POVERTY, INCOME DIVERSIFICATION AND WELFARE IN NORTHERN GHANA

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Abstract

Households in several sub–Saharan African countries including Ghana usually have to cope with poverty, income and consumption volatility by diversifying their income sources. Using the recent wave of the Ghana Living Standard Survey (GLSS 6), we examine the determinants of participation in farm employment as an income diversification strategy and its impact on welfare in the poorest regions of Ghana. Our findings show that marital status, household size, education and access to credit are important drivers of participation in farm work albeit regional differences. The effect of age on participation decision is intrinsically non–linear in an inverted U–shaped fashion. Further findings from the propensity score matching reveal that engaging in farm employment positively and significantly impacts on welfare. While we recommend substantial investment in the agriculture sector, it is simplistic to assume that the resource allocation in itself will engender the needed agricultural productivity and ultimately translate into improved welfare. Moreover, while the obsession with agricultural–led growth as a poverty reduction strategy has genuine merits, we submit that non-farm activities also make substantial contributions to household welfare and can play significant roles in transforming northern Ghana.

Keywords: Non-farm; Propensity score matching; Welfare; Poverty; Northern Ghana.

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1. Introduction

Undoubtedly, households in several sub-Saharan African countries including Ghana usually have to cope with poverty, income and consumption volatility. Bardhan and Udry (1999) argue that households commit substantial amount of resources to stabilizing their income in order to shield themselves from the ramifications of huge income fluctuations due to the lack of complete insurance and credit markets. To smoothen consumption, households in these conditions often diversify income sources by engaging in farm and non-farm work or both.

Extant studies (see for instance Ellis, 1998) have supported the argument that income diversification is intrinsically linked to a reduced risk and as such, risk-averse households are more willing to accept lower income for greater security (Ellis, 2000). Thus, given the crucial role income diversification play in stabilizing incomes and consumption, household-level diversification may have several implications for poverty alleviation since traditional approaches involving single employment in either farm or non-farm work by rural households have limited capacity to smooth the expected outcomes especially when income and consumption are very volatile.

In the case of Ghana, evidence abounds in the Ghana Living Standard Surveys (GLSS 4, 5 and 6) that there are multiple income sources for households (GSS, 2000; 2008; 2014). Haggblade et al. (2002) provide evidence suggesting that most rural communities in Africa earn about 42% of their income from rural non-farm activities. Farm income does not only contribute to welfare but also stimulates growth in other sectors. Stamoulis and Zezza (2003) note that the extra income from agricultural growth can create demand for goods and services, thus creating a virtuous cycle in which agricultural and rural off-farm income grow and sustain each other's growth. To the extent that poverty incidence in Ghana largely concentrates in the North and often prevalent in the savannah areas, investing and promoting participation in farm work in Ghana may well contribute positively to welfare and poverty reduction. This should be useful bait to genuine policy interventions aimed at addressing the deep seated poverty in the North.

Apart from analyzing the determinants of participation in farm work, this paper examines the impact of participation in farm employment as an income diversification strategy on household welfare in Northern Ghana. The analyses are done region-by-region in order to document regional variations.

This paper contributes to the literature by empirically examining the impacts of farm work on household real consumption expenditure using the sixth round of GLSS. We employ propensity score matching method to correct for self-selection bias. By explicitly considering the regional differences both in terms of factors influencing participation in farm work and impacts, this paper seeks to bring to bear the heterogeneous

drivers and impacts in seemingly homogenous settings so as to make specific policy recommendations.

The rest of this paper is organised as follows: the next Section discusses the patterns and trends of poverty in Ghana while Section 3 presents a review of related literature. Section 4 outlines the conceptual framework and empirical strategy while Section 5 discusses the findings. Section 6 concludes the paper with some recommendations for policy.

2. Patterns and trends of poverty in Ghana

The first part of this section provides a diagnostic analysis of poverty trends in Ghana based on the fifth and sixth rounds of the GLSS of GSS (2014b).[2] This trend is particularly relevant as it appreciates the variations of poverty and inequality across the 10 regions of Ghana. Ghana's poverty analysis is based on consumption poverty where an individual is considered poor or non-poor based on one's ability to meet basic consumption (food and non-food) needs. This expenditure threshold is referred to as the (absolute) poverty line.

The Ghana Statistical Service (GSS) calculates regional/national household consumption and expenditures based on the GLSS. It then sets a nutrition–based income poverty lines which translates in monetary terms as GH¢792.05 (US$208.43) (lower poverty line) and GH¢1,314.00 (US$345.80) (upper poverty line) per adult per year.[3] The implication is that, individuals whose total consumption expenditure falls below GH¢792.05(US$208.43) are considered to be in extreme poverty and thus unable to meet their minimum calorie requirement even if they allocate their whole budgets to food consumption.[4] However, individuals those whose consumption expenditure exceeds GH¢1,314.00(US$345.80) are able to purchase or consume enough food to meet their nutritional requirements as well meet other basic non-food needs (GSS, 2014b). Thus, the standard of living for each individual is measured as the total consumption expenditure per equivalent adult.[5]

The poverty incidence measures the proportion of the population that is poor. Given the upper poverty line of GH¢1,314 (US$345.80), from Table 1 below, the proportion of the population defined as poor decreased from 31.9% in 2005/2006 to 24.2% in 2012/2013, with a poverty gap index of 7.8%. Similarly, the percentage of people living in extreme poverty reduced from 16.5% in 2005/2006 to 8.4% denoting a decline of 8.1%. The implication is that although 8.4% of the population are in extreme poverty,

2 Ibrahim and Yeboah (2014) provided an excellent analysis of Ghana's poverty trends based on the third, fourth and fifth rounds of the GLSS.
3 These are based on US$1= GH¢3.8 exchange rate.
4 Given that they consume the average consumption basket.
5 The consumption expenditure for a minimum food basket providing 2,900 calories per adult equivalent per day is estimated following the GLSS 5 methodology.

fewer Ghanaians are extremely poor compared to 2005/2006. While the country has recorded a modest reduction in poverty, variations in poverty levels and gaps have been disproportionately distributed largely according to demographic and regional groupings.

