



Financial inclusion and multidimensional child poverty

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Abstract

Despite the concerted efforts being made at the global, regional, and national levels to reduce child poverty, children in resource-poor countries continue to experience deprivations in multidimensional forms. This study examines the link between parental financial inclusion and multidimensional child poverty using a nationally representative living standards data from Ghana—a nation with documentative evidence of high incidence of multidimensional child poverty. Employing different variants of the propensity score matching technique and multidimensional constructs of financial inclusion and child poverty, our overall finding indicates that financial inclusion decreases multidimensional child poverty. This outcome is consistent across different cut-offs used in measuring multidimensional child poverty and alternative propensity score matching methods. We also find that financial inclusion reduces child poverty more for male and rural-located children. Relatively, financial inclusion has the biggest effect in reducing children’s deprivations in living conditions, followed by their health- and education-related deprivations respectively. Household income per capita and durable asset accumulation serve as potential pathways through which financial inclusion transmits to multidimensional child poverty.

Keywords Financial inclusion · Child poverty · Gender · Rural · Ghana

JEL codes G2 · G21

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1 Introduction

While an adult may fall into poverty temporarily, falling into poverty in childhood can last a lifetime—rarely does a child get a second chance at education or a healthy start in life. Even short periods of food deprivation can impact children’s long-term development (Kofinti et al., 2022). Child poverty threatens not only the individual child, but is likely to be passed on to future generations, entrenching and even exacerbating inequality in society (Ortiz et al., 2012, p. 1). The problem of multi-dimensional child poverty—MCP (used interchangeably with child deprivation) has gained traction in development circles across the globe. This is reflected in the priority given to child poverty in the Sustainable Development Goals (SDGs), and the internationally coordinated efforts to eliminate it (BAPPENAS and UNICEF, 2017; Dorman, 2017; Pemberton et al., 2012; Sanfilippo et al., 2012). The spotlight on MCP highlights intra-household differences in resource distribution and its effect on children. Children tend to be more vulnerable to deprivations because they do not have control over resource distributions; instead, they are dependent on adult household members such as their parents to meet the needs critical to their survival and development (Roelen et al., 2010; Trani & Cannings, 2013). MCP tends to be more prevalent among boys and rural-located children (de Milliano & Plavgo, 2018; Lekobane & Roelen, 2020). Given the relative novelty of the discussion around MCP, substantial research effort has gone into establishing and measuring the phenomenon (see e.g., Abdu & Delamonica, 2018; Chzhen et al., 2018; Kim, 2019).

Beyond measurement, empirical studies that explore policies for addressing MCP have been sparse despite its harmful impact on children’s development into adulthood (see e.g., Osei & Turkson, 2022; Roelen et al., 2017; Whitworth & Wilkinson, 2013). Osei and Turkson (2022) and Roelen et al. (2017) argue that cash transfers to impoverished families help to reduce multiple forms of deprivations faced by children. Roelen et al. (2017) also argue that these cash transfers are more effective when moderated by social workers. Whitworth and Wilkinson (2013) also advocate that designing and implementing a comprehensive social security grant can enhance the alleviation of the child poverty canker.

Financial inclusion has been identified as being able to address household poverty including vulnerability to poverty (Awaworyi Churchill & Marisetty, 2020; Inoue, 2019; Koomson et al., 2020a). The main reason for this is based on the increased purchasing power associated with financial inclusion and its ability to enhance welfare either directly or through indirect channels such as institutional quality (Aracil et al., 2022), technology (Polloni-Silva et al., 2021) and relative income (Li, 2018). This notwithstanding, the financial inclusion-MCP nexus has received little attention. Studies that come close to analysing the link between financial inclusion and MCP are Álvarez-Gamboa et al. (2021); Koomson et al. (2020a); and Churchill and Marisetty (2020). However, these studies focused on multidimensional household poverty and not MCP. Also, previous studies (Koomson et al., 2020a; Koomson & Danquah, 2021) have provided empirical support to the 2010 Maya declaration (AFI, 2015) which sought to reduce poverty through financial inclusion, but researchers are yet to ascertain whether this evidence extends to children. This makes it imperative to analyse the financial inclusion-MCP nexus to fill an important gap in the literature and inform policy.

We contribute to the literature by examining the link between financial inclusion and MCP using a multidimensional index of financial inclusion that cuts across four dimensions—account ownership, access to credit, insurance ownership and receipt of financial remittance. We further engage in a subgroup analysis to ascertain the differential effect of financial inclusion on MCP for male and female children, rural-urban located children and for those in different age cohorts. We do these by using data extracted from the seventh round of the Ghana Living Standards Survey and address the biasedness of financial inclusion using several propensity score matching (PSM) techniques. We also explore the roles of income and durable asset accumulation in serving as potential channels via which financial inclusion influences MCP.

Specifically, our study makes the following contributions to the literature. First, we extend the current literature to analyse data on the financial inclusion-MCP nexus, which helps to answer the question on whether the effect of financial inclusion on poverty applies to children. Second, we conceptualise financial inclusion using a multidimensional measure unlike majority of the previous studies which have focused on the impact of financial inclusion on welfare outcomes in general using unidimensional measures (Awaworyi Churchill & Marisetty, 2020; Koomson et al., 2020a). Third, our potential channel analysis helps to identify policy complementarities that can be explored along with financial inclusion to achieve desired socioeconomic outcomes. Fourth, our engagement in various subgroup analyses for gender, age, and location provides empirical support to the SDG's primary goal of segmenting research findings among various groups to 'leave no one behind' in the design and execution of development policies (World Health Organization, 2016).

Overall, our findings suggest that financial inclusion is associated with a decrease in MCP, with heterogeneous outcomes for children in different age cohorts, male and female children, and those in rural-urban locations. We also find that household income per capita and durable asset accumulation serve as mediators in the link between financial inclusion and MCP.

