman test is statistically significant at 1% and thus, favours the IVprobit estimates. Having validated that financial inclusion is endogenous regardless of whether or not the informal sector is captured, we proceed with analysis and discussion using the IVprobit estimates presented in Table 4.

The standard probit results displayed in Table A3 suggest that financial inclusion does not affect multidimensional poverty. However, when the potential endogeneity present in the model is resolved, financial inclusion significantly reduces multidimensional poverty (see Table 4). This implies that modelling the direct link between financial inclusion and multidimensional poverty in a developing country context without accounting for the role of transaction cost is likely to produce insignificant (or misleading) results and thus, supports the position of Stiglitz and Weiss (1981). This notwithstanding, The IVprobit estimates confirm findings

from previous studies that financial inclusion significantly reduces poverty (Ahmed et al., 2015; Chibba, 2009; Dimova & Adebowale, 2018; Imai et al., 2010; Krumer-Nevo et al., 2017) but the dualized conceptualisation and analyses of the financial inclusion-poverty nexus in this paper produces some interesting findings. A careful look at the coefficients under columns 1 and 2 of Table 4 shows that the exclusion of ownership and use of informal financial products and services in the measurement of financial inclusion downwardly biases the estimates. Considering only formal products and services, an improvement in financial inclusion reduces the likelihood of being multidimensionally poor by 9.1 percentage points, but when only informal financial products and services are considered, the likelihood of being multidimensionally poor is reduced by 8.0 percentage points. Further, when only mobile money services are considered, financial inclusion reduces multidimensional poverty by 4.6 percentage points. However and remarkably, when both formal and informal financial products and services are considered in the conceptualisation, the likelihood of being multidimensionally poor is reduced by 19.0 percentage points. These estimates are all statistically significant at 1% and thus, our findings show that the conceptualisation of financial inclusion does not only matter in identifying the financially included and excluded but it has a significant implication on how financial inclusion influences multidimensional poverty.

Other control variables (household size, employment, education, marital status) equally have a positive effect on multidimensional poverty. For example, males have a 2.1% chance of being multidimensionally poor compared to their female counterparts, *ceteris paribus* and it is statistically significant at 1% indicating the importance of gender differences. Still, from Table 4, living in a rural setting rises one's chances of being poverty multidimensionally by 6.4 percentage points and it is statistically significant at 1% indicating the importance of locational differences. Being employed reduces a person's probability of being multidimensionally poor by 7.6 percentage points compared to an unemployed person and it is statistically significant at 1%. Education significantly reduces multidimensional poverty across all levels of financial inclusion. Thus, tertiary education has the highest (12.3 percentage points) multidimensional poverty reduction effect among various levels of education.

4.2 | Gender dimension to the effect of financial inclusion on poverty

In Table 5, we present the effect of financial inclusion on multidimensional poverty along gender lines. The findings suggest that the effect of financial inclusion on multidimensional poverty is stronger in male-headed households when the informal sector is excluded in the measurement of financial inclusion. For instance, financial inclusion reduces the probable risk of multidimensional poverty by 10.6 and 9.8 percentage points among male-headed and female-headed households respectively when financial inclusion does not capture the demand for informal products and services. Conversely, when the measurement of financial inclusion focuses on only the informal sector, its effect on poverty is much felt among female-headed households relative to male-headed households. Precisely, financial inclusion (measured from an informal perspective) significantly reduces multidimensional poverty by 8.4 and 10.1 percentage points among male-headed and female-headed households respectively. Further, being included in the mobile money sector only, significantly decreases the chances of being multidimensionally poor by 7.7 and 9.1 percentage points among male-headed and female-headed households. Overall, when financial inclusion captures the demand for informal financial products and services, its effect on multidimensional poverty is greater among females. For example, by capturing the

TABLE 5 Effect of financial inclusion on multidimensional poverty (gender analysis).