Table 1: Poverty incidence by region (Poverty line GH¢1,314.00)

Region	GLSS 6 (2012/2013)		GLSS 5 (2005/2006)	
	Poverty incidence (%)	Contribution to total poverty (%)	Poverty incidence (%)	Contribution to total poverty (%)
Ashanti	14.8	12.0	24.0	12.6
Western	20.9	7.9	22.9	7.3
Greater Accra	5.6	3.8	13.5	5.9
Volta	33.8	12.1	37.3	8.7
Brong Ahafo	27.9	11.4	34.0	9.8
Eastern	21.7	9.3	17.8	7.5
Central	18.8	6.9	13.5	5.9
Northern	50.4	20.8	55.7	21.0
Upper West	70.7	8.4	89.1	10.0
Upper East	44.4	7.4	72.9	10.9
Ghana	24.2	100.0	31.9	100.0

Extreme poverty incidence by region (Poverty line GH¢792.05)				
Region	GLSS 6 (2012/2013)		GLSS 5 (2005/2006)	
	Poverty incidence (%)	Contribution to total poverty (%)	Poverty incidence (%)	Contribution to total poverty (%)
Ashanti	2.9	6.9	9.8	9.9
Western	5.5	6.0	6.8	4.2
Greater Accra	1.5	2.9	5.2	4.4
Volta	9.0	9.3	13.3	6.0
Brong Ahafo	6.6	7.8	13.7	7.6
Eastern	6.0	7.3	5.8	4.7
Central	6.8	7.1	7.6	4.0
Northern	22.8	27.0	36.1	26.3
Upper West	45.1	15.4	76.0	16.4
Upper East	21.3	10.3	56.9	16.4
Ghana	8.4	100.0	16.5	22.1

Source: (GSS, 2014b).

Regionally, Greater Accra has the lowest (5.6%) poverty incidence followed by Ashanti (14.8%) and Central region (18.8%). The case of Greater Accra has been phenomenal as the region recorded a drop in poverty rates from 13.5% in 2005/2006 to its current rate which is about 18.6% lower than the national poverty rate (24.2%). Figures from Table 1 show that poverty has been concentrated in Northern Ghana (Upper West, Upper East and Northern regions). Although poverty generally declined in these regions, the rates are still very high compared to regions in Southern Ghana. For instance, the incidence of extreme poverty in Upper West decreased from 89.1% in 2005/2006 to 70.7% in 2012/2013 and from 55.7% to 50.4% in Northern region over the same period. In Upper East, the reduction is impressive as poverty incidence decreased from 72.9% in 44.4% representing 28.5% reduction rate. One noticeable quagmire here is that, despite proximity of the regions in Northern Ghana to each other and the seeming homogeneity in many characteristics, there exist very wide disparities in their rates of poverty incidence. For instance, the current rates suggest that more than four in every ten persons in Upper East are poor, one in every two in the Northern region and seven out of every ten in Upper West. Regional contributions to national poverty remain the same between 2005/2006 to 2012/2013. It is imperative to note that, even though Upper West region has the highest poverty rate in Ghana, it contributes less than 10% to national poverty perhaps due to its small size in terms of population. While Greater Accra consistently contributed the least, Northern region is the highest contributor to national poverty with current rate measuring about 21% compared to 3.8% in Greater Accra.

In terms of extreme poverty incidence, apart from the three northern regions, whose rates are at least 2.5 times higher than the national rate, all the other regions have rates lower than the national average of 8.4%. Indeed the northern regions account for a significant share in terms of contribution to extreme poverty, the combined size of the three northern regions accounts for more than half (52.7%) of those living in extreme poverty in the country. A careful analysis of Table 1 does not reveal substantial variations in extreme poverty rates although the three northern regions accounted for a relatively lower proportion in 2012/13 than in 2005/06 (59.1%).

Essentially, the contribution to poverty incidence also varies across various demographic groupings. In 2012/13, the rural population which comprised of about 50% of Ghana's population accounted for 78% of Ghana's poverty. This pattern is similar to the fourth and fifth round of GLSS where over 80% of the total population living below the poverty line were those in the rural areas. Even within rural areas where poverty is prevalent, poverty incidence is exceedingly higher among those living in the savannah areas.

The above discussions so far do not highlight on the depth of poverty. That is the proportion by which the average consumption level of poor households falls below the poverty line and knowledge of this is crucial as it gives some indication of the severity

of poverty in Ghana. The poverty depth reveals that on average the poor population lived 32 and 27% below the upper (GH¢1,314.00) and lower (GH¢792.05) poverty line respectively.

There is also some noticeable heterogeneity in poverty incidence according to employment type. For instance, incidence of poverty is highest among households where the head is self-employed in the agricultural sector. However, households whose heads are paid employees, those who are self-employed in non-agricultural sector or have retired from the formal sector are far from poverty. Even though farmers experienced some reduction in poverty from about 45% in 2005/2006 to 39.2% in 2012/2013, they are still the poorest.

3. Income diversification: Determinants and welfare implications

Dimova and Sen (2010) opine that household income diversification has become a norm especially in rural societies and that concentration in a single employment is an exception. Through diversification, households generate extra income and are improving on their welfare (Barrett et al., 2001; Ellis and Mdoe, 2003).

The concept of farm and non-farm income has received much attention in the literature. While some studies (Deininger and Olinto, 2001; Lanjouw, 2001; Chang and Mishra, 2008) have concentrated on examining the impact of non–farm activity on welfare, others (Abdulai and Delgado, 1999; Abdulai and CroleRees, 2001; Barrett et al., 2001; Canagarajah et al., 2001) have analyzed the factors influencing households' decision to participate in either farm or non-farm work.

Theoretical explanation provides that, households diversify due to either push or pull factors (Ellis, 2000; Barrett et al., 2001). For instance, Reardon et al. (1994) explicitly distinguishes between these two factors. They argue that diversification undertaken for accumulation objective is largely driven by "pull factors" while diversification undertaken to manage risk, cope with shock, or escape from agriculture in stagnation or in secular decline are driven by "push factors". They further argue that while diversification caused by the pull factors is usually associated with an income surge and assets for the households, diversification by push factors sometimes leaps a household out of poverty, but can merely sustain as the household adds an equivalent of subsistence–level non-farm activity to a risky and poor agricultural income base.

