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## Tackling the Last Hurdles of Poverty Entrenchment: An Investigation of Poverty Dynamics for Ghana during 2005/06-2016/17

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# **Tackling the Last Hurdles of Poverty Entrenchment: An Investigation of Poverty Dynamics for Ghana during 2005/06–2016/17**

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## **Abstract**

Ghana has managed to consistently keep its poverty rate lower than the regional average over the past 25 years, but this positive trend slowed down recently. We investigate the dynamics of overall, moderate, and extreme poverty in Ghana during 2005/06–2016/17, addressing the lack of actual panel data by constructing synthetic panel data from repeated cross-sectional data. While we find considerable conditional chronic (extreme) poverty rates hovering around 50–60 percent, there is more upward mobility than downward mobility. Poor households are also more likely to have enjoyed stronger consumption expenditure growth. Our findings suggest that factors such as education attainment, female household headship, urban residence, and non-agricultural work are positively correlated with poverty reduction. Compared to all other correlates, education attainment appears to be most effective in pushing households out of poverty and keeping them from falling into poverty.

**JEL codes:** C15, D31, I31, O10, O57

**Key words:** Poverty, poverty dynamics, pro-poor growth, synthetic panel, household surveys, Ghana, sub-Saharan Africa

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## **I. Introduction**

Ghana, a lower-middle income country, is one of the most successful countries in sub-Saharan Africa in terms of reducing poverty. It has managed to consistently keep its poverty rate lower than the regional average over the past 25 years (figure 1). In fact, the country's poverty rate is even slightly lower than that of other lower-middle income countries as a whole. Our analysis using the latest nationally representative household consumption surveys from Ghana shows that, between 2005/06 and 2012/13, the overall poverty rate fell by one-fourth from 32 percent to 24 percent. Moreover, the extreme poverty rate fell by one-third from 12 percent to 8 percent during this period.

Yet, this trend sharply slowed between 2012/13 and 2016/17, when the country's poverty rates remained almost unchanged. During this period, the overall and extreme poverty rates decreased slightly, by less than one percentage point. This lackluster performance is likely caused by the country's reduced growth rate in national income (as measured by the gross domestic product) after 2013. More importantly, it raises concerns that a considerable proportion of households might have fallen into poverty. It is also likely that a number of households might have been caught in chronic poverty during the whole period.

A challenge that hinders a deeper understanding of these poverty dynamics is the absence of nationally representative household panel surveys that collect consumption data for Ghana during this period. Without these panel survey data, we cannot tell whether the eight percent of the households that remained poor in 2016/17 consist of the same poor households in 2012/13, or they represent households that newly fell into poverty in 2016/17, or any combination of these two extreme cases (for example, whether five percent of the households remained poor and three percent freshly fell into poverty in 2016/17, or no households were chronically poor and all the

poor households in 2016/17 were the new poor). This lack of understanding poses challenges for poverty reduction policies, since policies to address chronic poverty are generally different from those that tackle transient poverty (Barrett, 2005; Ravallion, 2016).

We make multiple new contributions in this study. First, we contribute new evidence to both the general literature on poverty dynamics and to the specific country studies for Ghana, since, to our knowledge, very few studies exist that examine poverty dynamics in a developing country context.<sup>1</sup> We investigate these poverty dynamics for Ghana over the decade from 2005/06 to 2016/17, addressing the absence of panel data with synthetic panels constructed from three nationally representative cross-sectional rounds of the Ghana Living Standards Surveys (GLSSs). To enrich the analysis, we examine two shorter time segments, 2005/06–2012/13 and 2012/13–2016/17, along with the full period of 2005/06–2016/17.

It is useful to investigate the dynamics of extreme poverty in Ghana in particular for three reasons. Firstly, the country’s poverty rates of more than 20 percent appear relatively large and can be further disaggregated for a more refined analysis. Secondly, since extreme poverty represents a more severe form of poverty, it may even be more important to understand the dynamics of extreme poverty for better policy formulation. Thirdly, the country’s relatively low poverty mobility rates could mask dynamics for its “poorest of the poor,” the extreme poor.

Second, we employ a well-defined decomposition framework to guide our analysis and interpretation of unconditional and conditional measures of dynamics (with the latter being our preferred measure), which appears not to have been applied in previous literature. Finally, we offer a rich profile of the dynamics for different population groups, which could bring more granular

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<sup>1</sup> See also Baulch (2011) and Iversen *et al.* (2021) for recent review studies on poverty mobility in developing countries.

inputs for policy formulation. Additionally, we investigate the dynamics of the full consumption expenditure distribution.

We find that (conditional) upward mobility out of poverty was more than three times higher than downward mobility into poverty for all the three periods (namely, the subperiods of 2005/06–2012/13 and 2012/13–2016/17, and the full period of 2005/06–2016/17). Further disaggregating poverty into extreme and moderate poverty, upward mobility could range from about 20 percent more to almost eight times more. Yet, (conditional) chronic poverty and chronic extreme poverty still remained high at around 60 percent and 50 percent, respectively. Mobility also slowed during the 2012/13–2016/17 subperiod, compared to the 2005/06–2012/13 subperiod. We also find that growth was pro-poor for Ghana for all the two subperiods and the full period. Annual consumption expenditure growth rates for the extreme poor and the moderate poor reaches up to 2–3 percent during 2005/06–2012/13 and 0.5–1.2 percent during 2012/13–2016/17 (and 0.5–1 percent for the full period of 2005/06–2016/17).

Factors that were positively associated with higher-than-average probabilities of exiting poverty include female headship, higher education attainment, urban residence, migration, and wage employment and self-employment in non-agricultural sectors. In particular, attaining the highest level of education (i.e., tertiary education) was strongly associated with upward mobility: 70 percent of the moderate poor and 35–40 percent of the extreme poor with tertiary education exited poverty. These factors are also associated with less downward mobility.

Our analysis of poverty and consumption expenditure dynamics contribute to a growing literature on different aspects of poverty for Ghana. We briefly summarize a few recent studies that are most relevant to our study, which mostly analyze static poverty using cross-sectional surveys. In the absence of panel data, Dang and Dabalen (2019) offer the first study that constructs

synthetic panels using cross-sectional data for Ghana for the 1998–2005 period. The authors find much higher upward mobility than downward mobility for the country in this period.<sup>2</sup> Analyzing the Ghana Living Standards Surveys (GLSS's) spanning 1991/92–2012/13, Clementi *et al.* (2018) reveal a persistent trend of increased polarization in Ghana's household consumption expenditure distribution. This polarization is characterized by a concentration of households at both the highest and lowest deciles, indicating a widening income gap and deeper concerns on enduring chronic poverty. Awuni *et al.* (2023) study a panel survey for Ghana during 2009/10–2012/13 and call for more attention on struggling households, which form a considerable proportion of the transient poor with different characteristics from other vulnerable groups.

Other studies focus on dynamics related to vulnerability to food poverty. Analyzing a survey for northern Ghana, Zereyesus *et al.* (2017) find that households currently experiencing food poverty are more likely to experience food poverty in the future compared to households that are currently not experiencing food poverty. Addai *et al.* (2023) obtain a similar finding from analyzing data for smallholder farmers in Ghana. The authors further find that more than one-third of smallholder farmers may escape food poverty soon, as they belong to the category of transitory food poverty, while less than 15 percent of households are not currently experiencing food poverty and are less vulnerable to it. Tsiboe *et al.* (2023) investigate both spatial and intra-annual disparities in food poverty among Ghanaian households by extracting weekly household food

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<sup>2</sup> Several important features set our study apart from Dang and Dabalen (2019). Specifically, we analyze more data (three GLSS rounds) and a more recent and longer period (2005/06–2016/17), whereas Dang and Dabalen (2019) analyze two GLSS rounds during the period 1998–2005. We also offer a more granular country study for Ghana (including country-specific analysis based on national poverty lines), while Dang and Dabalen (2019) provide a regional, comparative analysis for 21 sub-Saharan African countries including Ghana (based on international poverty lines). The topics of analysis also differ: We focus more on poorer population groups, with some discussion for the whole consumption expenditure distribution, while Dang and Dabalen (2019) study poverty dynamics and vulnerability for richer population groups.

consumption expenditure data from GLSSs for 2012/13 and 2016/17. The authors argue that considering both spatial and intra-annual dynamics in poverty assessment offers the lowest risk of inaccuracies in identifying poverty compared to static models.

The remainder of the paper comprises four sections. We discuss the analytical framework in section II, before describing the data in section III. In section IV, we present the empirical estimates for overall poverty dynamics (section IV.1), extreme poverty dynamics (section IV.2), the profiling of the population (section IV.3), and the dynamics of the full consumption expenditure distribution (section IV.4). Section V concludes.

## **II. Analytical Framework**

We apply recent statistical methods developed by Dang *et al.* (2014) and Dang and Lanjouw (2023) to construct synthetic panel data from repeated cross-sections. Recent validations and applications of synthetic panel methods have been performed by various researchers for different country and regional contexts, ranging from Africa to Latin America, the Middle East, and Europe (Ferreira *et al.*, 2012; Cruces *et al.*, 2015; Beegle *et al.*, 2016; UNDP, 2016; OECD, 2018; Salvucci and Tarp, 2021; Ghomi, 2022; AlAzzawi *et al.*, 2023).<sup>3</sup> These methods essentially estimate the change in poverty (or welfare) using two sets of characteristics: one, time-invariant individual characteristics (for example, ethnicity, religion, place of birth, or completed education) and, two, unobserved time-varying factors (for example, unexpected shocks to household consumption). Certain deterministic variables, such as age, can also be included in the first set since given its

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<sup>3</sup> Other alternatives to panel data include collecting retrospective data on household poverty status over the recent past or using a household asset index to measure household wealth transitions (Sahn and Stifel, 2000; Booysen *et al.*, 2008). While these approaches are useful, recent studies point to several unsettled challenges such as accurate recall data can be quite difficult to collect (Beegle *et al.*, 2016) or interpretation issues with asset indices (Harttgen *et al.*, 2013).

value in one survey round, age can be determined by the time interval between the two rounds. Similarly, time-varying household characteristics can also fall under the first set if retrospective questions about the values of such characteristics in the first survey round are asked in the second round. We present a more detailed discussion of these methods in appendix A, and focus here on presenting the decomposition of the different quantities of poverty dynamics.

Let  $y_{ij}$  and  $z_j$  denote household  $i$ 's consumption expenditure (or income) and the poverty line in survey round  $j$ ,  $j= 1$  or  $2$ , respectively. We are interested in knowing such quantities as

$$P(y_{i1} < z_1 \text{ and } y_{i2} > z_2), \quad (1)$$

which represents the percentage of households that are poor in the first survey round (year) but non-poor in the second survey round, or

$$P(y_{i2} > z_2 | y_{i1} < z_1), \quad (2)$$

which represents the percentage of poor households in the first round that exit poverty in the second round.<sup>4</sup> In other words, for the average household, quantity (1) provides the joint (unconditional) probability of household poverty status in both years, and quantity (2) the conditional probability of household poverty status in the second year given their poverty status in the first year. For convenience, we also refer to (1)-type quantities and (2)-type quantities, respectively as the unconditional measure and the conditional measure of poverty mobility.

Next, we present a decomposition of poverty mobility that can be analyzed using synthetic panels. While these decomposition formulae are simple, they can help fix ideas for better clarity. In addition, to our knowledge, they appear not to have been clearly laid out in previous literature.

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<sup>4</sup> Note that quantities (2) and (3) respectively represent the probability that household  $i$  is poor in the first survey round (year) but nonpoor in the second survey round and the probability that the poor household  $i$  (in the first round) exits poverty in the second round. At the population level, these quantities can also be interpreted as percentages of the population groups of interest as discussed above.



The following equality holds for the unconditional probabilities

$$P(y_{i1} < z_1 \text{ and } y_{i2} < z_2) + P(y_{i1} < z_1 \text{ and } y_{i2} > z_2) = P(y_{i1} < z_1), \quad (3)$$

where the first and second terms on the left-hand side, respectively, represent chronic poverty (i.e., the percentage of households that are poor in both years) and upward mobility (i.e., the percentage of households that are poor in the 1<sup>st</sup> year but exit poverty in the 2<sup>nd</sup> year). These two terms together make up the percentage of the population that is poor in the 1<sup>st</sup> year (i.e., the poverty rate in the 1<sup>st</sup> year). Thus, given the same poverty rate in the 1<sup>st</sup> year, equation (3) implies an inverse relationship between chronic poverty (the 1<sup>st</sup> term on the left-hand side) and upward mobility (the 2<sup>nd</sup> term on the left-hand side) since they sum up to the same total.

We can have a similar decomposition for the poverty rate in the 2<sup>nd</sup> period by simply reversing the inequality signs in the 2<sup>nd</sup> term on the left-hand side, which results in

$$P(y_{i1} < z_1 \text{ and } y_{i2} < z_2) + P(y_{i1} > z_1 \text{ and } y_{i2} < z_2) = P(y_{i2} < z_2). \quad (4)$$

The 2<sup>nd</sup> term on the left-hand side now represents downward mobility (i.e., the percentage of households that are non-poor in the 1<sup>st</sup> year but fall into poverty in the 2<sup>nd</sup> year), which together with chronic poverty (the 1<sup>st</sup> term on the left-hand side) sums up to the poverty rate in the 2<sup>nd</sup> period. Similar to equation (3), equation (4) also implies that for the same poverty rate in the 2<sup>nd</sup> year, an inverse relationship exists between chronic poverty and downward mobility.

A key result from equations (3) and (4) is that, while the chronic poverty rate is always less than or equal to the poverty rates (in the 1<sup>st</sup> or 2<sup>nd</sup> years), there can be *no* correlation between the former and the latter. Put differently, analyzing poverty rates using cross-sectional data may not reveal useful information on poverty dynamics that can be obtained with the panel data.

Equations (3) and (4) provide the unconditional versions of poverty mobility, which do not take into account the information offered by a household's poverty status in any given year. This

additional information on household's past poverty status is highly relevant for policy formulation. For example, policy makers are typically interested in understanding what share of the poor exit poverty, and whether these dynamics can be attributed to certain anti-poverty or development policies that they have implemented. Consequently, while we present both the unconditional and conditional measures of poverty dynamics, the conditional measure is our preferred measure for interpretation. Hereafter, if not noted otherwise, we refer to chronic poverty and upward (downward) mobility as conditional quantities.

Dividing all terms in equations (3) and (4) by the right-hand side, we have the conditional versions of these equalities

$$P(y_{i1} < z_1 \text{ and } y_{i2} < z_2 | y_{i1} < z_1) + P(y_{i1} < z_1 \text{ and } y_{i2} > z_2 | y_{i1} < z_1) = 1, \quad (5)$$

$$P(y_{i1} < z_1 \text{ and } y_{i2} < z_2 | y_{i2} < z_2) + P(y_{i1} > z_1 \text{ and } y_{i2} < z_2 | y_{i2} < z_2) = 1. \quad (6)$$

Several remarks are in order. First, similar to the unconditional quantities in equations (3) and (4), since the two terms on the right hand sides of equations (5) and (6) sum to 1, an inverse relationship exists between conditional chronic poverty and conditional upward mobility or conditional downward mobility. Due to the different denominators, the conditional quantities on the left-hand side in equations (5) and (6) can also be quite different from the unconditional quantities in equations (3) and (4).

Second, while the first terms on the left-hand sides of equations (5) and (6) share the same common denominator (i.e., the poor in the 2<sup>nd</sup> period), they have different numerators. Consequently, the conditional chronic poverty rate in the 1<sup>st</sup> period (the first term on the left-hand side in equation (5)) is not the same as the conditional chronic poverty rate in the 2<sup>nd</sup> period (the first term on the left-hand side in equation (6)). This difference, however, does not exist with the

unconditional probabilities in equations (3) and (4). Consequently, when referring to conditional chronic poverty, we need to make clear which period that we discuss it.

Third, the framework above can be straightforwardly extended to allow investigation of extreme poverty dynamics together with poverty dynamics. That is, we can modify equations (1) to (6) to add the dynamics of the additional category of extreme poverty. For example, let  $ez_j$  represent the extreme poverty line in survey round  $j$ ,  $j= 1$  or  $2$ . The decomposition of the unconditional poverty dynamics in equation (3) can be extended to show that for the unconditional extreme poverty dynamics as

$$P(y_{i1} < ez_1 \text{ and } y_{i2} < ez_2) + P(y_{i1} < ez_1 \text{ and } ez_2 < y_{i2} < z_2) + P(y_{i1} < ez_1 \text{ and } y_{i2} > z_2) = P(y_{i1} < ez_1). \quad (7)$$

Similarly, the decomposition of the conditional poverty dynamics in equation (5) can be extended to show that for the conditional extreme poverty dynamics as

$$P(y_{i1} < ez_1 \text{ and } y_{i2} < ez_2 | y_{i1} < ez_1) + P(y_{i1} < ez_1 \text{ and } ez_2 < y_{i2} < z_2 | y_{i1} < ez_1) + P(y_{i1} < ez_1 \text{ and } y_{i2} > z_2 | y_{i1} < ez_1) = 1. \quad (8)$$

The equations can be interpreted in a mostly similar manner as with the equation for poverty dynamics. For example, for equation (7), the first term on the left-hand side represents chronic extreme poverty (i.e., the percentage of households that are extremely poor in both years). The second and third terms on the left-hand side respectively represent upward mobility from extreme poverty into moderate poverty (i.e., the percentage of households that are extremely poor in the 1<sup>st</sup> year but move up into moderate poverty in the 2<sup>nd</sup> year) and out of poverty (i.e., the percentage of households that are extremely poor in the 1<sup>st</sup> year but move out of poverty in the 2<sup>nd</sup> year).

Since upward mobility out of poverty represents a stronger transition than upward mobility from extreme poverty into moderate poverty, the third term tends to be smaller than the second

term in most contexts. But since there are three terms on the the left-hand side now, equation (7) indicates an inverse relationship between chronic extreme poverty and the sum of other two terms for upward mobility (and not necessarily any of these two terms separately). Similarly, as discussed with equations (5) and (6), given the different probability denominators for different periods, the chronic extreme poverty rate can vary for different periods and we should refer to it under the specific period under discussion.

Finally, to study the dynamics of the complete consumption expenditure distribution, a useful method is to employ growth incidence curves (GICs) (Ravallion and Chen, 2003), which traces the growth rates over time for the different percentiles along the full consumption expenditure distribution instead of several poverty categories. Consumption expenditure growth is then naturally considered pro-poor if the poorer part of the consumption expenditure distribution, which can be delineated by the poverty line, grows faster than the richer part. By construction, the anonymous curve (based on cross-sectional data) tends to underestimate growth for the poorer part of the consumption expenditure distribution while overestimating that of the richer part. Consequently, our non-anonymous curve (based on synthetic panels) can provide upper and lower bound estimates for consumption expenditure growth.<sup>5</sup> Thus, these two curves taken together can help bound the true growth for the poorer and the richer parts of the consumption expenditure distribution.