Variables	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		
	Male		Female		Female		Female		Female		Female		Female		Female		
	FII_overall ME	FII_formal ME	FII_informal ME	FII_MoMo ME	FII_overall ME	FII_formal ME	FII_informal ME	FII_MoMo ME	FII_overall ME	FII_formal ME	FII_informal ME	FII_MoMo ME	FII_overall ME	FII_formal ME	FII_informal ME	FII_MoMo ME	
Financial inclusion	-0.196*** (0.068)	-0.106*** (0.021)	-0.084*** (0.021)	-0.077*** (0.070)	-0.208*** (0.070)	-0.098*** (0.010)	-0.101*** (0.080)	-0.091*** (0.010)									
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage																	
Distance to bank (in minutes)	0.126*** (0.004)	0.125*** (0.001)			0.021*** (0.001)	0.021*** (0.001)			0.021*** (0.001)	0.021*** (0.001)							
Distance to MFI (in minutes)	-0.072* (0.001)		-0.023*** (0.001)		-0.147*** (0.002)				-0.147*** (0.002)								
Number of mobile money agents	0.392*** (0.002)	0.392*** (0.002)	0.278*** (0.005)	0.244*** (0.009)	0.349*** (0.018)	0.276*** (0.004)	0.270*** (0.002)		0.349*** (0.018)	0.276*** (0.004)	0.270*** (0.002)						
F-statistic	68.67***	72.090***	31.230***	33.150***	32.421***	24.020***	31.970***	47.100***	32.421***	24.020***	31.970***	47.100***					
Sargan p-value	0.189	0.189	0.210	0.210	0.140	0.211	0.211	0.211	0.140	0.211	0.211	0.211					
Wald χ^2	154.710***	151.650***	154.551***	154.990***	140.070***	114.400***	140.260***	140.610***	140.070***	114.400***	140.260***	140.610***					
Wald test of exogeneity	23.965***	51.758***	36.317***	29.197***	33.066***	27.846***	34.033***	21.033***	33.066***	27.846***	34.033***	21.033***					
Hausman test	10.382***	8.500***	12.381***	9.889***	21.348***	10.826***	11.397***	19.395***	21.348***	10.826***	11.397***	19.395***					
Observations	1265	1265	1265	1265	1718	1718	1718	1718	1718	1718	1718	1718					

Note: Dependent variable is the multidimensional poverty index (MPI) which is dichotomous and takes a value of 1 if the household is multidimensionally poor and 0 otherwise. FII_overall is an overall financial inclusion index for formal and informal financial services including mobile money services. FII_formal is an index measuring financial inclusion for only formal financial services. FII_informal is an index measuring financial inclusion for only informal financial services. FII_MoMo is the financial inclusion index for only mobile money services. Instruments for FII_informal are the distance (in minutes) to the nearest bank, MFI, and the number of mobile money agents closest to the individual. The instrument for FII_formal distance (in minutes) to the nearest bank. Instruments for FII_informal are the distance (in minutes) to the nearest MFI and the number of mobile money agents closest to the individual. Instruments for FII_MoMo is the number of mobile money agents closest to the individual. Heads with no formal education are the omitted category for education. Heads below 33 years are the omitted category for age. Heads in other marriage types are the omitted category for marital status. Greater Accra region is the omitted category for the region. ME refers to the average marginal effects. Standard errors in parentheses.

* $p < .1$; ** $p < .05$;

*** $p < .01$.

informal sector, financial inclusion reduces the probable risk of being multidimensionally poor by 19.6 and 20.8 percentage points among male-headed and female-headed households respectively. These estimates are all statistically significant at 1%. The implication of these findings is that males tend to benefit more from financial inclusion when measured from the formal perspective, but the reverse becomes apparent when the measurement of financial inclusion includes both formal and informal financial products and services. This gives credence to the largely held opinion that females dominate the Ghanaian informal sector compared to males. This outcome is also a reflection of the widely documented constraints faced by women in their access to and ownership of formal financial products and services (Demircug-Kunt et al., 2018; GSS, 2018), which pushes them to the informal financial sector to satisfy their financial needs. When steps are taken by governments and policymakers to develop the informal financial sector, credit constraints faced by women will reduce and will also help to narrow the existing gender gap in financial inclusion. The reduction in the gender gap will also help in the achievement of SDG1 since women are considered more entrepreneurial (GSS, 2018).

