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Migration and non farm activities as income diversification strategies: the case of Northern Ghana

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Migration and non farm activities as income diversification strategies:
the case of Northern Ghana[1]

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Abstract

Environmental changes affect the livelihood of the rural population. This is especially true for those households who mainly rely on farming for their subsistence. In Northern Ghana, during the last two decades, soil erosion, the increasing unpredictability of the rains and the raise in the population size - with the ensuing pressure on the land - contributed to make people even more vulnerable to environmental conditions. These factors - together with the adverse market conditions for the local produce and the neglect of the region in the design of adjustment policies - pushed rural population towards income generating activities alternative to farming (i.e. migration and non farm activities). In this paper, we use a multivariate analysis to explore the determinants of income diversification from a household perspective. We find that non agricultural activities represent an option that better-off households - and communities - can resort to, in order to overcome the difficulties of the agricultural sector; while out-rural seasonal migration is emerging as a coping strategy adopted by poor households to meet their basic needs, and it is unlikely to improve their socioeconomic condition in the long run.

JEL Classification: I32, O15, O55, Q12.
Keywords: income diversification, poverty, inequality, migration.

1. Introduction

The share of the agricultural sector in a country's gross domestic product has often been taken as a synthetic yardstick of the process of structural transformation that should accompany economic growth (e.g. Chenery and Syrquin, 1975). The long-standing tradition of this indicator notwithstanding, it is unclear whether a fall in the agricultural share should be necessarily equated with a process of development. The rise of non farm activities could be pushed by and revealing the crisis of the agricultural sector. Although the employment in the rural non farm sector could represent a good source of income, it should not be neglected that this may as well represent a sort of shelter for immiserizing farming households.

Furthermore, the growth of the non farm sector is not always beneficial for the rural poor, and this entails that the poverty reduction potential of this sector should be carefully assessed, rather than being assumed as a leap of faith. Some studies emphasized that the most profitable non farm activities are characterized by significant barriers to entry – e.g. financial or human capital requirements – that hinder their accessibility for the poor, who are often bound to low-return activities that do not offer them a way out of poverty. In such a context, the development of the non farm sector could determine a worsening of income inequality (Davis *et al.,* 2007).

Migration out of the rural areas represents a second potential sign of structural transformation of the economy, as the Lewis (1954) model well explains, and it could be beneficial for the rural areas, since migration reduces the demographic pressure on natural resources, and it could give rise to substantial flows of transfers to migrant sending households. But, rural-out migration is often perceived as a consequence of poverty: several studies found that domestic and seasonal migration are typical of the poorest households (Mendola, 2008; Waddington and Wheeler, 2003) and other studies demonstrate that poor households resort to remittances sent by relatives as a social security mechanism in order to reduce vulnerability, not as an accumulation strategy[3].

In the Northern part of Ghana, a process of diversification in income generating activities other than farming is occurring: both the employment in sectors different from agriculture and the share of remittances in the household income are increasing.

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[3] See for example Lucas and Stack (1985) for Botswana; Cox *et al.* (1998) for Peru; Gubert (2000) for Mali.

In the first part of the paper, we briefly describe the reasons below this increasing income diversification both at a macro and at a household level, pointing out how several factors indicate that a process of modernization of the economy in Northern Ghana is far to come about and that the development of off farm activities (i.e. non farm activities and migration) is rather the symptom of a severe crisis in the agricultural sector.

The causes of this crisis are often traced back to the climate changes that are negatively affecting this area of the country; here we maintains that there are also other political and institutional factors that made the situation worse. Rural population has to find a way to face the new livelihood context, where it is everyday more difficult to earn a living resorting to the agricultural activity alone. The household and the communal assets people have at their disposal determine their ability to cope with these adverse external conditions.

Therefore, the main objective of the paper is to investigate the factors that drive households' choices with respect to the set of possible income sources they could undertake, trying to identify the common traits of the households that share the same sources of income, focusing on the relationships between household – and community - assets and activities. The connections between poverty, inequality and income diversification are also investigated.

The paper structures as follows. Section 2 discusses some specific features of the process of income diversification that is occurring in Northern Ghana, largely drawing from a field study conduced by Marchetta (2008) in the area. In section 3 we present the datasets used in the paper and we briefly illustrates the income generating strategies of sample population. Section 4 uses statistical techniques to gain some understanding about the links between household characteristics and poverty; it also present an analysis of the contribution of the various income sources to overall income inequality. We then move – in section 5 and 6 - to the core of the paper that is represented by the multinomial logistic model on household income diversification strategies. Section 7 finally draws the main conclusions of the paper.

2. The Northern Ghana case study

The Ghanaian economy has been steadily growing since it implemented the *Economic Recovery Program* in 1983, and it achieved a reduction in the incidence of income poverty; nonetheless, the country is characterized by a great deal of spatial

inequality, and income disparities across the North-South divide represent a major concern for Ghana.

The three northern regions - Northern Region, Upper East Region and Upper West Region -[4] account for about 40 percent of the country area, but only for about 10 percent of the country population, 77 percent of whom live in rural areas. Northern Ghana has a poor endowment of natural resources, it is entirely covered by the savannah, and its per capita gross domestic product falls well short of the national average.

In the last decades, this part of the country has been characterized by a progressive change in climatic conditions, that negatively affected the agricultural sector: today the rainy season begins later than before, and rainfall variability has been increasing, with drought periods even at that time of the year. The plots of land are becoming increasingly sandy, and display worrisome signals of a progressive desertification. This means that farmers are exposed to higher risk of crop failure, crop yields reduction and livestock losses due to water shortage.

Moreover, with the began of structural adjustment policies in 1983, the country opened up to international trade, and this proved not to be beneficial for Northern Ghana's agriculture. The region suffered from the increased competition by foreign producers[5], from the removal of the subsidies for fertilizers and seeds, and for the reduction of ploughing and extension services. Moreover, the projects – began in early 1970s – that were successfully promoting the economic resources of Northern Ghana were broken up for fiscal reasons, and the region was neglected in the design of the new economic polices. All this occurred in a weak institutional environment, where there are difficulties in market access for farmers, there are not irrigation schemes and storage systems and there are not credit provision services.

No wonder that these environmental and economic changes affected the livelihood strategies of rural households, whose main source of income was their own agricultural production. Although agriculture still represents the prevailing economic

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[4] The Northern Region is the largest region of the country. Tamale is the capital and it is the main business centre of the entire North. In the town there are modern infrastructure services. But in the rest of the region infrastructure facilities are inadequate. Upper East and Upper West were a unique region until 1983. More than 90 percent of population of Upper East live in rural areas, the capital – Bolgatanga – is densely populated. The capital of the Upper West Region is Wa; more less 85 percent of the population of the region live in rural areas.
[5] Specifically, subsidies to cotton production provided by European countries damaged local producers and imported rice, poultry and tomato paste induced a significant decline in the demand for the corresponding domestic products.

activity, survey data show an increasing diversification into non farm activities and migration.

As it is evidenced in table 1, employment in sectors different from agriculture has increased, in particular in the Upper East Region, which is the region with more food insecurity: today agriculture is not the first sector of employment for a lot of household heads. Construction, manufacturing, wholesale and retail trade are the fastest-growing activities. Even subordinate employment, both regular and occasional, seems to be on the rise.

Table 1. Employed persons aged 15 years and older,
distribution by branch of activity, regions

	Year	Northern (percentage)	Upper East (percentage)	Upper West (percentage)
Agriculture Forestry, Fishing	*1997*	*66.24*	*73.9*	*74.5*
	2003	61.5	35.4	57.1
Mining, Quarrying	*1997*	0	0	0
	2003	0.1	2.4	0.3
Manufacturing	*1997*	*10.35*	*1.83*	*3.02*
	2003	5.6	9.1	10.3
Construction	*1997*	*1.4*	*0.62*	*0.52*
	2003	1.6	12	5.2
Transport Storage	*1997*	*1.36*	0.46	*0.92*
	2003	1.5	2.3	1.7
Wholesale and Retail trade	*1997*	*15.76*	*9.8*	*5.25*
	2003	20.7	22.4	14.8
Services (finance & insurance, Electricity gas & water, social services)	*1997*	*5.31*	*13.33*	*15.78*
	2003	9.1	16.4	10.8

Source: GSS (2000) and GSS (2005)

Marchetta (2008) conduced a field study[6] in a sample of rural communities in Northern Ghana. Her findings confirm a widespread increase in non farm activities, as farming activities alone became hardly sufficient to earn a living. Households engaged in new activities, as mining, tree cropping and the production of charcoal, while traditional activities as weaving and food processing became more market-oriented. The lack of access to credit and high transport costs in more remote areas hindered the development of non farm activities, that did not replace farming as the key household occupation, but rather supplemented farming as a source of income.

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[6] The field study has been conduced between April and June 2007 in a sample of eight communities located in Northern Ghana. The communities have been selected through a stratified sample selection process aimed at identifying geographical areas that shared similarities in terms of some key variables that were expected to play a key role in shaping household livelihood strategies. First, five districts have been selected on the base of a clustering analysis carried out by WFP (2004), that derived homogeneous clusters with respect to population density, elevation and ground cover. Then, two communities have been randomly drawn within each selected district. Focus group discussions and interviews to key informants are the main tools used in the field study.

Several data sources show also an increase of out-migration flows from the area. Since the beginning of the 20th century, northerners have travelled to the South during the dry season to work in agricultural jobs, returning in April or May. Most people move from North toward the food crop frontier in the 'middle belt' of the country, but the Greater Accra Region has progressively become the highest recipient of migrants. There is also a flow from the densely populated Upper East Region and western part of the Upper West to the sparsely populated parts of Northern Region and the eastern part of Upper West. Census data indicate that the Upper East and the Upper West Regions are areas of net out-migration; instead Northern Region is still a slightly net receiver of migrants (GSS, 2005a; GSS, 2005b; GSS, 2005c).

