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Income Diversification and Household Welfare – Empirical Evidence for Ghana

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☙ The important thing is not to stop questioning.
Curiosity has its own reason of existing. ❧
Albert Einstein (1879-1955)

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Summary

Halving the proportion of people living on less than $1 a day between 1990 and 2015 is the first goal of the eight Millennium Development Goals expressed by the United Nations in 2000 (United Nations, 2005, p. 6). Whilst regions like Eastern and South-Eastern Asia have already managed to achieve this goal, Sub-Saharan Africa failed to remarkably reduce its proportion of poor people, which was the initially highest among the regions, and still is the world's region with the highest poverty rate. However, the pattern of poverty is quite diverse across the region. Countries like Cameroon and Côte d'Ivoire show rather low levels of poor people among the population, whereas, for example, in Ghana and Niger, more than 40% and 60% of the population, respectively, lived below the respective national poverty line in 1999 and 1995, respectively. Nevertheless, Ghana is regarded to be one of the major success stories in Sub-Saharan Africa, since the country is very likely to achieve the first Millennium Development Goal and halve its proportion of people living on less than $1 a day by 2015. But, the distributions of poverty and income inequality are quite diverse across the country, with rural households more affected by poverty and income inequality than households in urban areas.

Since the majority of the population in Sub-Saharan Africa, about 65%, lives in rural areas, poverty remains primarily a rural burden. Due to the strong dependency on agricultural production mainly the rural population is affected by income shortfalls because of harvest failures, illness or death of livestock or a family member, and economic shocks causing food price variability. To cope with this situation, households are deriving several strategies to spread these risks and smooth their income. One of these strategies is the participation in nonfarm employment due to its independency on agricultural risks, but researchers have already indicated that households may face various entry barriers to the nonfarm sector.

The main objective of the study is therefore to assess whether nonfarm employment is a viable strategy to reduce poverty. Additionally, it is investigated first, whether nonfarm activities can serve as a risk-coping strategy and what entry barriers households willing to engage in the nonfarm sector are confronted with. For this purpose, hypotheses concerning nonfarm employment in general and the households' perception of a risky environment are derived from the literature and investigated by a quantile regression implementing the Censored Least Absolute

Deviations estimator. The study indicates that households perceiving that they live in a risky environment expand their extent of nonfarm employment, whereas the endowment with valuable physical capital seems to serve as a risk-coping strategy on its own, since households endowed with valuable assets reduce their engagement in nonfarm activities. This finding is in accordance with the theory of decreasing risk aversion as well. Households endowed with valuable physical capital, i.e. wealthier households, are less risk-averse and therefore reduce their extent of participation in nonfarm employment. The most important entry barriers revealed by the Heckman two-stage method are the educational level of the household head as well as the household's amount of savings. Starting a small business often requires start-up capital and therefore, households without sufficient financial capital are excluded from these nonfarm income sources. Additionally, due to the poor availability of nonfarm activities in rural areas, households living in rural areas are less likely to participate in the nonfarm sector, but with increasing remoteness, the participation probability enhances.

In the last stage of the study, the causal effects of participation in nonfarm employment on the household's wealth as well as poverty status are examined utilising the Propensity Score Matching (PSM) method. This method allows the comparison of households participating in the nonfarm sector with non-participants to investigate the average treatment effect on the treated. To better understand different efficiency levels the PSM is implemented for several subsamples, e.g. according to the household's locality or the gender of the household head. The empirical results show that especially female headed households and households living in rural areas are the main beneficiaries from nonfarm employment. The participation in nonfarm activities not only increases the household's per-head expenditures, but also has the potential to reduce and even eliminate poverty.

To conclude, the engagement of rural households in Ghana in nonfarm employment is a viable strategy to spread income risk and significantly improve their economic situation. Policy makers are recommended to remove entry barriers to the nonfarm sector mainly by improving the quality of schooling and the enrolment ratio as well as the access to microcredits. Moreover, females and the rural population should be the main target group of such policies.

Zusammenfassung

Das Halbieren des Anteils der Personen, die von weniger als einem $1 pro Tag leben, im Zeitraum von 1990 bis 2015 ist das Erste der Millennium-entwicklungsziele, die im Jahr 2000 von den Vereinten Nationen formuliert wurden. Während Regionen wie Ost- und Südostasien dieses Ziel bereits erreicht haben, hat es Sub-Sahara Afrika nicht geschafft, seine Armutsrate, die 1990 die Höchste aller Regionen war, deutlich zu verringern und ist immer noch die Region mit dem höchsten Anteil an armen Menschen an der Gesamtbevölkerung. Allerdings ist das Ausmaß der Armut innerhalb der Region sehr unterschiedlich. Länder wie Kamerun oder die Elfenbeinküste verzeichnen eine eher gemäßigte Armutsrate, wohingegen zum Beispiel mehr als 40% der ghanaischen Bevölkerung und mehr als 60% der Bevölkerung von Niger 1999 beziehungsweise 1995 unterhalb der nationalen Armutsgrenze lebten. Nichtsdestotrotz wird Ghana als eine der größten Erfolgsgeschichten der Region Sub-Sahara Afrika angesehen, da das Land höchstwahrscheinlich das erste Millenniumentwicklungsziel erreichen und den Anteil seiner Bevölkerung, der von weniger als $1 pro Tag lebt, halbieren wird. Die Verteilung der Armut und der Einkommensungleichheit ist innerhalb des Landes allerdings sehr unterschiedlich, wobei Haushalte in ländlichen Gebieten stärker von Armut und Ungleichheit betroffen sind, als in städtisch geprägter Umgebung.

Da die Mehrheit der Bevölkerung in Sub-Sahara Afrika, nämlich ungefähr 65%, in ländlichen Gebieten leben, stellt Armut hauptsächlich ein ländliches Problem dar. Darüber hinaus ist vor Allem die ländliche Bevölkerung von Einkommensausfällen bedroht, da sie auf Grund ihrer Abhängigkeit von landwirtschaftlicher Produktion am stärksten von Ernteausfällen, Krankheit oder Tod von Nutzvieh oder sogar eines Familienmitglieds und ökonomischen Krisen, die zu Preisschwankungen bei Nahrungsmitteln führen können, betroffen ist. Um dieser Situation gewachsen zu sein, haben Haushalte verschiedene Strategien entwickelt, dieses Risiko zu streuen und ihr Einkommen auszugleichen. Eine solche Strategie ist das Nachgehen einer nicht-landwirtschaftlichen Betätigung, da diese von den in der Landwirtschaft vorherrschenden Risiken entkoppelt ist. Allerdings weisen Forscher bereits darauf hin, dass Haushalte höchstwahrscheinlich zahlreichen Eintritts-barrieren zum nicht-landwirtschaftlichen Sektor gegenüber stehen.

Das Hauptziel dieser Studie ist daher die Bewertung, ob nicht-landwirtschaftliche Beschäftigung eine praktikable Strategie zur Armutsreduzierung darstellt.

Zusätzlich wird zunächst untersucht, ob nicht-landwirtschaftliche Tätigkeiten auch als Strategie dienen können, Risiko zu bewältigen, und welchen Eintrittsbarrieren Haushalte ins Auge sehen müssen, wenn sie einer nicht-landwirtschaftlichen Beschäftigung nachgehen wollen. Zu diesem Zweck werden Hypothesen bezüglich nicht-landwirtschaftlicher Betätigung allgemein und bezüglich der Risikowahrnehmung der Haushalte im Speziellen aus der Literatur abgeleitet und mittels einer Quantilregression unter Zuhilfenahme des *Censored Least Absolute Deviations* Schätzers getestet. Die Studie zeigt, dass Haushalte, die ihre Umwelt als Risiko behaftet wahrnehmen, den Umfang ihrer nicht-landwirtschaftlichen Tätigkeit ausweiten. Der Besitz wertvollen physischen Kapitals scheint dagegen selbst als Risikobewältigungsstrategie eingesetzt zu werden, da Haushalte, die wertvolles Eigentum besitzen, ihre Beschäftigung im nicht-landwirtschaftlichen Sektor verringern. Dieses Ergebnis stimmt auch mit der Theorie abnehmender Risikoaversion überein. Haushalte, die wertvolles physisches Kapital besitzen, sind risikofreudiger und verringern daher den Umfang ihrer Teilnahme an nicht-landwirtschaftlichen Tätigkeiten. Die bedeutendsten Eintrittsbarrieren, die mit Hilfe der *Heckman two-stage* Methode aufgedeckt wurden, stellen zum einen der Bildungsstand des Haushaltsvorstandes, sowie der Besitz von Ersparnissen dar. Um ein kleines Geschäft zu eröffnen, wird meistens Startkapital benötigt und aus diesem Grund werden Haushalte, die über kein ausreichendes Finanzkapital verfügen, von diesen nicht-landwirtschaftlichen Einkommensquellen ausgeschlossen. Zusätzlich haben Haushalte, die in ländlichen Gebieten leben, auf Grund der schlechteren Verfügbarkeit eine geringere Wahrscheinlichkeit der Beschäftigung im nicht-landwirtschaftlichen Sektor, wobei allerdings eine steigende Abgeschiedenheit des Haushalts die Wahrscheinlichkeit einer solchen Beschäftigung erhöht.