Lanjouw (2001) found that participation in non-farm income comprise a significant share of income for both poor and non-poor. However, while poor households engage in last resort non-farm activities not associated with high levels of labour productivity, the least poor engage in productive non-farm employment associated with high likelihood

of upward mobility. Lanjouw's (2001) finding is consistent with Deininger and Olinto (2001). Relying on data gleaned from rural households in Colombia, Deininger and Olinto (2001) find that off-farm employment contributes about 45% to household income. The authors also found a strong positive relationship between total income and specialization (in either farm or non-farm activities) suggesting that even though non-farm work contributes to diversification of income generating activities, individual households may still be better-off by exclusively relying on one main income source. Reardon et al. (2006) also argue that specialization rate is much higher in richer areas as more households tend to specialize in purely farm or purely non-farm work as a result of the larger markets (aggregate demand) which support specialization in the richer zones, and less aggressive risk management pursuit by households who diversify their income sources. However, households in poor areas typically operate both farm and non-farm activities and may not do either very efficiently but are however able to manage risk, compensate for a poor asset base and survive. Using bio-economic modelling, Holden et al. (2004) found that better access to low-wage non-farm income has a substantial positive effect on household income.

Even though agriculture remains the predominant income source and employment for majority of rural households, these national level household surveys highlight non–farm employment as an important source in rural Ghana given their relative contributions to household incomes and employment. Senadza (2012) examines the pattern and determinants of non-farm income diversification in rural Ghana. Findings from the study show that off-farm income constituted about 43% of rural household income. Further evidence suggests that female-headed households tend to have larger off-farm income proportions relative to male-headed households. Interestingly, the author also found that, non-farm self-employment income is more important than non-farm wage-employment income in rural Ghana and findings from the determinants of participation show that the gender, age, education, access to credit, electricity and markets are important factors influence participation in multiple non-farm activities and non-farm income.

Newman and Canagarajah (2000) find that non-farm participation is associated with lower poverty levels and greater reductions in poverty over time in Ghana and Uganda. In both countries, rural poverty rates rapidly decreased for female heads of household engaged in non-farm activities where these activities provided the highest average incomes and constituted the larger proportion of household income in Ghana. In terms of effect of farm income on inequality, Canagarajah et al. (2001) find that, at the household level, contribution of non-farm income to rural inequality depends largely on the income sources. By distinguishing between the different kinds of non-farm earnings, the authors found that income from self-employment contributed most to growing inequality in rural Ghana and that wage earnings is inversely related to income inequality less even than agricultural income.

In Ghana, poverty and unemployment are major issues policy makers face. These challenges are more pronounced in Northern Ghana. However, a major source of income for many households especially in rural and savannah areas is agriculture despite the little attention paid to this sector. Apart from the poor budgetary allocations, severe droughts, bush fires and volatile commodity prices adversely affect productivity levels. The urge to maintain a stable income and consumption have necessitated the diversification of household income sources. We contextualise this in the next section.

4. Developing the concept and empirical strategy

We conceptualise the study similar to that of Huffman (1991) and where a typical household allocates their time to individual activities including farm work. A household is assumed to maximize utility U from the consumption of good Q and leisure W such that the utility function is defined as:

$$U = U(Q, W)$$

<div align="right">1</div>

In maximizing this utility function, households are subject to time, budget, production and the non-negativity constraints. We define the time constraints as $T = L_1 + L_2 + W$ where T is total time available, L_1 is the time allocated to non-farm work while L_2 is the time allocated to farm as a result of the desire to diversify income source. Following this, we express the household budget constraint on farm income as:

$$PQ = p_1 x_1 - r_1 L_1 + r_2 L_2 + I$$

<div align="right">2</div>

where P is the price of consumption good; p_1 is the price for farm output; x_1 is the quantity of farm output produced; r_1 and r_2 are the returns to non-farm work and farm work respectively while I is non-labour income. L_1 and L_2 are as previously defined.

From our household utility function, the first order condition for optimal time allocation to the three activities is given as:

$$\partial U / \partial L_i = r_i \, \partial U / \partial Q - \partial U / \partial L = 0$$

<div align="right">3</div>

When a household engages in the three activities, we derive their labour supply functions allocated to non-farm and farm work as follows:

$$L_1 = L_1(r_1, r_2, p_1, p_2; V) \qquad\qquad 4$$

$$L_2 = L_2(r_1, r_2, p_1, p_2, I; V) \qquad\qquad 5$$

where V is a vector of household's socio-economic traits influencing the individual's reservation wage and farm income. We define a reservation wage for farm work as the additional value of the individual's available time when all is allocated to leisure and non-farm wage. Thus, an individual i will allocate some hours to farm work if the expected farm wage (r_i^*) sufficiently exceeds the reservation wage ($r_i^|$). In other words, as income diversification strategy, an individual will engage in farming (ie $L_2=1$) if $r_i^* > r_i^|$ and will never allocate any time for farm work (ie $L_2 = 0$) if $r_i^* > r_i^|$. It is imperative to note that, while the decision to participate in farm work is inextricably influenced by the differential wage between the farm or market wage and the reservation wage, these differential wages cannot be observed expect the decision to participate or not to participate in farm work (L_1). We model this decision as:

$$L_i^* = \gamma V_i + \varepsilon_i \qquad\qquad i. = 1, 2, \ldots\ldots, N \qquad\qquad 6$$

$$L_i = \begin{cases} 1 \ if \ L_i^* > 0 \\ 0 \ if \ L_i^* \leq 0 \end{cases} \qquad\qquad 7$$

where is a vector of parameters; is socio-economic characteristics for individual i, while is the error term.

We postulate that, an individual i engages in farm work with the view to raising additional income to improve on household consumption and to investigate the impact of participation in farm work on the outcome (consumption) variable, we specify the following simple linear function which links the outcome, participation decision and household socio-economic characteristics.

$$Y_i = \beta_i + \delta L_i + \pi V_i + \mu_i \qquad\qquad 8$$

where Y_i denotes the household consumption, L_i is the participation decision already defined in equation (7) above, V_i is also defined as a vector household socio-economic

characteristics, β_i is a vector of unknown parameters while π is also a vector of parameters to be estimated, μ_i is the error term.

In equation (8) above, the participation variable (L_i) and the decision to participate in farm work is specifically treated as an exogenous variable since the decision to participate in farm work is seen to increase household income and subsequently consumption and welfare. However, this motive is not always true as some wealthier individuals may be better disposed to farming. This is more apt as modern farming well depends on the availability of farm equipment often expensive to the poor and cheap to the rich. The ownership of farm equipment also makes it possible for large scale farming and bigger harvests all things being equal. Thus, participation in farm work is not random culminating in selection bias where the error terms now correlate. In other words, the unobservable factors affect both the error term (ε) of participation in equation (6) and the error term (μ) of consumption in equation (8). However, estimating equation (8) in the presence of correlation using ordinary least squares approach leads to biased results hence we employ the propensity score matching technique to examine the impact of participation in farm activities on household welfare.