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<sup>5</sup> A simple example can help illustrate this. Given some upward mobility, some households in the poorest consumption expenditure decile in the first year moved to other richer deciles in the second year. Thus the cross-sectional growth (underlying the anonymous curve) for mean consumption expenditure of the poorest decile in the two survey rounds would not capture these upward mobile households and would underestimate consumption expenditure growth for this decile. A similar reasoning results in this cross-sectional growth of the richest overestimating consumption expenditure growth since some households moved down instead. The (synthetic) panel growth (underlying the non-anonymous curve) can capture these households and can provide better estimates for their consumption expenditure growth over time. For example, see Glewwe and Dang (2011) for a related discussion in the context of consumption expenditure growth for Vietnam.

### **III. Data**

We examine three recent rounds of the Ghana Living Standards Surveys (GLSSs) administered in 2005/06 (GLSS 5), 2012/13 (GLSS 6), and 2016/17 (GLSS 7). First administered in 1987/88 and then conducted periodically by the Ghana Statistical Service, the GLSSs provide the official data sources for monitoring poverty for the country. As earlier surveys are not perfectly comparable with the later surveys, we analyze these three survey rounds.

All survey rounds follow the same two-stage stratified sampling design (although the numbers of primary and secondary sampling units can differ across rounds). In the first stage, the GLSSs are stratified by regions and urban/rural areas and enumeration areas are selected based on probability proportional to population size to form primary sampling units. A complete listing of households in the selected primary sampling units is subsequently undertaken, from which a fixed number of households (secondary sampling units) are selected. All survey rounds are representative at the national and region-by-area (urban/rural) levels.

For the 2012/13 and 2016/17 GLSSs, the enumeration areas (along with their respective population and household sizes, used for determining the GLSS sampling weights) are obtained from Ghana's 2010 Population and Housing Census, while the 2005/06 GLSS draws these data from Ghana's 2000 Population and Housing Census. The 2005/06 GLSS was conducted between September 2005 to September 2006 and interviewed 8,687 households from 580 primary sampling units across the country. The 2012/13 GLSS was conducted between October 2012 and October 2013 and successfully interviewed 16,772 households from 1,200 primary sampling units across the country. The 2016/17 GLSS was conducted between October 2016 and October 2017. The survey successfully interviewed 14,009 households from 1,000 primary sampling units across the

country. While the various rounds of the GLSS gathered data through different types of questionnaires, the data used in this study come from the household questionnaire only.

Our poverty estimates are obtained using the country's official poverty lines. Ghana uses two poverty lines: an upper (or overall) poverty line below which an individual is considered unable to meet all their food and non-food needs, and a lower (or extreme) poverty line below which an individual is considered unable even to meet their food needs. For 2013, the overall poverty line is set at 1,314 cedis per adult equivalent per year, and the extreme poverty line is set at 792 cedis per adult equivalent per year.<sup>6</sup> We define the moderate poor as households with consumption expenditure below the overall poverty line and above the extreme poverty line, and the extreme poor as households with consumption expenditure below the extreme poverty line. Consumption expenditure data are spatially and temporally deflated in January 2013 prices and adjusted for differences in need for different ages and economies of scale. The construction of the main explanatory variables used in the analysis is presented in appendix B.

We use a restricted sample that includes only household heads age 25–55 in the first survey round, as the same cohort of individuals has to be followed across time. In addition, restricting the household head's age to a specific range allows keeping the household composition stable over different periods. It is useful to check that the distributions of the time-invariant variables for the two survey rounds are similar across different periods, since the synthetic panel approach that we employ relies on the assumption that both surveys represent the same population. The time-invariant variables that we employ to construct the synthetic panels are the following: age, gender, birthplace, religion, language, education attainment (in levels), parents' educational and

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<sup>6</sup> The exchange rate between Ghana shillings and US dollars is 1.98 in 2013 (World Bank, 2023).

occupational characteristics, and regional characteristics. Table A.1 (in appendix A) reports the summary statistics of the time-invariant characteristics for the three survey rounds. The table shows that household heads tend to be older and the share of female household heads increases over time. Moreover, the population also tends to become more educated over time. Some characteristics associated with higher household welfare (for example, heads with tertiary education or urban residents) show a statistically significant improvement over time. Still, in general, these changes appear rather negligible with most of the differences being not statistically significant.

## **IV. Results**

### **IV.1. Overall Poverty Dynamics**

Our estimation model (model 1) includes time-invariant characteristics of the household head, namely age, gender, the place of birth, religion, language, education attainment, parents' occupational and educational characteristics, and the household's area of residence (which assumes the absence of internal rural-urban migration). Results from the OLS regressions for each period (based on equation 1) are reported in table A.2. Most of the estimated coefficients are highly significant and consistent over time. The adjusted  $R^2$  statistic for these equations ranges from 0.37 to 0.40, indicating a good fit. These  $R^2$  values are higher than those reported in many previous studies using synthetic panels for other developing countries (see table A.3 in appendix A), which might be because of the inclusion of additional highly significant regressors, such as parents' characteristics. Further adding additional regional controls to model 1 does not significantly increase the model's explanatory power, so we use this model for the analysis.

Table 1 reports the estimation results for the unconditional poverty dynamics (based on equation 2) for the two subperiods of 2005/06–2012/13 and 2012/13–2016/17, and the full period of 2005/06–2016/17.<sup>7</sup> There were relatively low levels of transition into and out of poverty during all these periods. Both upward and downward mobility rates hover close to 10 percent, with somewhat more upward mobility. Put differently, immobility was relatively high with immobility rates reaching roughly more than 80 percent (the sum of the cells in the main diagonal of the matrices).

More specifically, panel A of table 1 shows that for the 2005/06–2012/13 subperiod, 14.9 percent of the population remained in poverty (unconditional chronic poverty), 9.7 percent were poor in the first year but exited poverty in the second year (unconditional upward mobility), and 8.7 percent were not poor in the first year but fell into poverty in the second year (unconditional downward mobility). The dynamics remained rather similar for the other periods, although the 2012/13–2016/17 subperiod observed somewhat less upward mobility (8.4 percent), and unconditional upward mobility was also slightly lower than unconditional downward mobility for this subperiod. For the full period of 2005/06–2016/17, the chronic poverty rate was slightly higher, at 16.3 percent.

Further probing into our preferred conditional dynamics measures, panel A in figure 2 shows the estimated conditional poverty mobility rates (equation 3), where each bar in this figure shows the decomposition of poverty status in the second year using colors (blue for poverty and orange for non-poverty). The bars are grouped by poverty status in the first year (the first bar and the second bar show poverty and non-poverty in the first year, respectively). Table A.5 in appendix A

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<sup>7</sup> We employ the second survey round as the base year for the main analysis. Estimation results based on the first survey as the base year (see table A.4 in appendix A) remain qualitatively similar.



reports the full estimation results. The (conditional) mobility rates tell a more positive story where poor households had upward mobility rates that are more than three times the downward mobility rates of non-poor households (i.e., upward mobility was 39.5 percent, 36.8 percent, and 37.6 in 2005/06–2012/13, 2012/13–2016/17, and 2005/06–2016/17, respectively, compared with downward mobility of 11.6 percent, 11.4 percent, and 11 percent for the same periods, respectively). Put differently, seemingly similar unconditional upward mobility rates translate into higher conditional upward mobility rates for these periods. This result is due to the fact that the proportion of the population that was poor in the first year was lower than the proportion that was not poor in the same year, and is consistent with our earlier discussions for equations (5) and (6).

Yet, figure 2 also shows that chronic poverty rates still remain high at around 60 percent for the two subperiods and the full period. Defining the mobility rates using household poverty status in the second survey year produces similar estimates (figure A.1 in appendix A).

#### **IV.2. Extreme Poverty Dynamics**

Table 2 further disaggregates the poor households in table 1 into two groups: those that are extreme poor (i.e., have consumption expenditure levels below the extreme poverty line) and those that are moderate poor (i.e., have consumption expenditure levels higher than the extreme poverty line but lower than the overall poverty line). The estimated unconditional poverty dynamics are broadly consistent with the trends discussed in table 1. In all the three periods, the unconditional immobility rates remain high at roughly 76–77 percent of the population (i.e., summing the proportions of the population in the three cells along the diagonal of the transition matrix). In other words, we see less than 25 percent of the population experiencing mobility in these periods.

Specifically, during the 2005/06–2012/13 subperiod, the unconditional upward mobility rate was 12.6 percent (i.e., the proportion of the population that moved up one or two consumption expenditure categories, which equals the sum of the upper off-diagonal cells) and was slightly higher than the unconditional downward mobility rate of 11.5 percent (i.e., the proportion of the population that moved down one or two consumption expenditure categories, which equals the sum of the lower off-diagonal cells) over the same period (panel A). However, during the 2012/13–2016/17 subperiod, the unconditional upward mobility rate was 10.7 percent, which was slightly lower than the unconditional downward mobility rate of 12 percent (panel B). Consistent with our earlier theoretical discussion in section II, of those that moved, a lower percentage of the population was associated with more than one jump across the consumption expenditure categories. For example, during the 2005/06–2012/13 subperiod, the unconditional downward mobility rate from non-poverty into moderate poverty was 7.0 percent, but the unconditional downward mobility rate from non-poverty into extreme poverty was only 1.8 percent.<sup>8</sup>

Panel C in table 2 shows consumption mobility over the full period of 2005/06–2016/17. The patterns appear quite similar to the two subperiods, where a similar significant degree of immobility exists (unconditional immobility rate of 76 percent) and somewhat higher upward mobility than downward mobility (12.7 percent versus 11.3 percent).

Turning next to our preferred conditional dynamics measure, panel B in figure 2 shows more clearly that mobility decreased during the 2012/13–2016/17 subperiod compared to the 2005/06–2012/13 subperiod, with a growing number of the moderate poor transitioning downwards into the category of extreme poor and an increasing number of the extreme poor who find themselves stuck

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<sup>8</sup> We employ the second survey round as the base year for the main analysis. Estimation results based on the first survey as the base year, reported in table A.6 in appendix A, remain qualitatively similar.

in chronic poverty. (Table A.7 in appendix A reports the full estimation results). Specifically, the chronic extreme poverty rate remained sizable at 47.7 percent during the 2005/06–2012/13 subperiod and 54.1 percent for both the 2012/13–2016/17 subperiod and the full period of 2005/06–2016/17. The upward mobility rate for the extreme poor was 52.3 percent during the 2005/06–2012/13 subperiod, but this rate decreased to 45.9 percent during the 2012/13–2016/17 subperiod. The upward mobility rate for the extreme poor out of poverty also decreased from 21.2 percent to 18.9 percent across the two subperiods.

However, the increased mobility of the moderate poor is mainly explained by the downward mobility of the group falling into extreme poverty, from 18.2 percent in the 2005/06–2012/13 subperiod to 22.4 percent in the 2012/13–2016/17 subperiod. Examining the full period of 2005/06–2016/17 also indicates that only about 20 percent of the extreme poor was able to exit poverty by the end of the period. The situation is better for the moderate poor – less than one-third of the moderately poor (29.7 percent) were chronically poor, and half of the group was able to exit poverty by the end of the period.

Still, there was more upward than downward mobility in the two subperiods and the full period. Compared to downward mobility, upward mobility ranges from about 20 percent more ( $=27.1/22.4$ , when comparing upward mobility from extreme poverty to moderate poverty against downward mobility from moderate poverty to extreme poverty during the 2012/13–2016/17 subperiod) to almost eight times more ( $=21.2/2.4$ , when comparing upward mobility from extreme poverty to non-poverty against downward mobility from non-poverty to extreme poverty during the 2005/06–2012/13 subperiod).

### **IV.3. Profile of Population Groups**

We further examine household heads' characteristics associated with (conditional) upward mobility out of poverty for the both the extreme poor and the moderate poor, and plot the results in figure 3. (Table A.8 in appendix A reports the full estimation results.) These characteristics include gender, education attainment, place of birth, residence area, and occupational sector. Several main findings stand out from this figure. First, consistent with our discussion for the general population, the moderate poor have a far higher chance of moving out of poverty than the extreme poor for all the population groups considered. Second, factors that are positively associated with higher-than-average probabilities of exiting poverty include female headship, higher education attainment, urban residence, migration (to some extent), and wage employment and self-employment in non-agricultural sectors.<sup>9</sup> These factors are also associated with less downward mobility (figures A.6 to A.10 in appendix A). Finally, while these results could vary for specific periods, overall they appear rather consistent for the two subperiods and the full period.

It is useful to make some remarks for specific population groups. While female household heads were only slightly more likely to exit poverty during the 2005/06–2012/13 subperiod than their male counterparts (panel A in figure 3), this difference was more pronounced during the 2012/13–2016/17 subperiod, with female-headed households experiencing a substantially higher transition out of poverty (panel b in figure 3). Migrated households also had stronger upward mobility during the 2012/13–2016/17 subperiod compared to the 2005/06–2012/13 subperiod.

Comparing mobility over different levels of education attainment, the population with the highest level of education attainment (tertiary education) remained significantly more upward

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<sup>9</sup> We further examine other similar factors and plot the results in figures A.2 to A.5 in appendix A. These figures provide supportive evidence that working in non-agricultural occupations or sectors, or having a lower child-dependency ratio, better market access, and electricity are associated with better upward mobility out of poverty. On the other hand, Figure A.5 also shows that hotter temperature and drought are associated with lower upward mobility.

mobile in both subperiods (i.e., approximately 70 percent of the moderate poor and 35–40 percent of the extreme poor exited poverty). In addition, the population with complete lower or upper secondary education showed high levels of upward mobility (i.e., 60–65 percent of moderate poor and 33–37 percent of the extreme poor exited poverty). Households with uneducated heads showed the lowest upward mobility rate compared to other education attainment levels (i.e., only 33–43 percent of the moderate poor and less than 20 percent of the extreme poor exited poverty in both subperiods). Yet, while the disadvantage stemming from the lack of formal education appears to have increased over time, some diminishing returns to education attainment might exist at the upper secondary or post-secondary education levels particularly during the 2012/13–2016/17 subperiod and during the full period of 2005/06–2016/17.

Figure 3 also shows that more households moved out of poverty in urban areas than in rural areas, particularly during the 2012/13–2016/17 subperiod. By the end of 2016/17, around 37 percent of the urban extreme poor and about 65 percent of the urban moderate poor exited poverty (panel C).

Panels D to F in figure 3 illustrate the combined relationship between the occupational sector (agriculture, industry, or services sectors) and employment status (wage employment or self-employment). First, the results show that non-agricultural work was associated with a higher chance of moving out of both extreme and moderate poverty in the 2005/06–2012/13 subperiod (panel D) and in the 2012/13–2016/17 subperiod (panel E). For example, the chance for workers in the services sector to move out of poverty in 2012/13, given that they were moderate poor in 2005/06, would be more than 10 percentage points higher than the self-employed in the agricultural sector. The corresponding figure for the 2012/13–2016/17 subperiod climbed even higher to almost a 20 percentage-point difference between these two types of workers regarding moderate

poverty and about a 15 percentage-point difference regarding extreme poverty. Furthermore, the chances of self-employed agricultural workers exiting extreme and moderate poverty significantly decreased in the 2012/13–2016/17 subperiod compared to the earlier subperiod. Second, there was an interactive effect between the occupational sector and employment status for those in agricultural work during the 2012/13–2016/17 subperiod, with wage-employed workers in agriculture in a better welfare position than self-employed workers in agriculture.

#### **IV.4. Consumption Expenditure Dynamics**

Figure 4 plots two GICs, one for the cross-sectional data (lighter blue) and the other for the synthetic panel data (darker blue). These two GICs are also known respectively as the anonymous curve and the non-anonymous curve due to their different treatments of the longitudinal nature of the data. The non-anonymous curve is constructed based on the upper bound approach in Dang *et al.* (2014) and, thus, provides an upper bound estimate of consumption expenditure mobility.

Both curves are graphed based on the changes in the median consumption expenditure levels of the consumption expenditure deciles. The anonymous curve was rather flat along the consumption expenditure distribution between 2005/06 and 2012/13, indicating that consumption expenditure growth was more equitable, with the poor experiencing almost the same positive consumption expenditure growth as the rich. Since 2012/13, the trend has reversed with the poorest quintile experiencing negative consumption expenditure growth (below zero). During the full period of 2005/06–2016/17, median consumption expenditure among the poorest decile has not significantly changed, while the richest decile experienced modest positive consumption expenditure growth.

However, by construction, the anonymous curve tends to underestimate growth for the poorer part of the consumption expenditure distribution and overestimates that of the richer part (as discussed in section II). Our non-anonymous curve can better indicate the true picture of consumption expenditure growth through its upper bound. The non-anonymous curve shows higher consumption expenditure growth for the lower deciles of the initial consumption expenditure distribution and even negative growth for the richest four deciles, suggesting that growth was pro-poor in the two subperiods and the full period. Moreover, the poor enjoyed slightly more consumption expenditure growth during the 2012/13–2016/17 subperiod than during the 2005/06–2012/13 subperiod.

In particular, annual consumption expenditure growth rates for the extreme poor and the moderate poor could respectively reach up to 2–3 percent during the 2005/06–2012/13 subperiod and 0.5–1.2 percent during the 2012/13–2016/17 subperiod. For the full period of 2005/06–2016/17, the corresponding maximal annual consumption expenditure growth rates for the two groups can be 0.5–1 percent.

## **V. Conclusion**

In this study, we examine the dynamics of overall poverty, extreme poverty, and the whole consumption expenditure distribution in Ghana during the period 2005/06–2016/17. Applying new statistical methods developed by Dang and Lanjouw (2023) and Dang *et al.* (2014), we construct synthetic panel data from the three rounds of GLSS cross-sections. In the absence of true panel household survey data, these synthetic panel data allow us to study these dynamics and profile the population that remained in poverty or moved out of or into poverty.

We uncover findings that might be masked by analysis based on cross-sectional data alone. On the one hand, there was a significant reduction of cross-sectional extreme poverty rates between 2005/06 and 2016/17. Poor households were somewhat more likely to exit poverty than non-poor households falling into poverty, and more likely to have enjoyed stronger consumption expenditure growth. Yet, our findings also point to considerable chronic poverty, with conditional chronic overall poverty and chronic extreme poverty hovering around 60 percent and 50 percent. Furthermore, less than half of the extreme poor moved up one or two consumption expenditure categories during the 2005/06–2016/17 period. A potential concern emerging from the patterns we observe is that further poverty reduction will become increasingly difficult to achieve if policies fail to address the structural factors that constrain upward mobility out of poverty. Factors such as education attainment, having a female household head, urban residence, wage employment, and non-agricultural work strongly correlate with poverty reduction.