Im letzten Schritt der Studie werden die Auswirkungen der Teilnahme an nicht-landwirtschaftlicher Tätigkeit auf den Wohlstand sowie auf die Armutssituation des Haushalts mittel der *Propensity Score Matching* Methode untersucht. Diese Methode ermöglicht den Vergleich von Haushalten, die im nicht-landwirtschaftlichen Sektor beschäftigt sind, und Haushalten, die nicht in diesem Sektor beschäftigt sind, und die Prüfung der durchschnittlichen Effekte der Teilnahme auf die Teil nehmenden Haushalte. Um mögliche Unterschiede bezüglich der Effizienz der Teilnahme zu berücksichtigen, wird diese Methode auch für unterschiedliche Teildatensätze angewandt. Die empirischen Ergebnisse zeigen, dass besonders Haushalte mit einem weiblichen Haushaltsvorstand und/oder Haushalte in

ländlichen Gebieten die Hauptprofiteure einer nicht-landwirtschaftlichen Beschäftigung sind. Tätigkeiten im nicht-landwirtschaftlichen Sektor erhöhen nicht nur die Pro-Kopf-Ausgaben des Haushalts, sondern eignen sich auch dafür, Armut zu reduzieren beziehungsweise sogar auszumerzen.

Zusammenfassend lässt sich festhalten, dass das Nachgehen einer nicht-landwirtschaftlichen Beschäftigung eine praktikable Strategie für ländliche Haushalte in Ghana darstellt, um ihr Einkommensrisiko zu streuen und ihre wirtschaftliche Situation deutlich zu verbessern. Politischen Entscheidungsträgern wird daher empfohlen, Eintrittsbarrieren zu nicht-landwirtschaftlichen Tätigkeiten hauptsächlich dadurch abzubauen, indem die Qualität der Bildung verbessert, die Schuleinschreiberate erhöht, sowie der Zugang zu Mikrokrediten vereinfacht werden. Darüber hinaus sollten Frauen und die ländliche Bevölkerung die Hauptzielgruppe solcher Strategien sein.

List of Acronyms

ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
CIA	Conditional Independence Assumption
CLAD	Censored Least Absolute Deviations
EA	Enumeration Area
ERP	Economic Recovery Program
FGT	Foster-Greer-Thorbecke
GDP	Gross Domestic Product
GHC	Ghanaian Cedi (local currency until the monetary reform in 2007)
GLSS	Ghana Living Standards Survey
GNI	Gross National Income
GNP	Gross National Product
GPRS I	Ghana Poverty Reduction Strategy
GPRS II	Growth and Poverty Reduction Strategy
GSS	Ghana Statistical Service
HDI	Human Development Index
HIPC	Heavily Indebted Poor Countries
HPI	Human Poverty Index
ILPA	Iterative Linear Programming Algorithm
IMF	International Monetary Fund
IPRSP	Interim Poverty Reduction Strategy Paper
MDG	Millennium Development Goal

MMM	Mahalanobis Metric Matching
NDPC	National Development Planning Commission
NGO	Non-Governmental Organisation
OLS	Ordinary Least Squares
PRS	Poverty Reduction Strategy
PRSP	Poverty Reduction Strategy Paper
PSM	Propensity Score Matching
SAP	Structural Adjustment Policy
SCLS	Symmetrically Censored Least Squares
SSA	Sub-Saharan Africa
UNDP	United Nations Development Programme

1. Introduction

"Halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day." (United Nations, 2005, p. 6) This is the first goal of the by now well-known Millennium Development Goals (MDGs) expressed by the United Nations in the year 2000. Since the adoption of these goals by the international community, a lot of efforts have been made and improvements have been achieved regarding the incidence of poverty in developing countries. But the extent of achievements is diverse across regions. In contrast to Eastern and South-Eastern Asia which managed to reduce their proportion of people living on less than $1 a day by about two thirds, the countries of Sub-Saharan Africa (SSA) which had the highest initial proportion of extreme poor people only show slow positive development. Whilst, for example, Eastern Asia had experienced a reduction of the proportion of people living on less than $1 a day from 33% in 1990 to 9.9% in 2004, Sub-Saharan Africa only observed a reduction from 46.8% to 41.1% over the same period (United Nations, 2007, p. 6). But even in SSA the development of poverty is diverse. For instance, only 14.8% of the population of Côte d'Ivoire lived on less than $1 a day in 2002, 17.1% in Cameroon in 2001, and in Burkina Faso, 27.2% lived on less than $1 a day in 2003. In contrast, the proportion of people living on less than $1 a day amounted to 36.1% in Mali in 2001, to 44.8% in Ghana in 1999, and to even 60.6% in Niger in 1995 and to 63.8% in Zambia in 2004, respectively (World Bank, 2007, p. 336-337). Obviously some countries in the region (like Côte d'Ivoire, Cameroon, and Burkina Faso) are doing better than others (like Ghana, Niger, and Zambia). Though the World Bank data show that, for example, Ghana is one of the countries with a higher proportion of people living on less than $1 a day compared to other West-African countries like Mali and Côte d'Ivoire, Ghana is nevertheless regarded as one of the major success stories in Sub-Saharan Africa since it is likely to achieve the first Millennium Development Goal within the scheduled time span (Ghana Statistical Service, 2000, p. 8; IDA, 2007, p. 1). However, the country has experienced an unevenly distributed reduction of poverty. The Poverty Headcount Index is much higher in rural areas compared to urban areas and the Savannah region is affected more heavily than the other two ecological zones (Coastal and Forest). As far as the administrative regions are concerned, Upper West, Upper East, and Northern show the highest incidence of poverty across the country (Ghana Statistical Service, 2000, p. 9, 13; IDA, 2007, p. 3-4).

But it is not only Ghana that has to deal with this phenomenon since rural poverty is predominantly a rural burden in SSA as a whole. The majority of the population in Sub-Saharan Africa, 65%, lives in rural areas and therefore, rural people are more affected by poverty than the people in urban areas (Joint Staff Advisory Note, 2006, p. 3; Adjasi, Osei, 2007, p. 451; Abdulai, CroleRees, 2001, p. 438; Anríquez, Stloukal, 2008, p. 309; World Bank, 2009a, p. 3; World Bank, 2009b, p. 5).

In contrast to other developing regions and high income countries, agriculture still plays a major role in SSA and serves as an important income source, especially for young people in rural areas (World Bank, 2009, p. 6; Canagarajah et al., 2001, p. 405). The countries of South Asia and Sub-Saharan Africa had the highest initial shares of agriculture in their Gross Domestic Product (GDP) compared to the other developing regions. But, South Asia managed to reduce this share by ten percentage points between 1999 and 2006, whereas SSA only observed a reduction by 3 percentage points. Still, the agricultural sector produces 15% of the GDP in SSA (World Bank, 2001, p. 297; World Bank, 2007, p. 341).

But this dependence on agricultural production bears some risks for rural inhabitants in SSA. The household's income can be threatened due to harvest failure caused by weather shocks or seasonality, but illness of livestock or a family member and economic shocks can cause variability in income as well. As a consequence, households living in such a risky environment develop certain strategies to prevent a shortfall in their consumption, not least due to the usual absence of insurance and credit markets in developing countries. One possible but drastic strategy to reduce these fluctuations in income is the migration to other regions or even foreign countries. More common strategies are the diversification of crops produced, farming on scattered fields to spread the risk of climatic shocks, the implementation of self-insurance through savings or the removal of labour force from agriculture to participate in nonfarm activities (Dercon, 2002, p. 141-145). This strategy is widespread and very popular, since the share of nonfarm income compared to the whole income of a farm household is evidently growing and accounts for about 40-45% of the average rural household income in Sub-Saharan Africa (Buchenrieder, 2005a, p. 1).

Nonfarm employment is not a new story in developing countries and a variety of studies have already contributed to the literature. As mentioned above, a lot of researchers state that poverty is mainly rural (e.g. Adjasi, Osei, 2007, p. 451; Sahn, Stifel, 2004, p. 14ff; Abdulai, CroleRees, 2001, p. 438) and Dercon (2003)

stresses that the failure of markets is one major reason for this persisting poverty. According to him, one common market failure is the inefficiency and the imperfectness of credit markets which aggravate the poor's situation since most of the poor are faced with asset inequality and are therefore affected severely by credit market failures. Furthermore, externalities like geographical disadvantages are also driving forces of chronic poverty. Remoteness and poor infrastructure often isolate poor regions from important markets. These major conditions in developing countries can be regarded as poverty traps since these situations disable the rural poor to improve their living conditions by keeping them away from financial capital, valuable assets and efficient markets. In general, rural nonfarm activities serve as an adequate tool to alleviate poverty, since they offer income opportunities during the off-farm season, constitute appropriate strategies to manage and cope with risk, and provide jobs for the redundant rural labour force (Gordon, Craig, 2001, p. 7).