Given the conceptual framework above, the propensity score matching compares the welfare of farm households with their counterfactual group that do not diversify into farming activities and essentially depending on non-farm work as the main income source. An advantage of this approach is that, it addresses selectivity bias and also allows for a decomposition of the treatment effect on the outcome (Rosenbaum and Rubin, 1983; Heckman et al., 1999).

We define the propensity score $p(V_i)$ as the conditional likelihood of participating in farm work given the pre–treatment characteristics:

$$p(V_i) \equiv p(L_i = 1|V_i) = E(L_i|V_i); \qquad p(V_i) = F[\varphi(V_i)] \qquad\qquad 9$$

The variables in equation (9) remain as previously defined except for $F[\bullet]$ which denotes the normal or logistic cumulative distribution.

The predicted propensity scores are then used to estimate the treatment effects. This is done using the average treatment effect on the treated (ATT) which captures the participation effect and the average treatment effect (ATE) which captures the treatment effect of the whole sample. Thus given $p(V_i)$, we evaluate these effect as follows:

$$\text{ATT} = E[E\{Y_i|L_i = 1, p(V_i)\} - E\{Y_i|L_i = 0, p(V_i)\}|L_i = 1] \qquad\qquad 10$$

$$\text{ATE} = E[E\{Y_i|L_i = 1, p(V_i)\} - E\{Y_i|L_i = 0, p(V_i)\}] \qquad\qquad 11$$

where $E\{Y_i|L_i=1\}$ is the expected consumption outcome of households in farm activities while $E\{Y_i|L_i=0\}$ is the counterfactual consumption of non-farm households.

We proceed to match the sample using the nearest neighbour matching technique which matches our sampling groups using different criteria to find the degree of similarity in the probability of receiving the treatment. In other words, the nearest neighbour matches each individual with their closest neighbour with similar observed traits either replacement or without replacement. We test the robustness of the propensity score using a balancing property specified as $L \perp V \mid p\ (\ V\ )$ which implies that as in a randomized control trials, conditional on the propensity score, each individual should have equal probability of participating in farm activity.

4.1 Data description

Data used for this paper was gleaned from the recent sixth round of the GLSS conducted by the Ghana Statistical Service (GSS) from 18th October, 2012 to 17th October, 2013. The survey covered a nationally representative sample of 18,000 households in 1,200 enumeration areas (EAs). A two-stage stratified random sampling design was employed with each EA assigned as a primary sampling unit while households within each EA constituted the secondary sampling units. To facilitate the data collection, the EAs were first stratified into ten domains according to the ten administrative regions and within each region the EAs were further categorised into rural and urban areas. Each EA was also classified into the three ecological zones namely coastal, forest and savannah area. The survey focused on key socio-economic traits as well as living conditions and welfare of households in Ghana where a household is defined as a person or group of (un)related persons living together in the same housing unit and sharing the same housekeeping and cooking arrangements and are considered a single unit, who acknowledge an adult male or female as the head (GSS, 2014). Specifically, it collected key household data on areas including but not limited to demographics, education, employment, health, housing, expenditure, agriculture, non-farm household enterprise, income generating activities, assets, savings and access to finance (GSS, 2014). The survey enumerated 16,772 households and 71,524 household members. For the purpose of this study, we extracted data on the three northern regions namely Northern, Upper East and Upper West regions and this provided us with a household sample size of 1,702, 1,447 and 1,399 respectively.

Devereux (2008) argues that less food-endowed households in Northern Ghana experience food shortages in January but "hungrier periods" spans from March to July each year. Given the poverty background of these regions, most rural households devise various livelihood strategies in order to overcome poverty (Ashong and Smith, 2000). The

regional vegetation and the single rainy season coupled with long dry season adversely affect revenue from agricultural productivity thus pushing households to diversify their income sources and subsequently participate in non-farm work as an income diversification strategy. These non-farm works include manufacturing, trading and other activities and incomes from these activities smooth households' consumption owing to fluctuations in farm income. In this study, our dependent variable is a dummy taking the value one (1) if a household participates in farm work and zero (0) otherwise. Our outcome variable is welfare proxied by total real household annual consumption expenditure. The reasoning is that, a poor household will be unable to enjoy higher consumption expenditure relative to a rich household. In line with standard literature on participation of farm work, we include such variables as gender, age, marital status, education, household size and access to credit as factors perceived to influence participation in farm employment.

5. Results and discussions

This section discusses results on the empirics. First, it presents discussions on the descriptive analyses largely on the demographics, poverty and inequality levels in the regions. The second section analyzes the determinants of participation in farm work as well as the effect of the latter on household welfare. With regard to participation in farm work, Table 2 shows that about 67% of the households in Northern region participate in farm work compared with that of 55 and 62% in Upper East and Upper West regions respectively. Thus, Upper East region has the least number of participants in farm work. Values of the standard deviations show homogeneity in an intra–level variability in farm work participation. We compute the coefficient of variation (CV) as the ratio of standard deviation to mean in order to allow for regional comparisons since the usage of standard deviation may be misleading. On this score, while an intra-level homogeneity exist, results from the CV identifies Upper East region as the region with the highest variability in participation despite its low participation rate. The implication is that, this region has a higher a farm participation turnover where households who frequently exit farm participation is potentially compensated for by new entrants in order to balance the overall participation rate. With regard to the outcome variable, further results show that households in all the three Northern regions have an average household consumption expenditure of at least GH¢6,000 (US$1,578.95) per annum. This notwithstanding, Northern region has the highest average consumption expenditure of GH¢6,634.69 (US$1,745.97) per annum relative to GH¢6,323.74 (US$1,664.16) and GH¢6,014.65 (US$1,582.80) in Upper East and Upper West regions respectively. Given GH¢9,317 (US$2,451.84) as the national annual mean household expenditure (GSS, 2014), our findings reveal that average household expenditure in all the three Northern regions is well below the national average thus echoing the rather poor nature of households from these regions. Interestingly, Northern region with the highest consumption expenditure

has the lowest real household expenditure volatility given the rather low value of its coefficient of variation. Similarly, real household consumption expenditure is very volatile in Upper West and measures about one-and-half times that of Northern region despite the rather low consumption expenditure in Upper West.