On the other hand, households with less education, rural residence, as well as working in agriculture (including the self-employed in agriculture) are markedly more likely to experience downward mobility. Compared to all the other correlates, education attainment appears to be most effective in pushing households out of poverty and keeping them from falling into poverty. These results are broadly consistent with those in review studies on poverty mobility (Baulch, 2011; Iversen *et al.*, 2021).

Our results also strongly resonate with those in recent studies on Ghana. In particular, Zereyesus *et al.* (2017) find non-agricultural work significantly increases future expected food consumption, reducing vulnerability to food poverty in Ghana. While on-farm specialization leads to significant welfare costs and lower income poverty reduction for rural households, income diversification increases poverty reduction (Dagunga *et al.*, 2020; Dzanku, 2020). Furthermore,



Dzanku (2020) finds that education attainment is significantly correlated with continued diversification. Awuni *et al.* (2023) also find that household heads' gender and education and the household's residence area are key determinants of vulnerability to poverty.

Our finding on the important role of urban residence in reducing poverty and upward mobility among the poor is consistent with Janz *et al.*'s (2023) finding for several other sub-Saharan African countries. Yet, Janz *et al.* (2023) also observe that not everyone equally experiences the positive impacts of urbanization in sub-Saharan Africa. As an example, rural households have higher levels of energy poverty than urban households (Crentsil *et al.*, 2019). This could result in worsened poverty trends during times of crises.

Indeed, the poor were particularly vulnerable during the recent coronavirus pandemic, where economic damages to Ghana's GDP significantly surpassed the economic impacts documented in comparable African countries (Aragie *et al.*, 2021), and as many as 3.8 million Ghanaians were estimated to fall into temporary poverty (Amewu *et al.*, 2020). The low-income urban population and workers in informal self-employment were found to be severely affected by the coronavirus pandemic-induced partial lockdown, particularly in terms of earnings, job losses and increased food prices (Aberese-Ako *et al.*, 2022; Schotte *et al.*, 2023). Furthermore, rural households experienced a 22 percentage-point higher increase in poverty compared to urban households (Bukari *et al.*, 2022). Analysis of the welfare distribution from government utility subsidies in Ghana during the pandemic shows a disparity favoring non-poor households, with non-poor urban and rural households experiencing higher welfare gains from subsidies compared to their poor and very poor counterparts, a trend that was more pronounced before the pandemic (Nkrumah *et al.*, 2021). As a solution to these challenges, Cuesta *et al.* (2021) call for a variety of urban social assistance programs for Ghana that include adjustments of cash benefits to align with urban living

costs and inflation, job creation focused on youth and women, ensuring low-income residents' access to basic services, with poverty targeting based on proxy-means tests and other approaches.

This highlights the fact that addressing chronic poverty, especially chronic extreme poverty, might be most effectively achieved via a mix of interventions that lift long-term income prospects. The interventions can also include measures that promote economic growth in sectors where the poor are active, such as agriculture or measures that support increased education attainment.

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**Table 1. Poverty Dynamics, Synthetic Panel Analysis, Unconditional Probabilities (Percentage)**

<b>Panel A: 2005/06–2012/13</b>		2012/13		
		Poor	Non-poor	Total
2005/06	Poor	14.92 (0.39)	9.72 (0.16)	24.64 (0.53)
	Non-poor	8.73 (0.11)	66.63 (0.59)	75.36 (0.53)
	Total	23.65 (0.45)	76.35 (0.45)	100
<b>Panel B: 2012/13–2016/17</b>		2016/17		
		Poor	Non-poor	Total
2012/13	Poor	14.37 (0.36)	8.37 (0.10)	22.74 (0.41)
	Non-poor	8.78 (0.14)	68.48 (0.52)	77.26 (0.41)
	Total	23.16 (0.48)	76.84 (0.48)	100
<b>Panel C: 2005/06–2016/17</b>		2016/17		
		Poor	Non-poor	Total
2005/06	Poor	16.34 (0.48)	9.86 (0.15)	26.20 (0.56)
	Non-poor	8.10 (0.12)	65.70 (0.64)	73.80 (0.56)
	Total	24.44 (0.56)	75.56 (0.56)	100

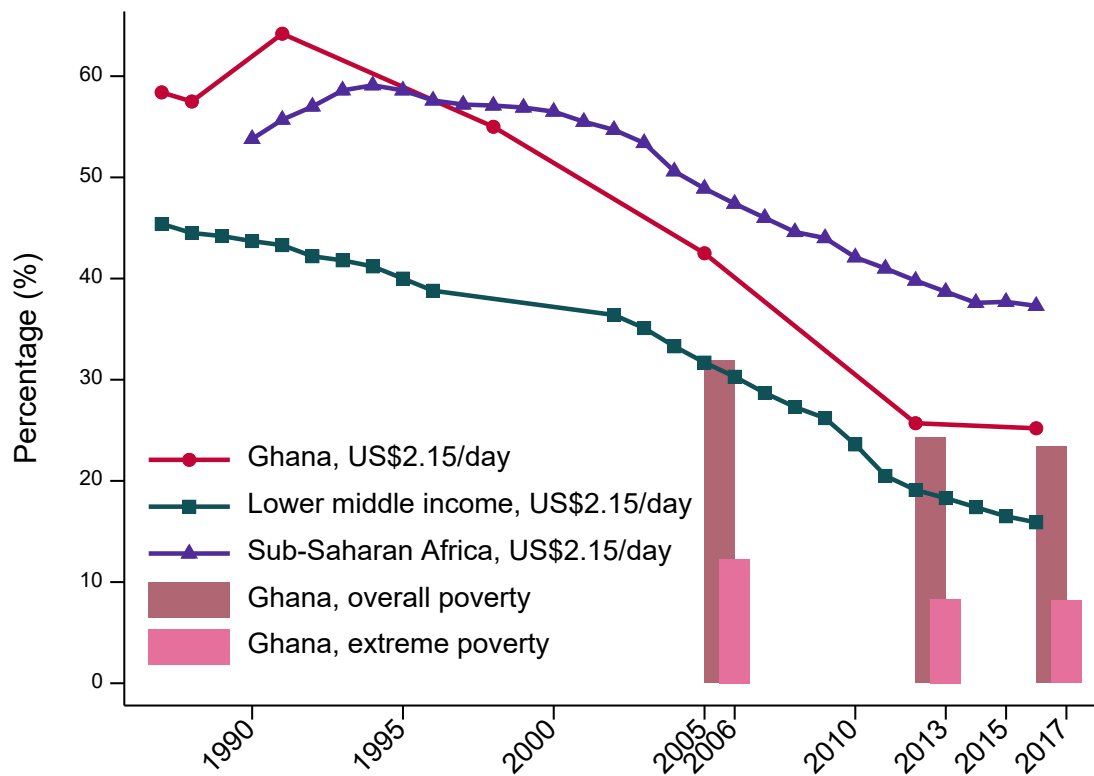
**Note:** Poverty rates (in percent) are based on household consumption expenditure per equivalent adult. Consumption expenditure data are converted to 2013 prices using consumer price index deflators. The poverty line is set at 1,314 cedis per adult equivalent per year in 2013 prices. All numbers are estimated with synthetic panel data, with population weights, and where the second round is used as the base year. Household heads' ages are restricted to 25–55 for the first survey round and adjusted accordingly for the second survey round. Bootstrapped standard errors, based on 1,000 replications, are reported in parentheses.

**Table 2. Extreme and Moderate Poverty Dynamics, Synthetic Panel Analysis, Unconditional Probabilities (Percentage)**

<b>Panel A: 2005/06–2012/13</b>		2012/13			
		Extreme poor	Moderate poor	Non-poor	Total
2005/06	Extreme poor	4.42 (0.17)	2.88 (0.09)	1.97 (0.05)	9.27 (0.30)
	Moderate poor	2.80 (0.07)	4.81 (0.09)	7.75 (0.12)	15.37 (0.26)
	Non-poor	1.78 (0.03)	6.95 (0.08)	66.63 (0.59)	75.36 (0.53)
	Total	9.00 (0.24)	14.65 (0.22)	76.35 (0.45)	100
<b>Panel B: 2012/13–2016/17</b>		2016/17			
		Extreme poor	Moderate poor	Non-poor	Total
2012/13	Extreme poor	4.65 (0.17)	2.33 (0.05)	1.62 (0.03)	8.60 (0.23)
	Moderate poor	3.16 (0.09)	4.23 (0.07)	6.75 (0.08)	14.14 (0.19)
	Non-poor	2.15 (0.06)	6.64 (0.09)	68.48 (0.52)	77.26 (0.41)
	Total	9.96 (0.31)	13.20 (0.19)	76.84 (0.48)	100
<b>Panel C: 2005/06–2016/17</b>		2016/17			
		Extreme poor	Moderate poor	Non-poor	Total
2005/06	Extreme poor	5.59 (0.24)	2.81 (0.08)	1.94 (0.04)	10.34 (0.34)
	Moderate poor	3.24 (0.10)	4.70 (0.09)	7.92 (0.11)	15.86 (0.26)
	Non-poor	1.83 (0.05)	6.26 (0.08)	65.70 (0.64)	73.80 (0.56)
	Total	10.66 (0.36)	13.78 (0.22)	75.56 (0.56)	100

**Note:** Poverty rates (in percent) are based on household consumption expenditure per equivalent adult. Consumption expenditure data are converted to 2013 prices using consumer price index deflators. Overall and extreme poverty lines are set at 1,314 and 792 cedis per adult equivalent per year in 2013 prices, respectively. Extreme poor is the population with per adult equivalent consumption expenditure below the extreme poverty line, and moderate poor is the population with per adult equivalent consumption expenditure between the overall and extreme poverty lines. All numbers are estimated with synthetic panel data, with population weights, and where the second round is used as the base year. Household heads' ages are restricted to 25–55 for the first survey round and adjusted accordingly for the second survey round. Bootstrapped standard errors, based on 1,000 replications, are reported in parentheses.

**Figure 1. Trends in Poverty, Ghana, 1987-2017**

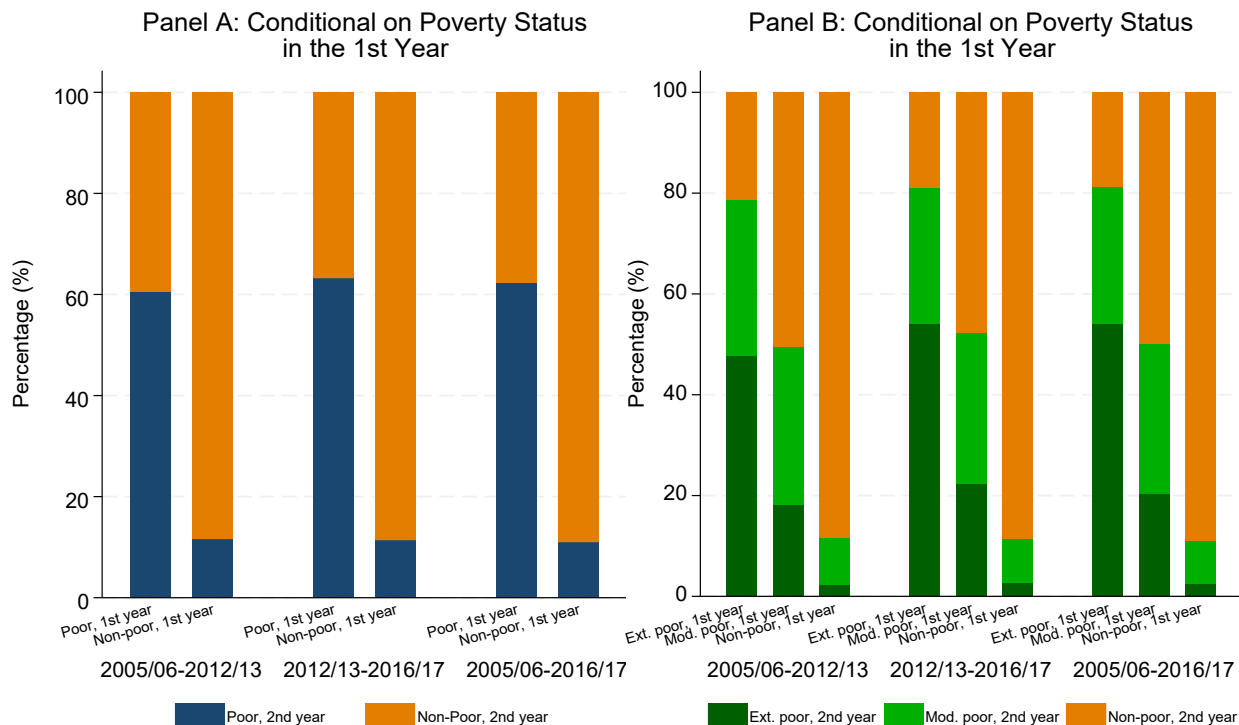


**Note:** The international global poverty line of \$2.15 per person per day reflect the typical national poverty lines of low-income countries in 2017 prices. Purchasing power parity was used to convert values in local currency to equivalent purchasing power measured in U.S dollars. The national overall poverty line of 1,314 cedis and the national extreme poverty line of 792 cedis are expressed in 2013 prices. Consumption expenditure data are expressed in 2013 prices. The Ghana Living Standards Surveys (GLSSs) were administered in 2005/06, 2012/13 and 2016/17.

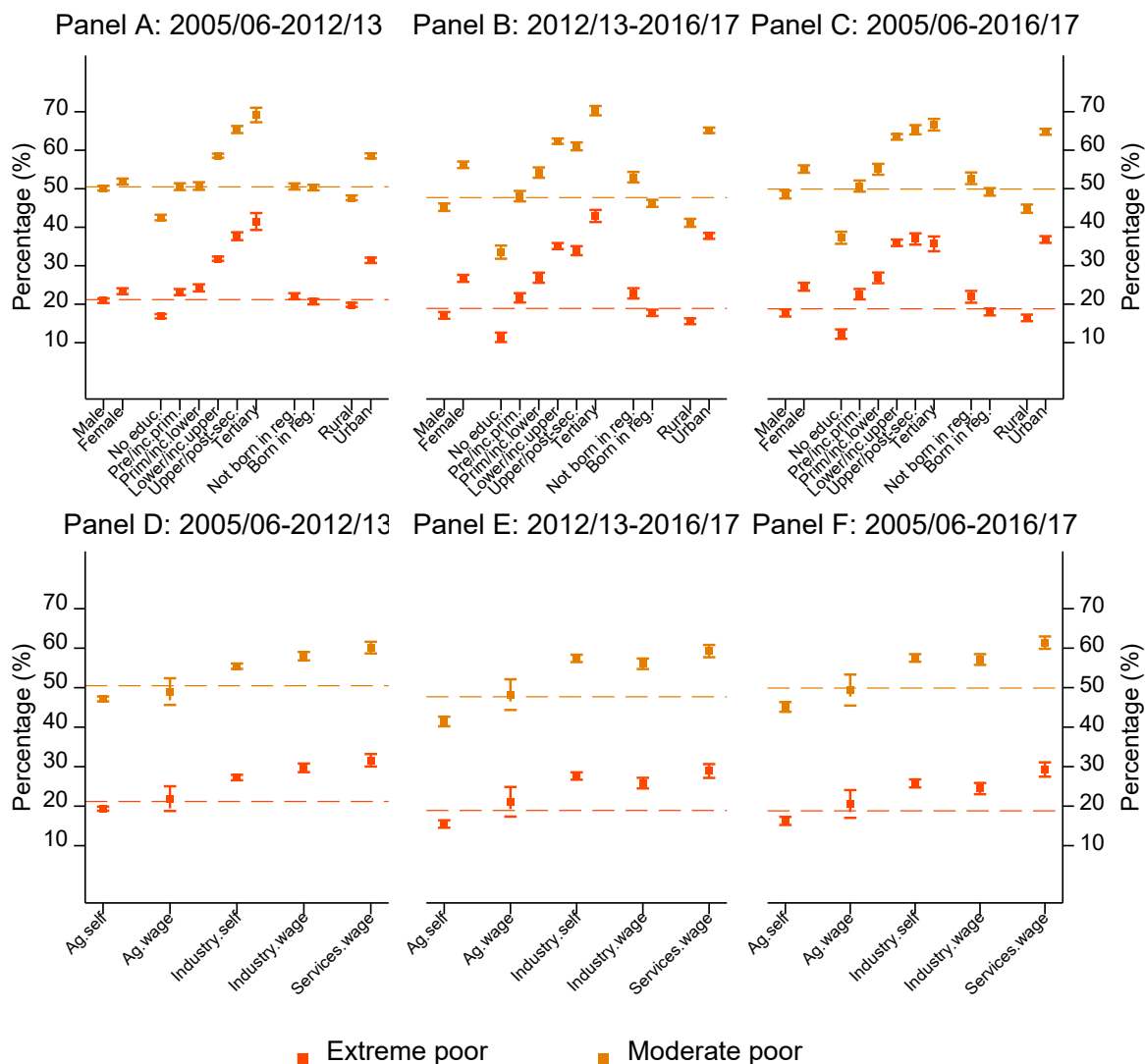
**Source:** World Bank's World Development Indicators (WDI) database; GLSSs 2005/06, 2012/13 and 2016/17.