Our focus on Ghana as a case for this study is motivated by several reasons. First, Ghana as a nation in sub-Saharan Africa mirrors the general pervasiveness of poverty in the region. While 45.6% of Ghana's population was multidimensionally poor in 2020 (GSS, 2020), the proportion of multidimensionally poor children was 73.4% in the same year (NDPC et al., 2020). This shows that a significant proportion of children living in Ghana are exposed to MCP. Second, the current level of financial inclusion in Ghana is 58%, which is considerably low (Demirgüç-Kunt et al., 2018). This has prompted the Government of Ghana and policy-makers to set an ambitious target of achieving 85% rate of financial inclusion by 2023. It would be prudent to understand how the achievement of this target will help to improve the welfare of children through a reduction in MCP. Third, although Koomson et al. (2020a) find that financial inclusion reduces poverty and vulnerability to poverty more in rural than in urban areas, rural households are less financially included than urban households (Demirgüç-Kunt et al., 2018). Children living in rural areas of Ghana also tend to be more exposed to multidimensional forms of childhood deprivation and its effects than their counterparts in urban areas (Agyire-Tettey et al., 2021). It is imperative that we understand, from an empirical standpoint, the role that financial inclusion plays in reducing MCP across locations, thus giving us deeper insights into the financial inclusion-MCP nexus. Moreover, exploring the potential pathways by

which financial inclusion could assuage the levels of MCP would prove useful in the design of targeted policy responses to the multiple forms of deprivations children face and the long-lasting adverse effects they have on their development into adulthood.

The remaining parts of the study are structured as follows. Section “Conceptual link between financial inclusion and MCP” discusses the pathways through which financial inclusion may influence MCP. Section “Data and variables” provides details of the type of data and variables used in the study while Section “Estimation technique” covers the estimation technique employed in the study. Section “Results” presents and discusses the results from the estimation and draws conclusions useful for policy recommendations.

2 Conceptual link between financial inclusion and MCP

The concept of financial development can be employed to establish a theoretical basis for the link between financial inclusion and MCP (King & Levine, 1993; Rajan & Zingales, 1998). This is because, advances in the financial system of an economy enhance access to the indicators of financial inclusion (account ownership and insurance product ownership, access to credit, and receipt of financial remittance) which can provide the resources needed to cater for the needs of children (Demirgüç-Kunt et al., 2015, 2018; King & Levine, 1993; Koomson et al., 2020a, 2021; Rajan & Zingales, 1998). It can be deduced from these theories and other empirical studies that financial inclusion can impact MCP either directly or indirectly through different pathways. In the ensuing subsections, we highlight some potential pathways by which financial inclusion may influence MCP.

2.1 Household income

Financial inclusion has been found to have a strong positive effect on household income (Attanasio et al., 2014; Mahmood et al., 2022; Prina, 2015). The effect tends to hold across households with differing levels of income with low-level income households benefiting more from the effects of financial inclusion than the high and mid-level income households (Koomson & Danquah, 2021). The observed relationship has been attributed to several factors including improved access to demand and saving accounts and payment platforms (Zhang & Posso, 2019). This creates a chain effect where individuals become empowered, save, and invest more (Hendriks, 2019). Over time, this translates into an increase in income and consumption (Ashraf et al., 2010; Dupas & Robinson, 2013). Financial inclusion also creates improved access to credit which in turn affects consumption and eventually, the income of these households (Attanasio et al., 2014; Prina, 2015). There are however some scholars who tested the relationship between financial inclusion and consumption and, found evidence to the contrary. For instance, Bernerjee et al. (2015) and Angelucci et al. (2015) found that access to credit did not significantly impact the consumption expenditure of households. Clearly, financial inclusion could significantly alleviate MCP by increasing the income available for consumption to the parents or guardians who cater for these children. If on the other hand, financial

inclusion is found not to influence income, then the hypothesised effect on MCP would be non-existent.

2.2 Financial and durable asset accumulation

According to Jalilian and Kirkpatrick (2002), financial inclusion strengthens the productive assets of the poor by enabling them to invest in new technologies, education and health. Fomum and Jessie (2017) confirm their findings as they find a significantly positive relationship between financial inclusion and asset accumulation. Duvendack and Mader (2020) explain this relationship by suggesting that access to credit and accumulated financial assets could provide a useful buffer to assuage shocks, invest in household assets or even pay off existing loans with higher interest costs. The savings that financial inclusion offers could also allow people to avoid taking high-interest loans in the first place and, instead, accumulate funds against a rainy day so as to handle shocks better and also acquire durable assets. Additionally, the ability of households to accumulate durable assets tends to reduce borrowing constraints and empowers them to take risky actions which could lead to future increments in income (Azpitarte, 2011). This suggests that the accumulation of financial and durable assets as facilitated by financial inclusion could significantly affect the economic wellbeing of households which extends to children. We hypothesise that this could translate into reduction in MCP.

2.3 Entrepreneurship

Financial inclusion creates improved access to credit which in turn creates entrepreneurial opportunities for individuals (Ajide, 2020; Attanasio et al., 2014; Prina, 2015). Lyons & Contreras (2017) explored possible dual causality in the relationship between financial inclusion and entrepreneurship by collecting data from 21 developing countries. They found that while financial inclusion affects the likelihood of venturing into entrepreneurship, entrepreneurship also gives young people greater access to financial services and products. The entrepreneurial opportunities created by financial inclusion are expected to lead to higher household incomes. This can put parents and guardians of children exposed to multidimensional deprivations in a better position to address these deprivations.

2.4 Health investment

Financial inclusion has far-reaching welfare benefits. One of these benefits is its effects on the health habits of individuals. According to Dupas and Robinson (2013), access to financial services and savings products leads to a substantial increment in the investment that individuals make in preventative health. Others also posit that having access to financial inclusion improves people's health and wellbeing by enabling them to effectively manage their medical bills (Koomson et al., 2021; Ke et al., 2011). This practice also reduces one's vulnerability to health shocks. Investment in preventative health creates savings which can be channelled into addressing other pertinent household needs (Baicker et al., 2010). Aside from that, there is a strong association between being healthy and being able to work to raise

sufficient income to meet household needs (Bevan & Cooper, 2021). Healthy parents are in a better position to provide for the psychological and physiological needs of their children. Health-associated deprivations are one of the important dimensions of deprivation that children face (Kofinti et al., 2022). The ability of financial inclusion to improve the health habits and conditions of individuals could have a spill over effect and help alleviate MCP.