Van der Geest (2003) highlights that even more people turn to migration, mainly domestic, as a livelihood strategy. This trend is confirmed by the study of CEPA and ODI (2005) that shows that remittances represent a growing proportion of households' incomes. Moreover, GLSS data show that households' average percentage of income from remittances was 2.3 percent in 1991/92 and became 10 percent in 1998/99. The main increase has been in the Northern Region and in the Upper West Region. CWIQ data show that in 2003 in these two regions only 23 percent of households declared to never receive any kind of support from relatives during the year. Marchetta (2008) shows that out-rural seasonal migration is the more common migration pattern.

To make a point, data show that in Northern Ghana diversification in non farm activities and migration from rural areas are on rise at the expense of the farming activity, but they are largely the effect of push factors. What is occurring in Northern Ghana is not a process of *deagrarianisation* (Yaro, 2006), but rather an attempt of people to adapt to the new environmental and institutional conditions through the adoption of new strategies. In fact, a predominantly agriculture-based economy still represents the distinct trait of the area and the factors that are pushing towards a diversification of income sources and a minor reliance on subsistence agriculture are hindered by the absence of opportunities other than the market orientation of traditional economic activities.

Therefore we could affirm that, contrary to traditional economic theories, the declining share of the agricultural sector in the gross domestic product of Northern Ghana is a symptom of the crisis of the agricultural sector rather than an evidence of the process of structural transformation of its economy.

In such a framework, our aim is to investigate how households differ among them in the adaptation to this new context, in particular we wonder how assets composition affects households' livelihood strategies. We also analyze how income diversification relates with poverty and inequality. The findings drawn from Marchetta (2008) play a critical role in drafting some hypotheses that are then tested in the econometric analysis, and they help to interpret its estimates.

3. Income generating strategies of sample population

We draw our data from the third and the fourth round of the *Ghana Living Standards Survey*, GLSS3 and GLSS4 henceforth, conducted by the Ghana Statistical Service (GSS), that have been collected in 1991-92 and in 1998-99 respectively (GSS, 1995a; GSS, 2000c). This is a multi-purpose survey, which gathers information on several facets of the household living conditions, and it provides very detailed data on the patterns of household income and consumption. The survey covers a sample of 5,998 households[7] in 1998/99 and 4,552 in 1991/92, that is representative at the regional level. The list of the 1984 population census enumeration areas, which contains population and household information, was used in the process of sample design. The enumeration areas were first stratified according to the three ecological zones - coastal, forest and savannah - and then within each zone further stratification was conducted with respect to the rural or urban location.

The questionnaire is the same for both rounds, so that the data are directly comparable, but it has not been submitted to the same households, so that our data does not have a longitudinal dimension. Most analyses are conducted using GLSS4, but we also make use of GLSS3 data to investigate eventual changes in the relationships of interest over time. We use only the data collected in the rural areas of the three regions of Northern Ghana, thus restricting the sample to 600 households for GLSS4 and to 519 households for GLSS3.

Beside the data drawn from the household questionnaire, we also rely on information drawn from a community questionnaire that was administrated in every rural enumeration areas. This represents a major methodological innovation that provides us with relevant information on communal assets and infrastructures; such an innovation would have been unfeasible if we were to use the whole sample, as in the

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[7] "For the purpose of the survey a household was defined as a person living alone or any group of persons staying together and sharing the same catering arrangements" (GSS, 2000b, p.1)

other regions it was not possible to match household with community-level data[8]. The main content of the community questionnaire regards the economic infrastructures, education and health facilities existing in the communities, as well as a description of any problems that affects the community well-being.

The first step in the analysis of household income generating strategies is to identify and to define all the relevant income sources of the area. Agricultural incomes are all the incomes from farming either for self-consumption or for selling non processed crop products in the market, plus the earnings derived from various activities related to agriculture, as the sale of eggs, honey or milk.

We maintain that an household has an income from non farm activities if it derives its income from at least one of the following sources[9]:

a) non farm self employment income;
b) revenue in cash from non farm enterprises;
c) revenue in goods and services from non farm enterprises;
d) wages from employment;
e) revenue from the sale of processed crop products.

This definition is partially different from the one given by the GSS, which includes the last income source in the definition of 'agricultural income'. But, we rather regard the sale of processed crop products as a non farm activity, since it requires an additional, and often substantial, effort besides the one devoted to farming, and it may requires the use of specific tools.

According to GLSS4 data, the most common non farm activity is retail trade. Beverage industries and food manufacturing are widespread. Minor activities are represented by manufacturing of pottery and of wearing apparel and repair services. These activities are generally practiced as a second job. 5.20 percent of households have a wage from employment - generally in the public sector - and half of them are engaged in the educational system.

We consider remittances as a distinct income source, rather than pooling them with the incomes from non farm activities. Remittances are defined as the transfers

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[8] Each enumeration area can contain more than one rural communities, and the GSS does not disclose the information that would allow to attribute each household to its community; in the three Northern regions, luckily we have only one community for each sampled rural enumeration areas, while this correspondence breaks down for most of the other regions.

[9] The basic aggregates we use in the analysis have been constructed by the GSS.

received from any source outside the same village where the household resides, as these are unrelated to migration and rather reflect a system of reciprocity among households. Since all the households in our sample have some income from agricultural activities, we classified households in four mutually exclusive classes according to their income sources:

1. households who have an income from agricultural activities;
2. households who have an income from both agricultural and non agricultural activities;
3. households with an income from both agricultural activities and remittances;
4. households who have all the three sources of income.

A non negligible contribution to income of Northern Ghana households is rental income. But we decided to not consider it in our analysis because it is almost entirely constituted by imputed income for house owners[10], while we are interested here in the income generating activities. The remaining sources of income account for just a negligible share of total income (see section 5).

The distribution of the households in the four income categories has changed between 1991 and 1998, as we can see in table 2.

Table 2. Distribution of households according to their livelihood strategies

Livelihood Strategy	1991/92 (percentage)	1998/99 (percentage)
1. Only agricultural income	31.13	31.20
2. Agricultural and non agricultural income	48.19	37.93
3. Agricultural income and remittances	6.61	15.86
4. Agricultural, non agricultural income and remittances	14.07	15.01

Source: author's elaboration on GLSS3 and GLSS4

The decrease of the percentage of households with income from non farm activities between the two surveys is unexpected, and puzzling. All the other data sources - first of all the data collected in the two *Core Welfare Indicator Questionnaires* (GSS, 2005) – rather suggest that income diversification in non farm activities has certainly increased over time in the study area.

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[10] The other components of rental income are income from renting out livestock and agricultural equipment; only 3.17 percent of households have an income from renting out livestock and 0.8 percent have an income from renting out equipment, while none of the sample households has an income from renting out land.

The observed decrease of non farm activities may be due to a different sampling design between the two rounds of the survey, as some data point along this line of explanation. For instance, in GLSS3, 55 percent of the communities hosted a market, while in GLSS4 this percentage dropped to 40 percent. It is possible that in GLSS4 survey more remote communities have been over-sampled. Unfortunately, we do not know the exact location of the sample communities, so that we cannot test this hypothesis any further, although we argue that it is plausible.

The most impressive change between the two surveys is the increase of income from remittances. Usually the households receive remittances by only one person, but in a few cases remittances are sent by more than one household member. They are sent both in food and in cash.

It is interesting to analyse the characteristics of the remittances sent to the third and the fourth group of households, in order to understand if there is any difference among them.

The median amount of remittances is the same for the two groups (80,000 cedis). For the group adopting the third strategy, remittances are received from close relatives (parent, spouse, child, brother or sister) in 81.7 percent of the cases, and from other relatives in 18.3 percent of cases. For the fourth strategy, the percentage of remittances sent by close relative is higher (86.9 percent). In this group also the percentage of remittances sent by women is higher: 26.7 percent compared to 22.8 percent for the other group. Remittances are more regular for the first group (50 percent are transferred on a monthly, quarterly or annual basis); instead for the fourth group only 32 percent are sent on a regular base.

Another relevant difference concerns where the individuals who send remittances live: for the third group, 52.49 percent lives in urban areas, 34.14 percent in rural areas and 13.37 percent of remittances comes from abroad (of whom 11.9 from other African countries). The percentage of people living in urban areas is higher (61.98 percent) for the fourth group, and only 21.14 percent of the remittances come from rural areas, while the percentage of migrants living abroad is 16.88, with a major incidence of people living out of Africa (3.19 per cent). The differences in the geographical origin of remittances could be an indication of the differences in migrant's jobs, and skills. To sum up, in the fourth group remittances are less regular, mainly coming from close relatives, who are more often female and live in urban areas.

From the data we showed, it is clear that the role of international migration in Northern Ghana is very small, especially if we consider that migration toward other African countries is more similar to the domestic migration than to the international one[11].

4. Poverty and inequality in Northern Ghana

Poverty has been falling in Ghana in the 1990s, but poverty reduction has been concentrated in Accra and in the forest areas, while the savannah has not recorded a significant reduction in the incidence of poverty, and it still hosts 37 percent of the Ghanaian poor.

GSS measures poverty with a set of different indicators, with an extreme poverty line and upper poverty line, that are both estimated according to the minimum subsistence needs of the population (GSS, 2000a). The upper poverty line has been constructed including both essential food and non food consumption, and it is set at 900,000 cedis per adult per year, while the extreme poverty line considers what is needed to meet only the nutritional requirements of households members and it has been set at 700,000 cedis per adult per year; both lines are defined with respect to the prices prevailing in Accra in January 1999, and the GSS provides the factors required to account for inflation and for the geographical variations in prices[12].