Figure 2. Poverty Dynamics, Conditional on Poverty Status in the 1<sup>st</sup> Year

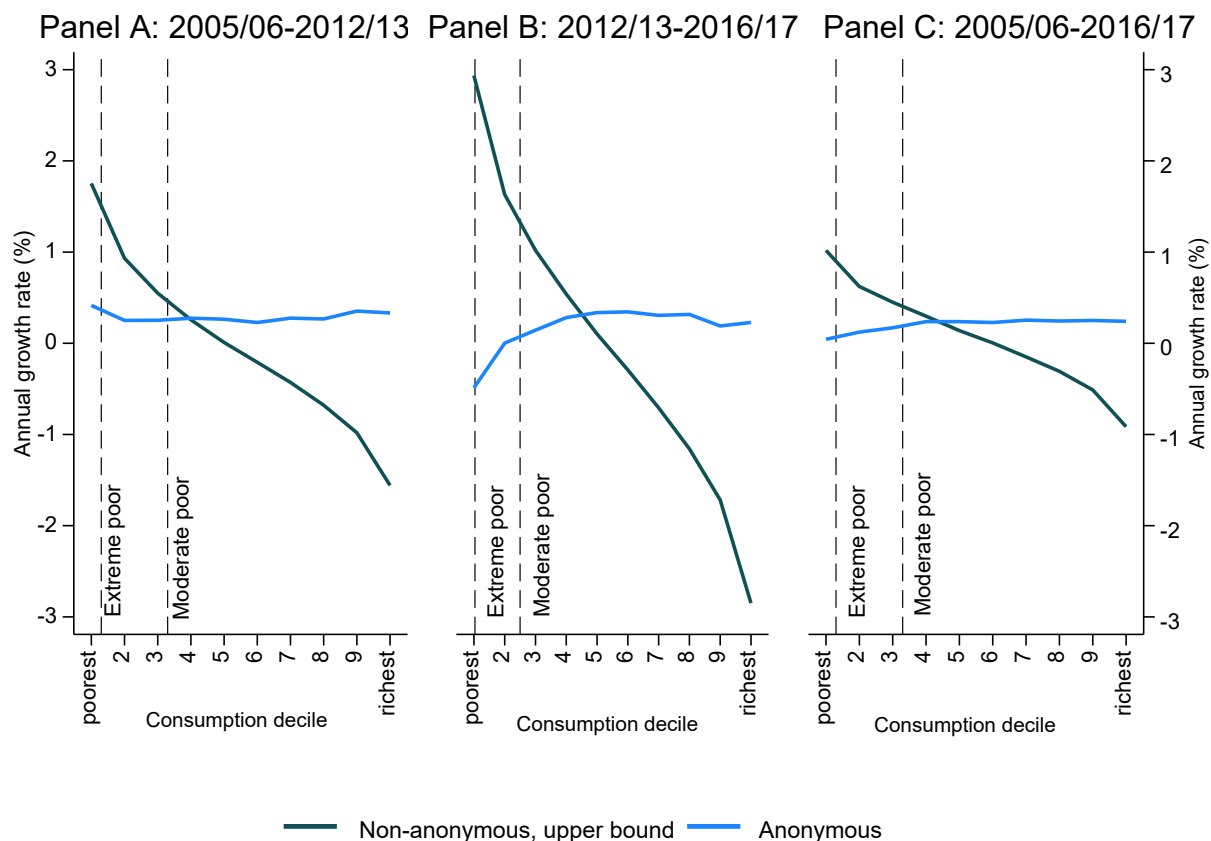


**Figure 3. Profile of the Extreme and Moderate Poor Population that Exited Poverty, Conditional on Being Poor in the 1<sup>st</sup> Year**



**Note:** Dashed lines represent the national average for each period (i.e., 21.2 percent for 2005/06–2012/13, 18.9 percent for 2012/13–2016/17, and 18.8 percent for 2005/06–2016/17 for the extreme poor, and 50.5 percent for 2005/06–2012/13, 47.7 percent for 2012/13–2016/17, and 49.9 percent for 2005/06–2016/17 for the moderate poor). Time-invariant and labor characteristics are measured in the second period.

**Figure 4. Growth Incidence Curves, 2005/06–2016/17**



**Note:** Growth rates (in percent) are based on household consumption expenditure per equivalent adult. Consumption expenditure data are converted to 2013 prices using consumer price index deflators. All numbers are estimated with synthetic panel data and weighted with population weights, where the second round is used as the base year. Number of replications for upper-bound estimates is 500. Household heads' ages are restricted to 25–55 for the first survey round and adjusted accordingly for the second survey round.

## Appendix A. Overview of Synthetic Panel Methods

In this appendix, we provide an overview of the methods to construct synthetic panels, developed by Dang *et al.* (2014) and Dang and Lanjouw (2023). Recent applications and further validation of synthetic panel methods have been implemented for data from various countries in sub-Saharan Africa, as well as in the East Asia and Pacific, Europe and Central Asia, Latin America, South Asia, and Middle East and North Africa regions (see Dang, Jolliffe, and Carletto (2019), Dang (2021), and Dang and Lanjouw (2023) for recent reviews).

Let  $x_{ij}$  be a vector of household characteristics observed in survey round  $j$  ( $j= 1$  or  $2$ ) that are also observed in the other survey round for household  $i$ ,  $i= 1, \dots, N$ . These household characteristics can include such time-invariant variables as ethnicity, religion, language, place of birth, parental education attainment, and other time-varying household characteristics if retrospective questions about the first-round values of such characteristics are asked in the second-round survey. To reduce spurious changes due to changes in household composition over time, we usually restrict the estimation samples to household heads in a certain age range, say ages 25 to 55, in the first cross-section and adjust this age range accordingly in the second cross-section. This restriction also helps ensure certain variables such as heads' education attainment remains relatively stable over time (assuming most heads are finished with their schooling).<sup>10</sup> This age range is usually used in traditional pseudo-panel analysis but can vary depending on cultural and economic factors in each specific setting. Population weights are then employed to provide estimates that represent the whole population.

Then let  $y_{ij}$  represent household consumption or income in survey round  $j$ ,  $j= 1$  or  $2$ . The linear projection of household consumption (or income) on household characteristics for each survey round is given by

$$y_{ij} = \beta_j' x_{ij} + \varepsilon_{ij}. \quad (1.1)$$

Let  $z_j$  be the poverty line in period  $j$ . We are interested in knowing the unconditional measures of poverty mobility such as

$$P(y_{i1} < z_1 \text{ and } y_{i2} > z_2), \quad (1.2)$$

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<sup>10</sup> While household heads may still increase their education attainment in theory, this rarely happens in practice.

which represents the percentage of households that are poor in the first survey round (year) but nonpoor in the second survey round, or the conditional measures such as

$$P(y_{i2} > z_2 | y_{i1} < z_1), \quad (1.3)$$

which represents the percentage of poor households in the first round that escape poverty in the second round.

If true panel data are available, we can straightforwardly estimate quantities (1.2) and (1.3). In the absence of such data, we can use synthetic panels to study mobility. To operationalize the framework, we make two standard assumptions. First, we assume that the underlying population being sampled in the first and second survey rounds are identical such that their time-invariant characteristics remain the same over time. More specifically, combined with equation (1.1), this implies that the conditional distribution of consumption expenditure in a given period is identical whether it is conditional on given household characteristics in period 1 or period 2 (i.e.,  $x_{i1} = x_{i2}$  implies  $y_{i1}|x_{i1}$  and  $y_{i1}|x_{i2}$  have identical distributions). Second, we assume that  $\varepsilon_{i1}$  and  $\varepsilon_{i2}$  have a bivariate normal distribution with a positive correlation coefficient  $\rho$  and standard deviations  $\sigma_{\varepsilon_1}$  and  $\sigma_{\varepsilon_2}$ , respectively. Quantity (1.2) can be estimated by

$$P(y_{i1} < z_1 \text{ and } y_{i2} > z_2) = \Phi_2\left(\frac{z_1 - \beta_1' x_{i2}}{\sigma_{\varepsilon_1}}, -\frac{z_2 - \beta_2' x_{i2}}{\sigma_{\varepsilon_2}}, -\rho\right), \quad (1.4)$$

where  $\Phi_2(\cdot)$  denotes the bivariate normal cumulative distribution function (cdf) (and  $\phi_2(\cdot)$  denotes the bivariate normal probability density function (pdf)). Note that, in equation (1.4), the estimated parameters obtained from data in both survey rounds are applied to data from the second survey round ( $x_2$ ) (or the base year) for prediction, but we can use data from the first survey round as the base year as well. It is then straightforward to estimate quantity (1.3) by dividing quantity (1.2) by  $\Phi\left(\frac{z_1 - \beta_1' x_{i2}}{\sigma_{\varepsilon_1}}\right)$ , where  $\Phi(\cdot)$  denotes the univariate normal cdf.

In equation (1.4), the parameters  $\beta_j$  and  $\sigma_{\varepsilon_j}$  are estimated from equation (1.1), and  $\rho$  can be estimated using an approximation of the correlation of the cohort-aggregated household consumption between the two surveys ( $\rho_{y_{c1}y_{c2}}$ ). In particular, given an approximation of  $\rho_{y_{c1}y_{c2}}$ , where  $c$  indexes the cohorts constructed from the household survey data, the partial correlation coefficient  $\rho$  can be estimated by

$$\rho = \frac{\rho_{y_{i1}y_{i2}} \sqrt{\text{var}(y_{i1})\text{var}(y_{i2})} - \beta_1' \text{var}(x_i) \beta_2}{\sigma_{\varepsilon_1} \sigma_{\varepsilon_2}} \quad (1.5)$$

Dang and Lanjouw (2023) provide more discussion and alternative options to estimate  $\rho$ .

Equation (1.4) can be extended to incorporate the dynamics of extreme poverty. For example, we can estimate the unconditional upward mobility rate out of extreme poverty into poverty (i.e., the percentage of extreme poor households in the first period that exit extreme poverty but still remain poor in the second period) as

$$P(y_{i1} < ez_1 \text{ and } ez_2 < y_{i2} < z_2) = \Phi_2\left(\frac{ez_1 - \beta_1'x_{i2}}{\sigma_{\varepsilon_1}}, \frac{z_2 - \beta_2'x_{i2}}{\sigma_{\varepsilon_2}}, \rho\right) - \Phi_2\left(\frac{ez_1 - \beta_1'x_{i2}}{\sigma_{\varepsilon_1}}, \frac{ez_2 - \beta_2'x_{i2}}{\sigma_{\varepsilon_2}}, \rho\right), \quad (1.6)$$

where  $ez_1$  and  $ez_2$  denote the extreme poverty lines in period 1 and period 2, respectively. More detailed derivations are provided in the studies provided below in the Additional References.

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**Table A.1. Summary Statistics**

Characteristics of household head	Period		Difference (2)–(1)	Period		Difference (5)–(4)
	2005/06 (1)	2012/13 (2)		2012/13 (4)	2016/17 (5)	
Age (in years)	41.07 (0.14)	45.22 (0.12)	4.15*** (0.19)	40.93 (0.10)	43.39 (0.12)	2.47*** (0.16)
Female	21.37 (0.77)	23.93 (0.62)	2.56*** (1.06)	23.00 (0.61)	26.36 (0.63)	3.35*** (0.93)
<i>Birthplace (region/country)</i>						
Western	7.92 (0.69)	7.34 (0.56)	–0.58 (1.32)	7.57 (0.56)	8.19 (0.70)	0.62 (1.22)
Central	10.72 (0.65)	11.47 (0.61)	0.75 (1.44)	11.00 (0.59)	9.97 (0.51)	–1.04 (1.15)
Greater	8.12 (0.62)	8.32 (0.61)	0.20 (1.20)	8.66 (0.63)	8.95 (0.59)	0.29 (1.17)
Eastern	10.15 (0.56)	11.39 (0.55)	1.23 (1.28)	11.10 (0.57)	10.34 (0.66)	–0.76 (1.24)
Volta	13.73 (0.73)	12.65 (0.57)	–1.08 (1.58)	12.41 (0.56)	12.39 (0.64)	–0.01 (1.29)
Ashanti	16.66 (0.72)	18.88 (0.91)	2.22 (1.90)	18.85 (0.88)	19.58 (1.08)	0.73 (2.09)
Brong-Ahafo	7.58 (0.53)	8.20 (0.57)	0.62 (1.23)	8.15 (0.55)	8.54 (0.60)	0.39 (1.18)
Northern	13.41 (1.00)	12.06 (0.69)	–1.35 (1.98)	12.46 (0.69)	11.74 (0.64)	–0.71 (1.49)
Upper West	6.09 (0.53)	4.89 (0.31)	–1.19 (0.93)	5.05 (0.36)	4.91 (0.34)	–0.15 (0.69)
Upper East	4.53 (0.38)	3.88 (0.29)	–0.65 (0.73)	3.91 (0.30)	3.87 (0.29)	–0.04 (0.55)
Other country	1.09 (0.18)	0.92 (0.15)	–0.17 (0.23)	0.85 (0.11)	1.52 (0.17)	0.67*** (0.20)
<i>Religion</i>						
Muslim	17.54 (1.19)	18.19 (0.92)	0.65 (1.76)	18.51 (0.92)	18.79 (1.05)	0.28 (1.58)
Catholic	13.15 (0.74)	12.03 (0.59)	–1.13 (0.98)	11.36 (0.57)	10.21 (0.52)	–1.15 (0.80)
Protestant	34.82 (1.12)	47.65 (0.88)	12.83*** (1.69)	48.05 (0.90)	47.58 (1.11)	–0.47 (1.61)
Other Christian	15.83 (0.81)	10.92 (0.58)	–4.91*** (1.04)	11.14 (0.59)	12.58 (0.66)	1.44 (0.92)
Animist/Traditional	11.32 (1.02)	4.57 (0.42)	–6.75*** (1.21)	4.26 (0.40)	4.46 (0.42)	0.20 (0.65)
Other	7.33 (0.52)	6.64 (0.52)	–0.69 (0.75)	6.68 (0.44)	6.39 (0.46)	–0.30 (0.65)
<i>Language</i>						
English	6.77 (0.64)	10.06 (0.80)	3.28*** (1.09)	10.32 (0.80)	9.40 (0.58)	–0.92 (1.08)
Akan	66.91 (1.33)	73.05 (1.04)	6.14*** (2.34)	72.95 (1.05)	74.52 (0.98)	1.58 (1.90)
Ewe	5.57 (0.59)	5.38 (0.50)	–0.18 (1.09)	5.24 (0.51)	5.46 (0.53)	0.22 (0.98)
Ga-adagbe	4.51 (0.61)	3.00 (0.46)	–1.50* (0.88)	2.87 (0.44)	2.33 (0.37)	–0.54 (0.62)
Dagbani	6.82 (0.92)	4.51 (0.56)	–2.32 (1.41)	4.63 (0.57)	2.81 (0.54)	–1.82** (0.92)
Other	9.42 (0.89)	4.01 (0.44)	–5.42*** (1.22)	3.99 (0.48)	5.47 (0.54)	1.48* (0.84)
<i>Education attainment</i>						
No formal education	29.13 (1.09)	24.12 (0.80)	–5.01*** (1.82)	22.47 (0.79)	21.53 (0.78)	–0.93 (1.40)
Preschool or incomplete primary	10.18 (0.52)	9.45 (0.44)	–0.73 (0.70)	9.39 (0.44)	13.14 (0.52)	3.74*** (0.70)
Completed primary or incomplete lower secondary	11.48 (0.54)	10.64 (0.42)	–0.85 (0.72)	11.19 (0.42)	11.10 (0.54)	–0.08 (0.70)
Completed lower secondary or incomplete upper secondary	34.60 (1.00)	38.26 (0.84)	3.66** (1.51)	37.88 (0.81)	34.82 (0.87)	–3.06** (1.31)
Completed upper sec. or vocational or post-sec. tech. education	10.70 (0.57)	11.89 (0.50)	1.18 (0.85)	13.46 (0.52)	12.03 (0.58)	–1.44* (0.84)



Tertiary	3.91 (0.41)	5.65 (0.42)	1.74*** (0.62)	5.61 (0.41)	7.38 (0.45)	1.77*** (0.65)
<i>Parents' characteristics</i>						
Father has not formal education	69.57 (0.90)	66.77 (0.94)	-2.79* (1.59)	62.41 (0.99)	59.48 (1.03)	-2.93* (1.65)
Father has formal education	30.43 (0.90)	33.23 (0.94)	2.79* (1.59)	37.59 (0.99)	40.52 (1.03)	2.93* (1.65)
Mother has not formal education	85.37 (0.69)	81.40 (0.74)	-3.97*** (1.14)	77.69 (0.80)	75.89 (0.87)	-1.80 (1.30)
Mother has formal education	14.63 (0.69)	18.60 (0.74)	3.97*** (1.14)	22.31 (0.80)	24.11 (0.87)	1.80 (1.30)
Father is not farmer	30.61 (0.93)	34.60 (0.90)	4.00** (1.61)	36.82 (0.92)	36.80 (0.86)	-0.02 (1.50)
Father is farmer	69.39 (0.93)	65.40 (0.90)	-4.00** (1.61)	63.18 (0.92)	63.20 (0.86)	0.02 (1.50)
Mother is not farmer	36.17 (1.17)	40.53 (0.98)	4.35** (1.91)	42.66 (0.94)	46.22 (1.01)	3.56** (1.73)
Mother is farmer	63.83 (1.17)	59.47 (0.98)	-4.35** (1.91)	57.34 (0.94)	53.78 (1.01)	-3.56** (1.73)
<i>Type of locality</i>						
Rural	61.36 (1.05)	48.31 (1.20)	-13.05*** (3.01)	48.14 (1.21)	47.89 (1.21)	-0.26 (2.87)
Urban	38.64 (1.05)	51.69 (1.20)	13.05*** (3.01)	51.86 (1.21)	52.11 (1.21)	0.26 (2.87)
<i>Region</i>						
Western	10.46 (0.69)	9.30 (0.68)	-1.16 (1.83)	9.48 (0.69)	10.75 (0.90)	1.27 (1.74)
Central	8.43 (0.49)	9.11 (0.67)	0.68 (1.67)	8.79 (0.59)	8.46 (0.49)	-0.33 (1.39)
Greater Accra	14.76 (0.94)	17.39 (1.29)	2.63 (2.53)	17.92 (1.36)	17.11 (1.00)	-0.81 (2.59)
Eastern	6.91 (0.45)	8.33 (0.47)	1.41 (1.39)	8.25 (0.51)	8.11 (0.61)	-0.14 (1.36)
Volta	13.26 (0.77)	9.99 (0.51)	-3.27 (1.99)	9.80 (0.52)	10.24 (0.63)	0.44 (1.52)
Ashanti	17.32 (0.65)	20.22 (1.06)	2.89 (2.45)	20.19 (1.01)	19.93 (1.18)	-0.26 (2.64)
Brong Ahafo	8.95 (0.52)	9.73 (0.55)	0.78 (1.65)	9.50 (0.55)	9.14 (0.60)	-0.35 (1.48)
Nothern	12.31 (0.84)	9.57 (0.56)	-2.74 (2.04)	9.65 (0.57)	9.76 (0.54)	0.11 (1.50)
Upper East	4.45 (0.42)	3.56 (0.26)	-0.89 (0.92)	3.74 (0.33)	3.86 (0.31)	0.12 (0.71)
Upper West	3.14 (0.22)	2.80 (0.20)	-0.34 (0.68)	2.68 (0.21)	2.63 (0.16)	-0.05 (0.48)
<i>Ecological zone</i>						
Coastal	28.70 (1.52)	26.74 (1.42)	-1.96 (2.84)	27.36 (1.47)	29.86 (1.27)	2.51 (2.73)
Forest	43.12 (1.76)	48.71 (1.46)	5.59* (3.06)	48.01 (1.46)	47.47 (1.51)	-0.54 (2.89)
Savannah	28.18 (1.40)	24.55 (1.06)	-3.63 (2.62)	24.63 (1.08)	22.67 (1.08)	-1.97 (2.17)

**Note:** Classification of regions is per Ghana's 2010 Population and Housing Census. All estimates are obtained from cross-sectional data for each year, using population weights. In columns (1), (2), (4), and (5), standard deviations are reported in parentheses; in columns (3) and (6), standard errors are reported in parentheses. Household heads' ages are restricted to 25–55 in the first survey round and adjusted accordingly in the second round.