3 Data and variables

The data for this research comes from the seventh round of the Ghana Living Standards Survey (GLSS7) (GSS, 2019), which was conducted in 2016/17 throughout Ghana's ten regions (now sixteen) by the Ghana Statistical Service (GSS). The survey used a two-stage random sampling approach to collect information on individual- and household-level characteristics. These include children's health, education and other welfare indicators. It also included the financial inclusion indicators, farm and non-farm activities, migration, and other relevant information. We used only the GLSS7 data because GLSS7 is the only round of the survey that included anthropometric measures which are required for the health domain of the MCP measure. The GLSS7 covered 15,000 households with response rates being 93.4%, leading to a final sample size of 14,009 households. After merging the files/sections containing our variables of interest, we had a working sample of 8967 households with 24,461 children aged 0 to 17 years. After adjusting for missing data in the regression analysis, the model with the most observations comprised 12,079 children.

3.1 Multidimensional child poverty (MCP)

The MCP adopts the Oxford Poverty and Human Development Initiative (Alkire & Foster, 2011) approach to the conceptualisation of poverty. The approach draws on the relative deprivation theory by Townsend (1979) and the concept of capabilities put forward by Sen (1976). The method identifies children experiencing multi-dimensional deprivations by using a dual cut-off. First is the deprivation cut-off which identifies indicator-specific deprivation in all the nine indicators as stated in Table 8 of the Appendix. Second is the poverty cut-off k (dimension-specific) which identifies the multidimensionally poor child as a child deprived in at least two dimensions out of the three based on the vector of weighted deprivations. Following Alkire and Roche (2012), we adopt the conventional MCP cut-off of 0.333. Consistent with the existing studies (Alkire & Foster, 2011; Alkire & Roche, 2012), we concentrated on three broad equally weighted dimensions (health, education and living conditions) with corresponding nine indicators (see Table 8) having well-defined deprivation cut-offs. Equation (1) specifies the deprivation profile of children with the corresponding cut-offs.

$$\alpha_i = w_1l_1 + w_2l_2 \dots + w_nl_n \quad (1)$$

Whereas α_i denotes MCP/deprivation score, $l_i = 1$ if the child records deprivation in indicator i and $l_i = 0$ if the reverse is the case. Also, w_i is the weight apportioned to

indicator i with $\sum_i^n w_i = 1$. We use Eq. (1) to estimate a multidimensional child deprivation score which ranges from 0 to 1. Based on k , we assign the value 1 to a child if his/her multidimensional deprivation score is greater than 0.333 and 0 if otherwise (Alkire & Roche, 2012).

There are methodological differences in conceptualising child poverty for children under-five and those above five years (Alkire et al., 2015; Alkire & Roche, 2012; Gordon et al., 2003; Minujin, 2011). Indicators for those under-five do not include the education dimension because they are not of school age (Gordon 2003; Minujin, 2011). The measure for those five years and above includes education but based on the Ghana Education Service formal school entry age children start school at age six (Adu-Gyamfi et al., 2016; Afoakwah et al., 2020). Hence, our MCP measure for children above age five excludes those who are five-year-old because they have missing data on the education indicator required for capturing deprivation in education dimension. This is consistent with previous studies that have MCP for Ghana (Kofinti & Annim, 2016; Mba et al., 2009; National Development Planning Commission 2020).

3.2 Financial inclusion (FI)

Consistent with the approach in recent studies (Koomson et al., 2020a, 2021; Koomson & Danquah, 2021; Zhang & Posso, 2019), we construct a multidimensional index of financial inclusion across four dimensions—account ownership (bank or mobile money), insurance product ownership, credit access, and receipt of financial remittances through bank or mobile money (Koomson et al., 2020a, 2021; Koomson & Danquah, 2021; Zhang & Posso, 2019). Inspired by the Alkire-Foster (2011) methodology, we produce a multidimensional financial inclusion score using the formula in Eq. (2), which allocates each dimension an equal weight of 0.25. A unit increase in the financial inclusion score signifies an increase in financial inclusion. As in extant studies, we produce a binary indicator variable of financial inclusion using a dual cut-off of 0.5, where a household is assigned the value 1 if its financial inclusion score is greater than 0.5 and 0 if otherwise (Koomson & Danquah, 2021; Zhang & Posso, 2019). For purposes of robustness/sensitivity tests, we use a variety of weighting schemes and cut-offs (see Subsection “Gender and location of child”).

$$FI_i = \tau_1 I_1 + \tau_2 I_2 + \dots + \tau_n I_n \quad (2)$$

where FI_i depicts the financial inclusion score of the household. $I_i = 1$ if a household head's response to an indicator is in the affirmative, and $I_i = 0$ if otherwise. With τ_i being the weight assigned to indicator i , we have $\sum_{i=1}^n \tau_i = 1$. Table 9 provides definition and weights of the financial inclusion indicators used in the paper.

3.3 Durable asset/wealth accumulation

We follow the Filmer and Pritchett (1999) method which is used to generate household wealth index in the Demographic and Health Surveys (DHS) and other related studies (Rustein & Johnson, 2004; Rutstein, 2015). First, we identify household durable assets such as televisions, radios, sewing machines, cars, plots of

land, wall clocks, bicycles, and other household durable assets which are captured as indicator variables. In line with this method, sources of drinking water, electricity, and cooking fuel, as well as the number of sleeping rooms and bathroom facilities are included since they connote wealth. Second, we apply principal component analysis to create the asset *accumulation/wealth index* which is a singular variable representing all the household assets. Seshan (2020) constructed a household wealth index utilising six durable assets and eleven housing quality variables and obtained the index using the first principal component. The asset accumulation index is a continuous variable for which a unit increase reflects an improvement in household wealth. In Table 10, the average wealth index is negative, which connotes low levels of wealth. This is consistent with a previous study in Ghana (GSS., 2019) and that of Rustein and Johnson (2004).

3.4 Household per capita income

Household per capita income is derived by dividing total household income by household size. This is done to enable us account for the portion of the household income that is used to cater for the needs of each child within the household. To solve the problem of outliers in the values across different households, we smooth the variable by using the log version of the per capita household income.