Figure 1. Poverty headcount ratios in 1991/92 and in 1998/99, by regions.
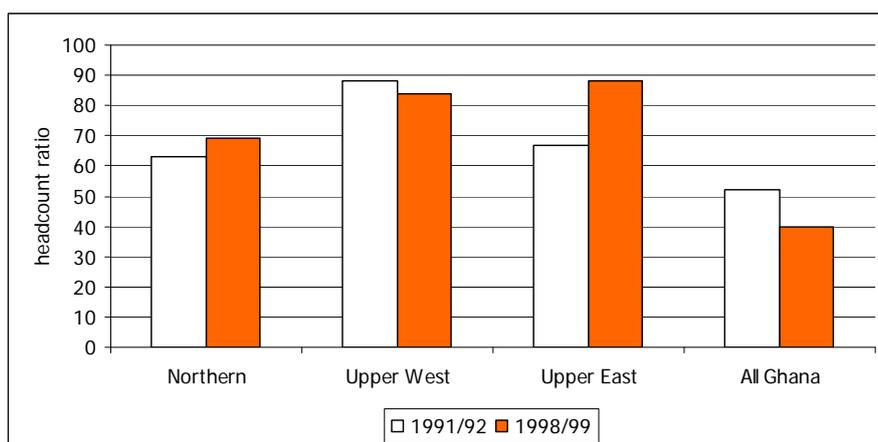
Data source: GLSS4. Note: poverty line set at 900,000 cedis.

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[11] For a treatment of migration flows across West African countries, see Adepoju (2005).
[12] The US dollar – cedi exchange rate was 368 cedis per dollar in 1991, 437 cedis per dollar in 1992, 2,314 cedis per dollar in 1998 and 2,669 cedis per dollar in 1999 (World Bank, 2006).

Figure 1 shows the poverty headcount ratios[13] using the upper poverty line in the three Northern regions and for the whole country for both surveys. The figure clearly shows the sharp increase in poverty incidence in the Upper East Region, which is indeed the poorest region of the country. The gap with the rest of the country is large and has increased over time.

The percentages of sample households having an income below the extreme poverty line, between the extreme and the upper poverty line and above the upper poverty line are reposted in table 3. The percentage of 'non poor' is small indeed, especially in the Upper West and Upper East regions.

Table 3. Distribution of households according to their poverty status.

Region	Below the extreme poverty line (percentage)	Between the two poverty lines (percentage)	Above the upper poverty line (percentage)
Northern	54.74	11.15	34.12
Upper West	76.63	11.24	12.13
Upper East	79.31	10.25	10.44

Source: author's elaboration on GLSS4 data

Figure 2 shows the median values of the household nominal income across income quintiles. The first and second quintiles are below the extreme poverty line, while only the fourth and the fifth are above this poverty line.

Figure 2. Nominal household income across quintiles of the income distribution - Cedis
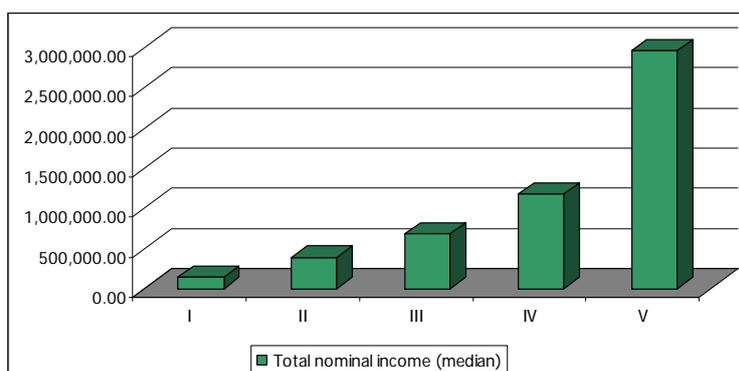
Source: author's elaboration on GLSS4

Besides the overall pattern of poverty in the region, we are particularly interested in the relationship between poverty and economic activities. In the whole Ghana, poverty is highest among the food crop farmers: around 58 percent of poor in Ghana are from households primarily engaged in food crop cultivation. And even for export farmers the poverty headcount ratio is high, although it decreased in the 1990s. On

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[13] Computed for the overall sample of Northern Ghana, that is considering also the urban areas.

the other hand, around 24 percent of the poor are from households whose main income source is non farm self employment (GSS, 2000a).

Table 4. Household income and percentage of households
below the extreme poverty line in 1998/99, according to the livelihood strategy

Livelihood strategy	Median household income, cedis	Percentage of households below the extreme poverty line
Only agricultural income	436,173	75.42
Agricultural and non agricultural income	1,169,576	52.12
Agricultural income and remittances	389,943	76.73
Agricultural, non agricultural income and remittances	844,437	60.85
All	686,285	64.60

Source: author's elaboration on GLSS4

In the three Northern Regions, the situation seems similar, since the largest concentration of poverty is among farmers. In table 4, we report the poverty headcount by income sources groups, that is the percentage of households below the extreme poverty line in each livelihood strategy group.

Figure 3 Percentage of households involved in each livelihood strategies across income quintiles in 1998/99
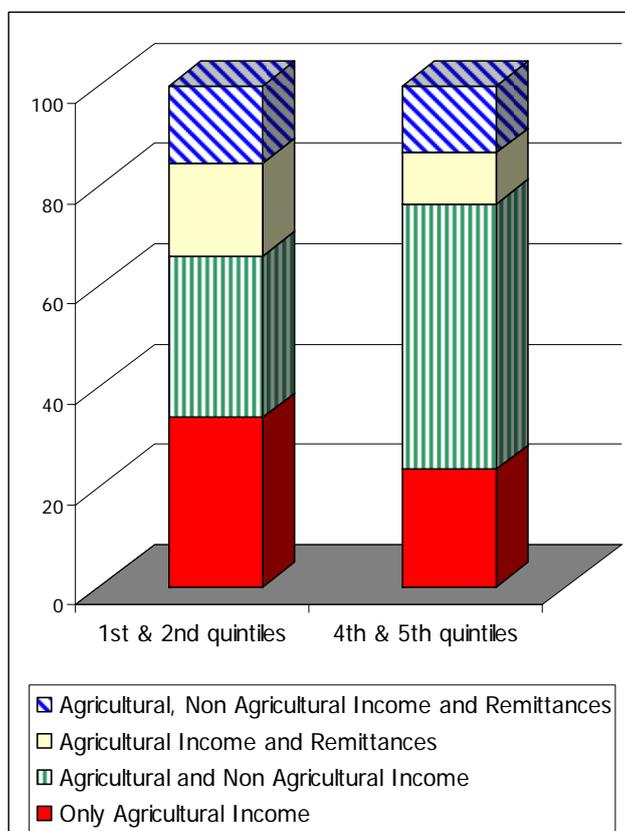
Source: author's elaboration on GLSS4

The households with an income from non agricultural activities generally have an higher income and the incidence of poverty in their groups is lower; households that draw their livelihood from farming activities alone are the poorest group, together with the households who receive remittances.

This table suggests that migration is used as a coping strategy rather than as an accumulative strategy, and that it seems to be unlikely to improve the household socioeconomic status. This pattern could be explained by the kind of migration prevailing in the region. As we observed in the previous section, migrants move inside the country, or at most toward other African countries, so we mainly deal with 'domestic migration', that often does not offer opportunities to move out of poverty (Mendola, 2008).

The welfare status of the households can be better assessed in figure 3, that shows the share of households adopting each livelihood strategy in the first two and in the last two quintiles of the income distribution.

Most households without non agricultural incomes belongs to the first two quintiles of income; the situation seems to be better for households with both agricultural and non agricultural incomes (group 2): 53 percent of them are in the last two quintiles.

GLSS3 data show that households who have an income from non farm activities were poorer in 1991/92. This is interesting because it indicates that despite the decrease of the percentage of people involved in non farm activities, there has been an increase in the return to these activities between the two surveys.

Conversely, households who received remittances in 1998/99 – even though they represent a greater share of the rural population - were located in lower income quintiles than in 1991/92. Moreover, it is interesting to observe that the percentage of households receiving an income only from agricultural activities located in the higher quintiles has reduced over the time period.

Figure 4. Percentage of households involved in each livelihood strategies across income quintiles in 1991/92
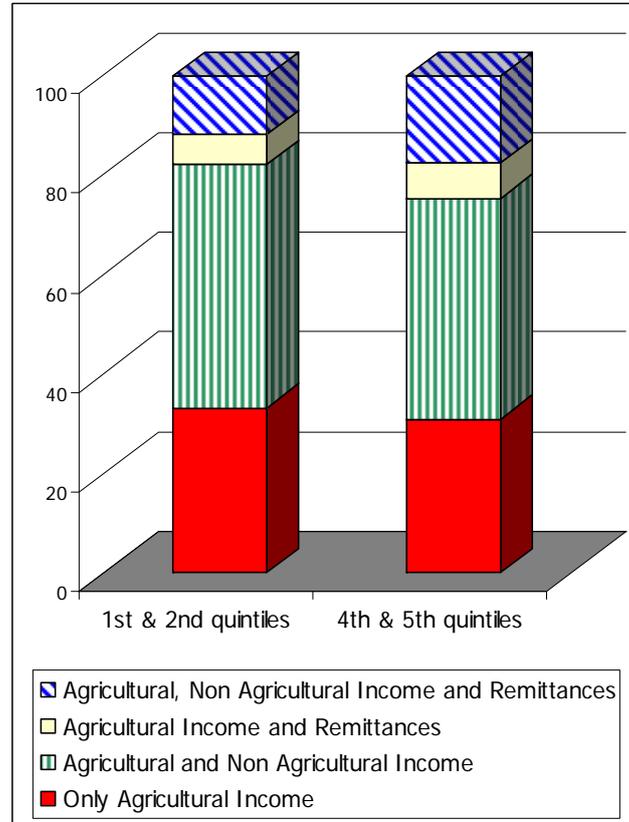
Following Morduch and Sicular (2002), we use the Theil index to decompose the income inequality, in order to assess the role played by each type of income in increasing or decreasing inequality. The Theil index is better than the Gini index to analyze this issue, because it does not give rise to any residual term once it is decomposed. We can compute the Theil (1967) index for each income component *k* as:

$$T(Y^k) = \frac{1}{n} \sum_{i=1}^{n} \left[\left(\frac{y_i^k}{\mu_y} \right) \ln \left(\frac{y_i}{\mu_y} \right) \right]$$

where *n* is the sample size; the subscript i indexes the households, y_i is the total per capita income; y_{ik} is the household income from component *k* and μ_y is the mean total per capita income. The Theil index is given by the sum of the indexes defined on each component, and it ranges between 0 and ln(*n*).