**Table A.2. Household Consumption Models**

Period:	2005/06–2012/13				2012/13–2016/17			
<i>Dependent var:</i> Log of per adult equivalent consumption expenditure	2005/06		2012/13		2012/13		2016/17	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age (in years)	−0.010*** (0.001)	−0.010*** (0.001)	0.000 (0.001)	0.000 (0.001)	−0.007*** (0.001)	−0.007*** (0.001)	−0.001 (0.001)	−0.001 (0.001)
Female	0.173*** (0.022)	0.174*** (0.021)	0.104*** (0.019)	0.108*** (0.019)	0.094*** (0.018)	0.100*** (0.018)	0.134*** (0.019)	0.136*** (0.018)
<i>Birthplace (reference region: Ashanti)</i>								
Western	−0.001 (0.050)	−0.131** (0.060)	−0.071* (0.041)	−0.117** (0.051)	−0.077* (0.041)	−0.108** (0.049)	−0.068 (0.053)	−0.015 (0.051)
Central	0.044 (0.043)	−0.083* (0.044)	−0.095** (0.040)	−0.093** (0.045)	−0.107*** (0.041)	−0.071* (0.043)	−0.070 (0.044)	−0.135*** (0.044)
Greater Accra	−0.034 (0.051)	−0.016 (0.051)	0.040 (0.045)	0.032 (0.047)	0.014 (0.042)	0.018 (0.043)	0.182*** (0.044)	0.049 (0.044)
Eastern	−0.079 (0.050)	−0.064 (0.051)	−0.130*** (0.047)	−0.070 (0.044)	−0.138*** (0.045)	−0.079* (0.042)	−0.102** (0.049)	−0.051 (0.046)
Volta	0.067* (0.039)	0.063 (0.042)	−0.100*** (0.038)	−0.030 (0.044)	−0.131*** (0.038)	−0.052 (0.042)	0.010 (0.042)	0.010 (0.040)
Brong-Ahafo	−0.062 (0.046)	−0.069 (0.046)	−0.109** (0.043)	−0.026 (0.046)	−0.123*** (0.042)	−0.047 (0.043)	−0.099** (0.050)	0.030 (0.051)
Northern	−0.134** (0.068)	−0.167** (0.067)	−0.409*** (0.054)	−0.070 (0.052)	−0.358*** (0.054)	−0.062 (0.049)	−0.320*** (0.059)	−0.172*** (0.060)
U/West	−0.309*** (0.071)	−0.130** (0.056)	−0.282*** (0.054)	−0.140** (0.058)	−0.289*** (0.053)	−0.115** (0.052)	−0.409*** (0.058)	−0.104* (0.058)
U/East	−0.558*** (0.078)	−0.268*** (0.073)	−0.586*** (0.058)	−0.159*** (0.061)	−0.541*** (0.057)	−0.187*** (0.055)	−0.599*** (0.063)	−0.220*** (0.064)
Other country	−0.111 (0.097)	−0.077 (0.079)	−0.170 (0.109)	−0.077 (0.091)	−0.117 (0.086)	−0.054 (0.081)	−0.218*** (0.068)	−0.167*** (0.063)
<i>Religion (reference religion: Protestant)</i>								
Muslim	0.040 (0.038)	0.060 (0.037)	0.063* (0.034)	0.106*** (0.033)	0.041 (0.033)	0.080** (0.032)	0.076** (0.032)	0.130*** (0.032)
Catholic	−0.009 (0.030)	−0.009 (0.029)	−0.005 (0.029)	0.025 (0.028)	−0.024 (0.028)	0.008 (0.027)	−0.046 (0.030)	0.001 (0.029)
Other Christian	−0.075*** (0.028)	−0.088*** (0.027)	−0.078*** (0.028)	−0.078*** (0.028)	−0.096*** (0.027)	−0.096*** (0.027)	−0.052* (0.028)	−0.054** (0.027)
Animist/Traditional	−0.100** (0.046)	−0.062 (0.044)	−0.039 (0.041)	0.003 (0.041)	−0.043 (0.045)	0.002 (0.045)	−0.241*** (0.060)	−0.165*** (0.059)
Other	−0.102*** (0.037)	−0.119*** (0.035)	−0.019 (0.034)	−0.020 (0.034)	−0.048 (0.033)	−0.044 (0.032)	−0.107*** (0.037)	−0.094*** (0.036)
<i>Language (reference group: Akan)</i>								
English	0.066 (0.042)	0.156*** (0.044)	0.146*** (0.034)	0.224*** (0.036)	0.173*** (0.032)	0.249*** (0.033)	0.009 (0.033)	0.101*** (0.036)
Ewe	−0.003 (0.062)	0.049 (0.070)	−0.078 (0.055)	−0.048 (0.083)	−0.084 (0.052)	−0.068 (0.075)	−0.201*** (0.056)	−0.120* (0.070)
Ga-adagbe	−0.183**	−0.112	0.029	0.010	0.054	0.036	0.130**	0.041

Dagbani	(0.081) -0.240**	(0.084) -0.134	(0.079) 0.083	(0.080) 0.285***	(0.069) 0.047	(0.069) 0.234***	(0.061) -0.413***	(0.061) -0.324***
Other	(0.097) -0.414***	(0.112) -0.177**	(0.068) -0.197***	(0.075) -0.062	(0.065) -0.183***	(0.074) -0.052	(0.086) -0.313***	(0.097) -0.185***
	(0.068)	(0.076)	(0.054)	(0.057)	(0.056)	(0.059)	(0.059)	(0.065)
<i>Education attainment (reference level: no formal education)</i>								
Pre-school/primary not completed	0.105*** (0.031)	0.096*** (0.030)	0.134*** (0.028)	0.127*** (0.027)	0.124*** (0.028)	0.117*** (0.027)	0.154*** (0.030)	0.143*** (0.029)
Completed primary or incomplete lower secondary	0.148*** (0.034)	0.141*** (0.033)	0.162*** (0.028)	0.142*** (0.028)	0.161*** (0.028)	0.145*** (0.028)	0.207*** (0.034)	0.178*** (0.033)
Completed lower secondary or incomplete upper secondary	0.220*** (0.030)	0.222*** (0.029)	0.281*** (0.026)	0.258*** (0.025)	0.264*** (0.025)	0.242*** (0.024)	0.338*** (0.030)	0.305*** (0.028)
Completed upper secondary/vocational or post-secondary technical	0.420*** (0.037)	0.425*** (0.037)	0.499*** (0.034)	0.478*** (0.033)	0.502*** (0.031)	0.488*** (0.030)	0.501*** (0.035)	0.473*** (0.034)
University and higher	0.853*** (0.056)	0.858*** (0.058)	0.807*** (0.045)	0.776*** (0.043)	0.766*** (0.039)	0.745*** (0.038)	0.865*** (0.043)	0.826*** (0.042)
<i>Parents' characteristics</i>								
Father has formal education	0.078*** (0.023)	0.074*** (0.022)	0.103*** (0.022)	0.087*** (0.022)	0.099*** (0.020)	0.080*** (0.020)	0.060** (0.024)	0.039* (0.024)
Mother has formal education	0.078*** (0.025)	0.077*** (0.025)	0.072*** (0.024)	0.066*** (0.024)	0.079*** (0.021)	0.075*** (0.021)	0.058** (0.023)	0.048** (0.023)
Father is farmer	-0.037* (0.022)	-0.036 (0.022)	-0.075*** (0.020)	-0.080*** (0.020)	-0.084*** (0.018)	-0.091*** (0.018)	-0.056** (0.022)	-0.063*** (0.022)
Mother is farmer	-0.074*** (0.023)	-0.080*** (0.022)	-0.080*** (0.020)	-0.067*** (0.019)	-0.090*** (0.019)	-0.080*** (0.018)	-0.087*** (0.023)	-0.086*** (0.023)
<i>Type of locality (reference type: urban)</i>								
Rural	-0.375*** (0.033)	-0.375*** (0.035)	-0.301*** (0.028)	-0.266*** (0.029)	-0.323*** (0.027)	-0.289*** (0.028)	-0.387*** (0.030)	-0.333*** (0.030)
<i>Region (reference region: Greater Accra)</i>								
Western		0.245*** (0.086)		0.070 (0.065)		0.050 (0.067)		-0.365*** (0.068)
Central		0.294*** (0.072)		0.002 (0.060)		-0.049 (0.058)		-0.183*** (0.056)
Eastern		0.025 (0.085)		-0.098 (0.092)		-0.088 (0.086)		-0.429*** (0.083)
Volta		0.123 (0.077)		-0.065 (0.071)		-0.098 (0.072)		-0.358*** (0.074)
Ashanti		0.140* (0.080)		0.075 (0.071)		0.056 (0.068)		-0.275*** (0.077)
Brong Ahafo		0.116 (0.083)		-0.023 (0.084)		-0.026 (0.082)		-0.376*** (0.082)
Nothern		0.010 (0.129)		-0.465*** (0.105)		-0.415*** (0.103)		-0.410*** (0.119)
Upper East		-0.345*** (0.123)		-0.159 (0.118)		-0.205* (0.110)		-0.580*** (0.114)

Upper West		-0.516*** (0.145)		-0.492*** (0.115)		-0.425*** (0.110)		-0.686*** (0.117)
<i>Ecological zone (reference zone: forest)</i>								
Coastal		0.046 (0.048)		0.082* (0.045)		0.044 (0.045)		-0.060 (0.051)
Savannah		0.018 (0.050)		-0.085 (0.069)		-0.096 (0.066)		-0.224*** (0.068)
Constant	8.221*** (0.069)	8.099*** (0.096)	7.825*** (0.058)	7.791*** (0.082)	8.188*** (0.055)	8.175*** (0.077)	7.940*** (0.071)	8.262*** (0.091)
Adjusted $R^2$ statistic	0.470	0.485	0.366	0.387	0.392	0.409	0.467	0.488
$N$	5,659	5,659	9,524	9,524	10,341	10,341	8,403	8,403

**Note:** Classification of regions is per Ghana's 2010 Population and Housing Census. Household heads' ages are restricted to 25–55 in the first survey round and adjusted accordingly in the second round. All estimates are obtained using cross-sectional (representative) data for each round. The variance inflation factor does not exceed the value of 3 in Model 1. Standard errors, clustered at the primary sampling unit level, are reported in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , and \*  $p < 0.1$ .

**Table A.3. Estimated  $R^2$  Statistics from Previous Studies**

No.	Country	Study source	Survey year	R-squared statistic
1	Bosnia- Herzegovina	Dang and Lanjouw (2023)	2001	0.08
			2004	0.08
2	Chile	Cruces <i>et al.</i> (2015)	1996	0.21–0.43
3	Colombia	Balcazar <i>et al.</i> (2018)	2008	0.18
			2010	0.21
			2012	0.2
			2014	0.19
			2016	0.16
4	Cote d'Ivoire	Dang and Dabalen (2019)	2002	0.2
			2008	0.18
5	Egypt	Dang and Ianchovichina (2018)	2004	0.3
			2009	0.28
6	Egypt	AlAzzawi <i>et al.</i> (2023)	2012	0.23
			2015	0.24–0.25
			2017	0.16–0.17
			2020	0.21
7	Ethiopia	Mekasha and Tarp (2021)	2011	0.27
			2016	0.27
8	Jordan	Dang and Ianchovichina (2018)	2006	0.16
			2008	0.21
9	Jordan	AlAzzawi <i>et al.</i> (2023)	2010	0.16
			2013	0.18
10	India	Dang and Lanjouw (2020)	1987/88	0.24
			1993/94	0.24–0.27
			2004/05	0.31–0.25
			2011/12	0.22
11	Indonesia	Dang <i>et al.</i> (2014)	2000	0.24–0.40
12	Iraq	AlAzzawi <i>et al.</i> (2023)	2007	0.08
			2012	0.13
13	Lao PDR	Dang and Lanjouw (2023)	2002/03	0.16
			2007/08	0.22
14	Malawi	Dang and Dabalen (2019)	2004	0.28
			2010	0.35
15	Mauritania	AlAzzawi <i>et al.</i> (2023)	2004	0.18
			2008	0.32
			2014	0.16–0.18
			2019	0.18
16	Mozambique	Dang and Dabalen (2019)	2002	0.29
			2008	0.24
17	Mozambique	Salvucci and Tarp (2021)	1996/97	0.16
			2002/03	0.19
			2008/09	0.13
			2014/15	0.25
18	Myanmar	Ferreira <i>et al.</i> (2021)	2015	0.44
			2017	0.37
19	Nicaragua	Cruces <i>et al.</i> (2015)	2001	0.30–0.53
20	Palestine	Dang and Ianchovichina (2018)	2005	0.09
			2009	0.11
21	Palestine	AlAzzawi <i>et al.</i> (2023)	2007	0.08

			2009	0.09
			2011	0.09
			2017	0.11
22	Peru	Dang and Lanjouw (2023)	2004	0.41
			2005	0.44
			2006	0.46
23	Peru	Cruces <i>et al.</i> (2015)	2008	0.41–0.62
24	Peru	Canavire-Bacarreza and Robles (2017)	2003	0.45
			2004	0.44
			2005	0.45
			2006	0.47
			2007	0.47
			2008	0.44
			2009	0.45
			2010	0.42
			2011	0.39
25	Senegal	Dang <i>et al.</i> (2014)	2006	0.36–0.44
			2011	0.33–0.41
26	Senegal	Dang and Dabalen (2019)	2005	0.28
			2011	0.26
27	Syria	Dang and Ianchovichina (2018)	1997	0.05
			2004	0.14
28	Togo	Dang and Dabalen (2019)	2006	0.43
			2011	0.34
29	Tanzania	Aikaeli <i>et al.</i> (2021)	2011/12	0.22
			2017/18	0.22
30	Tunisia	Dang and Ianchovichina (2018)	2005	0.34
			2010	0.34
31	Tunisia	AlAzzawi <i>et al.</i> (2023)	2005	0.30
			2010	0.29
			2015	0.29
			2021	0.21
32	Vietnam	Dang and Lanjouw (2023)	2004	0.45
			2006	0.42
			2008	0.37
33	Vietnam	Dang <i>et al.</i> (2014)	2008	0.32–0.60
34	Vietnam	Dang <i>et al.</i> (2019)	2010	0.43–0.69
			2012	0.41–0.69
35	Yemen	Dang and Ianchovichina (2018)	1998	0.13
			2006	0.19
36	Zambia	Dang and Dabalen (2019)	2006	0.47
			2010	0.46
Mean				0.27–0.29

**Table A.4. Poverty Dynamics, Synthetic Panel Analysis, Unconditional Probabilities (Percentage)**

<b>Panel A: 2005/06–2012/13</b>		2012/13		
		Poor	Non-poor	Total
2005/06	Poor	18.56	10.37	28.93
		(0.50)	(0.15)	(0.60)
	Non-poor	9.65	61.43	71.07
		(0.15)	(0.67)	(0.60)
	Total	28.21	71.79	100
		(0.58)	(0.58)	
<b>Panel B: 2012/13–2016/17</b>		2016/17		
		Poor	Non-poor	Total
2012/13	Poor	14.39	8.09	22.48
		(0.41)	(0.11)	(0.46)
	Non-poor	9.41	68.11	77.52
		(0.19)	(0.63)	(0.46)
	Total	23.80	76.20	100
		(0.58)	(0.58)	
<b>Panel C: 2005/06–2016/17</b>		2016/17		
		Poor	Non-poor	Total
2005/06	Poor	20.49	8.44	28.93
		(0.57)	(0.12)	(0.60)
	Non-poor	11.29	59.79	71.07
		(0.20)	(0.73)	(0.60)
	Total	31.78	68.22	100
		(0.70)	(0.70)	

**Note:** Poverty rates (in percent) are based on the household consumption expenditure per equivalent adult. Consumption expenditure data are converted to 2013 prices using consumer price index deflators. The poverty line is set at 1,314 cedis per adult equivalent per year in 2013 prices. All numbers are estimated with synthetic panel data, with population weights, and where the first round is used as the base year. Household heads' ages are restricted to 25–55 for the first survey round and adjusted accordingly for the second survey round. Bootstrapped standard errors, based on 1,000 replications, are reported in parentheses.

**Table A.5. Poverty Dynamics, Synthetic Panel Analysis, Conditional Probabilities (Percentage)**

<b>Panel A: 2005/06–2012/13</b>		2012/13		
		Poor	Non-poor	Total
2005/06	Poor	60.55	39.45	100
		(0.34)	(0.34)	
	Non-poor	11.59	88.41	100
		(0.24)	(0.24)	
<b>Panel B: 2012/13–2016/17</b>		2016/17		
		Poor	Non-poor	Total
2012/13	Poor	63.21	36.79	100
		(0.44)	(0.44)	
	Non-poor	11.37	88.63	100
		(0.34)	(0.34)	
<b>Panel C: 2005/06–2016/17</b>		2016/17		
		Poor	Non-poor	Total
2005/06	Poor	62.36	37.64	100
		(0.48)	(0.48)	
	Non-poor	10.97	89.03	100
		(0.35)	(0.35)	

**Note:** Poverty rates (in percent) are based on the household consumption expenditure per equivalent adult. Consumption expenditure data are converted to 2013 prices using consumer price index deflators. The poverty line is set at 1,314 cedis per adult equivalent per year in 2013 prices. All numbers are estimated with synthetic panel data, with population weights, and where the second round is used as the base year. Household heads' ages are restricted to 25–55 for the first survey round and adjusted accordingly for the second survey round. Conditional probabilities are calculated by conditioning individuals' movement on their poverty status in the first period. Bootstrapped standard errors, based on 1,000 replications, are reported in parentheses.