4.3 | Location dimension to the effect of financial inclusion on poverty

In Table 6, we present the effect of financial inclusion on multidimensional poverty along location dimensions. Generally, a glimpse of Table 6 upholds the argument that FI matters most for rural dwellers regardless of its conceptualizations. Thus, across various perspectives, financial inclusion reduces multidimensional poverty more in rural areas compared to urban areas. For instance, financial inclusion reduces the probable risk of multidimensional poverty by 8.3 and 5.6 percentage points in rural and urban settings respectively when financial inclusion does not capture the demand for informal products and services. Similarly, when financial inclusion captures the demand for only informal financial products and services, its effect on multidimensional poverty is greater in rural areas. For example, by capturing only the informal sector, financial inclusion reduces the probable risk of being multidimensionally poor by 11.0 and 4.8 percentage points in rural and urban areas respectively. Similar patterns hold at the aggregated level when the measurement of financial inclusion captures both the formal and informal financial sectors. Specifically, the probability of being multidimensionally poor significantly falls by 14.0 and 6.8 percentage points in rural and urban areas respectively when the measurement of inclusion captures financial services and products across all sectors. These findings imply that, when the rural poor are financially included through an increase in access to both formal and informal financial services, the probable risk of being multidimensionally poor reduces much more than their urban counterparts. When steps are taken by governments and policymakers to develop the informal financial sector, credit constraints faced by rural dwellers will reduce and will also help to narrow the existing location gap in financial inclusion. The reduction in the location gap owing to more inclusive finance would also help in the achievement of SDG1 (Yang & Fu, 2019).

4.4 | Effect of financial indicators on poverty

In this section, we decomposed the financial inclusion index and analysed the effect of individual indicators on multidimensional poverty as shown in Table 7. Saving with mobile banking

TABLE 6 Effect of financial inclusion on multidimensional poverty (locational analysis).

Variables	(1)		(2)		(3)		(4)	
	Rural		Urban		Rural		Urban	
	FIL_overall ME	FIL_formal ME	FIL_informal ME	FIL_MoMo ME	FIL_overall ME	FIL_formal ME	FIL_informal ME	FIL_MoMo ME
Financial inclusion	-0.140*** (0.043)	-0.083*** (0.021)	-0.110*** (0.052)	-0.081*** (0.015)	-0.068*** (0.001)	-0.056*** (0.001)	-0.048*** (0.001)	-0.035*** (0.001)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage								
Distance to bank (in minutes)	-0.132*** (0.001)	-0.126*** (0.001)			-0.024*** (0.000)	0.024*** (0.000)		
Distance to MFI (in minutes)	-0.094*** (0.001)		-0.034*** (0.000)		-0.164*** (0.004)		-0.067*** (0.001)	
Number of mobile money agents	0.183*** (0.002)		0.273*** (0.001)	0.239*** (0.001)	0.367*** (0.002)		0.286*** (0.002)	0.270*** (0.003)
F-statistic	67.155***	68.322***	33.110***	36.322***	31.560***	26.877***	30.123***	51.701***
Sargan p-value	.206		.187		.100		.120	
Wald χ^2	128.780***	124.988***	122.371***	122.100***	76.144***	60.050***	75.144***	119.800***
Wald test of exogeneity	9.185***	14.395***	10.140***	6.855***	13.223***	8.537***	15.049***	9.151***
Hausman test	11.582***	12.561***	31.154***	10.748***	10.597***	21.240***	11.121***	22.114***
Observations	1351	1351	1351	1351	1632	1632	1632	1718

Note: Dependent variable is the multidimensional poverty index (MPI) which is dichotomous and takes a value of 1 if the household is multidimensionally poor and 0 otherwise. FIL_overall is an overall financial inclusion index for formal and informal financial services including mobile money services. FIL_formal is an index measuring financial inclusion for only formal financial services. FIL_informal is an index measuring financial inclusion for only informal services including mobile money services. FIL_MoMo is the financial inclusion index for only mobile money services. Instruments for FIL_overall are the distance (in minutes) to the nearest bank, MFI, and the number of mobile money agents closest to the individual. The instrument for FIL_formal distance (in minutes) to the nearest bank. Instruments for FIL_informal are the distance (in minutes) to the nearest MFI and the number of mobile money agents closest to the individual. Instruments for FIL_MoMo is the number of mobile money agents closest to the individual. Heads with no formal education are the omitted category for education. Heads below 33 years are the omitted category for age. Heads in other marriage types are the omitted category for marital status. Greater Accra region is the omitted category for the region. ME refers to the average marginal effects. Standard errors in parentheses.

* $p < .1$;** $p < .05$;*** $p < .01$.

TABLE 7 Effects of the decomposed measures of financial inclusion on multidimensional poverty.