4 Estimation technique

We employ a linear probability model (LPM) to estimate the relationship between financial inclusion and MCP while accounting for relevant control variables. Since both the outcome and explanatory variables are binary, the LPM estimates are not prone to the possible biases associated with continuous explanatory variables when utilised in an LPM (Deke, 2014; Koomson et al., 2020b). Additionally, the LPM estimates are simpler to interpret as marginal effects (Afoakwa et al., 2020; Afoakwa & Koomson, 2021) and are easily comparable to the 2SLS estimates employed to resolve endogeneity. Our preliminary model employed in this study is specified in Eq. (3).

$$ChdPOV_{ih} = \beta FI_h + \gamma CHILD_i h' + \eta HH'_h + \mu_R + \varepsilon_{ih} \quad (3)$$

Where $ChdPOV_{ih}$ is the MCP status of child i in household h ; FI denotes financial inclusion status of household head; $CHILD_i$ is a vector of child-specific variables such as age, sex of the child and child work; and HH_i is a vector of household-specific variables identified in the literature as factors that influence MCP. These variables include age and gender of household head, location of household, household size, education of head, marital status of head and general price level of non-food items (see e.g., Agyire-Tettey et al., 2021; Lekobane & Roelen, 2020). The symbol μ represents regional fixed effects and ε is a random error term.

4.1 Potential bias

Studies that have focused on the financial inclusion-household welfare nexus have pointed to the selection or endogeneity bias associated with financial inclusion estimates (Koomson et al., 2021; Koomson & Danquah, 2021; Mora-Rivera & van Gameren, 2021; Smith & Floro, 2021). In this study, we employ PSM method to address the selection bias problem which may arise from unobservable characteristics of household heads that might make them more likely to be financially included. Put differently, this may emanate from compositional differences between the financially included (treatment group) and excluded (control group) which results in potential cases where children from financially included homes may have already experienced lower levels of deprivations before the survey. The PSM method generates propensity scores using observable characteristics of respondents in both the control and treatment groups which helps to resolve the problem of selection bias (Etwire et al., 2022; Khandker et al., 2010; Koomson & Danquah, 2021; Koomson et al., 2022a). In this study, we use observable characteristics of children and their parents to ensure that the estimated propensity scores are reliable.

PSM answers the counter-factual question by ascertaining the difference between the MCP outcome for children in financially included homes and the scenario where they belonged to a financially excluded household. This difference is called the average treatment of the treated (ATET). We employ Eq. (4) to obtain the ATET.

$$ATET = E(\Delta|P(X), FI = 1) = E(P(X), T = 1) - E(P(X), T = 0) \quad (4)$$

where T is equal to 1 if child is from a financially included home and 0 if otherwise; Y is the MCP status of child; and X is a set of observable child- and parent-specific characteristics. In essence, $P(X)$ is the propensity score capturing the probability of a child belonging to a financially included home given the observable characteristics (X). To ensure consistency in estimates, we use various matching methods which include nearest neighbour (1:1 and 1:5), radius, kernel, and local linear regression.

5 Results

5.1 Preliminary results

Table 1 reports preliminary estimates for the link between financial inclusion and MCP. Whereas Column 1 shows estimates for all children, Columns 2 and 3 present results for children under five years and children aged between 6-17 years respectively. In Column 1, we observe that financial inclusion is associated with a decrease in MCP by 6.9 percentage points. In Columns 2 and 3, financial inclusion is associated with decreases of 6.3 and 7.2 percentage points in MCP respectively. Although the findings above indicate that financial inclusion can reduce MCP, the potential selection bias associated with financial inclusion can result in unreliable estimates. We address this problem in “Bias-corrected results”.

The results of the control variables from the perspective of all children are largely intuitive and follow our a priori expectations (see Column 1). For instance, older household heads, rural households and those with larger membership increase child

Table 1 Financial inclusion and child deprivation (OLS results)

VARIABLES	(1) All children	(2) Children under 5 years	(3) Children 6–17 years
Financial inclusion	-0.069*** (0.009)	-0.063*** (0.015)	-0.072*** (0.010)
Female child	-0.039*** (0.008)	-0.020 (0.013)	-0.045*** (0.009)
Age of child	-0.024*** (0.001)	-0.009* (0.005)	0.006*** (0.001)
Child work	0.218*** (0.059)	–	0.163*** (0.057)
Age of household head	0.001* (0.000)	-0.000 (0.001)	0.001*** (0.000)
Female head	0.013 (0.013)	0.041* (0.024)	0.004 (0.014)
Rural	0.214*** (0.009)	0.336*** (0.018)	0.172*** (0.010)
Household size	0.004*** (0.001)	0.008*** (0.002)	0.004** (0.002)
Educated head	-0.138*** (0.009)	-0.176*** (0.018)	-0.126*** (0.011)
Married	-0.090*** (0.015)	-0.099*** (0.023)	-0.083*** (0.018)
Sep/Divorced/Widowed	-0.092*** (0.018)	-0.081** (0.034)	-0.087*** (0.021)
Price index (non-food)	0.029 (0.111)	0.041 (0.194)	-0.002 (0.127)
Region fixed effect	Yes	Yes	Yes
Observations	12,079	3,549	8,530
R-squared	0.203	0.333	0.118

Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

deprivation. On the flip side, older children, educated household heads and married households reduce child deprivations.

5.2 Bias-corrected results

Given that the preliminary results using OLS produces biased estimates in the existence of sample selectivity problems, we obtain PSM estimates using several matching methods and report the results in Table 2 Columns 1 to 5. Figure 1 displays the region of common support for children in financially included and excluded homes. The analyses excluded children who were not in the common support range. The strong overlap between the density distribution of propensity scores for the financially included and excluded supports the PSM findings.

Based on the results from the full sample reported in Panel A, it is observable from Columns 1 to 5 that all the matching techniques produced statistically significant relationship between financial inclusion and MCP. Specifically, they indicate that financial inclusion reduces MCP. Scrutinising the magnitude of the coefficients in absolute terms, it ranges between 0.066 and 0.134, implying that financial inclusion reduces MCP between 6.6 and 13.4 percentage points.