As learned above, rural households in developing countries are living in a risky environment. Thus they have the incentive to diversify their income generating process and allocate some labour time to nonfarm activities for several reasons. Either, if relative returns are lower in the agricultural sector, if farm output is actually insufficient, if returns to farming are threatened by risk or if input markets fail or are absent (Reardon et al., 2000, p. 275-276). As far as coping strategies to deal with shocks are concerned, Kinsey et al. (1998) show that in the case of the 1992 drought in Zimbabwe and associated harvest failures and food shortfalls, households tried to smooth their consumption by reducing the frequency of meals and by hunting. These strategies largely failed and therefore they were reliant on state assistance through income support in cash and in kind. Private mechanisms comprised the sale of livestock, the use of savings, if existent, remittances, and the participation in off-farm work.

Additionally, Ersado (2005) reports, examining the same Zimbabwean drought in 1992, that rural income portfolios became more diversified and that this strategy is positively correlated with wealth. Abdulai and Delgado (1999) show that the Ghanaians' probability to engage in nonfarm work is negatively correlated with age, i.e. younger persons are more probable to engage. Furthermore, higher levels of schooling, higher population density and well-developed infrastructure affect the probability to participate in a positive way. In contrast, a higher distance to the capital is negatively correlated with the participation probability due to higher

transportation costs (Abdulai, Delgado, 1999, p. 123ff). In his study about the impact of education on returns and labour allocation, Jolliffe (2004) finds that education is potent to enhance off-farm profit to a bigger extent than the farm profit. Furthermore, additional levels of education reduce the time allocated to farm work and increases the labour allocated to off-farm activities. Abdulai and CroleRees (2001) report that landholding and valuable equipment, i.e. the wealth of the household, have positive effects on the probability to participate in the production of cotton, the livestock sector as well as nonfarm activities. Furthermore, higher levels of education as well as an increasing number of adults in the household affect the likelihood of participation in nonfarm work positively. Moreover, Abdulai and CroleRees stress that the lack of capital seems to be the major constraint for poorer households to participate in income portfolio diversification activities. As learnt above, education can affect nonfarm returns and inter-location differences such as population density or infrastructure are influential factors as well since they constitute entry barriers to the nonfarm sector (Dercon, Krishnan, 1996, p. 869). In their study about Ghana, Adjasi and Osei (2007) stress that income diversification is highly important to increase the welfare of the household, since it is shown in the study that occupying a small business or receiving remittances increase the household's welfare level. To summarise these previous findings three major facts can be stressed. First, rural households in developing countries are faced with various risks and nonfarm employment is often used to manage existing shocks (e.g. Reardon et al, 2000; Ersado, 2005). Second, obviously there seem to be several entry barriers to activities in the nonfarm sector (e.g. Abdulai and CroleRees, 2001; Jolliffe, 2004; van den Berg and Kumbi, 2006, p. 469). Third, some researchers found out that income diversification towards nonfarm activities has the potential to increase a household's welfare and consequently to reduce poverty (e.g. Ersado, 2005; Adjasi and Osei, 2007).

This study is going to deal with these three attributes. First of all, the risky environment of rural households is a major topic in SSA and income diversification towards nonfarm employment is often regarded to be useful in dealing with those risks and additionally enhance the household's economic status. But only a small strand of the literature focuses on risks the households are faced with and most of the studies miss to analyse the risky environment and its influence on the nonfarm activity choice. Although some researchers dealt with the household's behaviour after a shock has occurred, most of the literature only describes the issue of risk and its sources but risk is then not included in the analysis of the household's time

allocation or labour supply decisions. Furthermore, numerous researchers focused on the identification of entry barriers to nonfarm employment but mainly ignored the impact of participation in nonfarm work on the household's wealth. Although some researchers point out that nonfarm activities have the potential to increase a household's welfare and reduce poverty, only a small number of researchers concerned themselves with this issue. However, the literature dealing with these effects only concentrated on correlations with income but not with the direct impact of nonfarm activities on the households' welfare by comparing participants and non-participants.

As a consequence, this study is therefore going to analyse whether factors representing risk actually have an influence on nonfarm employment and thus whether income diversification can serve as a risk-coping strategy in rural Ghana. For this purpose, and since there had not been a major source of risk documented in the data, hypotheses representing a risky environment are going to be derived from the literature (see section 4.4.). These factors are then included in a quantile regression to examine their effects on the participation in nonfarm employment. Furthermore, provided that a risky environment fosters the participation in nonfarm activities, possible entry barriers need to be revealed to better understand the factors influencing the participation probability and to develop strategies to prevent parts of the rural population from being excluded from income diversification. Previous research already concentrated on the detection of entry barriers but this study is going to examine entry barriers to nonfarm employment in the context of risk spreading since revealed entry barriers are therefore connected with risk intensification. Additionally, the influence of several factors on the household's wealth for households participating in nonfarm activities is going to be analysed. Finally, income diversification is often connected with an increase in welfare but also with an increase in income inequality. By implementing the Propensity Score Matching (PSM) method, the study is able to analyse the causal effects of nonfarm work on the households' welfare. Thus, the study contributes to the literature by enabling the comparison of households participating and not participating in nonfarm employment regarding their economic status, respectively, and by revealing differences between several social groups which is never done before for a developing country (e.g. Lanjouw, 2001; Holden et al., 2004; Chang and Mishra, 2008). Consequently, the study tries to find out whether income diversification towards nonfarm employment can serve as an appropriate tool to enhance the household's wealth as well as to reduce or even eliminate poverty in Ghana and if

there are differences between certain social groups. If indications for the nonfarm employment's potential to reduce poverty are revealed, the resulting policy recommendations would clearly need to target the abolishment of entry barriers.

The study is structured as follows. Chapter 2 deals with the research area, i.e. the country of Ghana. Therefore, a country profile of Ghana is presented by shedding light on Ghana's economic activity as well as its performance regarding several development indicators. The country's important policies implemented to target economic growth and poverty reduction comprising the Economic Recovery Program (ERP), the "Ghana Vision 2020", and the Poverty Reduction Strategy (PRS) are introduced as well. Finally, the dataset used, i.e. the Ghana Living Standards Survey, is going to be introduced and analysed descriptively.

The third chapter is going to deal with poverty and inequality in SSA in general and Ghana in particular. Thus, poverty and inequality are going to be defined and measures most commonly used in the literature like the Head Count Index and the Gini coefficient are presented. Finally, poverty and inequality are going to be analysed for Ghana and a decomposition analysis will be implemented to examine the influence of redistribution and growth on changes in poverty between 1999 and 2006.

Subsequently, in chapter 4 the risk and vulnerability aspect will be discussed first. Furthermore, this chapter is going to present income diversification as a risk-coping strategy and elaborate the factors determining the diversification decision. Additionally, factors representing risk will be derived from the literature and income diversification patterns in Ghana will be analysed. Therefore, the most commonly used indices measuring diversification are explained first, followed by a definition of 'nonfarm income' utilised in this study. Income diversification in Ghana is then analysed regarding the diversification measures introduced before.

The theoretical framework the study is executed within is going to explained in chapter 5. Thus, a nonseparable household model is defined to derive the household's theoretical activity choice and an empirical model is specified to describe the household's actual activity choice.

Chapter 6 is going to introduce the methodology implemented, i.e. a quantile regression using Powell's Censored Least Absolute Deviations (CLAD) estimator, the Heckman two-stage method, and the Propensity Score Matching (PSM). The CLAD estimator is going to be implemented to analyse the impact of household

characteristics as well as factors representing risk on the household's extent of income diversification, whereas the quantile regression is able to reveal discrepancies among different nonfarm participation intensities. By correcting for possible sample selection bias, the Heckman two-stage method will then identify possible entry barriers to nonfarm employment by estimating the participation probability as well as analyse the impact of several household characteristics on the household's participation intensity and wealth among participants. Finally, the PSM method is implemented to examine the causal effects of participation in nonfarm employment on the household's wealth and poverty status by comparing participants and non-participants and separately analysing different social groups like rural or female headed households.

The results of the study are going to be discussed in chapter 7 and the terminal chapter 8 is going to summarise the study's findings and derive important policy implications and prospects for future research.

2. The Research Area: Ghana

2.1. Country Profile

Ghana with its capital Accra is located in West Africa and borders on Côte d'Ivoire, Togo, Burkina Faso, and the Gulf of Guinea. The country is divided into ten administrative regions (see Figure 1) and because of its position short north the equator it enjoys a tropical climate with dry and wet seasons.