Explanatory variables	(1)	(2)		(3)	(4)		(5)
	Full ME	Gender		Female ME	Location		Urban ME
		Male ME			Rural ME		
Save with Mobile Banking	-0.089*** (0.010)	-0.121*** (0.020)		-0.071*** (0.020)	-0.143*** (0.02)		-0.056*** (0.004)
Save with formal Bank	-0.049*** (0.016)	-0.042** (0.012)		-0.059** (0.023)	-0.058** (0.020)		-0.044** (0.016)
Save with MFI	-0.299*** (0.070)			-0.271*** (0.072)	-0.354*** (0.102)		
Access to credit	-0.051*** (0.010)	-0.092*** (0.001)		-0.032** (0.002)	-0.071*** (0.001)		-0.046*** (0.002)
Micro-insurance cover	-0.059*** (0.010)	-0.047** (0.001)		-0.067*** (0.011)	-0.093*** (0.002)		-0.029* (0.015)
*Controls?	Yes	Yes		Yes	Yes		Yes
N	2983	1265		1718	1351		1632
Pseudo R ²	0.132	0.178		0.111	0.117		0.054
Likelihood ratio test	315.11	172.13		155.80	160.72		48.77
p-value (LR test)	.000	.000		.000	.000		.000
Hosmer-Lemeshow	15.86 (0.54)	14.0 (0.08)		13.6 (0.09)	13.9 (0.08)		3.38 (0.91)

Note: Standard errors are in parentheses. Instruments for FI-only formal: distance to bank. Instruments for FI-both formal & informal: distance to bank, distance to MFI, number of MoMo agents.

Abbreviation: ME, marginal effect.

*In each regression model, we controlled for age, gender, education, marital status, rural-urban location, household size, and employment.

*p < .1; **p < .05; ***p < .01.

reduces the likelihood of being multidimensionally poor, but the magnitude of the probability is about 5 percentage points and 8.9 percentage points bigger in male-headed households and rural areas respectively. Saving with a formal bank also decreases the probable risk of multidimensional poverty but the extent of the relationship is about 2.0 percentage points and 1.4 percentage points bigger in female-headed households and rural settings respectively. Saving with an MFI is also negatively associated with the risk of being multidimensionally poor, but this outcome was only experienced in female-headed households and rural areas. Saving with MFI produces significant outcomes in female-headed households because the MFI approach to lending largely targets females due to the documented evidence of constraints they face in the formal financial market (Demirguc-Kunt et al., 2018). Similar to saving with MFI, access to credit is seen as having a negative association with the probable risk of being multidimensionally poor but the outcome is only seen as being stronger in male-headed households and also in rural locations. The possible reason for this has to do with the advantages men have over women in the credit market which are also driven by the bigger proportion of formal accounts owned by men (Demirguc-Kunt et al., 2018; GSS, 2018). Ownership of micro-insurance

has a negative relationship with the likelihood of being multidimensionally poor and this is seen as being stronger in female-headed households. Similar to saving with MFI, this outcome is expected because micro-insurance is mainly patronized by women as part of their dealings with MFIs.

4.5 | Vulnerability coping strategies and poverty

Table 8 presents three sets of results for the effect of vulnerability coping strategies on multidimensional poverty. The first set of results (full model) is shown under column (1) of Table 8. Columns (2) and (3) represent the male and female models respectively. Columns (4) and (5) represent the urban and rural models respectively. Embarking on savings against vulnerability reduces the probability of being multidimensionally poor by 6.9 percentage points but the magnitude of the probability is about 1.5 percentage points and 5.6 percentage points higher in male-headed households and rural areas respectively. Ownership of micro-insurance against vulnerability is also negatively associated with the risk of being multidimensionally poor, but this outcome was significantly intense in female-headed households and also in urban settings. This is in support of the evidence in the literature that the acquisition of insurance represents a comprehensive system of protection for the poor (Dercon et al., 2008). Again, investing against vulnerability has a negative association with the likelihood of being multidimensionally poor but the result is only seen as being evident in male-headed households. Beyond these coping strategies, diversifying a household's income portfolio to earn an extra income reduces the likelihood of being multidimensionally poor by 6.4 percentage points. The benefits of earning extra income are about 2 percentage points and 5.5 percentage points higher in female-headed households and rural areas respectively. Outcomes of the other coping strategies are in line with the assertion of Dercon (2005) that access to financial resources and investing against risk helps to reduce poverty.

Internally created instruments based on a heteroskedastic covariance limitation are used in the Lewbel (2012) 2SLS technique.