Panels B and C report results for the sub-sample analyses of children under 5 years and their counterparts from 6 to 17 years. The results are in consonance with that of Panel A and corroborate our finding that financial inclusion has MCP reducing effects. Specifically, the reducing effect of financial inclusion on MCP is between 3.7 and 15.3 percentage points for children under age 5 and between 6.6 and 16.5 percentage points for children aged 6 to 17 years. Comparing the coefficients of

Table 2 Propensity Score matching using different matching methods

Variables	(1)	(2)	(3)	(4)	(5)
	Matching techniques				
	Nearest Neighbour (1:1)	Nearest Neighbour (1:5)	Radius	Kernel	Local linear regression
<i>Panel A: Full Sample</i>					
Financial inclusion	-0.068*** (0.014)	-0.066*** (0.011)	-0.134*** (0.008)	-0.069*** (0.009)	-0.070*** (0.006)
All control variables	Yes	Yes	Yes	Yes	Yes
Observations	12,079	12,079	12,079	12,079	12,079
<i>Panel B: <5 years Sample</i>					
Financial inclusion	-0.037** (0.014)	-0.052*** (0.017)	-0.153*** (0.017)	-0.062*** (0.022)	-0.062*** (0.016)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	3549	3549	3549	3549	3549
<i>Panel C: 6–17 years Sample</i>					
Financial inclusion	-0.066*** (0.017)	-0.069*** (0.012)	-0.165*** (0.010)	-0.072*** (0.008)	-0.071*** (0.009)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	8530	8530	8530	8530	8530

Standard errors in parentheses *** $p < 0.01$ Number of Bootstrap replications (50)

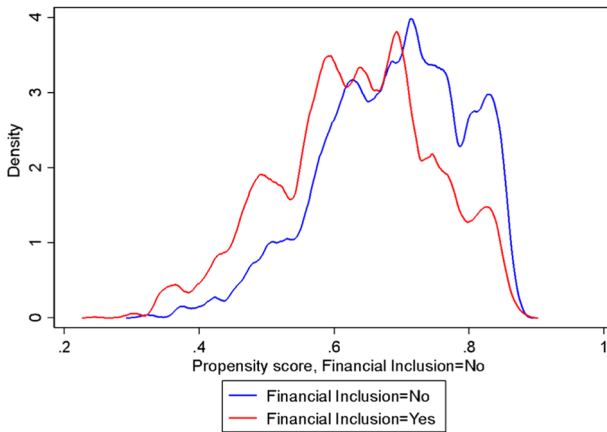


Fig. 1 Region of common support

Panels B and C, we can infer the financial inclusion has a bigger effect in reducing MCP among children aged 6 to 17 years.

Overall, the possible inference to be drawn from this outcome is that financially included households experience improved access to demand and saving accounts and

Table 3 Propensity score matching: gender and location

Variables	(1)	(2)	(3)	(4)	(5)
	Matching techniques				
	Nearest Neighbour (1:1)	Nearest Neighbour (1:5)	Radius	Kernel	Local linear regression
<i>Panel A: Male Sample</i>					
Financial inclusion	-0.077*** (0.020)	-0.061*** (0.016)	-0.139*** (0.013)	-0.076*** (0.010)	-0.076*** (0.012)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	6198	6198	6198	6198	6198
<i>Panel B: Female Sample</i>					
Financial inclusion	-0.070*** (0.021)	-0.054*** (0.016)	-0.128*** (0.013)	-0.061*** (0.013)	-0.062*** (0.012)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	5881	5881	5881	5881	5881
<i>Panel C: Rural Sample</i>					
Financial inclusion	-0.093*** (0.017)	-0.078*** (0.015)	-0.130*** (0.012)	-0.086*** (0.012)	-0.082*** (0.011)
All control variables	Yes	Yes	Yes	Yes	Yes
Observations	8105	8105	8105	8105	8105
<i>Panel D: Urban Sample</i>					
Financial inclusion	-0.023** (0.011)	-0.030* (0.018)	-0.050*** (0.014)	-0.035*** (0.013)	-0.040*** (0.013)
All control variables	Yes	Yes	Yes	Yes	Yes
Observations	3974	3974	3974	3974	3974

Standard errors in parentheses *** $p < 0.01$ Number of Bootstrap replications (50)

payment platforms which engenders investment and savings over time to increase income and consumption (Ashraf et al., 2010; Dupas & Robinson, 2013). Such increases in income and consumption could prioritise the survival and developmental needs of children in the household, hence the reduction in their deprivations. In addition, improved access to credit among the financially included households boost income and consumption levels with the result being a reduction in the deprivations experienced by children (Attanasio et al., 2014; Prina, 2015). Also, the results indicate that financial inclusion reduces MCP especially for older children (6–17 years). This can be linked to the relative needs of children in the different age cohorts. Children in the 6–17-year cohort are of school age and require more academic resources. Such needs also call for more financial resources to cater for their educational expenditure needs.

5.2.1 Gender and location of child

This subsection reports results for the male-female children and rural-urban subsamples to bring to fore gender and locational differences inherent in the link between financial inclusion and MCP. The analyses in this section align with the SDG's primary mandate of "leaving no one behind" by encouraging researchers and policymakers to carry out disaggregated analyses. Table 3 presents PSM estimates for male and female children in

Panels A and B as well as for rural and urban sub-samples in Panels C and D respectively across the five matching techniques. In Panel A, financial inclusion is associated with 6.1 to 13.9 percentage points decrease in MCP for boys. In Panel B, financial inclusion is associated with 5.4 to 12.8 percentage points decrease in MCP among girls. Comparing the estimates in Panels A and B across the individual matching techniques, reveal that the MCP-reducing effects are larger among boys than girls. In Panel C, financial inclusion decreases MCP by 7.8 to 13.0 percentage points among rural children. Also, in Panel D, financial inclusion decreases MCP by 2.3 to 5.0 percentage points for urban children. Comparing the estimates in Panels C and D for all matching techniques, reveal that the MCP-reducing effects are larger among rural-located children than their urban counterparts.