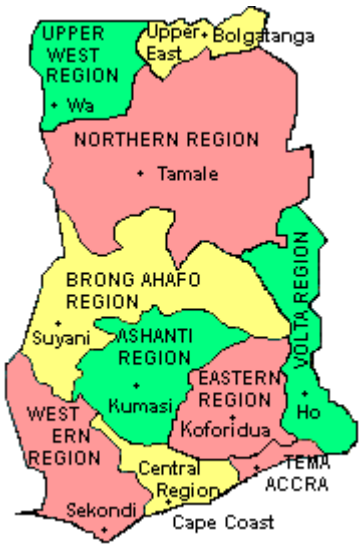


Figure 1: Administrative Regions (Source: http://www.ghanaweb.biz/GHP/img/pics/42291028.gif [08.06.2010])

The northern half of the country is characterised mainly by savannah woodland, experiences one dry season each year and therefore the regions located in the North are always confronted with the risk of droughts and consequently harvest shortfalls. In contrast, the southern part of Ghana, with its evergreen and semi-deciduous rainforest benefits from two dry seasons per year. The region along the coast of the Gulf of Guinea with the capital Accra is characterised by coastal grassland. In the months of winter, dry and dusty trade winds from the Sahara Desert provide cooling for the country, however, the threat of droughts as well, although the last drought had afflicted Ghana almost twenty years ago in the 1980s (Gocking, 2005, p. 2-5).

Ghana's population is multiethnic and amounts for approximately 23 million people whereas population density accounts for 99 persons per square kilometre (Lentz and Nugent, 2000, p. 11; World Bank, 2009b, p. 44; World Bank, 2007, p. 334).

Like almost all developing countries, the Ghanaian population is very young – about 38% younger than 15 and only 3.7% are older than 64 (World Bank, 2009a). Four main ethnic groups – the Akan, the Mole-Dagbani, the Ewe and the Ga and Adangbe - which can be further subclassified into different subgroups, as well as several other ethnicities contribute to the Ghanaian population. Typically, these groups are not spread randomly across the country. Each ethnic group mainly lives in a specific region. Indeed, the official language is English but due to the multitudinousness of ethnic groups, there exist a lot more languages additionally relevant in daily life (Gocking, 2005, p. 8ff).

Regarding several development indicators and drivers for growth in Ghana some achievements have already been made in the course of the Millennium Development Goals. But compared to SSA as a whole, Ghana lags behind in several areas. For instance, in 1998 almost 45% of all Ghanaians lived on less than $1 a day, whereas the proportion in SSA only amounted to about 41% in 2004, however the highest of all developing regions (World Bank, 2007, p. 336; United Nations, 2007, p. 6). But, as far as the incidence of poverty referring to the national poverty line[1] in Ghana is concerned, a remarkable reduction has taken place since 1990. Ghana managed to reduce the proportion of poor people from 51.7% in 1991 to 39.5% in 1998, and as will be seen in chapter 3.4.2., Ghana is on its way to meet the first MDG (Ghana Statistical Service, 2000, p. 8). However, one remarkable characteristic about poverty in Ghana is the regional differences. As indicated above, the incidence of poverty is much higher in the administrative regions Upper East, Upper West, and Northern. In general, the Savannah region is affected more heavily than the other two ecological zones (Coastal and Forest) and poverty is more prevalent in rural areas (Ghana Statistical Service, 2000, p. 9, 13; UNDP, 2007b, p. 25). Furthermore, as far as economic performance is concerned, the GDP per capita in Ghana grew by 2.4 percentage points from 1.9% in 2000-2001 to 4.3% in 2006-2007, though the GDP per capita growth in SSA even increased by 3 percentage points from 0.7% to 3.7% in the same period of time but still lags behind the Ghanaian growth rate (World Bank, 2002, p. 234-235; World Bank, 2009c, p. 354-355). In contrast, the Gross National Income (GNI) per capita in Ghana amounted to $590 in 2007 with an increase of $300 compared to 2001. The GNI per capita in SSA rose from $470 in 2001 to $952 in 2007 (World Bank, 2002, p. 234-235; World Bank, 2009c, p. 354-355). But the total GDP growth in

[1] For further information on the national poverty line in Ghana, see chapter 3.4.1.

2006 even amounted to 6.4% in Ghana, whereas SSA as a whole only had a GDP growth of 5.8% (World Bank, 2009b, p. 44).

Regarding the economic activity, agriculture still plays a major role in Ghana. In 2006, the agricultural sector accounted for 38% of the GDP, the service sector for 36.3%, and the industrial sector only for 25.8%. By contrast, in SSA only 14.5% of GDP are contributed by agriculture and the service sector is the most productive with 42.6% (World Bank, 2009b, p. 44). Consequently, latest data show that in Ghana 55% of the employed are working in the agricultural sector, whereas only 14% are employed in the industry (UNDP, 2007a, p. 300).

Besides oil palms, pineapples, coffee, shea nuts, peanuts, cotton, and citrus fruits, cocoa is Ghana's most important cash crop, since it is the second-largest export good after the natural resource gold. In 2003, gold exports made up 36% and cocoa 35% of the country's total exports. Other important natural resources exported are diamonds, bauxite, which is needed for the production of aluminium, and manganese. The main food crops in Ghana are yams, cassava, bananas, plantains, wetland rice, tropical fruits, millet, sorghum, and maize (Gocking, 2005, p. 3-8).

To better evaluate and compare the development of countries the Human Development Index (HDI) is frequently applied. It is a weighted sum of the country's performance concerning life expectancy, income, and literacy rate and therefore accounts for the multidimensional character of a population's standard of living (Grusky and Kanbur, 2006, p. 11f). Compared to SSA as a whole, Ghana is performing much better regarding its human development. In 2005, Ghana was ranked at 135 out of 177 countries worldwide with a HDI value of 0.553, whereas in 2000, although Ghana was ranked at 129, the HDI value was only 0.548. In contrast, SSA had a HDI value of 0.471 in 2000 and a value of 0.493 in 2005. In detail, life expectancy at birth in Ghana accounted for 56.8 years in 2000 and for even 59.1 years in 2005, whereas average life expectancy in SSA only amounted to 48.7 years in 2000 and 49.6 years in 2005, respectively (UNDP, 2002, p. 151-152; UNDP, 2007a, p. 231-232). Moreover, an improvement has taken place regarding the proportion of undernourished people and the access to safe water in Ghana. Between 1992 and 2004, the proportion of undernourished people could be reduced from 37% to 11%, whereas in the whole region of SSA, the proportion could only be reduced from 36% to 32%. Additionally, in 1990 only 55% of all Ghanaians used an improved water source, but in 2004 already 75% utilised an

improved water source. In contrast, this proportion could only be increased from 48% to 55% in SSA within the same period of time (UNDP, 2007a, p. 253-254). Another important aspect is the development of infrastructure. With 44.3% of the total population having access to electricity, Ghana is the fifth-best performing country in SSA and referring to the access to electricity of the rural population it is even the third-best performing country (World Bank, 2009a). Additionally, 18% of all roads in the country are paved, whereas the ratio is only 12% in SSA as a whole (World Bank, 2009b, p. 44).

As far as education is concerned, Ghana does worse compared to SSA regarding the gross enrolment ratios in primary and tertiary education (91.8% compared to 93.2% in SSA and 4.7% compared to 6.1% in SSA in 2008, respectively), but the ratio of girls to boys enrolled in primary and secondary education is 94% in contrast to 87% in SSA and the total primary school completion rate is 71% in Ghana compared to only 60% in the whole region within the relevant age group (World Bank, 2009b, p. 44-45). But regarding the adult literacy rate as a component of the HDI value, in 2005 60.3% of all people aged 15 and above in SSA and only 57.9% of all Ghanaians in the same age group were able to read and write (UNDP, 2007a, p. 231-232).

2.2. Ghana's Policies Targeting Economic Growth and Poverty Reduction

As the first African nation, Ghana declared its independence from the United Kingdom in 1957 and after some turbulent times associated with military coups there are democratic elections held since 1992, securing a strong political environment (Gocking, 2005, p. 11ff; World Bank, 1993, p. ix).

Not only since independence, the government of Ghana has formulated several development plans aiming at the improvement of the population's standard of living. Since the alleviation of poverty was not an explicit goal of these development plans and since most of these plans had a reactive and not proactive character, therefore lacking a long-run vision, the standard of living remained rather low between 1960 and 2000 (Amoako-Tuffour and Armah, 2008, p. 4; Amoako-Tuffour, 2008, p. 17). As a consequence of the economic decay in the 1970s, the government of Ghana, assisted by the World Bank and the International

Monetary Fund (IMF), developed the Economic Recovery Program (ERP) and Structural Adjustment Policies (SAP) implemented in 1983. The measures of the first stage (ERP 1: 1983-1986) targeted at encouraging the private sector development, rationalising the government's expenditures, and liberalising markets comprising the privatisation of state enterprises, the deregulation of the exchange rate to foster export-led growth, the improvement of the financial sector, and the abolishment of price controls to achieve single digit inflation. These provisions managed to stop the decline in economic growth and therefore arranged for some level of macroeconomic stability but the rate of economic growth was lower than planned and due to an only weak correlation between economic growth and poverty reduction, i.e. only weak pro-poor growth, regional inequality even increased as aggregate poverty decreased. In 1987, the ERP 2 (1987-1989) was implemented, guaranteeing a poverty reducing effect of the ERP 1 by targeting the delivery of and access to social services as well as the re-shaping of the government since only a proper policy environment could assure the success of anti-poverty measures. Therefore, the ERP 2 required re-shaping the government administrative machinery, limiting the government's involvement in the financial sector, reforming ineffective institutions, and rationalising the process of economic management. Additionally, the ERP 2 focused on reforms in the health sector, education, the civil service machinery, and public utilities, whereas the first Ghana Living Standards Survey (GLSS) had been conducted in 1987 to establish a baseline for future policy evaluation. Overall, the ERP failed its objectives due to a poor programme design and poor targeting, e.g. the elimination of fertiliser and pesticide subsidies in times of declining food production and the hasty retrenchment of the social service sector accompanied by user fees and charges for the access to safe drinking water and the use of services in education and health clinics. As a consequence, poor people were denied access to these services and the basic needs of nutrition and primary goods could not be fulfilled (Amoako-Tuffour, 2008, p. 39-42; Armah, 2008, p. 76f).