4.6 | Robustness checks

Here, we subject our main results to a series of robustness checks. In our IV identification strategy under Section 3.3, we seek to resolve endogeneity (i.e., omission of transactions costs). However, there may be other concerns over simultaneity or reverse causality. This is particular so because while financial inclusion (through access to financial services) impact poverty, the reverse can hold in that poor people may lack access to financial services due to their poverty status. To overcome this form of endogeneity, we implemented the Lewbel (2012) two-stage least squares which does not rely on any external instruments. The Lewbel (2012) method rely on a heteroskedasticity in the data to generate valid instruments (Lewbel, 2012). As a result, it has widely been employed in the literature to check the consistency of estimates when there are no external instruments to resolve endogeneity (Bukari et al., 2020; Churchill & Marisetty, 2019). As shown in Table A4, results from the Lewbel (2012) 2SLS are consistent with our baseline estimates. Finally, we used Oster's (2019) bounding approach to check the stability of our estimates and any further issues regarding possible omitted variable bias. Oster's (2019) method has been widely applied in the nascent literature for robustness checks on stability of estimates amid endogeneity associated with unobserved heterogeneity and omitted variable bias (Bukari et al., 2021; Oster, 2019; Pan et al., 2021). As shown in Table A5, results from

TABLE 8 Effect of vulnerability coping strategies on poverty.

Explanatory variables	(1)	(2)		(3)	(4)		(5)
	Full ME	Gender		Female ME	Location		Urban ME
		Male ME			Rural ME		
Savings against vulnerability	-0.069*** (0.013)	-0.078*** (0.012)		-0.063*** (0.018)	-0.100*** (0.023)		-0.044*** (0.015)
Micro-insurance-against vulnerability	-0.031*** (0.002)	-0.020*** (0.001)		-0.032*** (0.001)	-0.012*** (0.002)		-0.027*** (0.001)
Investment-against vulnerability	-0.248*** (0.089)	-0.135** (0.051)			-0.287*** (0.056)		
Earn extra income	-0.064*** (0.014)	-0.057*** (0.020)		-0.078*** (0.020)	-0.097*** (0.0245)		-0.042** (0.015)
Owens a house	0.029** (0.014)	0.033** (0.016)		0.048*** (0.015)	0.038** (0.015)		0.027** (0.013)
^a Controls?	Yes	Yes		Yes	Yes		Yes
N	2983	1265		1718	1351		1632
Pseudo R ²	0.113	0.162		0.091	0.086		0.073
Likelihood ratio test	270.40	161.03		125.47	118.26		66.12
p-value (LR test)	.000	.000		.000	.000		.000
Hosmer-Lemeshow	15.22	6.11		7.02	5.76		4.17
p-value	.065	.64		.53	.67		.84

Note: Standard errors are in parentheses. Instruments for FI-only formal: distance to bank. Instruments for FI-both formal and informal: distance to bank, distance to MFI, number of MoMo agents.

Abbreviation: ME, marginal effect.

^aIn each regression model, we controlled for age, gender, education, marital status, rural–urban location, household size, and employment.

*p < .1;

p < .05; *p < .01.

this additional test reveal that our main results are robust to omitted variable bias since the identified set does not include zero (Oster, 2019).

5 | CONCLUSION AND RECOMMENDATION

Despite the dual nature of financial markets in developing countries, studies that have focused on financial inclusion and poverty have mainly conceptualized financial inclusion by considering individuals' and households' ownership and use of formal financial products and services. Most studies have also used unidimensional measures of poverty and little attention has been given to multidimensional poverty, which is able to identify households that experience overlapping deprivations. Another gap in the extant literature has to do with the limited number of studies that generate a composite financial inclusion index from demand-side indicators. The inference to draw from these gaps is that the number of studies that integrate the informal financial sector in the conceptualization of financial inclusion to focus on multidimensional

poverty is markedly low. It is therefore prudent to determine whether conceptualisation has any implication on how financial inclusion influences multidimensional poverty, especially in a developing country context.

Based on the gaps identified, this study examined the effect of financial inclusion and vulnerability coping strategies on multidimensional poverty using four measures of financial inclusion—(i) one that focuses on only the formal financial services, (ii) another that concentrates on only the informal financial services, (iii) one that considers only mobile money services and (iv) finally, one that combines both formal and informal financial products and services including mobile money. The analysis was disaggregated to estimate male–female and urban–rural subsampled models to identify gender and location-specific effects of financial inclusion on multidimensional poverty. We generated financial inclusion index using multiple correspondence analysis and employed the Alkire and Foster method to measure multidimensional poverty.