To compute the index, we use the classification in income generating activities made by GSS, so we consider the following possible sources of income: income from employment, agricultural income, non farm self employment income, rental income, income from remittances and other incomes. We have slightly modified the definitions

given by the GSS, in order to make the original classification more similar to the one we are using. For this reason, we include net revenue from the sale of transformed crop products among the non farm self employed income activities.

Table 5. Percent contribution of income sources to total inequality (Theil index) and percent contribution of income sources to total income.

Income sources	Contribution to income inequality in 1998/99	Contribution to total income in 1998/99	Contribution to income inequality in 1991/92	Contribution to total income in 1991/92
Income from employment	38.95	3.9	14.51	5.5
Agricultural income	44.96	61.2	58.31	75.3
Non farm self employed income	17.99	15.9	25.56	7.4
Rental income	-0.83	4.5	-0.32	9.4
Income from remittances	-0.95	12.0	0.87	2.2
Other incomes	-0.12	2.5	1.06	0.2

Source: author's elaboration on GLSS4 and GLSS3

The results are summarized in the table 5, where is also reported the contribution of each income source to total income. The value of the Theil index decreased over the period, being 0.19 in 1991/92 and 0.17 in 1998/99.

The weight of agricultural income on the total is very high in both surveys, so that this income source is able to explain a large part of total inequality. However its weight is lower in 1998/99.

We can observe that the sign of the income sources related with non farm activities is positive and this indicates that they reflect a contribute to increase inequality. We also notice that the share of non agricultural activities to total income increased between the two surveys, while their contribution to income inequality decreased, so that we can suppose they became more accessible.

Contribution to inequality of the income from employment is particularly high in 1998/99. This could be easily explained: there are only a few households receiving this income, but it is very high. This category includes mainly public employees, who have a wage that is well above the average income.

Regarding income from remittances, it is important to note that, not only the number of households receiving remittances had a large increase, but also their contribution to total income raised. The sign of the income from remittances in 1998/99 is negative, indicating that they contribute to reduce inequality (because they are mostly received from those households with an income below the average), but this is a recent phenomenon.

Rental income contributed to reduce inequality both in 1991 and in 1998: this apparently anomalous result can be easily explained: GSS includes the imputed rents for households owner in the 'rental income' category. The rent is imputed to all the owner households in order to better measure the standard of living: even if the houses provided rent free are excluded, we are aware that in Northern Ghana almost all households own the house where they live, despite their welfare level.

5. Some working hypotheses on the determinants of income diversification

In this section, we depict the expected relationships between household characteristics, its assets, the characteristics of the place where the household lives, and the income strategies it undertakes, that we are going to test in the next section using multinomial logit analysis.

◇ Households characteristics[14]

Working age members

A larger household has stronger incentives to search for alternative sources of income, behind the agricultural activity. But, since only in an household where the number of adult member is sufficiently high there are the human resources available for non farm activities, we expect this variable is positively correlated to the probability of having an income from non farm activities (both strategies 2 and 4). "The more labor available to a household the more likely households are to participate in, and receive higher returns from, all activities, and particularly non farm activities" (Davis *et al*., 2007, p. 29).

On the contrary, according to the literature, households receiving remittances have, on average, a smaller number of members. Still Davis *et al*. (2007) argue that: "transfers, which are often provided to the elderly by the government and via remittances to parents, […] would tend to have smaller households" (p. 29).

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[14] Regarding the household's characteristics, there is a certain agreement in the literature in acknowledging that female headed households have a lower propensity to participate in non farm activities and that - on the contrary - they are more likely to receive both private and public transfers (Davis *et al*., 2007). On the other side, some studies have recently emphasized how the participation of woman on non farm activities is increasing: in Sub-Saharan Africa, women participate to a greater degree than before in wholesale or retail trade and in manufacturing, in particular in the informal sector. And they are often involved in activities with a lower start-up capital than those practiced by men (Gordon and Craig, 2001). Bryceson (1999) argues that gender barriers to participation in a wide set of activities are rapidly declining. Although Marchetta (2008) suggests that a similar process is occurring in Northern Ghana, we choose to not include sex of the household head in our specifications because we are not able to make clear hypotheses on its effect on our four possible livelihood outcomes. In fact, if we test for the differences in the sex of the household among the four outcomes, we do not find any significant result.

The same conclusion is drawn by Adams (2006): in his study on remittances and poverty in Ghana, he found a negative impact of the household size on the probability to receive domestic remittances[15]. Thus, we expect that the smaller is the number of working age members, the higher the probability to have an income from remittances[16].

Dependency ratio[17]

An high dependency ratio contributes to raise the incentives to search for an alternative sources of income. Therefore, diversification in off farm activities are pushed by the high number of dependents. But, it is easier that households with an high dependency ratio are involved in non farm activities, since they could be carried out by children and elderly and they do not require moving from the village.

Instead, when the dependency ratio is high, adult members are not able to leave the household in search for a better job, since they have to take care of children and elderly people, so the household is less likely to receive remittances[18].

Age of the household head

In some studies the age of the household head is included among the determinants of income diversification. The age of the household head is generally supposed to have a negative impact on the probability to have an income from non farm activities and a positive impact on the probability to receive remittances. We embrace these hypotheses, although these relations are only seldom confirmed in the empirical studies. For example, Corral and Reardon (2001) find a positive and statistically significant impact of the age of household head on wage employment, but not significant for self employment; Escobal (2001) finds no significant effect. On the contrary, Berdeguè *et al.* (2001) obtain a totally different result in Chile, where the households headed by women or by older individuals households have an higher probability to receive non farm incomes.

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[15] On the contrary, Smith (2000) observes that extended families positively influence the probability to migrate. Also Reardon (1997) states that households are able to send migrants out without affecting domestic production only if they have a sufficient labor supply.

[16] Part of the literature studying the determinant of migration shows that this negative relation could have endogeneity problem, being influenced by the migration of a member itself. In our case study, since migration is prevalently internal and seasonal, this problem less worrisome. Data on seasonal migrants are in fact collected in the survey.

[17] Dependency ratio is defined as the number of dependent members (0-14 years and above 65 years) on total household size. It is not correlated to the number of working age members, while it is strictly correlated to the household size.

[18] The same argument is suggested by some studies maintaining that households with fewer children under age 5 are more likely to participate in migration (Adams, 1993; Lipton,1980).

Income level

Non farm activities in Northern Ghana are inaccessible for the poorest, who are not able to overcome the entry barriers, even if they are low (Marchetta, 2008). Therefore, we hypothesize a positive relation between income level and the probability to be engaged in non farm activities[19].

While we hypothesize a negative relation between income and remittances receipt (strategy 3), since the poorest households are able to diversify only through migration. Finally, we suppose that households belonging to strategy 4 lie in between the better off and the poorest: they are able to undertake non farm activities with the support of relatives, who send them a certain amount of money.

In order to have an indicator of the income level, we use the variable 'poverty status', that can take the values 0, 1 and 2, if the household is below the extreme poverty line, between the lower and the upper poverty line or above the upper poverty line, respectively[20].

Home production

We computed the share of consumption of home produced food in household expenditures. This indicates the percentage of household's needs that is covered by resources directly produced by the household.

With an high percentage of consumption of home produced food, there is not an urgent need to receive incomes other than agricultural ones to supplement the household's basic needs. In other words, among the households having only agricultural incomes, we expect that the ones who do not manage to cover their basic needs with home production are mostly in need and ask for money to relatives and friends.

Therefore, we expect a negative relationship between self-consumption and all income sources other than agriculture.

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[19] We are aware that the introduction of a variable measuring the income level as a determinant of income diversification presents a not negligible problem of reverse causality: we hypothesize that wealthier households are the ones who would most probably undertake non farm activities, but we could also maintain that who is engaged in such activities receives an higher income. Despite this problem, we decided to include this variable in the model because both the findings of Marchetta (2008) and the analysis on poverty and inequality in Northern Ghana illustrated in the previous paragraphs, suggest a clear positive relationship between income level and non farm activities.

[20] Income is measured by the welfare index, that is the total household consumption expenditure per equivalent adult at constant prices in Accra in January 1999.

Education

We argue that education is important to explain why a household undertakes a non farm activity[21]. Educated people have a better awareness of existent opportunities and a greater ability to grasp them. "Education is often the most valuable asset for rural people to pursue opportunities in the new agriculture, obtain skilled jobs, start business in the rural non farm economy, and migrate successfully" (World Bank, 2007, p.9).

Moreover, through education they acquire skills that can prove useful in some non farm activities. We expect that primary education has the strongest effect in increasing the probability to have access to a non farm income; secondary and tertiary education are relevant only for certain professions.

The literature does not identify a clear relationship between education and income from remittances. Part of the literature on the determinants of migration finds a positive or a U-shaped relationship between education and the probability to migrate, although this applies specifically for international migration (Stark, 1991). Educational level of domestic migrants is not so different from the average level of their country. In their field studies in Ethiopia, Bangladesh and Mali, de Haan *et al.* (2000) found that the differences between migrants and non migrants in terms of education were not significant.

In Northern Ghana, migrants are generally not employed in qualified jobs, especially if they migrate to other rural areas. But, an higher education level is required in order to migrate to urban areas. Since the number of the migrants in the sample who send remittances from urban areas is quite consistent, especially in strategy 4, we suppose that a higher education level increases the probability to receive remittances.

◇ Household assets

According to the literature, the asset mix is one of the most important factors determining the accessibility to non farm activities. Households having access to a better asset mix are able to better diversify their incomes. De Haan *et al*. (2000), for example, point out that physical assets composition explain a large part of propensity to migrate.