For this reason, the National Development Planning Commission (NDPC) was established, charged to advise the President regarding development planning strategies and to prepare the National Development Policy Framework outlining the strategic direction for the national development regarding the period 1996 to 2020. The general goals of this "Vision 2020" were Ghana's transformation from an underdeveloped, poor, and low-income country into a prospering middle-income country within 25 years. In the course of this "Vision 2020", the Accelerated

Poverty Reduction Strategy called “Ghana-Vision 2020 - The First Step: 1996-2000” was implemented aiming at accelerating the equitable reduction of poverty and increasing the national average per capita income (Amoako-Tuffour and Armah, 2008, p. 5). In general, the medium-term objective of the “Vision 2020” was substantial progress with respect to human development, economic growth, rural and urban development, and an enabling environment. More detailed, it was aimed at an improved human resource and productivity management, especially regarding the education and employment of women and the disabled. Furthermore, the objectives comprised reduced malnutrition and poverty, a sound financial base for accelerated development, science-based behaviour in sustainable development, population control, and intensified community participation in the design and implementation of development programmes. Additionally, an increase in real per-capita income was aimed at, with particular focus on the rural population (Government of Ghana, 1995, p. 2f).

This Poverty Reduction Strategy (PRS) was followed by the Interim Poverty Reduction Strategy Paper (IPRSP) implemented in 2000. The main focus of this IPRSP was the reduction of poverty and the enhancement of the population’s welfare by reducing the incidence of both rural and urban poverty, decreasing gender, socio-economic as well as geographical inequality, improving the population’s education, health status, and productivity as well as fostering the poor’s capabilities to earn sufficient income. These goals were planned to be achieved by strengthening the agricultural sector by dint of implementing recent agricultural technologies to foster productivity as well as launching moderate fiscal, monetary and other macroeconomic policies to stimulate economic growth. Furthermore, the IPRSP determined increased investments to strengthen the economic infrastructure such as roads and communication networks and therefore reduce the isolation of poor communities as well as to improve the access to and quality of education, nutrition, health, water and sanitation services. Concluding, the access to financial service, credit, training, and local and foreign markets was aimed to be improved and the expansion of the service and manufacturing sectors was defined to provide new business facilities as well as rural and urban employment opportunities (Government of Ghana, 2000, p. 1f).

In addition, the new government of Ghana elected in 2001 aimed at reducing Ghana’s debts under the Heavily Indebted Poor Countries (HIPC) initiative of the World Bank and the International Monetary Fund since debt servicing absorbed a

significant proportion of the country's export earnings and domestic revenue. This initiative had been launched in 1996 by the World Bank and the IMF in order to provide debt relief to the world's poorest and most indebted countries. The initiative comprises a decision and a completion point, whereas at the decision point, it is decided whether a country is suitable to take part in the programme and to reach the completion point, i.e. the actual debt relief, three key conditions need to be fulfilled. First, an agreed PRS needs to be completed and implemented for at least one year. Second, a stable macroeconomic environment needs to be maintained and third, structural as well as social reforms need to be implemented targeting governance, health, education, decentralisation, and the energy sector. Additionally, since the HIPC initiative mainly aims at poverty reduction, the participating country is requested to allocate financial means available due to debt relief to the reduction of poverty. In 1998, Ghana's external debt amounted to US$ 3.8 billion, representing 187% of the country's exports and 51% of the Gross National Product (GNP). In 2001, Ghana's external debts even increased to US$ 5.9 billion and debt servicing would have required more than 70% of the government revenue. (World Bank[2], 2010; Osei and Quartey, 2001, p. 3; USAID[3], 2002)

The decision point for the country was February 2002 and as a consequence, in 2003, the Ghana Poverty Reduction Strategy (GPRS I) for the period 2003 to 2005 followed the IPRSP to fulfill the first major condition of the HIPC initiative. The government's priorities for this time frame concentrated on equitable growth due to economic stability, the protection of the vulnerable and excluded, the reduction of poverty within the framework of the MDGs, and the assurance of a decentralized and democratic environment. These goals were aimed to be achieved by promoting sustainable livelihoods, fostering production, guaranteeing gender equality and providing particular programmes to support the excluded and periled, ensuring good governance, supporting equitable human resource development, and intensely involving the private sector as the main driving force of growth. In the course of the GPRS I, human resource development and basic services were focused as well. As far as education is concerned, the government of Ghana aimed at quality, equity, and efficiency, targeting these goals by improving the equipment of public schools, developing, deploying and supervising teachers, reforming management, and starting partnership programmes with non-state partners.

[2] Available at: http://go.worldbank.org/EVLW566FY0 [08.06.2010]
[3] Available at: http://www.usaid.gov/pubs/cbj2003/afr/gh/ [08.06.2010]

Additionally, the youth were supported by an increased coverage of vocational and technical training and entrepreneurship among the youth was promoted. Furthermore, to promote the health status of the population, it was defined to improve the access to quality health services, the efficiency of service delivery and the financing arrangements to protect the poor. In addition, the combat of HIV/AIDS was addressed in the GPRS I by supporting the prevention of new transmission and the provision of medical care for infected persons. Since the protection of the vulnerable and excluded like unemployed, elderly, children, women, people with HIV/AIDS, or slum dwellers was also a target of the GPRS I, special programmes enforcing the rights of the vulnerable as well as enhanced essential services for the extreme poor were implemented, covered not only by governmental institutions, but also by non-governmental organisations (NGOs), offering the possibility to provide safety nets (IMF, 2003, p. 30, 100, 104, 106f, 110, 114ff). Consequently, in December 2004, Ghana reached the completion point and experienced a total debt relief of US$ 3.5 billion, representing a 56.2% reduction in debt (IMF, 2004, p. 3).

Subsequent to the GPRS I, the Growth and Poverty Reduction Strategy (GPRS II) was implemented in 2006 for the period 2006 to 2009, mainly aiming at the advancement of the country's economy since the goal formulated in the "Vision 2020" was to achieve middle-income status, defined by a per-capita income of at least US$ 1000 and embedded in a democratic environment. Additionally, the GPRS II targeted a social protection policy to empower the vulnerable and excluded in general and women in detail to contribute to and benefit from economic growth, accompanied by sustainable poverty reduction. Whereas the GPRS I mainly focused on poverty reduction, the GPRS II aimed at changing the economic structure, increasing productivity across sectors, diversifying the export base, and increasing rural incomes. The four main fields of action were macroeconomic stability, the development of the private sector, human resource development, and good governance and civic responsibility. Macroeconomic stability was aimed to be continued by reducing public debt by avoiding over spending, fostering growth and ensuring price stability, improving savings mobilization, developing the capacity to respond to external shocks effectively, and making credit affordable to the private sector. According to the GPRS II, the profitability of the private sector was to be enhanced by promoting industry and trade, providing sufficient infrastructure, improving investment conditions for fishing and agriculture, developing science and technology, and developing new sectors like tourism. In the field of human

resource development, the GPRS II aimed at developing well-informed, well trained, and healthy people interested in improving the country's situation. For this reason, measures were launched referring to improved education, training and skills development, sports development, and improved access to health care, malaria control and HIV/AIDS prevention. Finally, to deepen the civic responsibility and good governance, it has been defined to strengthen key institutions such as District Assemblies and the Parliament, to fight economic crimes and corruption, to improve political, administrative and fiscal decentralization, to encourage civil society agencies and the media to play an effective role in government, to promote civic responsibility and participation in decision making, to foster gender equity, and to enhance public safety. (NDPC, 2005, p. 5f, 20ff, 29ff, 42ff, 61ff)