The findings from this study show that: (i) the conceptualisation of financial inclusion matters in identifying the financially included or excluded; (ii) financial inclusion reduces poverty, especially when transaction cost that induce market failure in the financial market are accounted for; (iii) measuring financial inclusion using the ownership and use of only formal financial products and services understates the poverty-reducing effect of financial inclusion; (iv) when ownership of informal financial products and services are excluded from the measure of financial inclusion it has a bigger effect in male-headed households and the reverse is true when the conceptualisation include informal financial products and services; (v) financial inclusion it has a bigger effect in rural households regardless of its measurement and (vi) all the financial inclusion indicators and the vulnerability coping strategies have a part to play in poverty reduction but the outcomes exhibit gender differences in male- and female-headed households as well as location differences in urban and rural settings.

Policy-wise, there is a need to consider the nature of the existing financial markets within economies when conceptualizing financial inclusion. In developing countries, urgent steps need to be taken by policymakers to structure, regulate and formalise the informal financial markets to adequately cater to the financial needs of women and rural dwellers. This will go a long way to enhance women's economic empowerment and narrow locational gaps, and household welfare as a result. Nationally, government policy should aim at regulating the informal financial sector to optimize the sector's potential contribution to universal financial inclusion. Future studies should not ignore the endogeneity problem in the financial inclusion–poverty nexus.

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CONFLICT OF INTEREST STATEMENT

There is no conflict of interest or whatsoever among the authors.

DATA AVAILABILITY STATEMENT

Data was collected by World Bank and the authors thus, do not have the permission to share the data. However, access to the data can be requested from world bank at <https://microdata.worldbank.org/index.php/catalog/2730>.

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APPENDIX A

TABLE A1 Alkire Foster multidimensional methodology summary of MPI indicators.

Dimensions	Indicator	Type	Weight
Education (1/3)	Mother educated	Binary	1/6
	School attendance (all children ages 5–12 in school)	Binary	1/6
Health (1/3)	Medical Insurance	Binary	1/6
	Enough food	Binary	1/6
Standard of living (1/3)	Regular income	Binary	1/18
	Assets	Binary	1/18
	Safe water	Binary	1/18
	Modern Cook Fuel	Binary	1/18
	Modern Roofing	Binary	1/18
	Electricity	Binary	1/18
Main results	N = 3002		
	Coef.	Std. Err.	(95% Conf. Interval)
<i>H</i>	0.148	0.006	0.136
<i>M0</i>	0.069	0.003	0.063
Additional <i>A</i>	0.466	0.005	0.457

Note: **Deprived:** Percentage of individuals whose indicator values are below the threshold. Adjusted multidimensional headcount— $M0 = H^*A$.

TABLE A2 Definition and measurement of variables.

	Mean	SD
<i>Dependent variable(s)</i>		
MPI is the multidimensional poverty index (binary)	0.143	0.350
MPIscore is the multidimensional poverty score (continuous)	0.208	0.156
<i>Independent variable(s)</i>		
FII_overall is the overall financial inclusion index for formal and informal financial services including mobile money services	0.655	0.475
FII_formal captures financial inclusion for only formal financial services	0.433	0.495
FII_informal is financial inclusion index for only informal services including mobile money services	0.470	0.499
FII_MoMo is financial inclusion index for only mobile money services	0.306	0.461
<i>Controls</i>		
Household size captures total household members	4.044	5.217
Noedu captures household head without formal education (binary)	0.118	0.323
Basicedu captures household head with basic education (binary)	0.371	0.483
Secede captures household head with secondary education (binary)	0.405	0.491
Tereduc captures household head with tertiary education (binary)	0.106	0.308
Male if the household head is a male (binary)	0.423	0.494
Never married if the household head is never married (binary)	0.481	0.500
Married if household head is married (binary)	0.407	0.491
Separated if the household head is separated (binary)	0.033	0.180
Other marriage if the household head is in other marriage types (binary)	0.079	0.269
Location of the household (if household is located in a rural area) (binary)	0.452	0.498
Age below 33 years if the household head is below 33 years (binary)	0.012	0.110
Age 53–34 years if the household head is 53–34 years (binary)	0.083	0.276
Age 73–54 years if the household head is 73–54 years (binary)	0.245	0.430
Age 74 years and above if the household head is 74 years and above (binary)	0.660	0.474
Greater if the household located in the Greater Accra region (binary)	0.180	0.384
Western if the household located in the Western region (binary)	0.097	0.296
Central if the household located in the Central region (binary)	0.087	0.281
Volta if the household located in the Volta region (binary)	0.087	0.281
Ashanti if the household located in the Ashanti region (binary)	0.197	0.397
Brong-Ahafo if the household located in the Brong-Ahafo region (binary)	0.090	0.286
Eastern if household located in the Eastern region (binary)	0.107	0.309
Northern if the household located in the Northern region (binary)	0.090	0.286
Upper East if the household located in the Upper East region (binary)	0.040	0.196
Upper West if the household located in the Upper West region (binary)	0.027	0.162
<i>Vulnerability coping strategies</i>		
Vulsave captures whether the household has a savings account and contribute to it at least once a month (binary)	0.536	0.499