Table 2: Descriptive statistics

Variable	Definition	Northern N=1,702			Upper East N=1,447			Upper West N=1,399		
		Mean	**SD**	**CV**	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**
Treatment: Participation	=1 if households participates in farm work =0 otherwise	0.665	0.472	0.710	0.554	0.497	0.897	0.620	0.486	0.784
Outcome: Household consumption	In Ghana Cedis (GH¢)	6,634.693	6,102.995	0.9198	6,323.735	5,912.361	0.935	6,014.653	8,333.390	1.386
Independent variables: Age	In years	44.41	15.490	0.349	48.15	17.218	0.358	47.640	16.250	0.341
Education	=1 if formal education; 0=otherwise	0.336	0.472	1.405	0.406	0.491	1.209	0.394	0.489	1.241
Marital status	=1 if married; 0=otherwise	0.838	0.369	0.440	0.756	0.430	0.569	0.765	0.424	0.554
Household size	Number of household members	5.59	3.393	0.607	4.66	2.582	0.554	5.60	3.409	0.609
Access to credit	=1 if yes; 0=otherwise	0.51	2.011	3.943	0.49	1.89	3.857	0.48	2.185	4.552

Source: Authors' computation using GLSS 6 data.

The age of households also show a uniform distribution both in terms of average and level of variability although average age of household head is higher in Upper East and lower in Northern region. Turning to the educational background of the household heads, our findings show that, majority of the household heads in all the three regions do not have formal education and have never been to school. However, out of the 1,447 households in Upper East region, only 49% have formal education and this proportion is relatively higher than those in Northern (34%) and Upper West (39%) regions. Majority of all the household heads are married and a typical household in Upper East and Northern regions has the same average size of 5.6 relative to 4.7 in Upper West. The GSS (2014) reports a national average household size of 4 suggesting that the even a typical household in these three regions has a mean size above the national average. Household's access to credit does not differ across the three regions although about 51% of households in Northern region have access to finance relative to 49 and 48% in Upper East and Upper West regions respectively.

Table 3: Further descriptive statistics

Variable	Northern (N=1,702)		Upper East (N=1,447)		Upper West (N=1,399)	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Gender						
Male	1,506	88.5	1,088	75.2	1,137	81.3
Female	196	11.5	359	24.8	262	18.7
Welfare quintile						
First (Lowest)	673	39.5	497	34.3	817	58.4
Second	381	22.4	335	23.2	218	15.6
Third	289	17.0	250	17.3	127	9.1
Fourth	214	12.6	209	14.4	83	5.9
Fifth (Highest)	145	8.5	156	10.8	154	11.0

Source: Authors' computation using GLSS 6 data.

The gender distribution of the household heads reveals that in all the regional households, majority of the heads are males and this finding supports the evidence that males often head and manage the affairs of households in Northern Ghana. However, out of the number of households considered in the sample, majority fall under the first (lowest) quintile. This finding suggests that many of the households are very poor and the percentage of such households is higher in Upper West relative to the other two regions where 39.5 and 34.3% in Northern and Upper East regions respectively fall under this category. Further results show that as we move in ascending order, the percentage of households in each quintile consistently decreases suggesting that only few households make it into the wealthy class. Interestingly, Upper West is the only region with the highest proportion of households in the lowest quintile and at the same has the highest percentage of households in the wealthiest class relative to Northern and Upper East regions although its absolute percentage does not significantly differ from Upper East region. We extend this analysis to further highlight the level of income (in)equality in the regions using Lorenz curve which is a graphical representation of income or wealth distribution where the cumulative share of households' income is plotted against the cumulative share of the population. For the purpose of this section, we use real household consumption expenditure to proxy income and the Lorenz curves for the three regions are presented in Figures 1 to 3. For completeness, a perfectly equal income distribution is where every household in each region has the same income and this illustration is depicted as the line of equality and a perfect unequal income distribution is one in which just one household has all the income with the remaining households having none.

Thus, for complete regional income equality, the Lorenz curve would be a straight line and equal to the equality line. However, it becomes more curved and drifted away from the line of equality as inequality increases.

Figure 1 depicts the Lorenz curve for Northern region which shows the curve slightly drifting away from the line of equality. The implication is that, income distribution is relatively equal. To identify the degree of inequality, we compute the Gini coefficient which is equal to the ratio of the area between the line of equality and our observed Lorenz curve to the area between the line of equality and the line of perfect inequality. In other words, our computed Gini coefficient is given as half the area between the Lorenz curve for the income distribution and the line of equality. Here, the coefficient ranges from 0 to 1 and the higher (lower) the coefficient, the higher (lower) the income inequality. Our computed Gini coefficient for Northern region is 0.32 which collaborates with the Lorenz curve and shows a relatively lesser unequal society.
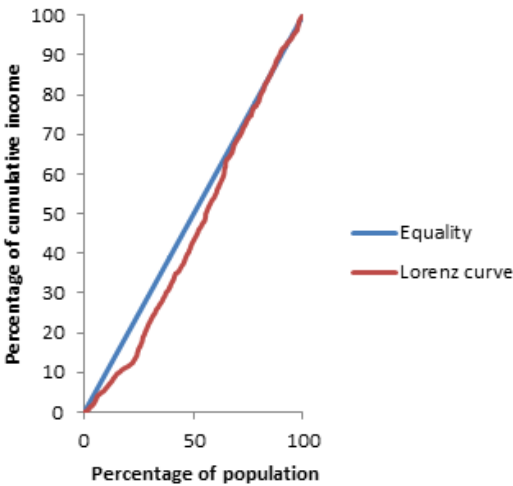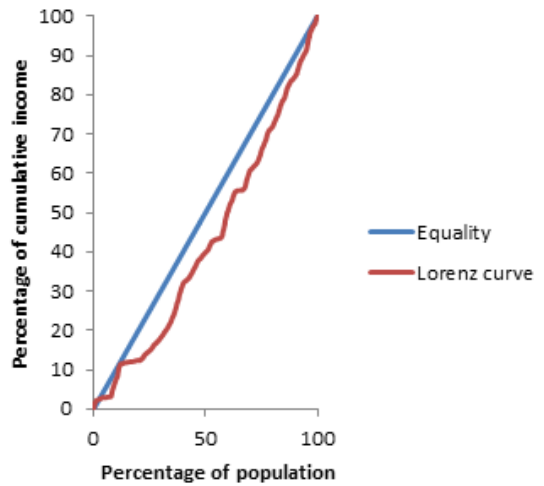

Figure 1: Lorenz curve for Northern region   Figure 2: Lorenz curve for Upper West region
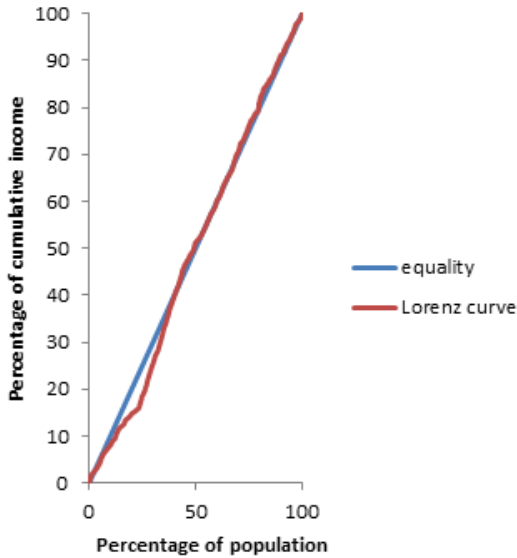
Figure 3: Lorenz curve for Upper East region

Source: Authors' construct using GLSS 6 data.