This finding is not far-fetched because financial inclusion is considerably low among rural residents while MCP is more prevalent in rural communities (de Milliano & Playgo, 2018; Lekobane & Roelen, 2020) so enhancing financial inclusion for rural folks makes a bigger difference in boosting their purchasing power which is required to cater for the needs of children. It is worth mentioning that this finding holds promise of narrowing the rural-urban gaps in deprivations experienced by children in Ghana and other developing countries that have signed the Maya declaration with the pledge of leveraging financial inclusion to achieve poverty reduction targets.

5.2.2 Relative effect of financial inclusion across dimensions of deprivation

Here, we analyse the relative effect of financial inclusion on the three dimensions that make up the MCP construct. We do this by decomposing MCP into its three main deprivation dimensions (living conditions, education and health) and ascertain the effect of financial inclusion on each of them respectively across Panels A, B and C of Table 4. In Panel A, financial inclusion is associated with 5.2 to 14.8 percentage points decrease in deprivations in living conditions. In Panel B, financial inclusion is associated with 2.9 to 5.3 percentage points decrease in education-related deprivations. Finally, in Panel C, financial inclusion is associated with 4.2 to 7.2 percentage points decrease in health-related deprivations. Comparing the magnitude of the coefficients across the three dimensions, our decomposition analyses show that the negative effect of financial inclusion on child deprivation is largely driven by its effect in decreasing deprivations in living conditions, followed by the deprivations in health and then education respectively. The sample size for the analyses in Panel B is relatively smaller because of the exclusion of children age five as explained in Section “Multidimensional child poverty (MCP)”.

5.3 Sensitivity tests

In this sub-section, we perform sensitivity tests to ascertain the consistency of our PSM estimates using alternative cut-offs for MCP and financial inclusion. Our initial measure of MCP used a conservative cut-off of 0.33 but in the sensitivity analysis presented in Panels A and B of Table 5, we used alternative cut-offs of 0.5 and 0.6, respectively. The main measure for financial inclusion on the other hand, employed a cut-off of 0.5 but in the sensitivity tests presented in Panels C and D, we applied alternative cut-offs of 0.25 and 0.6 respectively, which are consistent with the literature (Churchill et al., 2020;

Table 4 Financial inclusion and child deprivation (alternative cut-offs for child deprivation and financial inclusion)

Variables	(1)	(2)	(3)	(4)	(5)
	Matching techniques				
	Nearest Neighbour (1:1)	Nearest Neighbour (1:5)	Radius	Kernel	Local linear regression
<i>Panel A: Living conditions dimension</i>					
Financial inclusion	-0.052*** (0.015)	-0.058*** (0.013)	-0.148*** (0.010)	-0.068*** (0.009)	-0.062*** (0.008)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	12,079	12,079	12,079	12,079	12,079
<i>Panel B: Education dimension</i>					
Financial inclusion	-0.035*** (0.012)	-0.032*** (0.009)	-0.053*** (0.006)	-0.029*** (0.007)	-0.031*** (0.007)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	8530	8530	8530	8530	8530
<i>Panel C: Health dimension</i>					
Financial inclusion	-0.045*** (0.012)	-0.042*** (0.013)	-0.072*** (0.010)	-0.046*** (0.010)	-0.047*** (0.010)
All control variables	Yes	Yes	Yes	Yes	Yes
Observations	12,079	12,079	12,079	12,079	12,079

Standard errors in parentheses *** $p < 0.01$ Number of Bootstrap replications (50)

Koomson & Danquah, 2021). Across all the cut-offs, we find that the MCP-reducing effects of financial inclusion range from 2.6 to 13.4 percentage points. This shows that the effect of financial inclusion in reducing MCP is consistently established when alternative cut-offs are used in identifying the financially included or children who are experiencing multidimensional forms of deprivations.

5.4 Potential channel analysis

As discussed in Section “Conceptual link between financial inclusion and MCP”, there are several potential channels through which financial inclusion could affect MCP. Predicated on these channels, we adopt the Baron and Kenny approach to mediation analysis (Baron & Kenny, 1986; Kenny, 2021) using a two-stage procedure evident in existing studies (Alesina & Ferrara, 2005; Koomson & Churchill, 2021) to assess the possible mediating roles of per capita income and asset accumulation. Here, we use the LPM given that PSM is not applicable in this regard. If we use the PSM, and include the potential mediators (i.e., income per capita and asset accumulation), these variables will contribute to the estimation of the propensity scores and bias our outcomes (Khandker et al., 2010). This is so because it will violate the PSM requirement of excluding variables that can be influenced by the treatment variable.

Table 5 Financial inclusion and child deprivation (alternative cut-offs for child deprivation and financial inclusion)

Variables	(1)	(2)	(3)	(4)	
	Matching techniques				
	Nearest Neighbour (1:1)	Nearest Neighbour (1:5)	Radius	Kernel	Local linear regression
<i>Panel A: Deprivation cut-off (0.5)</i>					
Financial inclusion	-0.028** (0.012)	-0.036*** (0.008)	-0.083*** (0.007)	-0.041*** (0.005)	-0.044*** (0.006)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	12,079	12,079	12,079	12,079	12,079
<i>Panel B: Deprivation cut-off (0.6)</i>					
Financial inclusion	-0.026*** (0.010)	-0.031*** (0.007)	-0.069*** (0.005)	-0.036*** (0.005)	-0.039*** (0.006)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	12,079	12,079	12,079	12,079	12,079
<i>Panel C: Financial inclusion cut-off (0.25)</i>					
Financial inclusion	-0.067*** (0.015)	-0.066*** (0.010)	-0.134*** (0.008)	-0.069*** (0.008)	-0.070*** (0.009)
All control variables	Yes	Yes	Yes	Yes	Yes
Observations	12,079	12,079	12,079	12,079	12,079
<i>Panel D: Financial inclusion cut-off (0.6)</i>					
Financial inclusion	-0.061** (0.025)	-0.052*** (0.017)	-0.124*** (0.013)	-0.083*** (0.014)	-0.085*** (0.011)
All control variables	Yes	Yes	Yes	Yes	Yes
Observations	12,079	12,079	12,079	12,079	12,079

Standard errors in parentheses *** $p < 0.01$ Number of Bootstrap replications (50)

In the first step, we confirm that financial inclusion is significantly associated with per capita income and asset accumulation (see Table 6). The results reported in Columns 1 and 2 show that financial inclusion is positively associated with per capita income and asset accumulation which aligns with the literature (Banerjee et al., 2015; Fomum & Jesse, 2017; Jalilian & Kirkpatrick, 2002).