Today, Ghana is on the right track to achieve almost every goal defined in the "Vision 2020" or even has succeeded in achieving its targets. First, as can be seen in section 3.4., Ghana managed to reduce its incidence of poverty almost achieving the first MDG and even inequality in income distribution has been slightly reduced but still has to be focused in the future (Ghana Statistical Service, 2000, p. 8). However, one of the targets focused the enhancement of rural development but there are still significant disparities between rural and urban areas in the country which still need to be addressed in the future. Furthermore, an annual GDP growth rate of 8% was aimed for and the sectoral composition was targeted (Government of Ghana, 1995, p. viii). In 2006, the annual GDP growth was at least 6.4%, missing the target but indicating increasing growth rates with respect to 2020. Additionally, the share of the agricultural sector in GDP should be lower than 20% in 2020, but it was still 38% in 2006 and higher shares of the industrial and the service sector in the GDP have not been achieved as well. However, as far as human development is concerned, Ghana has reached the goals defined by the "Vision 2020". Ghana's annual population growth amounted to 2.1% in 2008, failing the target of 2% annual population growth by 2020 only slightly (World Bank, 2009, p. 44; Government of Ghana, 1995, p. vii). Moreover, the "Vision 2020" aimed at reducing child and infant mortality as well as increasing life expectancy and the country has successfully reduced mortality rates as well as increased life expectancy (Government of Ghana, 1995, vii; UNDP, 2002, p. 151-152; UNDP, 2007a, p. 231-232). Referring to nutrition and living conditions, Ghana managed to reduce the proportion of undernourished people by 26 percentage points and to increase the proportion of people using an improved water source by 20 percentage points between 1990 and 2004, providing its population higher food

security and improved access to safe water as targeted in 1995 (Government of Ghana, 1995, p. vii; UNDP, 2007a, p. 253-254). One further goal of the "Vision 2020" was the improvement of basic education and the literacy rate (Government of Ghana, 1995, p. vii). But since only 57.9% of all Ghanaians aged 15 and above were able to read and write in 2005, Ghana still has some challenges to face in achieving all goals defined in the "Vision 2020" (UNDP, 2007a, p. 231-232).

2.3. The Ghana Living Standards Survey

2.3.1. The Sample Selection Method

The dataset underlying the study is the Ghana Living Standards Survey (GLSS) 5, collected nationwide in 2005/2006 over a full 12-month period. The survey was conducted by order of the Ghana Statistical Service (GSS), with financial and technical support by the Government of Ghana, the World Bank as well as the European Union, and the former rounds have been surveyed in 1987/1988, 1988/1989, 1991/1992, and 1998/1999. The GLSS is a multi-topic household survey covering a nationally representative household sample and providing comprehensive information on the living standards of Ghanaian households. The survey provides information about demographic characteristics of the population, education, migration, health, housing conditions, employment and time use, as well as expenditures and consumption.

In order to make regional level indicators available, a nationally representative probability sample of households was selected based on a two-stage sampling procedure. In the first step, enumeration areas were selected based on those used for the 2000 population census, with probability proportional to size as recorded in the 2000 census, which resulted in 580 enumeration areas. At the second stage, 15 households per enumeration area were selected which resulted in a total number of 8,700 households and finally, 8,686 households (37,121 individuals) were successfully interviewed (Ghana Statistical Service, 2008, p. iii, iv, 118f; Ghana Statistical Service, 2000, p. iii, 57).

In order to compare descriptive statistics and to derive trends in the development of e.g. poverty and inequality, the GLSS 4, collected over a 12-month period in 1998/1999, is also utilised in this study. The sample selection method for this survey was the same as for the GLSS 5, but only 300 enumeration areas had been

selected based on the 1984 population census. At the second stage, 20 households were systematically selected from each selected enumeration area, resulting in a total number of 6,000 households, whereof 5,998 households (25,694 individuals) had finally been interviewed (Ghana Statistical Service, 2000, p. iii, 57; Ghana Statistical Service[4], *no date*, p. 7f).

2.3.2. Definitions

According to the GSS a "household consists of a person or group of related or unrelated persons, who live together in the same housing unit, who acknowledge one adult male or female as the head of the household, who share the same housekeeping and cooking arrangements, and are considered as one unit." (Ghana Statistical Service, 2004, p. 21)

Some household characteristics used in the study, for example the age or the educational level, refer to the household head since "[t]his is the person acknowledged as such by members of the household and who is usually responsible for the upkeep and maintenance of the household. The head of the household will be identified by the household members themselves. He is the person who is named in reply to the question 'Who is the head of the household?'" (Ghana Statistical Service, 2004, p. 22)

A third important definition is the classification of urban and rural areas. The official definition of rural in Ghana is an area with a population of less than 5,000 and the complement 5,000 and more is defined as urban (Ghana Statistical Service, Email on 20.05.2009).

2.3.3. Outliers

"An outlying observation, or 'outlier', is one that appears to deviate markedly from other members of the sample in which it occurs." (Grubbs, 1969, p. 1) Outliers always state a problem in analysis since they influence the mean and the variance of the dataset and even the results of statistical estimations. Such extreme values can arise either because of higher observations in the dataset, or because of

[4] Available at: http://siteresources.worldbank.org/INTLSMS/Resources/3358986-1181743055198/3877319-1190217341170/G4USERSG.pdf [08.06.2010]

measurement or report errors (Sim et al., 2005, p. 642; Sachs, 2004, p. 365). When looking at the variable 'total household income', a right skewed distribution is revealed. In order to delete the outliers in the dataset, Tschebyschow's Inequality is used (Fisz, 1978, p. 98-99).[5] The elimination of outliers aimed at keeping at least 94% of the dataset and finally, even 8385 households (96.5%) were kept in the dataset.

2.3.4. Descriptive Statistics

As mentioned before, the GLSS 5 comprises 8,385 households (35,961 individuals), 59.85% of which are located in rural areas and 40.15% in urban areas, respectively. As far as several household characteristics are concerned, significant differences are revealed between the rural and the urban areas in Ghana (see Table 1).

Table 1: Selected characteristics of Ghanaian households (Author's calculations, GLSS 5)

	Ghana	Rural	Urban
number of households	8,385	5,018	3,367
male household heads	72.3%	75.6%	67.4%
ø household size	4.289	4.732	3.629
ø age of household head	45.355	46.628	43.459
ø household age	28.365	28.089	28.777
ø hh members < 7 years	0.83	1.01	0.57
ø hh members 7 – 15 years	1.03	1.18	0.81
ø hh members 16 – 64 years	2.23	2.3	2.11
ø hh members > 64 years	0.2	0.24	0.14
ø years of education of hh head	7.38	5.53	10.13
ø per head expenditures (GHC[6])	7,634,100	5,523,861	10,800,000

[5] For the explanation of Tschebyschow's Inequality and the exact elimination see Annex 1.
[6] Note that 1€ ≈ 7,509GHC at the respective rate.

First of all, the vast majority of the households are headed by male person, whereas the proportion of male household heads is much higher in rural areas compared to urban areas and the whole country. Additionally, households in rural areas are much bigger than in urban areas and the average age of the head of the household also exceeds the average age in Ghana and in urban areas, respectively. Remarkably, although urban household heads are the youngest, the average age of an urban household is slightly higher than relating to the whole country and the rural areas, respectively. When looking at the age-composition of the households it is obvious that rural households on average have more members of each age class, but especially more household members under 16, explaining the lower average household age in rural areas. Urban households, which are far the oldest on average, are mainly composed of people between 16 and 64 years, and household members are rarely older than 64. As far as the educational level of the household is concerned, the study is referring to the household head's completed years of education since the head of the household is considered to be the person mainly responsible for the decision-making concerning the household's livelihood. With more than 10 years of education on average, the urban population is way better educated than Ghana as a whole and rural households, respectively. About 35% of all Ghanaian household heads have never completed a school year, and in rural areas the proportion of people even amounts to about 46%. In contrast, in urban areas only 18% report no completed school year. The second largest proportion of people in Ghana, 21.35%, experienced 12 years of education, whereas in urban areas this proportion amounts to 26.52% and in rural areas only to 17.88%. Since living standards of households are mainly measured by the household's consumption, the income generated by a household is not a sufficient indicator for the household's welfare status in developing countries (Ghana Statistical Service, 2000, p. 2ff) and therefore the household's expenditures per head are commonly used to illustrate the well-being of a household. It is obvious that households in urban areas are doing way better than referring to the whole country and especially the rural areas. According to the data, urban households had almost twice the expenditures per head in the period of 12 months.

In order to better understand the regional differences across the country, some household characteristics are presented relating to the administrative regions (see Table 2).