The case of Upper West is not fundamentally different from Northern region although its level of inequality is relatively higher than Northern region. The Lorenz curve shown in Figure 2 is somewhat mixed as the curve seemed to be closer to the line of equality at lower level of income (10%) but systematically bows away from the equality line after the 10% threshold. This finding may suggest that households at lower income levels may have the same income levels and those with higher incomes may also have similar income levels. However, our computed Gini coefficient is 0.45 suggesting that inequality in Northern region is relatively lower than Upper West region. In the case of Upper East region in Figure 3, the Lorenz curve is almost equal to the equality line revealing no apparent inequality in the region. This is confirmed by the low value of the Gini coefficient (0.09). What is clear from the three curves is that, although poverty is rife in the three Northern regions, there appear to be relatively less inequality in these areas. This perhaps can be the result of greater willingness of northerners to share the few resources in reciprocal neighbourliness. This is particularly so when northerners are generally profess to be each other's keeper and thus contribute together towards their common welfare. Apart from this, the lower inequality in Northern Ghana may also be influenced by alms giving (*zakat*) – a pillar of the Islamic religion – where Muslims are mandated to offer alms to the poor and destitute in society. This gesture, which is dominant especially in Northern region where majority of the population are Muslims could also be a key contributor to the reduced inequality.

Given the relative dispersion of income among households, individuals tend to diversify their income sources by engaging in either farm or non-farm activities with the aim of increasing household income and welfare. But what actually drives household participation in farm work? We investigate the determinants of participation in farm work relying on probit regression and results are shown in Table 4 below.

Table 4: Determinants of participation in farm work

Variable	Northern		Upper East		Upper West	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Constant	-2.139***	0.001	-1.983*	0.058	-1.619**	0.011
Male	0.661**	0.046	0.712**	0.014	0.816***	0.081
Age	0.141***	0.009	0.261*	0.051	0.158***	0.072
Age square	-0.214**	0.014	-0.287**	0.024	-0.231**	0.041
Marital status	0.612	0.218	0.119***	0.091	0.315	0.410
Household size	0.318***	0.001	0.418**	0.037	0.391*	0.008
Education	0.619	0.472	-0.318***	0.072	-0.518***	0.061
Access to credit	-0.116*	0.053	0.461*	0.001	0.417*	0.002
Diagnostics						
Pseudo-R^2	0.618		0.634		0.601	
Log likelihood	-961.265		-832.855		-802.331	
p-value	0.000		0.000		0.000	
Observations	1,702		1,447		1,399	

Notes: *, ** and *** respectively denote 10, 5 and 1% significance level. Female, not married, no access to credit and no formal education are used as controls in their respective groups.

Results from the diagnostics show adequate models in all cases. From Table 4 above, the values of the Pseudo-R^2 reveal that, between 60 to 63% of the variation in the dependent variable – participation in farm work – is explained by variations in the independent variables. The high log likelihood values and the low p-values show the overall significance of the models across all the regions. With regard to individual significance, our finding reveals that relative to women, men in all the three northern regions are more likely to engage in farm work given the positive and significant coefficients. However, the probability of men engaging in farming activities is higher in Upper West region and lower in Northern. Age as an independent variable also positively and significantly influences participation in farm work in all the regions. In the case of Northern region, a unit-percentage increase in age increases the probability of engaging in farm work by 14% compared with 26 and 16% in Upper East and West regions respectively. The implication is that, although age significantly matters in farm activities, households in Upper East region have higher probability of farming when it comes to age. We investigate for non-linearities in the age–participation nexus by including a square term of age in

the model to account for old age. In all the regions, the coefficient is negative and highly significant at 5% level suggesting the existence of an inverted U-shaped relationship. This finding implies that participation in farm work increases with age only up to a certain threshold beyond which further increases in age reduces the chances of farm participation. Interrogating the regional coefficients reveal that households in Upper East region are more likely to retire from farming owing to old age and this finding resonates well with its age–participation nexus. For instance, because chances of participation in farm work on account of age is higher in Upper East region, one would also expect household heads to have higher probability of retirement from active farming as they will get older earlier and hence unable to engage in farming which often requires some sort of physical labour. The impact of marital status on farm participation decision is mixed only in terms of significance but not the direction of effect. For instance, in Northern and Upper West regions, although a married household head is more likely to engage in farming, this effect is flatly insignificant at conventional levels suggesting that for these two regions, marital status and farm participation are completely independent. However, the effect of marital status is significant in Upper East region. Specifically, relative to unmarried household heads, married household heads have about 12% probability of engaging in farm work. Thus, for the Upper East region, the marital position of household heads matter in households' decision to participate in farm employment as an income diversification strategy.

The size of households has also proven crucial in farm participation decision. Its effect is positive and significant in all the three regions. In case of Northern region, a 1% increase in household size increases the likelihood of participation in farm work by 32% compared to 39% in Upper West. In Upper East region, this effect is higher as a unit–percentage increase in household size significantly increases participation decision by 42%. The increases in farm participation decision in response to increases in household size can be attributed the fact that larger households may incur lower labour cost as households themselves are crucial source of farm labour. Households with larger sizes will normally have a comparative advantage over those with smaller sizes and as such the probability of engaging in farming is higher among those with larger households.