In the second step, we separately include per capita income and asset accumulation as covariates in the MCP model and report the results in Panel A of Table 7. To engender seamless comparison of estimates, we re-estimate the preliminary model without the potential mediator variables in Panel B. Since the model with income has a reduced observation (11,976), restricting the model to the same observation ensures that the two coefficients to be compared are produced from the same sample. The mediating roles of income per capita and asset accumulation estimates are presented in Columns 1 and 2 of Panel A respectively. For income per capita to be suitable as a potential mediator, the coefficient of financial inclusion must diminish or become

Table 6 Effect of FI on income and durable asset accumulation

Variables	(1) log(Income per capita)	(2) Asset accumulation index
Financial inclusion	0.124*** (0.010)	0.467*** (0.023)
Child-specific variables	Yes	Yes
Household head variables	Yes	Yes
Household-level variables	Yes	Yes
Region fixed effect	Yes	Yes
Observations	11,976	12,079
R-squared	0.600	0.217

Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 7 Mediating effect of income and durable asset accumulation

Variables	(1) <i>Mediator: Income per capita</i>	(2) <i>Mediator: Asset accumulation</i>
Panel A: results for mechanism		
Financial inclusion	-0.065*** (0.009)	-0.047*** (0.009)
log(Income per capita)	-0.036*** (0.008)	
Asset accumulation index		-0.046*** (0.004)
Child-specific variables	Yes	Yes
Household head variables	Yes	Yes
Household-level variables	Yes	Yes
Region fixed effect	Yes	Yes
Observations	11,976	12,079
R-squared	0.205	0.213
Panel B: initial results for comparison		
Financial inclusion (Table 1)	-0.069*** (0.009)	-0.069*** (0.009)
Observations	11,976	12,079
R-squared	0.203	0.203
Panel C: Partial F-test		
F-statistic	(1, 11954) = 19.94	(1, 12057) = 165.46
Prob > F	0.0000	0.0000

Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

statistically insignificant when it is included as a covariate in the MCP model. This is the case in column 1 where the inclusion of income per capita in the model reduced the magnitude of the coefficient of financial inclusion compared to our preliminary model (see Colum 1 of Panel B). The potential mediating role of asset accumulation is also confirmed in Column 2, where its inclusion in the MCP model reduced the magnitude of financial inclusion compared to the preliminary model (see Colum 2 of Panel B). These observations imply that per capita income and asset accumulation are potential pathways through which financial inclusion influences MCP. Scrutinising the results, we observe that the reduction in the magnitude of the coefficient of financial inclusion from 0.069 to 0.065 represents a 5.8% reduction in the effect of financial inclusion on MCP which has policy implications. Since financial inclusion increases household per capita income, it implies that the increased income per capita can further boost the MCP reduction process by 5.8% through the income pathway.

The percentage reduction associated with asset accumulation is 31.9% and serves as a potentially stronger mediator compared to income per capita. The reason is that durable asset accumulation provides sustainable avenues for households to invest in non-farm entrepreneurial ventures compared to income per capita which mainly goes into consumption (Aryeetey, 2004; Koomson et al., 2022b).

We apply the partial F-test to provide a reasonable basis to infer that the estimated coefficients from the models with and without the mediators are statistically different (Jamshidian et al., 2007; Mahmoudi et al., 2016). The null hypothesis is that the coefficients in the models with and without the mediators are not statistically different. In doing this practice, the models with mediators are considered the complete/unrestricted models, while the restricted models are the ones without the mediators. Based on the reported F-statistics in Panel C (along with their respective p values), we reject the null hypothesis and infer at 1% alpha level that the coefficients obtained from the models with and without the mediators are statistically different. This notwithstanding, we note that the mediator variables explored in this paper are only identified as potential pathways in the link between financial inclusion and child poverty and are not exhaustive in practice.

6 Conclusion and recommendation

In spite of the combined efforts at the global and local levels to alleviate child poverty over the past two decades, children in low-income countries continue to experience multifaceted and overlapping forms of deprivation. This study complements the literature by examining the link between financial inclusion and MCP in Ghana, a country where the incidence of MCP outpaces adult poverty. Ghana, therefore, provides a fertile ground to add to the literature regarding the potential role of a policy variable such as financial inclusion in alleviating MCP. To augment the literature, data was sourced from the GLSS7 survey to examine the effect of financial inclusion on MCP. Sample selectivity problem inherent in the relationship between financial inclusion and MCP is addressed using various PSM techniques. Gender and locational dimensions in the link between financial inclusion and MCP are also explored. We also undertake a decomposition analyses of the MCP to ascertain which of its three dimensions (living conditions, education and health) is

accentuating the negative relationship between financial inclusion and MCP. We further explore the potential pathways through which financial inclusion influences MCP.

Overall, we find that financial inclusion reduces MCP, and this finding is consistently established when alternative cut-offs are employed in identifying children that are multidimensionally deprived and households that are financially included. Disaggregating the data into gender and locational dimensions, the results show that the reducing effect of financial inclusion on MCP is more pronounced among older children, boys and rural-located children. Decomposing the MCP in its three dimensions, we found that the financial inclusion effect on child deprivation is mainly driven by the living conditions, followed by the deprivations in health and then education dimensions. Furthermore, we identified household income per capita and durable asset accumulations as potential channels through which financial inclusion affects MCP. These findings are a further justification for policies that seek to enhance financial inclusion in Ghana and other developing countries. Specifically, it shows that Ghana's decision to sign the Maya declaration of reducing poverty through financial inclusion is a laudable policy which does not only reduce household poverty but also extends to address MCP by providing the resources needed to cater for the needs of children. Secondly, Ghana's ambitious target of achieving 85% financial inclusion by 2023 is likely to yield developmental benefits in enhancing household and children's welfare.