(Continues)

TABLE A2 (Continued)

	Mean	SD
Vulinsurance captures whether the household have an microinsurance cover insurance (i.e., medical, car or crop) (binary)	0.588	0.492
Vulinvestment captures whether the household owns any of any of the following investments: cultivated land, real estate, investment stocks or shares (binary)	0.206	0.4052
Vulhouse captures whether the household owns a house (binary)	0.297	0.457
<i>N</i>	3002	

TABLE A3 Effect of financial inclusion and multidimensional poverty (Probit estimates).

Variables	(1) FII overall ME	(2) FII_formal ME	(3) FII_informal ME	(4) FII_MoMo ME
Financial inclusion	-0.051 (0.030)	-0.060 (0.032)	-0.061 (0.033)	-0.054 (0.033)
Household size	-0.057*** (0.014)	-0.057*** (0.014)	-0.055*** (0.014)	-0.055*** (0.014)
Male (ref = female)	0.053*** (0.008)	0.030*** (0.001)	0.028*** (0.006)	0.019*** (0.006)
Employed (ref = unemployed)	0.179*** (0.001)	0.130*** (0.002)	0.087*** (0.006)	0.069*** (0.006)
Basic education	-0.243** (0.100)	-0.250** (0.099)	-0.252** (0.100)	-0.257*** (0.099)
Secondary education	-0.433*** (0.105)	-0.449*** (0.105)	-0.484*** (0.104)	-0.490*** (0.104)
Tertiary education	-0.450*** (0.153)	-0.479*** (0.153)	-0.631*** (0.147)	-0.645*** (0.148)
Never married	0.002 (0.175)	-0.002 (0.175)	0.005 (0.174)	-0.007 (0.174)
Married	-0.245*** (0.078)	-0.247*** (0.078)	-0.262*** (0.078)	-0.269*** (0.077)
Separated	-0.121 (0.128)	-0.117 (0.127)	-0.122 (0.127)	-0.126 (0.127)
Rural (ref = urban)	0.338*** (0.065)	0.345*** (0.065)	0.352*** (0.065)	0.356*** (0.065)
53–34 years	-0.035 (0.295)	-0.047 (0.295)	-0.037 (0.294)	-0.047 (0.292)
73–54 years	-0.081 (0.293)	-0.115 (0.293)	-0.065 (0.293)	-0.087 (0.291)
74+ years	-0.049 (0.294)	-0.086 (0.294)	-0.029 (0.294)	-0.044 (0.291)
Western region	0.387*** (0.136)	0.350*** (0.136)	0.423*** (0.135)	0.399*** (0.135)
Central region	0.545*** (0.138)	0.521*** (0.138)	0.562*** (0.136)	0.553*** (0.136)
Volta region	0.753*** (0.138)	0.726*** (0.138)	0.781*** (0.138)	0.780*** (0.138)
Ashanti region	-0.077 (0.131)	-0.089 (0.131)	-0.053 (0.131)	-0.065 (0.131)

(Continues)

TABLE A3 (Continued)

Variables	(1) FII_overall ME	(2) FII_formal ME	(3) FII_informal ME	(4) FII_MoMo ME
Brong-Ahafo region	0.524*** (0.140)	0.501*** (0.140)	0.538*** (0.139)	0.534*** (0.139)
Eastern region	0.522*** (0.133)	0.484*** (0.133)	0.533*** (0.132)	0.516*** (0.132)
Northern region	0.983*** (0.145)	0.970*** (0.145)	1.018*** (0.145)	1.025*** (0.145)
Upper East region	1.028*** (0.155)	1.021*** (0.155)	1.049*** (0.155)	1.052*** (0.155)
Upper West region	1.081*** (0.179)	1.062*** (0.179)	1.123*** (0.178)	1.112*** (0.178)
Observations	2983	2983	2983	2983