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[21] This hypothesis is consistent with a certain number of studies showing a positive relationship between education and non farm activities. See for example: Taylor and Yunez-Naude (2000) for Mexico, Adams (2006) for Ghana, Berdeguè *et al*. (2001) for Chile and Lanjouw *et al*. (2001) for Tanzania.

Livestock and agricultural equipment

A household that owns livestock or agricultural equipments has the resources to undertake non farm activities. In fact, livestock is the most important financial capital of a household in Northern Ghana (Marchetta, 2008). Ownership of agricultural equipments is another indicator of the wealth status of the household. We expect that wealthier households are able to better manage the risk of investment. Therefore, we expect these variables are positively correlated to the probability of having an income from non farm activities.

Conversely, it is reasonable to suppose that they reduce the need of remittances, so we expect a negative correlation between them and strategy 3.

Farm size

In the literature, farm size is usually considered the fundamental asset in order to undertake an agricultural activity. In our context, this is a controversial indicator: private property rights on land are not common, so it would be misleading to consider the size of the household plot as a constrain for the farmers. The system of land distribution is based upon the decisions of the *tendanaa*. Households can ask to the *tendanaa* to use a larger amount of land. The availability of land could be considered a real constrain only in the areas where there is scarcity of land, like in large parts of the Upper East Region. Marchetta (2008) showed that it is rather the soil infertility the major land issue.

Despite these limitations, the usual relationship between farm size and non agricultural activities found in the literature is negative: if a household can have access to a larger plot, it should have smaller probability to be engaged in non farm activities (cf. among the others Winters *et al*., 2002 for Mexico; Elbers and Lanjouw, 2001 for Ecuador; Adams, 2002 for Egypt).

Moreover, we expect that a household with a smaller plot needs to receive remittances to integrate its income and it is more inclined to send one of its member out of the village. The lack of land resources are documented as determining migration in Salemink (2002), Rwelemira *et al*. (2002), Schrinder and Kneer (2000) and Rogaly and Rafique (2003).

◇ Crop productivity[22]

Although the GLSS does not include any information on land productivity, we resort to the data collected from the regional offices of Ministry of Agriculture on the trend of main crops cultivated in Northern Ghana, in order to test the relationship between the crop yield and the income strategies undertaken by the households. This is the only instrument we can dispose to make a direct connection between environmental issues and household behaviors.

The dynamics of productivity of different crops are related with income diversification and different crops can have different impacts on it. Indeed, we do not expect the same behavior by staple crops, i.e. the ones used by the households mainly for their subsistence (like maize, millet and sorghum), vis-à-vis the crops that are directly sold or that can be processed and used for non farm activities (like rice or groundnuts or cassava[23]). We argue that the decrease of productivity of staple crops is associated with an increase of non agricultural activities. The hypothesis behind this is quite straightforward: if farming is not sufficient to fulfill basic food needs – e.g. due to soil infertility - households look for other income sources.

Vice versa, the trend of non farm activities based on the processing of some crops is consistent with the productivity of these crops. For example, an increase of cassava harvest would allow women to process part of it in order to produce gari and to sell it in the market[24].

For these reason, we decided to use the data on millet – as a proxy for staple crops - and groundnuts – as a proxy for crops that can be used in non farm activities (e.g. processing). We used the district level data to compute a productivity index for both of them in 1999 as well as the ratio between productivity in 1999 and in 1992[25].

We expect that millet productivity increase should strengthen the traditional structure of income, mainly based on subsistence farming, while it should be negatively correlated with other sources of income. Conversely, groundnut productivity should have a positive impact on the probability of being involved in non farm activities and a

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[22] Land productivity has been introduced among the determinants of non farm employment by Escobal (2001) for Peruvian case.

[23] "After drying and roasting the groundnut it can be used to make flour, soup, porridge, and milk. Groundnuts are often grown by small farm holders and is considered a woman's crop in Western Africa. Roasted peanuts is eaten as a snack in combination with banana; the kernels are pressed for the extraction of vegetable oil. This activity is a major source of income for women. Peanuts hay is an important livestock fee" (Kenny and Finn, 2004).

[24] The case of cotton (or of tomato and other vegetables, like pepper, garden eggs or okra) is peculiar, because they can only be directly sold. Therefore, they are cash crops that cannot be used as raw material to develop non farm activities.

[25] We computed, for each district of the sample, the productivity index as follows: we divided the value of the quantity produced of each crop by the hectares of land cultivated. We used the data relative to the current, the previous and the following year, in order to prevent any problem of production fluctuation.

negative impact on remittances, that are assumed to be less necessary to the household's subsistence.

◇ Community assets

In the literature it is quite usual to consider the access to public assets as important determinants of income choice[26]. But, often, micro-level data do not contain information on community assets[27]. Access to infrastructures or services – such as markets, schools, health care, public transports, etc. - play a crucial role in enabling activities other than farming. Moreover, the use of community variables is very handy because they do not suffer from the problem of endogenity.

Among the many available community variables, we chose the ones we consider particularly relevant, namely: the existence of a market, the presence of an hospital within an hour walking distance, and regular visits of extension officers.

Market

The presence of a periodical or daily market[28] indicates a place where people meet to exchange goods and, therefore, should be positively correlated to non farm activities, even if the market is mainly for farm produce. Access to the market may have a negative impact on the probability of receiving remittances: they are less necessary when it should be easier for the households to sell part of their harvest. The distance from market is used as a determinant of non farm income by Escobal (2001) and Jonasson (2005).

Hospital

Proximity of an hospital is an indicator of a better quality of life and, considering that an hospital is an attractor of people, it can in principle facilitate the development of non farm activities. The health status is an important determinant of the working ability of the individual. In the literature Smith *et al.* (2001) pointed out the importance of access to health facilities for the ability to earn from non farm activities. There is little evidence on the impact of health on the probability to migrate, although Kothari (2002) observes that illness can exclude the opportunity to migrate.

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[26] The positive link between infrastructure access and non farm activities is proven in a number of studies, including Winters *et al*. (2002) for Mexico, de Janvry *et al*. (2005) for China, Berdeguè *et al*. (2001) for Chile, and Corral and Reardon (2001) for Nicaragua.
[27] Even in the Ghanaian survey, community data can be matched to the households' data only for selected areas; luckily enough this can be done for the Northern regions.
[28] Which is highly correlated to the presence of a junior secondary school and the availability of public transports.

Regular visits of extension officers should in principle improve farming, other things being equal, making it be more profitable. As a result income generating activities other than agriculture would be less likely.

6. Modelling income diversification

The major econometric tool in the multivariate analysis carried out in this section is represented by a multinomial logit. Such a model "can be thought as a simultaneously estimating binary logits for all possible comparisons among the outcome categories" (Long, 1997, p.149). It is suitable in situation where an individual can choose one alternative from a set of more than two, unordered and mutually exclusive choices. Consider a outcome *y* with *n* categories, and a vector **x** of independent variables. We are interested in how, ceteris paribus, changes in the elements of **x** affect the response probabilities. Multinomial logit models are multi-equation models, and the system of equations cannot be univocally identified unless the vector of coefficients referring to one of the *n* categories – the reference category – has all its elements set to zero. Each equation is a binary logistic regression comparing a category with the reference category. The theoretical probability for each of the *n* outcomes of the response variable *y* are defined as follows:

$$\Pr(y = i) = \frac{e^{\boldsymbol{\beta}_i' \mathbf{x}_i}}{\sum_{i=1}^{n} e^{\boldsymbol{\beta}_i' \mathbf{x}_i}}, \text{ with } \boldsymbol{\beta}_1 = (0, \ldots, 0).$$

The above system of equations implies that the ratio of the probability of an outcome over the the reference outcome is given by:

$$\frac{\Pr(y=i)}{\Pr(y=1)} = e^{\boldsymbol{\beta}_i' \mathbf{x}_i}, \text{ with } i = 2, \ldots, n.$$

Thus, the vector of coefficients $\boldsymbol{\beta}_2$ represents the log odds of the response variable taking the value *y*=2 relative to the reference outcome (Ender, 2003). Note that this model has an important limitation: it has to satisfy the so called 'independence from irrelevant alternative' assumption. Relative probabilities for any two alternatives do not change when we add a further alternative to the set of possible outcomes (Wooldridge, 2002).

Here we present the results of the multinomial model estimation. In a multinomial logit model one outcome must be chosen as the 'base outcome': we assigned this role to outcome 1 (i.e. only agricultural income); consequently, the estimate of other

outcomes must be interpreted in comparison to a household who have only agricultural income.

We computed both the log odds and the marginal effects[29]. The meaning of these two estimates are different. Regarding the log odds, we are mostly interested in the sign of the coefficients, which show the direction of the relationship, and in the significance level of the z-test. The marginal effects indicate the change in the probability of being in group x as a consequence of a unit change of a given regressor, all other things being equal.

We estimated several models according to different specifications[30], namely:

1) the first specification includes as explanatory variables only household characteristics: working age members, dependency ratio, age of the household's head, the highest education level among household members[31], farm size[32], ownership of livestock[33] and equipment[34], percentage of home production on expenses and poverty status[35];

2) the second add to the previous variables also the community variables: market, hospital and extension officers;

3) the last one includes also millet and groundnuts productivity variables[36].

For all specifications of the model we tested the IIA hypothesis through the Hausman test[37], and the results are supportive of the assumption about the independence of irrelevant alternatives..

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[29] The marginal effects have been computed on the characteristics of the representative household, at the median value of continuous variables and at the mode for dummy and discrete variables. Marginal effect for a dichotomous variable is the change in the theoretical probability for a shift in the variable from 0 to 1.

[30] We tried to include a geographical dummy in order to take into account of any systematic difference between various locations not captured by the model specification. But, the regions reveal to be not statistically significant as determinants of income diversification.

[31] The variable 'highest level of education' has been defined as an ordered variable taking value 0 if none of the household members has at least 6 years of education; 1 if at least one of the members has attended school for 6 years; 2 if at least one member has attended between 7 and 12 years of school; and 3 if at least one member has attended more than 12 years of education.