**Table A.6. Extreme and Moderate Poverty Dynamics, Synthetic Panel Analysis, Unconditional Probabilities (Percentage)**

<b>Panel A: 2005/06–2012/13</b>		<b>2012/13</b>			
		Extreme poor	Moderate poor	Non-poor	Total
2005/06	Extreme poor	6.07 (0.24)	3.59 (0.11)	2.26 (0.06)	11.92 (0.38)
	Moderate poor	3.41 (0.11)	5.49 (0.10)	8.10 (0.10)	17.00 (0.26)
	Non-poor	2.07 (0.05)	7.57 (0.10)	61.43 (0.67)	71.07 (0.60)
	Total	11.55 (0.36)	16.66 (0.24)	71.79 (0.58)	100
<b>Panel B: 2012/13–2016/17</b>		<b>2016/17</b>			
		Extreme poor	Moderate poor	Non-poor	Total
2012/13	Extreme poor	4.54 (0.18)	2.26 (0.06)	1.54 (0.03)	8.34 (0.24)
	Moderate poor	3.32 (0.11)	4.27 (0.08)	6.55 (0.08)	14.14 (0.23)
	Non-poor	2.39 (0.08)	7.02 (0.12)	68.11 (0.63)	77.52 (0.46)
	Total	10.25 (0.36)	13.55 (0.24)	76.20 (0.58)	100
<b>Panel C: 2005/06–2016/17</b>		<b>2016/17</b>			
		Extreme poor	Moderate poor	Non-poor	Total
2005/06	Extreme poor	7.58 (0.31)	2.79 (0.08)	1.56 (0.03)	11.92 (0.38)
	Moderate poor	4.81 (0.16)	5.32 (0.10)	6.88 (0.09)	17.00 (0.26)
	Non-poor	3.06 (0.09)	8.23 (0.12)	59.79 (0.73)	71.07 (0.60)
	Total	15.44 (0.50)	16.34 (0.25)	68.22 (0.70)	100

**Note:** Poverty rates (in percent) are based on the household consumption expenditure per equivalent adult. Consumption expenditure data are converted to 2013 prices using consumer price index deflators. Overall and extreme poverty lines are set at 1,314 and 792 cedis per adult equivalent per year in 2013 prices, respectively. Extreme poor is the population with per adult equivalent consumption expenditure below the extreme poverty line, and moderate poor is the population with per adult equivalent consumption expenditure between the overall and extreme poverty lines. All numbers are estimated with synthetic panel data, with population weights, and where the first round is used as the base year. Household heads' ages are restricted to 25–55 for the first survey round and adjusted accordingly for the second survey round. Bootstrapped standard errors, based on 1,000 replications, are reported in parentheses.

**Table A.7. Extreme and Moderate Poverty Dynamics, Synthetic Panel Analysis, Conditional Probabilities (Percentage)**

<b>Panel A: 2005/06–2012/13</b>		<b>2012/13</b>			
		Extreme poor	Moderate poor	Non-poor	Total
2005/06	Extreme poor	47.69 (0.30)	31.07 (0.07)	21.24 (0.27)	100
	Moderate poor	18.22 (0.17)	31.33 (0.12)	50.45 (0.28)	100
	Non-poor	2.36 (0.07)	9.22 (0.17)	88.41 (0.24)	100
<b>Panel B: 2012/13–2016/17</b>		<b>2016/17</b>			
		Extreme poor	Moderate poor	Non-poor	Total
2012/13	Extreme poor	54.08 (0.42)	27.08 (0.13)	18.85 (0.37)	100
	Moderate poor	22.37 (0.30)	29.93 (0.15)	47.70 (0.41)	100
	Non-poor	2.78 (0.15)	8.59 (0.20)	88.63 (0.34)	100
<b>Panel C: 2005/06–2016/17</b>		<b>2016/17</b>			
		Extreme poor	Moderate poor	Non-poor	Total
2005/06	Extreme poor	54.07 (0.44)	27.16 (0.12)	18.77 (0.40)	100
	Moderate poor	20.41 (0.29)	29.65 (0.16)	49.93 (0.43)	100
	Non-poor	2.49 (0.14)	8.49 (0.22)	89.03 (0.35)	100

**Note:** Poverty rates (in percent) are based on the household consumption expenditure per equivalent adult. Consumption expenditure data are converted to 2013 prices using consumer price index deflators. Overall and extreme poverty lines are set at 1,314 and 792 cedis per adult equivalent per year in 2013 prices, respectively. Extreme poor is the population with per adult equivalent consumption expenditure below the extreme poverty line, and moderate poor is the population with per adult equivalent consumption expenditure between the overall and extreme poverty lines. All numbers are estimated with synthetic panel data, with population weights, and where the second round is used as the base year. Household heads' ages are restricted to 25–55 for the first survey round and adjusted accordingly for the second survey round. Conditional probabilities are calculated by conditioning individuals' movement on their poverty status in the first period. Bootstrapped standard errors, based on 1,000 replications, are reported in parentheses.

**Table A.8. Characteristics Associated with Poverty Mobility**

	Upward mobility				Downward mobility			
	Exited from extreme poverty to non-poverty		Exited from moderate poverty to non-poverty		Falling into extreme poverty from non-poverty		Falling into moderate poverty from non-poverty	
	% (1)	SE (2)	% (3)	SE (4)	% (5)	SE (6)	% (7)	SE (8)
<b>Panel A: 2005/06–2012/13</b>								
<i>Gender of household head</i>								
Male	20.9	(0.3)	50.1	(0.3)	2.5	(0.1)	9.5	(0.2)
Female	23.4	(0.4)	51.9	(0.4)	2.0	(0.1)	8.3	(0.2)
<i>Education of household head</i>								
No education	16.9	(0.3)	42.5	(0.4)	5.6	(0.1)	17.2	(0.2)
Less than primary	23.2	(0.4)	50.5	(0.4)	3.2	(0.1)	12.1	(0.3)
Less than lower secondary	24.2	(0.5)	50.7	(0.5)	2.9	(0.1)	11.3	(0.2)
Less than upper secondary	31.8	(0.3)	58.6	(0.3)	1.6	(0.0)	7.7	(0.1)
Completed upper secondary	37.7	(0.5)	65.4	(0.5)	0.7	(0.0)	4.1	(0.1)
University and higher	41.5	(1.1)	69.2	(1.0)	0.2	(0.0)	1.6	(0.1)
<i>Place of birth</i>								
Not born in current region	22.1	(0.4)	50.6	(0.4)	2.2	(0.1)	8.7	(0.3)
Born in current region	20.6	(0.4)	50.3	(0.4)	2.5	(0.1)	9.7	(0.2)
<i>Location</i>								
Rural	19.8	(0.3)	47.6	(0.3)	4.0	(0.1)	14.0	(0.2)
Urban	31.4	(0.4)	58.5	(0.3)	1.2	(0.0)	6.0	(0.1)
<i>Sector</i>								
Agriculture, self-employed	19.4	(0.3)	47.2	(0.3)	3.9	(0.1)	13.5	(0.2)
Agriculture, wage-employed	21.9	(1.6)	49.0	(1.7)	2.7	(0.4)	10.4	(1.0)
Industry, self-employed	27.2	(0.4)	55.4	(0.3)	1.7	(0.1)	7.5	(0.2)
Industry, wage-employed	29.7	(0.6)	58.0	(0.5)	1.3	(0.1)	6.4	(0.2)
Services, wage-employed	31.6	(0.8)	60.1	(0.8)	0.9	(0.1)	4.5	(0.3)
<i>Migration</i>								
Labor-related migration	23.7	(0.5)	51.9	(0.5)	2.2	(0.1)	8.8	(0.3)
Non-labor-related migration	21.1	(0.4)	50.2	(0.5)	2.6	(0.1)	9.9	(0.3)
Did not move to current place	20.6	(0.4)	50.0	(0.4)	2.3	(0.1)	9.0	(0.2)
<i>Occupation</i>								
Managers/professionals	34.0	(0.7)	62.6	(0.6)	0.7	(0.0)	4.0	(0.2)
Service workers	29.7	(0.4)	57.9	(0.4)	1.3	(0.1)	6.3	(0.2)
Agricultural workers	19.6	(0.3)	47.3	(0.3)	3.9	(0.1)	13.7	(0.2)
Blue-collar workers	27.7	(0.5)	55.8	(0.5)	1.7	(0.1)	7.5	(0.2)
<i>Dependency ratio</i>								
Child dep.ratio <50%	24.6	(0.4)	54.8	(0.4)	1.8	(0.1)	7.7	(0.2)
Child dep.ratio 50-99%	22.7	(0.4)	52.1	(0.4)	2.2	(0.1)	9.1	(0.2)
Child dep.ratio >99%	19.5	(0.3)	48.0	(0.3)	2.7	(0.1)	10.0	(0.2)
<b>Panel B: 2012/13–2016/17</b>								
<i>Gender of household head</i>								
Male	17.1	(0.4)	45.2	(0.5)	3.2	(0.2)	9.3	(0.2)
Female	26.7	(0.5)	56.2	(0.4)	1.7	(0.1)	6.8	(0.2)
<i>Education of household head</i>								
No education	11.4	(0.6)	33.5	(0.9)	9.1	(0.5)	19.0	(0.4)
Less than primary	21.6	(0.6)	48.1	(0.7)	3.7	(0.2)	11.8	(0.3)
Less than lower secondary	26.9	(0.7)	54.2	(0.7)	2.3	(0.1)	9.2	(0.3)
Less than upper secondary	35.1	(0.4)	62.3	(0.4)	1.2	(0.0)	6.2	(0.1)
Completed upper secondary	33.9	(0.6)	61.0	(0.5)	0.9	(0.1)	4.3	(0.2)
University and higher	42.9	(0.8)	70.3	(0.6)	0.3	(0.0)	1.6	(0.1)
<i>Place of birth</i>								
Not born in present place	22.8	(0.7)	53.0	(0.7)	1.9	(0.2)	7.2	(0.3)
Born in present place	17.8	(0.4)	46.2	(0.5)	3.1	(0.2)	9.0	(0.2)
<i>Location</i>								
Rural	15.6	(0.4)	41.1	(0.5)	5.5	(0.3)	14.5	(0.3)
Urban	37.7	(0.4)	65.2	(0.4)	0.8	(0.1)	4.3	(0.1)
<i>Sector</i>								

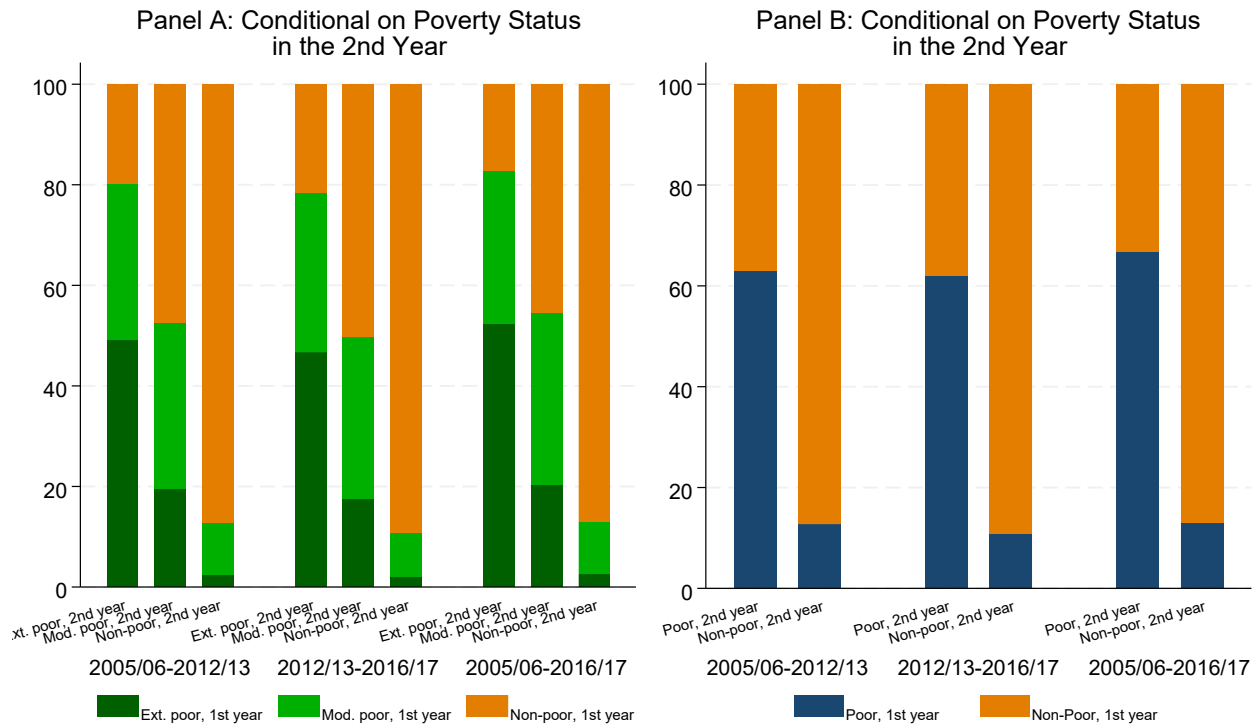
Agriculture, self-employed	15.5	(0.5)	41.4	(0.6)	5.1	(0.3)	13.3	(0.3)
Agriculture, wage-employed	21.1	(1.9)	48.2	(2.0)	2.9	(0.5)	9.3	(0.9)
Industry, self-employed	27.6	(0.5)	57.4	(0.5)	1.6	(0.1)	6.3	(0.2)
Industry, wage-employed	25.8	(0.7)	56.0	(0.7)	1.5	(0.2)	5.8	(0.3)
Services, wage-employed	28.9	(0.9)	59.3	(0.8)	0.9	(0.2)	3.9	(0.3)
<i>Migration</i>								
Labor-related migration	20.9	(0.7)	50.2	(0.8)	2.3	(0.2)	8.1	(0.4)
Non-labor-related migration	22.6	(0.7)	51.6	(0.7)	2.2	(0.2)	7.4	(0.3)
Did not move to current place	16.3	(0.6)	44.4	(0.6)	3.5	(0.2)	9.7	(0.3)
<i>Occupation</i>								
Managers/professionals	32.3	(0.9)	61.5	(0.7)	0.8	(0.1)	3.9	(0.3)
Service workers	29.4	(0.5)	59.3	(0.5)	1.3	(0.1)	5.5	(0.2)
Agricultural workers	15.3	(0.5)	40.9	(0.7)	5.7	(0.3)	14.6	(0.3)
Blue-collar workers	26.6	(0.8)	55.0	(0.8)	1.9	(0.2)	7.3	(0.4)
<i>Dependency ratio</i>								
Child dep.ratio <50%	24.9	(0.5)	55.2	(0.5)	1.7	(0.1)	6.6	(0.2)
Child dep.ratio 50-99%	20.2	(0.6)	49.4	(0.6)	2.5	(0.2)	8.2	(0.3)
Child dep.ratio >99%	16.5	(0.5)	44.1	(0.6)	3.4	(0.2)	9.8	(0.3)

**Panel C: 2005/06–2016/17**

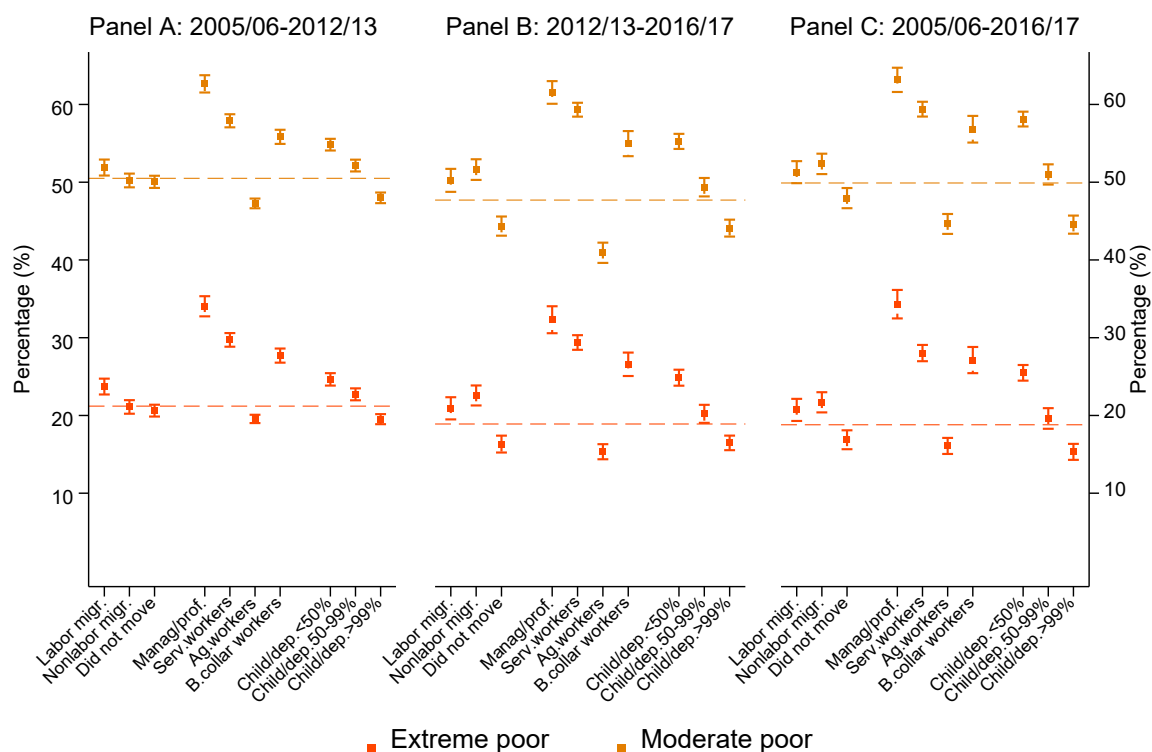
<i>Gender of household head</i>								
Male	17.7	(0.5)	48.5	(0.5)	2.8	(0.2)	9.0	(0.3)
Female	24.5	(0.5)	55.1	(0.5)	1.8	(0.1)	7.4	(0.2)
<i>Education of household head</i>								
No education	12.2	(0.6)	37.2	(0.8)	7.0	(0.4)	17.3	(0.4)
Less than primary	22.6	(0.7)	50.7	(0.7)	3.2	(0.2)	11.2	(0.3)
Less than lower secondary	26.8	(0.7)	55.0	(0.7)	2.3	(0.1)	9.0	(0.3)
Less than upper secondary	35.9	(0.4)	63.5	(0.4)	1.3	(0.0)	6.4	(0.1)
Completed upper secondary	36.9	(0.8)	65.3	(0.6)	0.8	(0.1)	4.0	(0.2)
University and higher	35.7	(1.0)	66.6	(0.8)	0.3	(0.0)	1.7	(0.1)
<i>Place of birth</i>								
Not born in present place	21.9	(0.8)	52.7	(0.8)	1.9	(0.2)	7.3	(0.4)
Born in present place	18.0	(0.5)	49.2	(0.5)	2.7	(0.2)	8.9	(0.2)
<i>Location</i>								
Rural	16.4	(0.4)	44.8	(0.6)	4.7	(0.2)	14.0	(0.3)
Urban	36.8	(0.4)	64.8	(0.4)	0.9	(0.1)	4.7	(0.1)
<i>Sector</i>								
Agriculture, self-employed	16.3	(0.5)	45.1	(0.6)	4.2	(0.3)	12.5	(0.3)
Agriculture, wage-employed	20.5	(1.8)	49.4	(2.0)	2.8	(0.6)	9.2	(1.0)
Industry, self-employed	25.7	(0.5)	57.5	(0.5)	1.6	(0.1)	6.5	(0.2)
Industry, wage-employed	24.4	(0.7)	57.1	(0.7)	1.4	(0.2)	5.9	(0.3)
Services, wage-employed	29.3	(0.9)	61.4	(0.8)	0.9	(0.2)	4.1	(0.3)
<i>Migration</i>								
Labor-related migration	20.7	(0.7)	51.3	(0.7)	2.2	(0.2)	8.0	(0.4)
Non-labor-related migration	21.7	(0.7)	52.4	(0.7)	2.1	(0.2)	7.6	(0.3)
Did not move to current place	16.9	(0.6)	48.0	(0.7)	3.0	(0.2)	9.4	(0.3)
<i>Occupation</i>								
Managers/professionals	34.3	(0.9)	63.2	(0.8)	0.8	(0.1)	4.1	(0.3)
Service workers	28.0	(0.5)	59.4	(0.5)	1.3	(0.1)	5.8	(0.2)
Agricultural workers	16.1	(0.5)	44.6	(0.7)	4.6	(0.3)	13.6	(0.3)
Blue-collar workers	27.1	(0.9)	56.8	(0.9)	1.8	(0.2)	7.2	(0.4)
<i>Dependency ratio</i>								
Child dep.ratio <50%	25.5	(0.5)	58.1	(0.5)	1.6	(0.1)	6.6	(0.2)
Child dep.ratio 50-99%	19.6	(0.7)	51.0	(0.7)	2.3	(0.2)	8.3	(0.3)
Child dep.ratio >99%	15.3	(0.5)	44.5	(0.6)	3.3	(0.2)	10.0	(0.3)

**Note:** Conditional probabilities are calculated by conditioning individuals' movement on their poverty status in the first period. SE = standard error. Bootstrapped standard errors, based on 1,000 replications, are reported in parentheses.