Note: Dependent variable is the multidimensional poverty index (MPI) which is dichotomous and takes a value of 1 if the household is multidimensionally poor and 0 otherwise. FII_overall is an overall financial inclusion index for formal and informal financial services including mobile money services. FII_formal is an index measuring financial inclusion for only formal financial services. FII_informal is an index measuring financial inclusion for only informal services including mobile money services. FII_MoMo is the financial inclusion index for only mobile money services. Instruments for FII_overall are the distance (in minutes) to the nearest bank, MFI, and the number of mobile money agents closest to the individual. The instrument for FII_formal distance (in minutes) to the nearest bank. Instruments for FII_informal are the distance (in minutes) to the nearest MFI and the number of mobile money agents closest to the individual. Instruments for FII_MoMo are the number of mobile money agents closest to the individual. Heads with no formal education are the omitted category for education. Heads below 33 years are the omitted category for age. Heads in other marriage types are the omitted category for marital status. Greater Accra region is the omitted category for the region. ME refers to the average marginal effects. Standard errors in parentheses.

* $p < .1$;

** $p < .05$; *** $p < .01$.

TABLE A4 Effect of financial inclusion on multidimensional poverty (Lewbel 2SLS estimates).

Variables	(1) FII_overall	(2) FII_formal	(3) FII_informal	(4) FII_momo
<i>Lewbel 2SLS with only external instruments</i>				
Financial inclusion	-0.193*** (0.001)	-0.094*** (0.003)	-0.081*** (0.002)	-0.048*** (0.001)
First stage				
Distance to bank (in minutes)	-0.037*** (0.001)	-0.034*** (0.002)		
Distance to MFI (in minutes)	-0.148*** (0.009)		-0.050*** (0.013)	
Number of mobile money agents	0.386*** (0.022)		0.280*** (0.010)	0.259*** (0.005)
F-statistic	65.980***	55.133***	59.100***	72.880***
Sargan p-value	0.321		0.411	
<i>Lewbel 2SLS with external and internal instruments</i>				
Financial inclusion	-0.189*** (0.013)	-0.090*** (0.015)	-0.078*** (0.014)	-0.046*** (0.014)
Controls?	Yes	Yes	Yes	Yes
F-statistic	0.186***	0.183***	0.179***	0.179***
Sargan p-value	0.226	0.189	0.321	0.120
Breusch-Pagan test	122.260***	120.290***	117.770***	114.499***
Pagan-Hall's test	156.563***	155.561***	151.165***	148.355***
Observations	2983	2983	2983	2983
R-squared	0.214	0.210	0.208	0.206

Note: Dependent variable is the MPI score (continuous) which is normalised to range between 0 and 1 for easy interpretation. Standard errors in parentheses.

* $p < .1$;

** $p < .05$;

*** $p < .01$.

TABLE A5 Testing for omitted variable bias and stability of estimates.

Treatment variable	(1) Baseline effect β (Std. Error), [R]	(2) Controlled effect β (Std. Error), [R]	(3) Identified set $[\hat{\beta}, \beta^* (R^2_{\max} \min\{1, 1.3\widehat{R}^2\}, 1)]$	(4) Excludes zero?	(5) δ for $\beta = 0$ given R_{\max}
FII_overall	-0.019*** (0.000) [0.043]	-0.101*** (0.010) [0.413]	[-0.194, -0.101]	Yes	2.502
FII_formal	-0.008*** (0.001) [0.042]	-0.059*** (0.013) [0.213]	[-0.123, -0.059]	Yes	1.280
FII_informal	-0.009*** (0.003) [0.010]	-0.082*** (0.020) [0.208]	[-0.104, -0.082]	Yes	2.649
FII_MoMo	-0.0062*** (0.013) [0.003]	-0.054** (0.023) [0.207]	[-0.132, -0.054]	Yes	3.210

Note: Dependent variable is the MPI score (continuous) which is normalised to range between 0 and 1 for easy interpretation. Baseline effect does not include any controls. Controlled effect includes the full set of controls: age, gender, education, marital status, educational attainment, employment status, household size, rural-urban location, and region of residence. Standard errors are in parentheses while R-squared is in brackets.

* $p < .1$;

** $p < .05$; *** $p < .01$.