[32] The variable 'farm size' refers to the size of the farm owned or operated by household members and is measured in acres.

[33] The variables 'livestock' is a dummy and takes value 1 or 0 if the household owns or not livestock (draught animals, cattle, sheep or goats), respectively.

[34] This variable is a dummy and takes value 1 if the household owns any agricultural equipment (tractor, plough, trailer/cart, other animal drawn equipment, other tractor drawn equipment, sprayer, outboard motor, canoe, net, safety equipment) and 0 otherwise.

[35] We computed the three specifications of the model without the variable 'poverty status' and we obtained similar results. The estimates are available upon request from the author.

[36] We include the variables on crop productivity in only one specification because they could suffer from the problems of data reliability (see section 5)

To control the goodness of fit of the model we report the percentage of correct predictions, and the maximum likelihood R^2[38].

Outcome 2: Income from farm and non-farm activities

Outcome 2 is the one that the model is better able to explain. The majority of our hypotheses are confirmed. It means that the differences between this outcome and the base one – i.e. including only farm activities – are strong and are well caught by the model. Non farm activities confirm to be more probable to be undertake when the number of working age members is high; this relation is significant across the three specifications. The same is for the dependency ratio, which is economically[39] significant especially in the first specification, where the community variables are not included. Also the age of the household head has the expected negative impact on the probability to have an income from non farm activities.

The role of education in explaining the determinants of non farm activities is very important, and the result is robust across all specifications. Its impact on the probability to receive an income from non farm activities is also very significant from an economic point of view. As hypothesized, primary education is particularly explicative, as well as tertiary education. Education is less significant in the specifications including community variables.

The impact of the farm size on the probability to have an income from non farm activities shows the expected sign, and its effect is quite robust across specifications. Assets like agricultural equipments and livestock show the expected signs on the probability to diversify in non farm activities, but unexpectedly they are not significant. The percentage of home production on the household's expenses has the expected negative sign in all specifications except the first one, but it is not statistically significant.

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[37] Hausman and McFadden (1984) apply the Hausman principle that compares the estimate of β using all alternatives to the estimate using a subset of alternatives.

[38] The maximum likelihood R^2 expresses the fit of the model as a transformation of likelihood ratio χ^2 in an analogous way to that of R^2 in a OLS regression, which can be though of as a transformation of the *F*-test statistic (Ender, 2003). Specifically:

$$R_{ML}^2 = 1 - e^{-G^2/N} \text{ where } G^2 = -2\sum_i \sum_j n_{ij} \ln\left(\frac{n_{ij}^*}{n_{ij}}\right)$$

[39] Loosely speaking, an effect is deemed as 'economically significant' when its size is such to produce a non trivial impact on the phenomenon of interest; a coefficient can be statistically different from zero, but nevertheless negligible as it exerts only a minor influence (for a formal discussion of the distinction between economic and statistical significance, see McCloskey and Zilick, 1996).

Table 6. Determinants of income from farm and non farm activities (Outcome 2)

Variables	Specification 1		Specification 2		Specification 3	
	Coefficient (z test)	Marginal Effects	Coefficient (z test)	Marginal Effects	Coefficient (z test)	Marginal Effects
Working age Members	0.227 (2.04)**	0.076 (4.22)***	0.344 (2.21)**	0.020 (2.07)**	0.323 (2.16)**	0.022 (1.90)*
Dependency Ratio	2.49 (4.11)***	0.400 (4.05)***	2.464 (3.01)***	0.102 (1.94)*	2.33 (2.60)***	0.106 (1.72)*
Household Head age	-0.020 (-2.33)**	-0.003 (-2.31)**	-0.023 (-2.15)**	-0.000 (-1.44)	-0.023 (-2.44)**	-0.001 (-1.44)
Education 1	1.703 (3.49)***	0.189 (2.40)**	1.516 (3.68)***	0.058 (1.39)	1.517 (3.37)***	0.045 (1.00)
Education 2	1.112 (3.25)***	0.118 (1.83)*	1.168 (4.51)***	0.058 (2.13)**	0.960 (3.97)***	0.040 (1.73)*
Education 3	3.569 (4.39)***	0.387 (2.77)***	3.702 (2.92)***	0.361 (2.16)**	3.622 (3.10)***	0.321 (2.24)**
Farm size	-0.016 (-2.79)***	-0.001 (-1.10)	-0.014 (-2.66)***	-0.000 (-0.83)	-0.014 (-3.45)***	-0.000 (-0.51)
Equipment	0.267 (0.85)	0.003 (0.09)	0.156 (0.41)	0.002 (0.20)	0.039 (0.12)	-0.000 (-0.04)
Livestock	0.103 (0.39)	-0.229 (-0.56)	0.217 (0.55)	0.002 (0.18)	0.363 (0.83)	0.009 (0.60)
Home Production	-0.523 (-0.82)	0.102 (1.05)	-1.363 (-1.34)	-0.019 (-0.49)	-1.278 (-1.18)	-0.027 (-0.54)
Poverty Status 1	1.238 (3.35)***	0.171 (2.34)**	1.270 (2.59)**	0.070 (1.62)	1.409 (2.80)***	0.091 (1.94)*
Poverty Status 2	1.746 (5.20)***	0.416 (6.74)***	2.000 (3.99)***	0.222 (2.40)**	1.958 (3.56)***	0.240 (2.53)**
Market	-	-	2.186 (4.25)***	0.174 (3.46)***	2.194 (4.29)***	0.204 (3.54)***
Hospital	-	-	2.631 (3.91)***	0.221 (2.48)**	2.348 (2.89)***	0.214 (1.85)*
Extension Officers	-	-	-1.838 (-4.13)***	-0.117 (-2.29)**	-1.557 (-2.94)***	-0.077 (-1.43)
Millet	-	-	-	-	-0.000 (-0.20)	-0.000 (-0.39)
Millet ratio	-	-	-	-	-1.854 (-2.33)**	-0.072 (-1.38)
Groundnut	-	-	-	-	0.000 (1.36)	0.000 (1.77)
Groundnut Ratio	-	-	-	-	1.012 (1.90)*	0.048 (1.50)
Constant	-1.552 (-2.58)**	-	-1.853 (-1.83)*	-	-1.847 (0.77)	-
Number of Observations	600		600		600	
Correct Prediction (percentage)	43.20		49.73		54.19	
Maximum Likelihood R²	0.286		0.402		0.453	

Notes: all households have some agricultural incomes; ***, ** and * denote significance at the 1, 5 and 10 percent respectively; standard errors adjusted for clustering on the sample enumeration areas. The marginal effects are computed at the median values of continuous variables, and at the value of the modal class for dummy and discrete variables. Outcome 1 is the base outcome.

Non poor households are more likely to undertake non farm activities. It is interesting that this effect is stronger for the variable 'poverty status 2' (cf. the two marginal effects), that is for households above the upper poverty line.

One of the most important result of this model is the robustness of the statistical and economic significance of the three community variables, that show the expected signs on the probability to diversify (i.e. positive for market and hospital, negative for rural extension). It is remarkable the magnitude of their marginal effects, which are quite high, confirming our hypothesis on the importance of community variables in explaining the decision to diversify.

The variation of the productivity of millet and groundnuts between 1991 and 1998 have the expected signs and they are both significant.

Outcome 3: Income from farm activities and remittances

Table 7 shows the estimates for outcome 3 across all specifications; they are not as good as the ones for outcome 2. Some of them are not statistically significant, but almost all show the expected signs.

Working age members is negative, as we expected, and statistically significant. The result is robust across the specifications. The dependency ratio, despite having the expected sign, is not significant. And the same is for the age of the household head.

Primary education, farm size and the percentage of home production on household consumption are the variables that better explain remittances receipt. Household assets are not significant either for the receipt of remittances, confirming the limitative rule of private assets in explaining the household livelihood strategies. Surprisingly, the sign of the relation is not the one we expected and in one of the specifications the variable 'livestock' is positively correlated to the probability to receive an income from remittances.

The fact that the coefficient of the market variable are not significant indicates that there are not systematic differences in market access between the farmers households receiving or not receiving remittances. The variable 'hospital' is statistically significant only in the second specification. While, the variable 'extension officers' is the sole community variable well able to distinguish between the households receiving or not receiving remittances[40].

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[40] If we compute the same model using outcome 4 as reference, we can make a direct comparison between farmers households having only remittances and the ones having also an income from non-farm activities. In this case, the presence of a market or of an hospital decreases the probability of receiving only remittances. Moreover, the households with higher education level (secondary and tertiary) and with an higher poverty status have a lower probability to receive only remittances.

The marginal effect of the variable 'poverty status 2' is statistically and economically significant: it means that, even if the variable is not significant *on average* in the model, being above the upper poverty line negatively affects the probability of the representative household to receive remittances.

Nevertheless, the model manages to explain the systematic differences between households who receive only farming income and the ones who receive also remittances. These two groups share similar household's characteristics, except for the ability to cover their expenses with home production, for the education level, for the farm size, and for the number of working age members. The visit of the extension officers permits to single out the two groups of households. Moreover, an interesting result is the negative impact of the increase of groundnuts productivity on the probability of receiving remittances. This partially confirms our hypothesis on the impact of crop productivity on income diversification strategies.

Outcome 4: Income from farm, non-farm activities and remittances

The number of working age members negatively affects the probability to diversify through both remittances and non-farm income, although this result is not consistent over the three specifications.

The dependency ratio and the age of household head are not significant, while the educational status variables show to be extremely important as determinants of this kind of income. In particular, it is notable the role of tertiary education.

Agricultural equipment ownership is significant only when we do not include the community variables into the model, while ownership of livestock and farm size are not significant.

Vice versa the access to community assets is a strong determinant of outcome 4, being statistically highly significant across all specifications, showing the expected signs, and having important marginal effects.

As we expected, an increase of the percentage of the share of home production in household consumption determines a decrease of the probability of having outcome 4.