Figure A.1. Poverty Dynamics, Conditional on Poverty Status in the 2<sup>nd</sup> Year

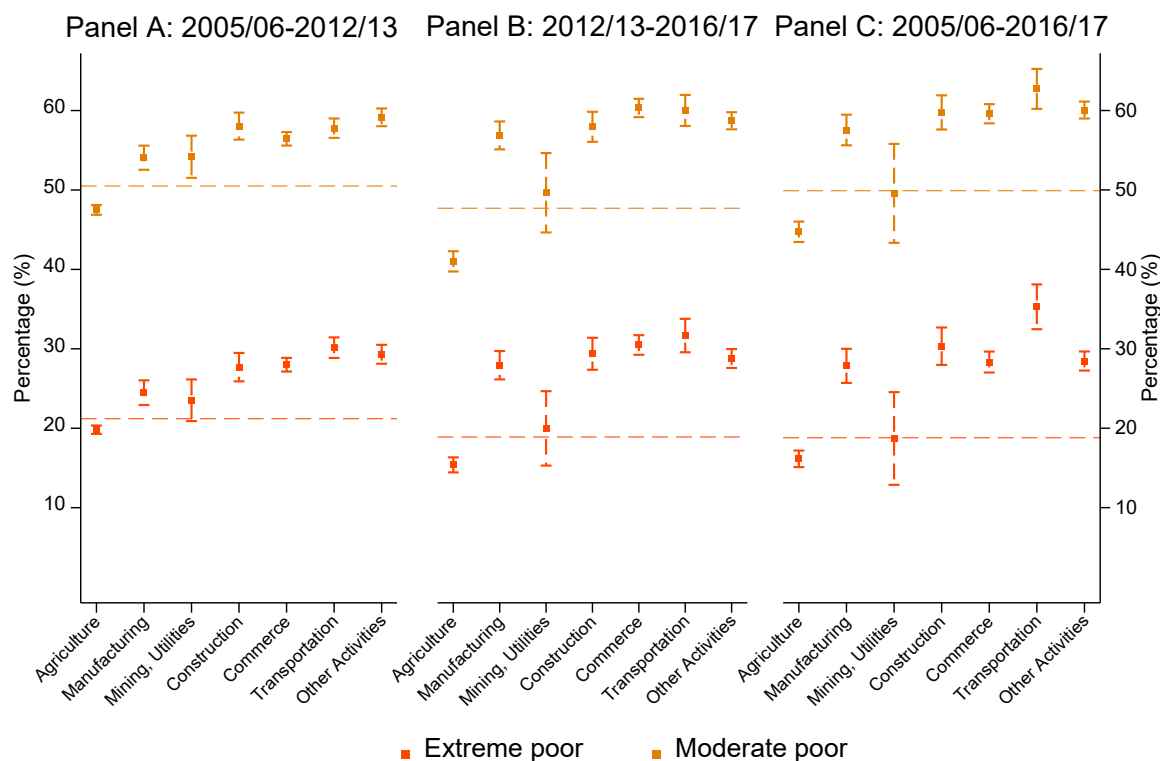


**Figure A.2. Profile of the Extreme and Moderate Poor Population that Exited Poverty, by Household Labor Characteristics, Conditional on Being Poor in the 1<sup>st</sup> Year**



**Note:** Dashed lines represent the national average for each period (i.e., 21.2 percent for 2005/06–2012/13, 18.9 percent for 2012/13–2016/17, and 18.8 percent for 2005/06–2016/17 for the extreme poor, and 50.5 percent for 2005/06–2012/13, 47.7 percent for 2012/13–2016/17, and 49.9 percent for 2005/06–2016/17 for the moderate poor). Time-variant characteristics are measured in second period.

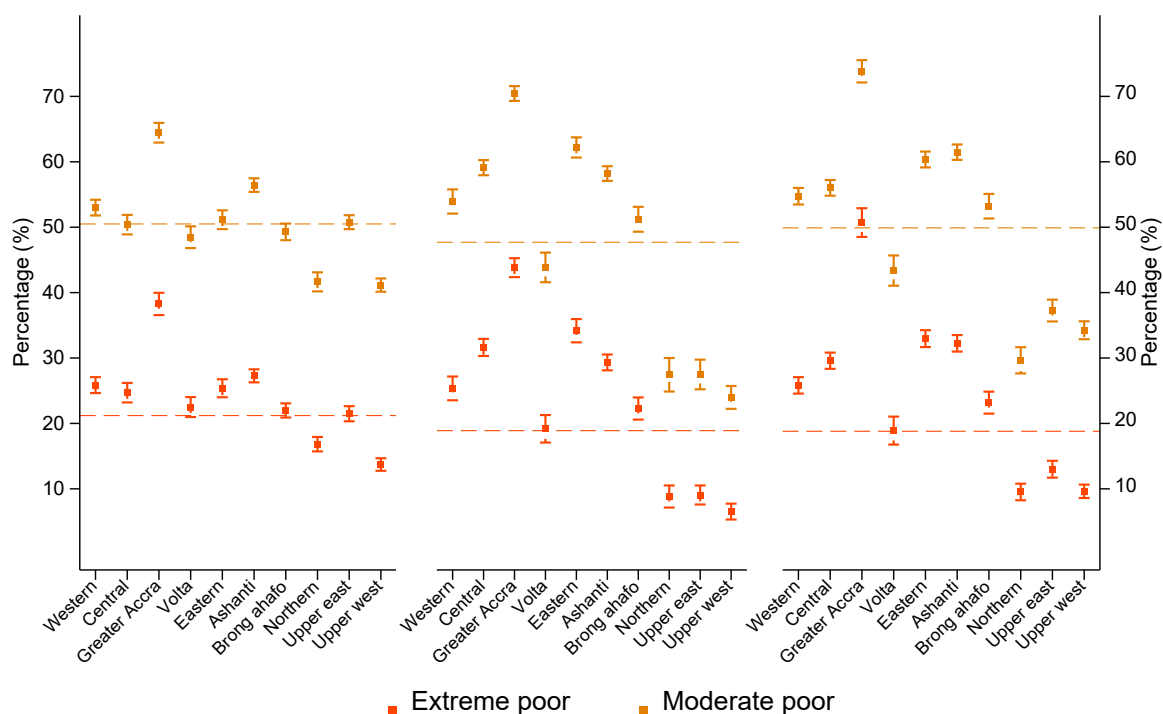
**Figure A.3. Profile of the Extreme and Moderate Poor Population that Exited Poverty, by Occupation Subsector, Conditional on Being Poor in the 1<sup>st</sup> Year**



**Note:** Dashed lines represent the national average for each period (i.e., 21.2 percent for 2005/06–2012/13, 18.9 percent for 2012/13–2016/17, and 18.8 percent for 2005/06–2016/17 for the extreme poor, and 50.5 percent for 2005/06–2012/13, 47.7 percent for 2012/13–2016/17, and 49.9 percent for 2005/06–2016/17 for the moderate poor). Time-variant characteristics are measured in second period.

**Figure A.4. Profile of the Extreme and Moderate Poor Population that Exited Poverty, by Region, Conditional on Being Poor in the 1<sup>st</sup> Year**

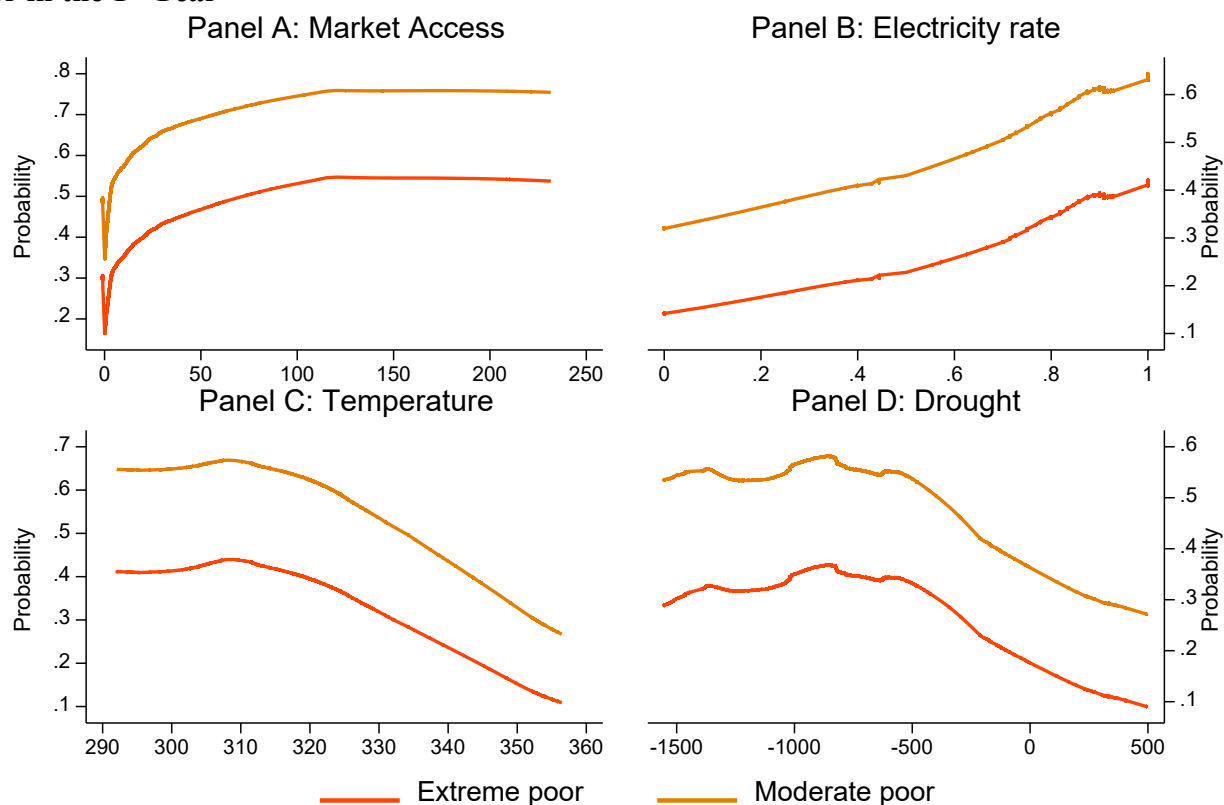
Panel A: 2005/06-2012/13    Panel B: 2012/13-2015/16    Panel C: 2005/06-2016/17



**Note:** Dashed lines represent the national average for each period (i.e., 21.2 percent for 2005/06–2012/13, 18.9 percent for 2012/13–2016/17, and 18.8 percent for 2005/06–2016/17 for the extreme poor, and 50.5 percent for 2005/06–2012/13, 47.7 percent for 2012/13–2016/17, and 49.9 percent for 2005/06–2016/17 for the moderate poor). Classification of regions is per Ghana’s 2010 Population and Housing Census. Time-variant characteristics are measured in second period.

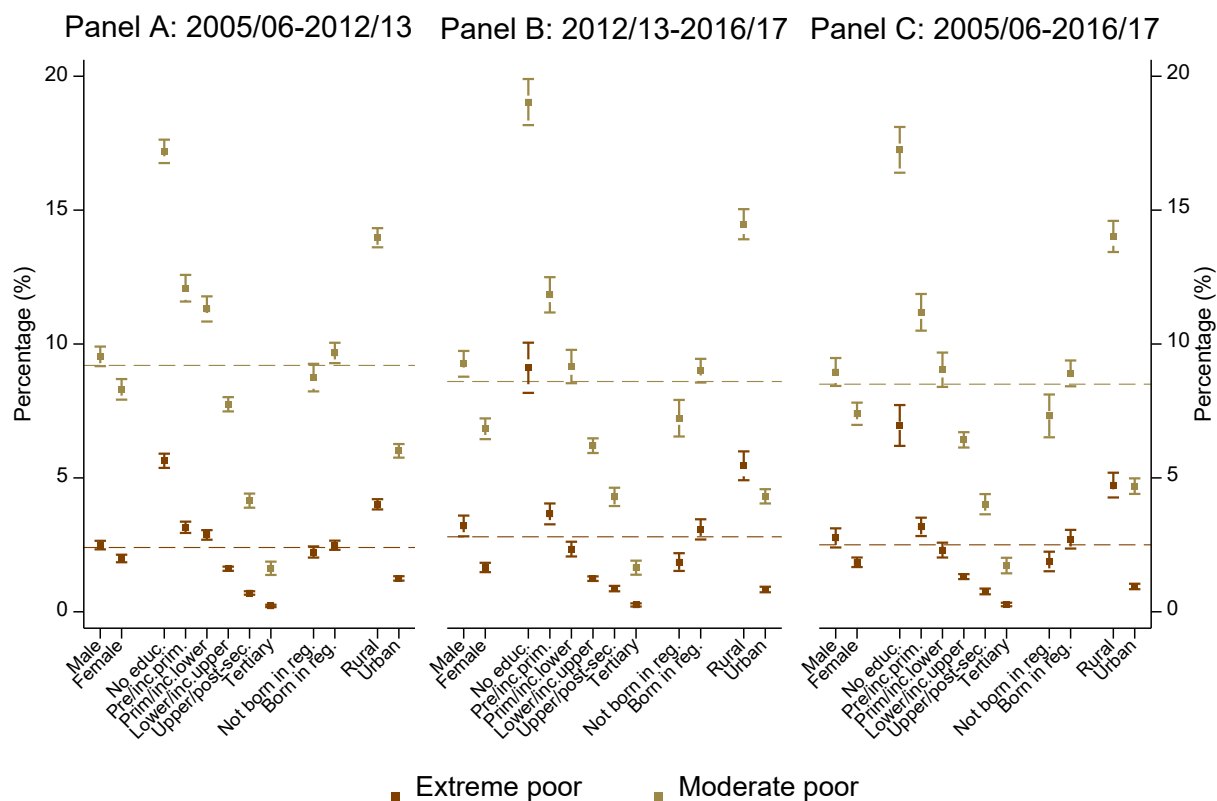


**Figure A.5. Correlation of the Probability a Poor Household in 2012/13 Exited Poverty in 2016/17 with Market Access, Electricity, Temperature, and Drought, Conditional on Being Poor in the 1<sup>st</sup> Year**



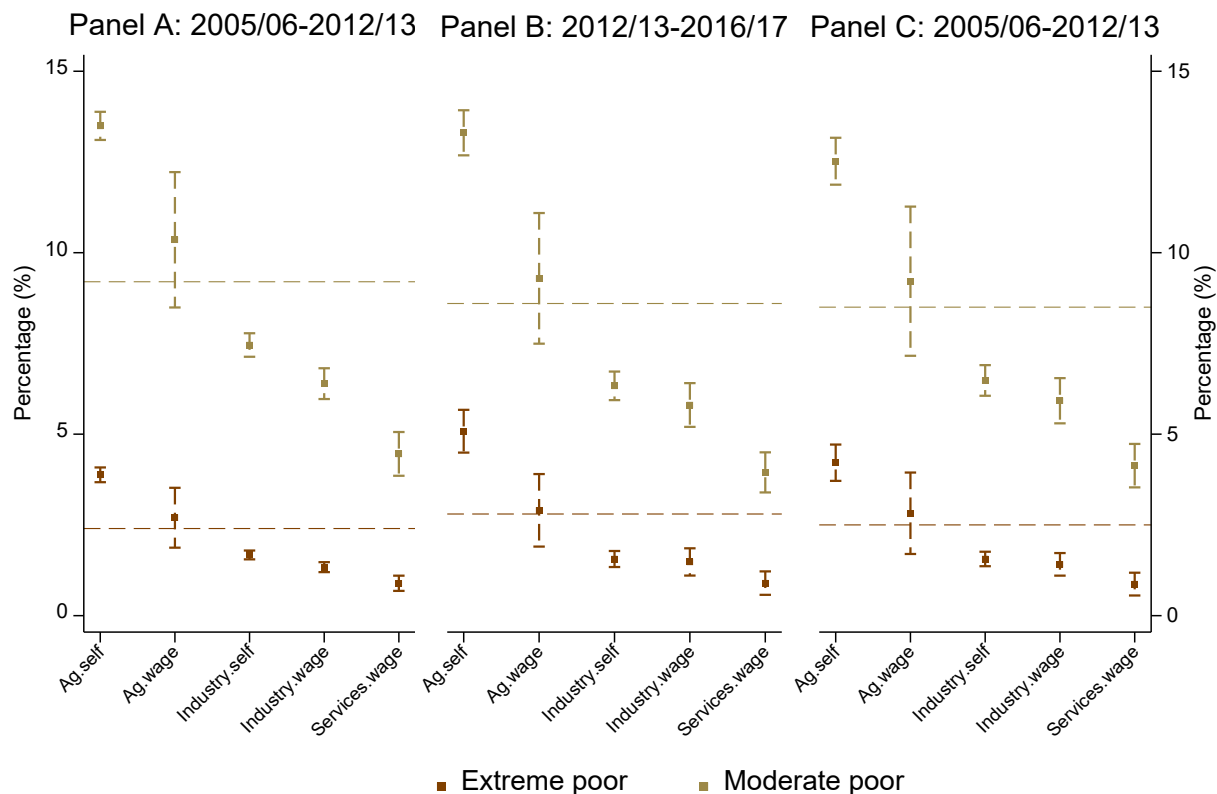
**Note:** Probability is averaged at the cluster level. Electricity, market access, and climate variables are measured in 2016/17.