The effect of financial inclusion on the mediating variables also reveals that policies aimed at enhancing financial inclusion can also have positive implications for achieving the SDGs. First, our finding that financial inclusion smoothens intra-household distribution of resources and asset acquisition can provide the resources required to reduce poverty in its multidimensional forms, threat of hunger, and inequality (SDGs 1, 2 and 10), promote entrepreneurship and employment in general (SDG 8), enhance children's education and women's empowerment through labour market participation (SDGs 4 and 5) and increase access to clean sources of water and energy for lighting and cooking (SDGs 6 and 7). To leave no one behind, as stipulated by the core objective of the SDGs, policymakers are entreated to increase the stock of loanable funds available to rural residents by designing policies that motivate private banks and financial institutions to extend services to rural communities.

A limitation of this study is that our data permitted us to only explore the potential channels of income per capita and asset accumulation despite several possible channels identified in our literature review. Also, we acknowledge that our data from the GLSS 7 may not capture financial inclusion in its entirety given that we have consistent data points on four dimensions of financial inclusion as displayed in Table 9 of the Appendix. Based on these limitations, we task future studies to explore additional potential channels, and engage prospective datasets that build on the current round of the survey for further studies.

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Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

7 Appendices

Tables 8–10

Table 8 MCP indicators

Dimension	Indicator	Deprivation cut-off definition	Age Cohorts
Living conditions (1/3)	Cooking fuel	Child is deprived if household of dwelling is cooking with solid fuels and not cooking outside the house	Under five and 6 to 17 years
	Water	Deprived if household gets drinking water from unclean source (<i>Tanker supply/Vendor provided; unprotected well; unprotected spring; river/stream; dugout/pond/lake/dam/canal; other</i>) OR it takes 30 minutes or more to collect water, round trip	Under five and 6 to 17 years
	Information	Deprived if household of dwelling does not have tv or radio	Under five and 6 to 17 years
	Housing	Deprived if household of dwelling uses inadequate flooring (<i>earth/mud, other</i>) or walls (<i>earth/mud, Palm leaves/Thatch (grass/Raffia), other</i>)	Under five and 6 to 17 years
	Electricity	Deprived if household of dwelling does not have electric power	Under five and 6 to 17 years
	Toilet	Deprived if household of dwelling has no toilet facilities, uses bucket/pan, uses public toilet, other OR toilet is shared outside the house	Under five and 6 to 17 years
Education (1/3)	School attendance	Deprived if child (6–17 years) is not attending school	Age 6 to 17 years
Health (1/3)	Nutrition	Deprived if child is undernourished (underweight or stunted)	Under five and 6 to 17 years
	Health insurance	Deprived if child not covered by the national health insurance scheme	Under five and 6 to 17 years

Table 9 Dimensions, indicators, and weights for multidimensional financial inclusion

Dimension (weight)	Description
Bank account (1/4)	Household has a bank account (bank account includes savings, current, fixed deposit or microfinance account) or mobile money account
Loan/Credit (1/4)	Household has access to loan/credit from bank, microfinance institution or other formal institution
Insurance (1/4)	Household has access to medical, life, property, unemployment/income or family insurance
Financial remittance (1/4)	Household receives financial remittance from the bank, money transfer service provider or through mobile money

Table 10 Summary statistics

Variable	Description	Mean	Std. Dev.	Min	Max
MCP (cut-off = 0.33)	Dummy variable equals 1 if multidimensional child deprivation score exceeds 0.33	0.392	0.488	0	1
MCP (cut-off = 0.5)	Dummy variable equals 1 if multidimensional child deprivation score exceeds 0.5	0.157	0.364	0	1
MCP (cut-off = 0.6)	Dummy variable equals 1 if multidimensional child deprivation score exceeds 0.6	0.108	0.311	0	1
Financial inclusion (cut-off = 0.5)	Dummy variable equals 1 if household financial inclusion score is greater than 0.5	0.331	0.471	0	1
Financial inclusion (cut-off = 0.25)	Dummy variable equals 1 if household financial inclusion score is greater than 0.25	0.714	0.452	0	1
Financial inclusion (cut-off = 0.6)	Dummy variable equals 1 if household financial inclusion score is greater than 0.6	0.096	0.294	0	1
Female child	Dummy variable equals 1 if child is female	0.487	0.5	0	1
Age of child	Age of child	8.572	5.146	0	17
Child work	Dummy variable equals 1 if child is economically employed	0.006	0.08	0	1
Age of household head	Age of the household head	46.62	13.275	15	99
Female head	Binary variable equals 1 if household head is female	0.252	0.434	0	1
Rural household	Binary variable equals 1 if household is located in a rural area	0.671	0.47	0	1
Household size	Number of persons in the household	6.881	3.403	1	27
Educated head	Binary variable equals 1 if household head is educated	0.356	0.479	0	1
Married	Binary variable equals 1 if household is married	0.737	0.44	0	1
Separated/Divorced/Widowed	Binary variable equals 1 if household is Separated/Divorced/Widowed	0.157	0.364	0	1
Price index (non-food)	Continuous variable for non-food price index	0.992	0.055	0.883	1.136
Account ownership	Binary variable equals 1 if household head owns bank or mobile money account	0.507	0.5	0	1
Access to credit	Binary variable equals 1 if household head has access to credit	0.136	0.343	0	1
Insurance ownership	Binary variable equals 1 if household head owns an insurance package	0.231	0.421	0	1
Remittance	Binary variable equals 1 if household head has received or sent financial remittance	0.278	0.448	0	1
Living standard deprivation	Binary variable equals 1 if household experiences deprivation in living standard	0.575	0.494	0	1
Education deprivation	Binary variable equals 1 if child experiences deprivation in education	0.125	0.33	0	1
Health deprivation	Binary variable equals 1 if child experiences deprivation in health	0.324	0.468	0	1
log(income per capita)	Log of household income per capita	1.579	0.776	0	9.119
Asset accumulation index	Durable asset accumulation index generated using PCA on household durable assets owned	-0.327	1.147	-1.463	13.467

MCP multidimensional child poverty, PCA principal component analysis

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