Another result consistent with expectations is that being above the extreme poverty line increases the probability of a household to diversify in both non farm activities and migration.

Considering the variables measuring crops production, the ratios of millet and groundnuts productivity in 1998 compared to the productivity of 1993 are significant and they show the expected signs.

Table 7. Determinants of income from farming and from remittances (Outcome 3)

Variables	Specification 1		Specification 2		Specification 3	
	Coefficient (z test)	Marginal Effects (z test)	Coefficient (z test)	Marginal Effects (z test)	Coefficient (z test)	Marginal Effects (z test)
Working age members	-0.530 (-2.58)**	-0.104 (-2.42)**	-0.538 (-1.90)*	-0.109 (-1.79)*	-0.535 (-1.73)*	-0.107 (-1.59)
Dependency ratio	-0.374 (-0.49)	-0.247 (-1.77)*	-0.387 (-0.53)	-0.115 (-0.75)	-0.095 (-0.13)	-0.058 (-0.39)
Household Head age	0.000 (0.07)	0.001 (0.68)	-0.001 (-0.10)	0.000 (0.03)	0.002 (0.26)	0.000 (0.41)
Education 1	1.147 (2.49)**	0.030 (0.38)	1.239 (2.98)***	0.223 (2.19)**	1.640 (3.59)***	0.302 (2.78)***
Education 2	0.217 (0.45)	-0.097 (-1.41)	0.353 (0.94)	0.017 (0.20)	0.565 (1.54)	0.064 (0.68)
Education 3	1.019 (0.78)	-0.213 (-2.75)***	0.916 (0.63)	-0.112 (-0.82)	1.294 (0.90)	-0.068 (-0.44)
Farm size	-0.017 (-1.68)*	-0.001 (-0.93)	-0.027 (-2.69)***	-0.005 (-2.24)**	-0.039 (-3.52)***	-0.077 (-2.91)***
Equipment	0.273 (0.71)	0.006 (0.10)	0.233 (0.63)	0.041 (0.54)	0.125 (0.34)	0.021 (0.29)
Livestock	0.550 (1.62)	0.079 (1.47)	0.554 (1.66)*	0.091 (1.66)*	0.430 (1.40)	0.068 (1.38)
Home production	-2.273 (-2.57)**	-0.344 (-1.97)**	-2.594 (-2.59)**	-0.470 (-2.60)***	-1.968 (-2.02)**	-0.340 (-1.84)*
Poverty Status 1	0.289 (0.65)	-0.079 (-1.18)	0.404 (0.78)	0.034 (0.34)	0.485 (0.87)	0.041 (0.38)
Poverty Status 2	-0.703 (-1.40)	-0.203 (-4.35)***	-0.592 (-1.30)	-0.146 (-2.01)**	-0.688 (-1.38)	-0.156 (-2.04)**
Market	-	-	0.451 (1.03)	-0.025 (-0.36)	0.323 (0.67)	-0.052 (-0.67)
Hospital	-	-	0.646 (1.66)*	-0.038 (-0.44)	0.306 (0.80)	-0.079 (-0.89)
Extension Officers	-	-	-0.826 (-2.25)**	-0.104 (-1.20)	-0.143 (-2.72)***	-0.195 (-1.95)*
Millet	-	-	-	-	0.000 (1.17)	0.000 (1.27)
Millet ratio	-	-	-	-	-0.830 (-1.60)	-0.131 (-1.19)
Groundnut	-	-	-	-	-0.000 (-2.73)***	-0.000 (-2.45)**
Groundnut Ratio	-	-	-	-	-0.281 (-0.69)	-0.079 (-1.03)
Constant	0.894 (1.10)	-	1.438 (1.44)	-	4.091 (2.24)*	-
Number of Observations	600		600		600	
Correct Prediction (percentage)	43.20		49.73		54.19	
Maximum Likelihood R²	0.286		0.402		0.453	

Notes: all households have some agricultural incomes; ***, ** and * denote significance at the 1, 5 and
10 percent respectively; standard errors adjusted for clustering on the sample enumeration areas. The marginal effects are computed at the median values of continuous variables, and at the value of the modal class for dummy and discrete variables. Outcome 1 is the base outcome.

Table 8. Determinants of income from farming, non agricultural activities and remittances (Outcome 4)

Variables	Specification 1		Specification 2		Specification 3	
	Coefficient (z test)	Marginal Effects	Coefficient (z test)	Marginal Effects	Coefficient (z test)	Marginal Effects
Working Age members	-0.146 (-2.98)***	-0.032 (-1.80)*	-0.283 (-1.61)	-0.004 (-0.92)	-0.296 (-1.84)*	-0.005 (-1.22)
Dependency Ratio	0.946 (1.21)	0.052 (0.68)	0.994 (1.04)	0.032 (0.98)	0.903 (0.92)	0.030 (0.78)
Household Head age	-0.001 (-0.11)	0.000 (0.31)	-0.004 (-0.30)	-0.000 (-0.20)	-0.000 (-0.04)	-0.000 (0.02)
Education 1	1.312 (2.46)**	0.037 (0.65)	1.235 (2.93)***	0.026 (1.19)	1.303 (2.94)***	0.021 (0.92)
Education 2	1.520 (3.68)***	0.169 (2.41)**	1.579 (3.36)***	0.087 (1.44)	1.519 (3.00)***	0.084 (1.25)
Education 3	3.438 (3.73)***	0.191 (1.44)	3.567 (2.53)**	0.246 (1.47)	3.627 (2.70)***	0.257 (1.40)
Farm size	-0.017 (-1.16)	-0.000 (-0.54)	-0.011 (-1.15)	-0.000 (-0.24)	-0.013 (-1.52)	-0.000 (-0.18)
Equipment	0.736 (1.84)*	0.076 (1.39)	0.468 (1.03)	0.015 (0.87)	0.301 (0.75)	0.010 (0.66)
Livestock	0.562 (1.52)	0.036 (1.17)	1.606 (1.22)	0.012 (0.99)	0.717 (1.32)	0.016 (1.24)
Home Production	-2.403 (-2.35)**	-0.168 (-1.50)	-3.473 (-2.71)***	-0.086 (-2.28)**	-3.103 (-2.54)**	-0.091 (-1.91)*
Poverty Status 1	1.188 (2.62)***	0.092 (1.44)	1.259 (2.72)***	0.055 (1.64)	1.224 (2.49)**	0.054 (1.30)
Poverty Status 2	0.386 (0.80)	-0.026 (-0.66)	0.643 (1.16)	0.020 (0.91)	0.475 (0.82)	0.013 (0.62)
Market	-	-	2.100 (4.41)***	0.124 (2.77)***	1.911 (4.23)***	0.113 (2.75)***
Hospital	-	-	2.621 (5.79)***	0.173 (3.35)***	2.363 (4.64)***	0.173 (2.91)***
Extension Officers	-	-	-1.213 (-2.70)***	-0.034 (-1.66)*	-0.972 (-2.55)**	-0.017 (-1.25)
Millet	-	-	-	-	-0.000 (-0.70)	-0.000 (-1.02)
Millet ratio	-	-	-	-	-0.812 (-1.75)*	-0.017 (-0.97)
Groundnut	-	-	-	-	-0.000 (-0.02)	0.000 (0.84)
Groundnut Ratio	-	-	-	-	0.981 (2.00)**	0.037 (1.72)*
Constant	-0.719 (-0.80)	-	-1.324 (-0.95)	-	-0.621 (0.28)	-
Number of Observations	600		600		600	
Correct Prediction (percentage)	43.20		49.73		54.19	
Maximum Likelihood R²	0.286		0.402		0.453	

Notes: all households have some agricultural incomes; ***, ** and * denote significance at the 1, 5 and
10 percent respectively; standard errors adjusted for clustering on the sample enumeration areas. The
marginal effects are computed at the median values of continuous variables, and at the value of the
modal class for dummy and discrete variables. Outcome 1 is the base outcome.

Cross-cutting remarks

In conclusion, we can characterize each group of households according to its typical traits:

1. Davis *et al*. (2007), in their research on rural income generating activities across the developing world, state: "households participating in on farm activities own land, have lower levels of education, are located at a distance from infrastructure facilities and have on average an older, male headed household" (p.33). Our results are consistent with their conclusions, except for the sex of the household head. Moreover, we can add that farming-only households are generally the ones who have a better staple crops production and that they are among the poorest of the region.

2. A household receiving remittances is very similar to the previous one, but it shows a lower share of self-consumption, a smaller farm size, a smaller number of working age members, a better level of education and less frequent extension visits. Moreover, the higher the cash crop productivity (e.g. groundnuts), the lower the probability of sending out a household member (i.e. to receive remittances).

3. Generally a household which diversifies in non-farm activities operates a smaller plot as compared to a farm-income-only household, has an higher number of working age members and an higher dependency ratio, has a younger household's head, a higher level of education, is located close to community facilities, and is less often visited by an extension officer. Generally it has good yield in crops that are used for non-farm activities (i.e. food processing) and is among the better off.

4. The households who diversify in all three activities are similar to the ones who have farm and non-farm incomes, but show, on average, a smaller number of household members and a smaller dependency ratio, lower home production on consumption and, more important, they are poorer. Compared to the households receiving only remittances, they have a better level of education, a better access to community facilities, except for extension services, and they are wealthier.

In order to better understand how each independent variable influences households livelihood strategies, we now compute the probabilities to chose each outcome by the representative household[41]. We suppose a unit change[42] of each regressor and we

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[41] The representative household is a household of 2 working age members, with a dependency ratio of 0.5, where the household head is 35 years old and none of the members is educated. It operates 5.05 acres of land with no agricultural equipment, but it owns livestock, and its home production covers 23 percent of its consumption. The representative household has an income under the extreme poverty line.

estimate how much would be ceteris paribus the implied change in the probability of choosing each outcome by the representative household. In doing this, we adopt the second specification, that is the one not featuring data problems (i.e. crop production data) and including the community variables.