Table 2: Selected characteristics of Ghanaian households, according to the administrative regions
(Author's calculations, GLSS 5)

	Western	Central	Greater Accra	Volta	Eastern
% rural	64.6%	64.4%	14.1%	73.2%	64.2%
main ecological zone	forest	coastal	coastal	forest	forest
male household heads	71.7%	64.1%	70%	70.1%	66.9%
ø household size	3.93	3.63	3.43	4.12	3.79
ø age of household head	44.22	47.24	42.73	48.25	45.44
ø years of education	8.56	7.98	11.24	7.48	8.44
main occupation of hh head	agriculture	agriculture	unempl./ handcrafter	agriculture	agriculture
main religion of hh	catholic/ pentecostal	pentecostal	pentecostal	catholic	pentecostal
remoteness	11min	11.2 min	10.2 min	12.2 min	10.2 min
ø per head expenditures in GHC	8,079,391	9,222,395	12,700,000	10,000,000	7,526,250

Table 2 *(continued)*

	Ashanti	Brong Ahafo	Northern	Upper East	Upper West
% rural	50.6%	63.1%	74.2%	87.7%	93.3%
main ecological zone	forest	forest	savannah	savannah	savannah
male household heads	67.5%	66.7%	88.5%	84%	86.9%
ø household size	4.04	4.11	5.62	5.34	6.62
ø age of household head	43.61	45.65	44.44	48.3	49.3
ø years of education	8.91	6.96	2.8	2.76	2.21
main occupation of hh head	agriculture	agriculture	agriculture	agriculture	agriculture
main religion of hh	other christian	moslem	moslem	traditional	moslem
ø remoteness	11.2 min	13.5 min	7.3 min	9.2 min	10.5 min
ø per head expenditures in GHC	8,080,353	6,123,637	3,846,092	3,241,412	1,798,660

Obviously, there are significant differences between the 10 administrative regions regarding specific household characteristics. First of all, although the proportion of households living in rural areas is high in all regions except Greater Accra, the percentage of rural households in much higher in the northern regions. Greater Accra includes the capital Accra, explaining its mainly urban character. As indicated in chapter 2.1., most of the regions are characterized by forest and coastal zones, whereas the northern regions Northern, Upper East, and Upper West are characterized mainly by savannah woodland. Furthermore, the average household size, the proportion of male household heads, and the average age of the household head are higher in the northern regions. In contrast, the average amount of completed school years is significantly lower in the northern regions and the highest in the Greater Accra region. In general, the main field of occupation of households is agriculture, whereas in detail, market gardeners and crop growers and subsistence agriculture and fishery workers are the main occupations. Only in Greater Accra a high number of households do not report any specific occupation and almost the same proportion are handcrafters. As mentioned in chapter 2.1., ethnic groups are not widespread across the countries. This fact is also revealed when looking at the main religious denomination of the household head, whereas

the religion of the household head can be assigned to the complete household. The northern regions are mainly dominated by Moslems, whereas the south is occupied mainly by Pentecostal believers. In order to evaluate the remoteness of households and since information about distance to markets is missing the average distance to school is measured. With respect to the significant rural character of the northern regions a more remote living condition would be expected. In fact, the opposite is the case with the northern population having a shorter distance to school. But, since population density is lower in these regions, schools are smaller and therefore, pupils even have a short way to school. Finally, the economic situation is important to observe. All southern regions have per-head expenditures close to the country average and higher than the rural average. Only the northern regions Northern, Upper East, and Upper West lag behind significantly. Especially the Upper West region only has average per-head expenditures of 1,798,660 GHC, more than four times lower than the country average.

3. Poverty and Inequality

3.1. Definition of Poverty

According to Foster (1998), a "person or family is identified as poor if its resources fall short of the poverty threshold." (Foster, 1998, p. 335) Since there are different ways to construct thresholds and define resources, one can differentiate between absolute and relative poverty. In order to define absolute poverty a monetary poverty line is established and every person whose income falls below this threshold is regarded as poor. To define this poverty line, Sen's definition of poverty being the inability to fulfil basic needs (Sen, 1999, p. 11f, 24) and the lack of elementary capabilities, such as school attendance, access to information and the participation in social life is utilised (Schröder, 2005, p. 32). Similarly, Fields (2001) defines poverty to be the inability to afford a basket of necessities like food and clothing, whereas such a basket of basic needs is composed and evaluated monetarily. This calculation results in a sum in dollars or the particular national currency and, as mentioned above, a person is considered to be poor if, depending on the measure of economic well-being chosen, either his or her income or expenditures fall below this threshold. In contrast, relative poverty is connected with the average income. A person is subject to relative poverty if his or her income is less than fifty per cent of the median income of the nation's population, though this relative definition is not typically used in developing countries (Foster, 1998, p. 336; Deaton, 2004, p. 14).

As suggested above, poverty comprises more than just income poverty. It is therefore a multidimensional phenomenon. There are more aspects contributing to the well-being of the household than solely income (Bhalla, 2002, p. 51). Poverty additionally comprises low achievements in health and education and interactions between them (World Bank, 2001, p. 15). Education provides an adequate opportunity to escape the vicious circle of poverty and the denial of school attendance, especially for girls, can be very harmful for the children since it restrains them from participating in activities only accessible for literates (Deaton, 2004, p. 11). Furthermore, a household can be regarded as better off than another if its living standard is higher even if the income is the same. Factors that contribute to a household's standard of living as well are for example the access to clean drinking water and medical attendance, the literacy rate (Baker, Grosh, 1994,

p. 3), infant mortality, life expectancy, the nutritional status, and a democratic environment providing and securing human rights (Kremer, 2005, p. 23; Hazell, Haddad, 2001, p. 4f).

3.2. Poverty Measures

A lot of poverty measures are available in order to picture the poverty situation of a country. The most frequently used measure of poverty is, because of its simple calculation, the Head Count Ratio. It shows the share of poor people q among the whole population N, whereas q is also called the head count:

$$H = \frac{q}{N} . \qquad [1]$$

Since the Head Count Ratio does not take into account the depth of the individual's poverty, it mostly meets with criticism and therefore, the use of the Income Gap Ratio broadens among researchers (Ravallion, 1996, p. 1329). The Income Gap Ratio represents the mean proportional distance of the individual poor person's income or expenditures y_i from the poverty line z and hence considers the depth of the whole population's poverty (Harrison, 2006, p. 9):

$$I = \frac{z - y_q}{z} , \qquad [2]$$

where

$$y_q = \frac{1}{q} \sum_{i=1}^{q} y_i . \qquad [3]$$

In order to obtain the Poverty Gap, the Income Gap Ratio, which is also called the poverty ratio, and the Head Count Ratio are multiplied. In order to evaluate the dimension of poverty more satisfactorily and to allow for more distribution sensitivity, the Squared Poverty Gap can be used. It weights the income gaps and assesses more weight to the very poor (Ravallion, 1996, p. 1330).

In addition, to give greater emphasis on the poorest of the poor, the Foster-Greer-Thorbecke (FGT) family of poverty measures can be utilised. To define a particular FGT poverty measure, a specific parameter of poverty aversion, α, has to be chosen.

In general, the FGT family of poverty measures can be written as follows:

$$P_\alpha(y; z) = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{g_i}{z}\right)^\alpha, \quad [4]$$

whereas g_i is the income shortfall of the ith household, i.e. $z - y_i$. For α = 0, P_0 is the Head Count Ratio, for α = 1, P_1 is the Poverty Gap, for α = 2, P_2 is the Squared Poverty Gap to measure the severity of poverty, and in general, the greater α is, the greater is the emphasis on the poorest (Foster et al., 1984, p. 763).

In conclusion, all monetary poverty measures have two major points of criticism in common. First, the only basis to measure poverty is the current expenditures or income of an economic entity (Bourguignon, 2006, p. 76; Sen, 2006, p. 33f). Second, if a poor person dies because of poverty, all indices would fall. Bourguignon refers to this issue as the 'income poverty paradigm' (Grusky, Kanbur, 2006, p. 11).

As mentioned above, poverty measures that only concentrate on monetary aspects do not take into account further factors that contribute to a household's welfare. An approach to better reflect the multidimensionality of poverty is the Human Poverty Index (HPI). This index measures the lack of necessities by referring to the lifespan, i.e. the part of the population that will not reach the age of 40, education, i.e. the rate of adults unable to read and write, and the standard of living, i.e. the combination of the population's percentage with no access to safe water and health services, and the proportion of undernourished children under 5 years. These three subindices are weighted so that the resulting HPI is a weighted mean of these three. The results of the HPI can be interpreted as follows. The HPI results in percentages, e.g. 30%. That means that an average of 30% of the population of the country examined suffer from these deficits observed in the HPI. The problem that arises is that the HPI does not provide any evidence of the number or a specific group of affected people (Subramanian, 2007, p. 156f; UNDP, 1997, p. 19).

In favour of comparability of results, the Head Count Ratio (P_0), The Poverty Gap (P_1), and the Squared Poverty Gap (P_2) have been calculated in this study. For the results of the poverty analysis please see chapter 3.4.2.

3.3. Inequality

Inequality, like poverty, is a major source of and therefore an indicator for the absence of social well-being (Subramanian, 2007, p. 135). Monetary poverty measures are only capable of evaluating income poverty. But “income is only one factor among many that influence the real opportunities people enjoy” (Sen, 1997, p. 195). Besides the proportion of poor people, the distribution of income is important to know in order to evaluate the economic situation of a country (Sen, 1997, p. 164). If the majority of the population possesses only a small percentage of the cumulated income of the country, the income is very unequally distributed.

The Lorenz curve provides an appropriate picture of inequality in income distribution since it shows the cumulative percentage of population, who have been ordered from lowest income to highest first, on the horizontal axis and the cumulative percentage of income on the vertical axis (see Figure 2).