The effect of education on participation decision is mixed. For instance, its coefficient is positive for Northern region suggesting that household heads with some form of formal education are more likely participate in farm work. However, the rather high *p*-value renders this effect insignificant. In the case of Upper East and Upper West regions, the coefficient of education is negative and highly significant. Thus, household heads with some sort of formal education are less likely to engage in farming with those in Upper West regions having the highest probability of participation attrition. We can infer from these findings that household heads in Upper East and Upper West regions may well be equipped with some entrepreneurial skills that provide better options when heads obtain some formal education thus discouraging them from venturing into farming. We

cannot also take for granted that some "educated" household heads may view farming as the preserve of the "uneducated" and may have no desire of farming. In the case of Northern region, education does not in any way influence household farming decision.

Access to credit is also an important determinant of participation in farm work although its effect differs in terms of direction. In Northern region, an increase in household heads' access to credit significantly decreases the probability of participating in farm work by 12%. However, in both Upper West and Upper East regions, participation in farm work is highly propelled by access to credit. While this holds, the effect of credit on the decision to participate in farming is slightly higher in Upper East given the size of the coefficient. The case of Northern region may be somehow surprising as one will expect higher farm participation in response to increase in access to credit. The contrary is however true in Northern region and this finding calls for re-examination of credit advancement as much attention is often paid to the quantity of credit instead of quality. Here, we define quality credit as those targeted form of credit which are often tied to a particular income generating activity. For instance, a credit not directed at any specific activity may influence households to entirely leave farming for other non-farm work as they now have some form of capital to embark on such activity. But does participation in farm work impact on welfare at all? We attempt to answer this question by employing the propensity score matching which controls for selection bias prevalent in the unobservable characteristics of the participation decision. The next section discusses the findings on this where we use real household annual consumption expenditure as the outcome variable. The results for the treatment effects estimated by the radius matching approach, sensitivity of matching algorithm as well as the quality indicators for the propensity score matching are presented and discussed.

Table 5: Treatment effects and sensitivity analysis for Northern region

Radius matching treatment	Outcome indicator	Propensity score matching		Treatment		Control	
		ATT	ATE	On–support	Off–support	On–support	Off–support
Participation	Consumption expenditure	2,604.94 (12.74)***	2,598.16 (12.31)***	1,132	-	570	-

Sensitivity of matching algorithm							

Nearest Neighbour	Outcome indicator	Propensity score matching		Treatment		Control	
		ATT	ATE	On–support	Off–support	On–support	Off–support
Participation	Consumption expenditure	2,611.45 (13.01)***	2,609.03 (12.54)***	1,132	-	570	-

Quality indicators for the propensity score matching					

Outcome Indicator	p–value (unmatched)	p–value (matched)	Mean absolute bias (unmatched)	Mean absolute bias (matched)	Absolute bias reduction
Consumption expenditure	0.0001	0.2913	12.917	6.913	79.051

Notes: *** denotes significance 1% level. Values in the parentheses are *t*-statistics.

Beginning with Northern region, from Table 5 above, both the average treatment effect on the treated (ATT) and the average treatment effect (ATE) produced consistent estimates of farm participation effect on welfare where participation in farm work positively and significantly impacts on households' welfare. Specifically, the ATT shows that relative to those who do not engage in farming, participation in farm work increases household real expenditure by GH¢2,604.94 (US$685.51). The ATE estimate of GH¢2,598.16 (US$683.73) is also consistent with the welfare-enhancing effect of farm participation although this suggest a relatively lower welfare compared to the ATT estimate. We check the robustness of the results to the matching algorithm by using the nearest neighbour approach. Consistent with the radius matching technique, results from the nearest neighbour also reveal that, participation in farm work significantly increases household consumption expenditure by GH¢2,611.45 (US$687.22) and GH¢2,609.03 (US$686.59) as respectively estimated by the ATT and ATE. Further findings show that results produced from the nearest neighbour treatment intrinsically outweighs that of the radius matching technique although both approaches a positive and statistically significant impact of farm participation on household welfare in Northern region.

The balancing property for the propensity score matching and the quality of indicators is checked before and after the matching and result is presented at the lower part of Table 5. Specifically, the high *p*-values of all the covariates after the matching are not jointly significant at conventional levels confirming that there are no pre-treatment differences and selection bias between the participants and non-participants of farm work in Northern region. Thus the covariates were significantly biased as a result of the propensity score matching.

Table 6: Treatment effects and sensitivity analysis for Upper West region

Radius matching treatment	Outcome indicator	Propensity score matching		Treatment		Control	
		ATT	ATE	On–support	Off–support	On–support	Off–support
Participation	Consumption expenditure	1,904.94 (12.74)***	1,998.16 (12.31)***	802	-	645	-
Sensitivity of matching algorithm							
Nearest Neighbour	Outcome indicator	Propensity score matching		Treatment		Control	
		ATT	ATE	On–support	Off–support	On–support	Off–support
Participation	Consumption expenditure	2,611.45 (13.01)***	2,609.03 (12.54)***	802	-	645	-
Quality indicators for the propensity score matching							
Outcome Indicator	*p*–value (unmatched)	*p*–value (matched)	Mean absolute bias (unmatched)	Mean absolute bias (matched)	Absolute bias reduction		
Consumption expenditure	0.0001	0.2913	12.917	6.913	79.051		

Notes: *** denotes significance 1% level. Values in the parentheses are *t*-statistics.

From Table 6, the effect of participation in farm work on welfare in Upper West region does not significantly differ from that of Northern region. The ATE estimate produced by the radius matching treatment shows that participation in farm work increases household's real consumption expenditure by GH¢1,998.16 (US$525.83). This is consistent with the ATT although its effect is relatively lower. Further results produced by the nearest neighbour treatment as a robust check are akin to the radius matching technique. Specifically, the ATT from the nearest neighbour treatment reveals that, participation in farm work significantly raises household's consumption expenditure by GH¢2,611.45

(US$687.22) compared to GH¢2,609.03 (US$686.59) of the ATE. Like Northern region, juxtaposing the two approaches show that estimates produced by the nearest neighbour technique are consistently higher than the radius matching approach. However, the overall evidence reveals that although participation in farm work improves welfare, higher welfare effects by way of higher consumption expenditure can be registered in Northern than in Upper West region. The balancing property for the propensity score matching and the quality of indicators show high *p*-values of all the covariates after the matched. Thus, self-selection bias eminent in such cross-sectional studies is eliminated and the results herein are reliable.