Table 9 reports the results of such analysis. For example, the representative household[43] has a 64.8 percent chance of having only an agricultural income; for a household with the same characteristics except for the level of education – that is now elementary – this chance decreases to only 33.9 percent, while the probabilities to undertake a non-farm activity (outcome 2 or 4) or to receive remittances clearly increase.

Figure 5 graphically shows the same results of Table 9, the marginal probabilities changes of choosing a given livelihood strategy as a consequence of a unit change of a given regressor: it is clear that education, poverty status and community variables imply larger changes.

Table 9. Probabilities associated to each outcome for the representative household and marginal probabilities changes of each independent variable. Percentages.

	Probabilities Outcome 1	Probabilities Outcome 2	Probabilities Outcome 3	Probabilities Outcome 4
Representative household	64.8	4.2	27.5	3.3
Working age members=3	72.5	6.6	18.0	2.8
Dependency ratio=0.6	64.5	5.3	26.4	3.6
Age of the household head=36	64.9	4.1	27.6	3.3
Education=1	33.9	10.0	49.9	6.0
Farm size=6.05	65.4	4.2	27.0	3.3
Equipment=1	58.9	4.5	31.7	4.8
Livestock=0	75.5	3.9	18.4	2.1
Home production=0.33	70.4	3.9	23.0	2.6
Poverty Status=1	48.8	11.3	31.0	8.9
Market=1	37.5	21.6	25.0	15.8
Hospital=1	29.2	26.3	23.7	20.7
Extension officers=0	39.2	15.9	39.1	6.8

In the community where it lives there is neither a market nor an hospital within an hour walking distance, but farmers are periodically visited by an extension officer.

[42] For the variables dependency ratio and home production, we suppose a 10 percentage point change. For the variable farm size, we suppose an increase from 5.05 to 6.05 acres.

[43] According to the results of the model, the representative household's characteristics are the ones typical of a household who does not receive any income from non farm activities. In fact, the probability to have outcome 1 and outcome 3 is very high in comparison to the percentages of sample households who effectively undertake these livelihood strategies (respectively 31.2 and 15.86 percent). If we compute the marginal effects for an household showing the characteristics we impute to an household receiving an income from non farm activities – i.e. an higher education level (elementary), a better poverty status (above the extreme, but under the upper poverty line), the presence of a market and an hospital in the community and the absence of an extension officer -, we found that our model assigns a 76.46 percent to the probability to have outcome 2 and a 22 percent to the probability of have outcome 4.

Figure 5. Probabilities associated to each outcome for the representative household and probabilities associated to an unit change of each independent variable.
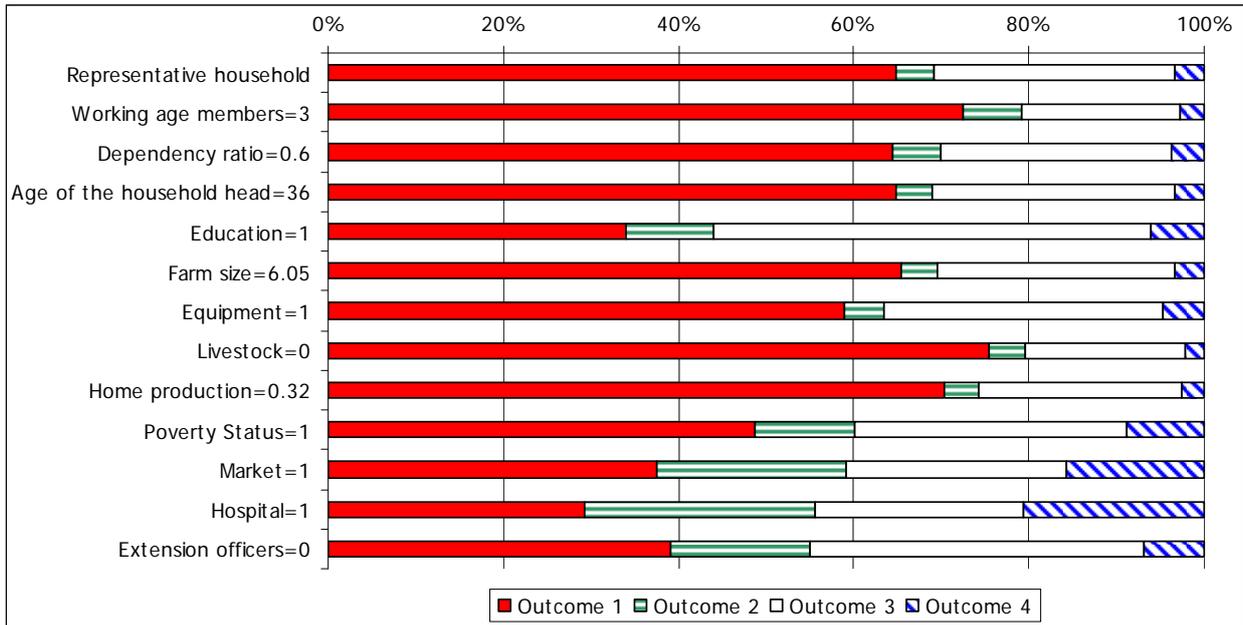
8. Conclusions

Our analysis of income diversification in the rural areas of Northern Ghana, which is indeed the first study on non farm activities and remittances using the GLSS data in this area, drew on a well-established body of literature on this topic, but it also introduced some methodological innovations, that play a non-negligible role in the main results of the analysis.

We used micro data from a household survey as well as data from a community questionnaire, that allow a better understanding of the role of public assets in explaining household choices. One of the reasons why it is crucial to include community-level variables in the analysis is that income inequality among communities in Northern Ghana is wider than inequality within the communities. This suggests that there is a certain degree of homogeneity in the welfare level of people living in the same community.

The increasing significance of remittances among income sources in Ghana, and particularly in Northern Ghana, led us to introduce another methodological innovation. In fact – differently from the majority of studies on income diversification - we explicitly regarded the receipt of remittances as a livelihood strategy that households

can resort to. This has close similarities with the analysis of participation in off-farm activities in Mexico by de Janvry and Saudolet (2001)[44].

At the beginning of this work, we wondered what were the household determinants of income diversification in Northern Ghana. The findings of the empirical analysis permit to give some tentative answers. Among the household characteristics, education level is the variable that better permits to distinguish among the different livelihood strategies a household can undertake: primary education is particularly important among the determinants of remittances receipt, while higher education levels are typical of households with an income from non farm activities.

The composition of the household is another important determinant of income diversification: the higher are the number of working age members and the dependency ratio, the higher are the incentives and the opportunities to diversify in non farm activities. While, a household with a few working age members is more likely to choice migration as a diversification strategy.

We evidenced –and this is new in the literature – the role of self consumption as a push factor of diversification. With an high percentage of consumption of home produced food, there is not an urgent need to receive incomes other than agricultural ones to supplement the household's basic needs. Household's assets showed a lower importance than we expected: only the farm size seems to be an important determinant of income diversification. Conversely, we found that access to community assets (i.e. markets and hospitals) is more important than the household-level characteristics. Moreover, the role of farmer support schemes is generally overlooked.

We also stressed the role of crop productivity, suggesting that cash crops and staple crops productivity have a different impact on household's livelihood strategies[45]. In particular, a drop in the productivity of a staple crop is positively associated to the non agricultural income sources, while a fall in the productivity of those cash crops that can be processed decreases the probability of undertaking non farm activities, and it increases the probability of receiving remittances.

The successful inclusion of this kind of variables (i.e. community assets and crop productivity) in an empirical model studying income diversification proves that it is necessary to adopt a wider perspective, moving beyond either an individual- or a

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[44] The authors included seasonal migration to the US in the set of activities that Mexican households can choose

[45] We are aware of the fact that this result needs to be well considered, since the source of the data has not the same reliability of GLSS data. Nevertheless, we argue that our attempt to include in the model a similar measure of two different kinds of crops points to the opportunity of a stronger effort to link the determinants of income diversification to the production trend of the main crops of the study area and – more generally – to the soil fertility.

household-level perspective, in order to understand the dynamics of household livelihood strategies.

Moreover, our results emphasized a positive correlation between non farm activities and household income level, since there are some entry barriers to non farm activities that prevent poorest households from engaging in them, and a positive relationship between non farm activities and inequality, in line with Davis *et al.* (2007)[46].

Still, the development of non farm activities have fared more where the access to health care facilities improved the health conditions of the rural population, and where communities are better connected to periodical markets. Instead, in more vulnerable communities, where the factors that promote non-farm activities are lacking, people are not able to find income sources other than agriculture. Thus, non agricultural activities represent an option that only better-off households - and communities - can resort to, in order to overcome the difficulties of the agricultural sector, and to meet a pressing need for cash.

At the same time, we found that the most common migration pattern - out-rural seasonal migration - is emerging as a coping strategy to meet the household basic needs. We found that remittances recipient households are among the poorest of the sample, in fact they marginally contribute to reduce inequality. Remittances serve as a social security mechanism for the poor, in order to reduce their vulnerability, so that migration is unlikely to improve the household socioeconomic condition in the long run. As Mendola (2008) well argues:

> "Asset-poor farm households are more likely to enter into domestic migration, which has lower entry costs, and lower absolute returns. […]. Lack of resources needed to bear the cost of migration may generate a poverty-trap whereby only better off households are able to exploit a virtuous circle of complementarities between overseas economic opportunities and productive activities at origin." (p.168)

Therefore, as we showed throughout the paper, migration and diversification in non agricultural activities are two strategies adopted by households who have different characteristics, so that we can not regard them as alternative strategies, and one should not put them in a single category of 'off farm diversification'. The common trait of these strategies is that they are both pushed by the crisis of agriculture, being the results of the attempt of rural households to adapt to the new environmental and institutional conditions caused by the agricultural crisis.

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[46] These results are relevant, although we maintain that a further distinction between high productivity and low returns non farm activities – following Davis *et al.* (2007) – would be necessary in order to better understand the full set of interactions between poverty, inequality and income diversification.

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