**Figure A.6. Profile of the Non-poor Population that fell into Extreme or Moderate Poverty, Conditional on Being Non-poor in the 1<sup>st</sup> Year**



**Note:** Dashed lines represent the national average for each period (i.e., 2.4 percent for 2005/06–2012/13, 2.8 percent for 2012/13–2016/17, and 2.5 percent for 2005/06–2016/17 for the extreme poor and 9.2 percent for 2005/06–2012/13, 8.6 percent for 2012/13–2016/17, and 8.5 percent for 2005/06–2016/17 for the moderate poor). Time-invariant characteristics are measured in second period.

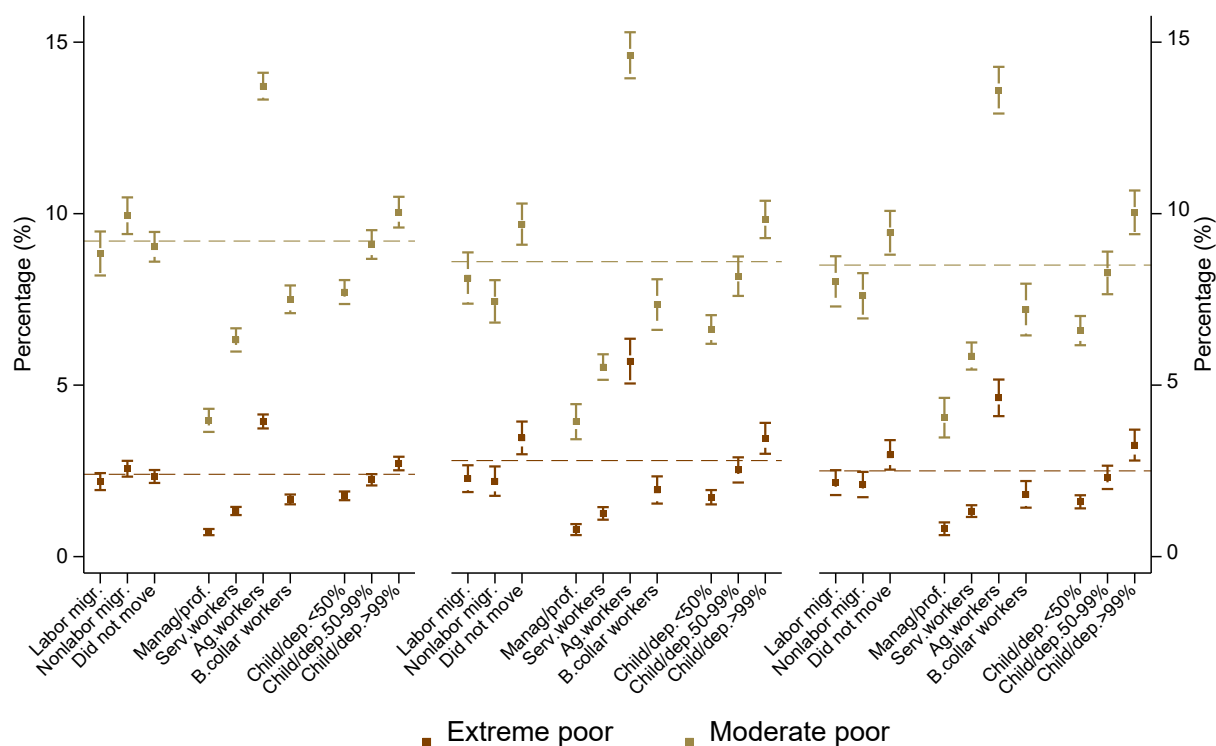
**Figure A.7. Profile of the Non-poor Population that fell into Extreme or Moderate Poverty, by Occupation Sector, Conditional on Being Nonpoor in the 1<sup>st</sup> Year**



**Note:** Dashed lines represent the national average for each period (i.e., 2.4 percent for 2005/06–2012/13, 2.8 percent for 2012/13–2016/17, and 2.5 percent for 2005/06–2016/17 for the extreme poor, and 9.2 percent for 2005/06–2012/13, 8.6 percent for 2012/13–2016/17, and 8.5 percent for 2005/06–2016/17 for the moderate poor). Occupation sector characteristics are measured in second period.

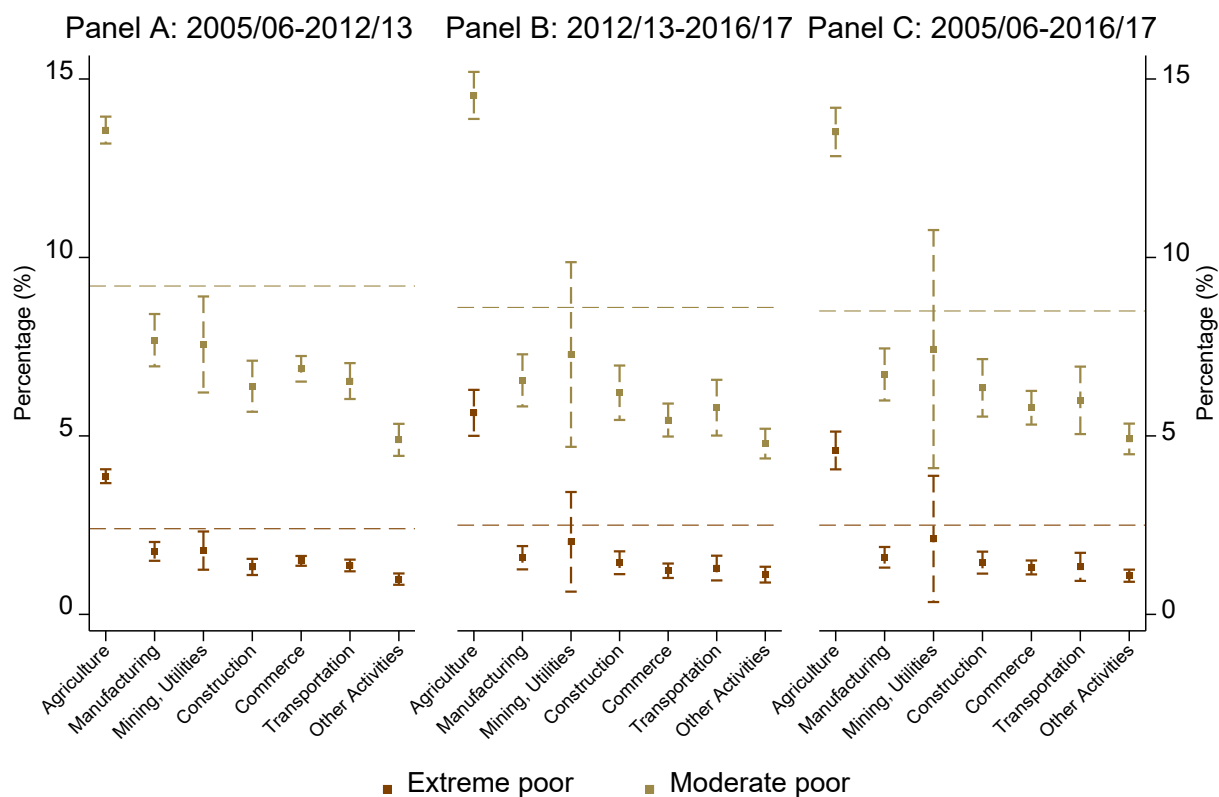
**Figure A.8. Profile of the Non-poor Population that Fell into Extreme or Moderate Poverty, by Household Labor Characteristics, Conditional on Being Non-poor in the 1<sup>st</sup> Year**

Panel A: 2005/06-2012/13    Panel B: 2012/13-2016/17    Panel C: 2005/06-2016/17



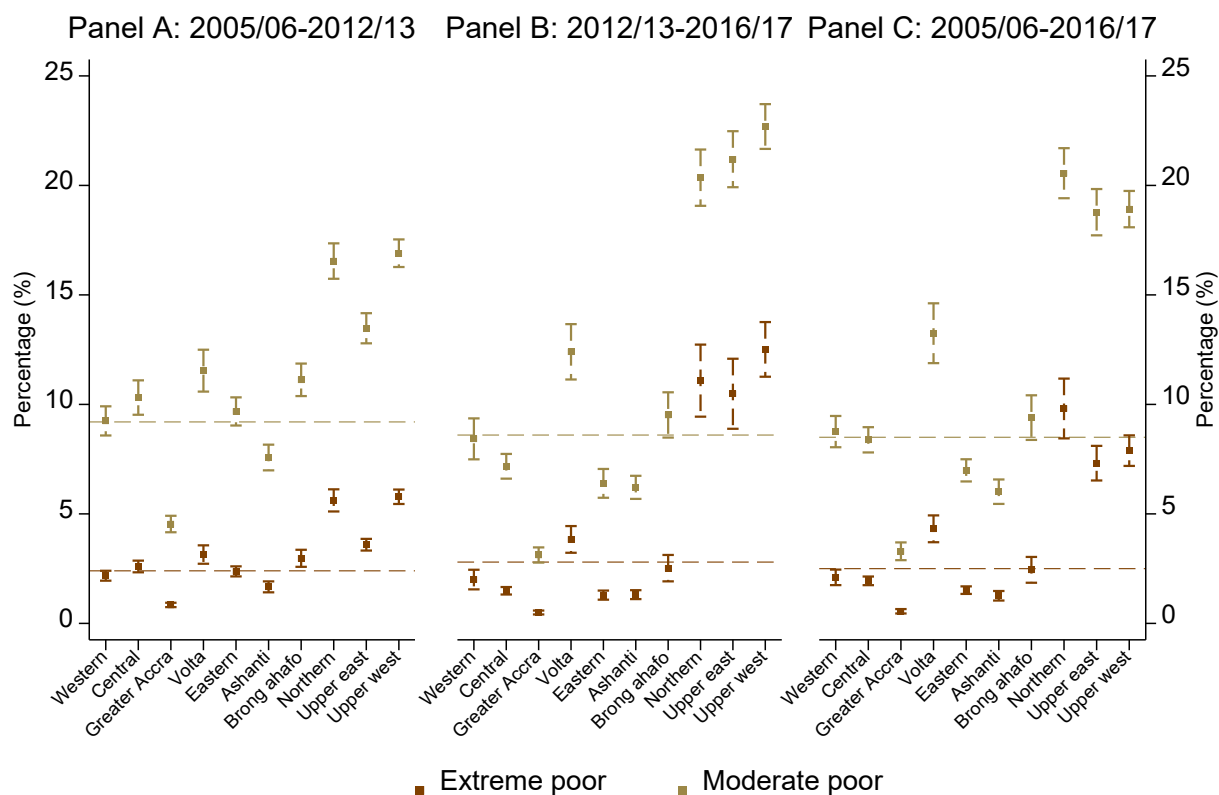
**Note:** Dashed lines represent the national average for each period (i.e., 2.4 percent for 2005/06–2012/13, 2.8 percent for 2012/13–2016/17, and 2.5 percent for 2005/06–2016/17 for the extreme poor, and 9.2 percent for 2005/06–2012/13, 8.6 percent for 2012/13–2016/17, and 8.5 percent for 2005/06–2016/17 for the moderate poor). Time-variant characteristics are measured in second period.

**Figure A.9. Profile of the Non-poor Population that Fell into Extreme or Moderate Poverty, by Occupation Sector, Conditional on Being Non-poor in the 1<sup>st</sup> Year**



**Note:** Dashed lines represent the national average for each period (i.e., 2.4 percent for 2005/06–2012/13, 2.8 percent for 2012/13–2016/17, and 2.5 percent for 2005/06–2016/17 for extreme poor, and 9.2 percent for 2005/06–2012/13, 8.6 percent for 2012/13–2016/17, and 8.5 percent for 2005/06–2016/17 for moderate poor). Time-variant characteristics are measured in second period.

**Figure A.10. Profile of the Non-poor Population that Fell into Extreme or Moderate Poverty, by Region, Conditional on Being Non-poor in the 1<sup>st</sup> Year**



**Note:** Dashed lines represent the national average for each period (i.e., 2.4 percent for 2005/06–2012/13, 2.8 percent for 2012/13–2016/17, and 2.5 percent for 2005/06–2016/17 for the extreme poor and 9.2 percent for 2005/06–2012/13, 8.6 percent for 2012/13–2016/17, and 8.5 percent for 2005/06–2016/17 for the moderate poor). Classification of regions is per Ghana’s 2010 Population and Housing Census. Time-variant characteristics are measured in second period.

## Appendix B. Description of Main Variables

	Variable	Definition
<i>Religion</i>	Muslim	If individual answered "Islam" or "Moslem" for their religious denomination.
	Catholic	If individual answered "Catholic" for their religious denomination.
	Protestant	If individual answered "Protestant", "Anglican", "Presbyterian", "Methodist", or "Pentecostal(/Charismatic)" for their religious denomination.
	Other Christian	If individual answered "Other Christian" for their religious denomination.
	Animist/Traditional	If individual answered "Traditional" or "Spiritualist" for their religious denomination.
	Other	If individual answered "No religion" or "Other" for their religious denomination.
<i>Language</i>	English	If the documented language used by respondent is English.
	Akan	If the documented language used by respondent is Akan.
	Ewe	If the documented language used by respondent is Ewe.
	Ga-adagbe	If the documented language used by respondent is Ga-Dangme.
	Dagbani	If the documented language used by respondent is Dagbani.
	Other	If the documented language used by respondent is Frara, Nzema, or other.
<i>Education</i>	<i>An individual's highest education level attained</i>	
	No formal education	If individual answered no to whether they have ever attended school .
	Preschool or incomplete primary	If individual answered no to whether they have ever attended school and reported an education level lower than grade 6 at primary school for their highest grade completed.
	Completed primary or incomplete lower secondary	If individual reported an education level between grade 6 at primary school and grade 2 at junior secondary school for their highest grade completed.
	Completed lower secondary or	If individual reported an education level between grade 3 at junior secondary school

incomplete upper  
secondary  
Completed upper  
secondary or  
vocational or post-  
secondary technical  
education  
Tertiary

and grade 2 at senior secondary school for  
their highest grade completed.  
If individual who reported grade 3 at senior  
secondary school, teacher training, vocational  
training, or nursing for their highest grade  
completed.

If individual reported polytechnic, university,  
or other tertiary for their highest grade  
completed.

*Parents` characteristics*

Father has not formal  
education

If individual reported that the highest level of  
education their father completed is "none" or  
"koranic"; or, in the case where the father lives  
in the same household, the father's self-  
reported education level is no formal  
education.

Father has formal  
education

If individual reported that the highest level of  
education their father completed is anything  
but "don't know", "none", or "koranic"; or, in  
the case where the father lives in the same  
household, the father's self-reported education  
level is anything between "preschool or  
incomplete primary" to "tertiary".

Mother has not formal  
education

If individual reported that the highest level of  
education their mother completed is "none" or  
"koranic"; or, in the case where the mother  
lives in the same household, the mother's self-  
reported education level is no formal  
education.

Mother has formal  
education

If individual reported that the highest level of  
education their mother completed is anything  
but "don't know", "none", or "koranic"; or, in  
the case where the mother lives in the same  
household, the mother's self-reported  
education level is anything between  
"preschool or incomplete primary" to  
"tertiary".

Father is not farmer

If individual reported that the primary work  
done by their father completed is anything but  
agriculture/animal husbandry; or, in the case  
where the father lives in the same household,  
the father's self-reported employment is non-  
agricultural.

Father is farmer

If individual reported that the primary work  
done by their father completed is  
agriculture/animal husbandry; or, in the case



		where the father lives in the same household, the father's self-reported employment is agricultural.
	Mother is not farmer	If individual reported that the primary work done by their mother completed is anything but agriculture/animal husbandry; or, in the case where the mother lives in the same household, the mother's self-reported employment is non-agricultural.
	Mother is farmer	If individual reported that the primary work done by their mother completed is agriculture/animal husbandry; or in the case where the mother lives in the same household, the mother's self-reported employment is agricultural.
<i>Migration characteristics</i>		
	Labor-related migration	If individual reported that main reasons for moving to current village/town were "job transfer", "seeking employment", "own business", or "spouse employment".
	Nonlabor-related migration	If individual reported that main reasons for moving to current village/town were "accompanying parents", "marriage", "other family reasons", "political/religious reasons", "education", "war", "fire", "flood/famine/drought", "other".
	Did not move to current place	If individual reported he/she never moved to current village/town.
	Not born in present region	If individual reported he/she was born in a region i.e. different from the current one.
<i>Occupational characteristics</i>		
	Managers/professionals	If individual reported that the occupation at primary work is "managers", "professionals", or "technicians and associate professionals".
	Service workers	If individual reported that the occupation at primary work is "clerical support" or "service and sales".
	Agriculture workers	If individual reported that the occupation at primary work is "skilled agricultural, forestry and fish".
	Blue-collar workers	If individual reported that the occupation at primary work is "craft and related trading" or "planting and machine operating and assembling or other elementary occupations".
<i>Household characteristics</i>		

Child dependency ratio	The number of children (aged 0–14) divided by the number of adults (aged 15–64) in a household
Agriculture, self-employed	If the majority of total hours worked in a household is in the agricultural sector and in self-employment*
Agriculture, wage-employed	If the majority of total hours worked in a household is in the agricultural sector and in wage employment*
Industry, self-employed	If the majority of total hours worked in a household is in the industrial sector and in self-employment*
Industry, wage-employed	If the majority of total hours worked in a household is in the industrial sector and in wage-employment*
Service, wage-employed	If the majority of total hours worked in a household is in the services sector and in wage-employment*

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**Note:** \* When the hours are equal between wage employment and self employment in a household, the household is defined as a “self-employed household”; and when the hours are equal between agricultural and industrial/services employment in a household, the household is defined as an “agricultural household.”