Table 7: Treatment effects and sensitivity analysis for Upper East region

Radius matching Treatment	Outcome indicator	Propensity score matching		Treatment		Control	
		ATT	ATE	On–support	Off–support	On–support	Off–support
Participation	Consumption expenditure	1,911.40 (12.74)***	1,983.72 (12.31)***	867	-	532	-
Sensitivity of matching algorithm							
Nearest Neighbour	Outcome indicator	Propensity score matching		Treatment		Control	
		ATT	ATE	On–support	Off–support	On–support	Off–support
Participation	Consumption expenditure	1,917.01 (13.01)***	1,952.74 (12.54)***	867	-	532	-
Quality indicators for the propensity score matching							
Outcome Indicator	*p*–value (unmatched)	*p*–value (matched)	Mean absolute bias (unmatched)	Mean absolute bias (matched)	Absolute bias reduction		
Consumption expenditure	0.0001	0.2913	12.917	6.913	79.051		

Notes: *** denotes significance 1% level. Values in the parentheses are *t*-statistics.

In the case of Upper East region, participation in farm work positively and significantly affects welfare. Table 7 above shows results from the propensity score matching for the region and findings based on the ATT of the radius matching treatment reveal that, households' consumption expenditure increases by GH¢1,911.40 (US$503.00) when they engage i n farming as an income diversification strategy. Although positive, the welfare gain from farm participation is higher when ATE is estimated. In particular, the ATE estimate shows that relative to non-participants, real household consumption expenditure increases by GH¢1,983.72 (US$522.03) following participation in farm

work. These findings are akin to Northern and Upper West regions although the welfare gain in Upper East is the lowest among the three regions. The robustness check using nearest neighbour treatment reveal consistent estimates both in terms of magnitude and direction of effect. Interestingly, estimates produced from the ATE using the radius matching technique is higher than that of the nearest neighbour and the reverse is true for the ATT. Specifically, the ATE shows that, households who engage in farming on the average have more real annual consumption of GH¢1,952.74 (US$513.88) than those who do not engage in farming and entirely depend on non-farm activities. Similarly, the ATT suggests that farm households have increased consumption expenditure relative to their non-farm counterparts. The stability and quality indicator check before and after the matching show that the covariates in the probit regression model are jointly not statistically different from zero given the high *p*-value of the matched controls. The insignificance of the covariates reveal how reliable our results are for policy formulation as the estimates are free from selection bias and pre-treatment differences between households who engage in farm work and those who do not.

6. Conclusion and policy recommendations

There are growing concerns for poverty reduction and this concern has been espoused by many policy documents including the Millennium Development Goals which in its first goal advocated for halving global poverty. The 2015 deadline for the global poverty reduction could not be achieved and this culminated into a new Sustainable Development Goals which among others also call for a massive reduction in poverty. The general consensus for poverty alleviation is on the premise that poverty violates the fundamental human rights and as well damages welfare of the poor. In the case of Ghana, poverty is prevalent in the North and largely a rural phenomenon. As such, individuals often resort to income diversification strategy as a coping strategy which sees some section engaging in farm activities to improve on welfare. This paper aimed at assessing the effect of participation in farm work on welfare in Northern Ghana using the recent sixth round of Ghana Living Standard Survey (GLSS) data. We employed the propensity score matching technique to correct for selection bias mostly persistent when unobservable factors influence the decision to participate in farm employment and consumption expenditure.

Our findings show that, inequality is generally lower in the face of widespread poverty in Northern Ghana. On the determinants of participation in farm employment, results from the probit regression show that relative to women, men in all the three northern regions are more likely to engage in farm work given the positive and significant coefficients. While this holds, the chances of men engaging in farming employment is higher in Upper West and lower in Northern region. The effect of age on participation decision is largely non–linear and an inverted U–shaped in particular suggesting that

participation in farm work increases with age only up to a certain age threshold beyond which further increases in age reduces the probability of engaging in farming. This inverted U-shaped nexus is higher in Upper East region suggesting that men in this region are more likely to retire from farming on account of old age. While married household heads in Upper East region are more likely to engage in farm employment, the effect of marital status on the decision to participate in farm work is insignificant in Northern and Upper West regions.

Another critical determinant of participation in all the three regions is the size of household although this effect is much higher in Upper East than Northern and Upper West regions. To the extent that households with larger sizes have a comparative advantage over those with smaller sizes, the probability of engaging in farming is expected to be higher among those with larger households. While educated household heads in Upper East and Upper West regions are less likely to engage in farming relative to the uneducated, in the case of Northern region, the educational background of household heads does not matter in participation decision. The effect of access to credit on participation is mixed. For instance, while access to financial credit is a conduit for farm participation in Upper West and Upper East, in the case of Northern region, access to credit significantly reduces the probability of participating in farm activities. Thus, household heads in Northern region opt for non-farm participation when an undirected credit is advanced to them.

With regard to the impact of participation in farm work on welfare proxied by households' real annual consumption expenditure, results from the propensity score matching reveal that engaging in farming employment positively and significantly affect welfare. In other words, compared with those who do not engage in farming, on the average, household heads who participate in farm employment have higher consumption expenditure and are better able to register improved welfare. While this holds, the effect of welfare gains is higher in Northern region and relatively lower in Upper East.

Results from this study reveal the crucial need to promote participation in agriculture in Northern Ghana as a means of bridging the gap between the North and South. Our findings fundamentally call for the allocation of more resources to the Savannah Accelerated Development Authority (SADA) in order for the institution to live up to its mandate. A more vibrant, purposeful and well co-ordinated efforts that culminates in the promotion and investment in the local agricultural sector will not only improve welfare but will also aid in alleviating households from poverty.

Also worthy of mention is the need for removal of barriers to entry in the agricultural sector. One critical barrier is the inadequate credit given to farmers as banks and other financial institutions often channel credit to the non-farm sector with little or even no credit to those willing to venture into farming. Apart from this, the rather high interest rate is also a disincentive. From our findings, we also recommend for the advancement of quality credit exclusively targeted at individuals willing to take up farm employment.

This we believe will not only lessen the constraints to entry but will by far improve agricultural productivity and welfare.

Indeed, improving welfare and reducing poverty require both commitment and planning. It is not enough to make budgetary allocations to the North on the simple assumption that agriculture is the mainstay of the economy of the North. It is also simplistic to assume that the allocation in itself will engender the needed agricultural productivity and ultimately translate into improved welfare. Policy makers need to invest in capacity to understand the factors that will ensure that targeted investments yield the desired results. Again, whilst the obsession with agricultural–led growth as a poverty reduction strategy for the North have genuine merits, we submit that non-farm activities also make substantial contributions to household welfare and can play significant roles in transforming northern Ghana. Policy makers can no longer continue to ignore the issues in front of us.

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