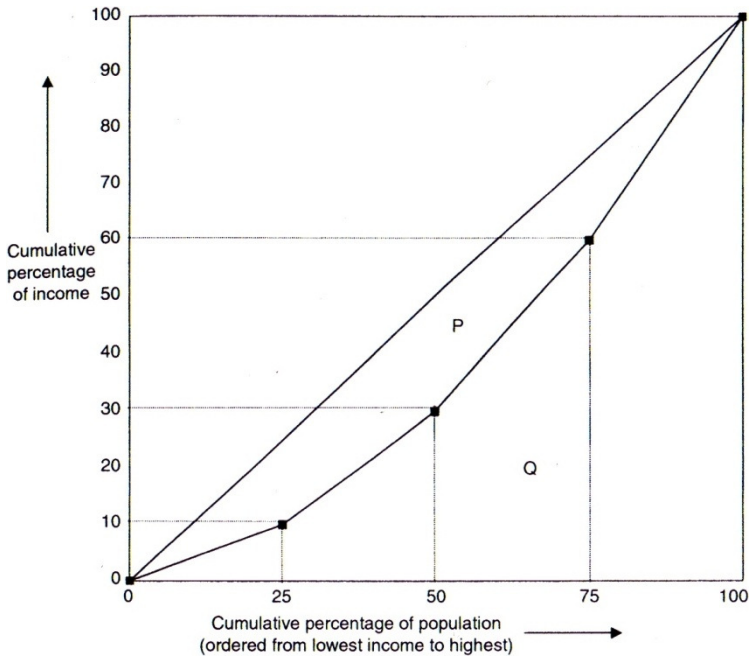


Figure 2: The Lorenz curve (Fields, 2001, p. 19)

If 50% of the population earn 50% of the total income, there would be perfect equality among the population and the Lorenz curve would result in a diagonal in the unit square. In reality, the Lorenz curve shows a convex shape and the higher the inequality, the bigger the gap between the diagonal and the Lorenz curve (P).

In order to describe the inequality in income distribution in a country, the Gini coefficient is used most often and calculated as follows:

$$G = \frac{P}{P+Q}. \qquad [5]$$

The coefficient ranges from 0 to 1, with 0 representing perfect equality and 1 representing perfect inequality (Subramanian, 2007, p. 136f, 142; Fields, 2001, p. 32f; Sen, 1997, p. 29f; Bhalla, 2002, p. 31).

Another frequently used inequality measure is the Theil's Entropy Index (T), since it is able to react sensitively on income transfers from the rich to the poor. The index equals 0 if there is perfect equality and the greater is the inequality in income distribution, the more tends the Theil index to ln$N$. The Theil's Entropy Index can be calculated as follows:

$$T = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\, ln\frac{y_i}{\bar{y}}\right), \qquad [6]$$

whereas y_i is the income of the ith household, $\bar{y}$ is the mean income, and N is the total number of households (Subramanian, 2007, p. 142).

3.4. Poverty and Inequality in Ghana

In this section, first the expenditure-based poverty line set by the GSS is introduced. In subsection 3.4.2., poverty patterns in Ghana are discussed and in subsection 3.4.3., the inequality levels of income distribution in Ghana are analysed. Finally, in subsection 3.4.4., the change in poverty observed between 1999 and 2006 is analysed referring to the influence of growth and redistribution.

3.4.1. The Expenditure-Based Poverty Line

Most of the poverty data mentioned before referred to the '$1 a day'-threshold proposed by the World Bank in 1990, in 1985 purchasing power parity prices. In the mid-1980s, the $1 a day poverty line corresponded to the national poverty lines of some of the poorest countries and therefore, this threshold had some intuitive potential and gained much attention in the poverty literature (Srinivasan, 2004, p. 4). But, this poverty line possesses obvious shortcomings since it is not measured

in real dollars of any existing country and it is a one-dimensional indicator only referring to expenditure on consumption. Furthermore, the adjustment of the base year from 1985 to 1993 has lowered the international poverty line in real terms and this $1 a day threshold does not seem appropriate to reflect the cost of meeting essential human needs since cost of living vary significantly across countries (Reddy, 2004, p. 6; Kakwani, 2004, p. 9).

Regarding these facts, and as long as an international comparison is not predominantly intended, the consideration of a national poverty line is more advisable. In Ghana, the GSS set a poverty line based on the households' food as well as non-food consumption expenditures, aiming at the comparability of living standards across the country. In order to define the nutrition based poverty line, the GSS examined the average consumption basket of the bottom 50% of individuals, who were ranked by the standard of living measure, and computed the amount of calories provided by this basket. These calculations resulted in 2900 kilocalories per adult equivalent and 2,884,700 GHC per adult per year (about 384€ at the respective rate), respectively. As a consequence, every person whose annual expenditures fall below this threshold is considered to be extremely poor. Thus, this poverty line represents extreme poverty but it is only nutrition based since it focuses solely on the fulfillment of basic nutritional requirements. For this reason, an additional poverty line was set at 3,708,900 GHC per adult per year (about 494€ at the respective rate) also taking into account the essential non-food consumption of household members. Regarding this threshold, every person with expenditures less than 3,708,900GHC is considered to be poor (Ghana Statistical Service, 2007, p. 4-6; UNDP, 2007b, p. 25-27).[7]

3.4.2. Poverty in Ghana

As mentioned in chapter 3.2., the P_0, P_1, and P_2 are calculated for the study. In order to picture the development of poverty over time, the results for the GLSS 4 are also mentioned, as well as the results for both poverty lines (see Table 3).

[7] The poverty lines used for the GLSS 4 are 700,000 GHC and 900,000 GHC, respectively. The poverty lines for the GLSS 5 have been inflated with the 1999 to 2006 Consumer Price Index to obtain 2,884,700 GHC and 3,708,900 GHC, respectively.

Table 3: Poverty Situation in Ghana (Author's calculations, GLSS 4, GLSS 5)

	Ghana		Rural		Urban	
	1999	2006	1999	2006	1999	2006
P_0						
lower poverty line	32.29%	29.34%	41.75%	42.15%	15.96%	11.12%
upper poverty line	43.63%	39.39%	54.49%	54.38%	24.87%	18.07%
P_1						
lower poverty line	11.78%	11.86%	15.76%	17.68%	4.91%	3.58%
upper poverty line	17.66%	16.88%	23.04%	24.51%	8.36%	6.04%
P_2						
lower poverty line	5.92%	6.58%	8.09%	9.98%	2.18%	1.76%
upper poverty line	9.45%	9.7%	12.64%	14.44%	3.96%	2.97%

Obviously, the number of extreme poor people diminished between 1999 and 2006, but there are significant differences between rural and urban areas. Urban poverty decreased perceptibly during this period of time, whereas even more rural households lived in extreme poverty in 2006 and only a very small proportion of rural households managed to reduce poverty regarding the upper poverty line. In general, the depth as well as the severity of poverty seems to increase except for urban areas and especially in rural areas the severity of poverty has significantly risen.

As indicated in Table 2, Ghana shows noticeable differences across its ten administrative regions regarding several household characteristics. These differences also become clear when comparing the Head Count Ratios for the particular region (see Figure 3).

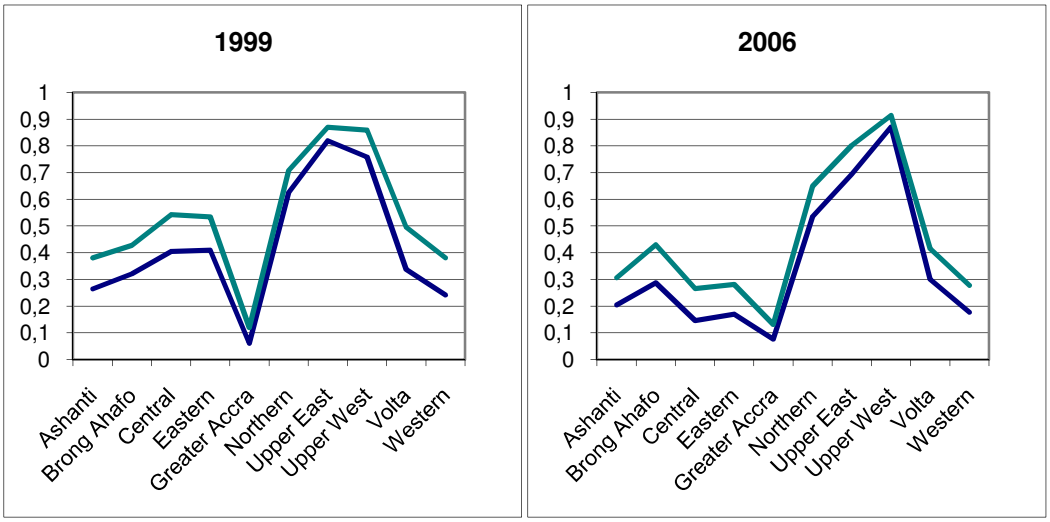


Figure 3: P_0 by administrative region[8] (Author's calculations, GLSS 4, GLSS 5)

Obviously, the regions differ significantly regarding the incidence of poverty. In Greater Accra, far the least people suffer from poverty. In contrast, the northern regions Northern, Upper East, and Upper West show the highest incidence of poverty across the country and the proportion of people with expenditures below the poverty lines in the southern regions are far lower than those of the northern regions. Furthermore, a significant reduction of poor people can be observed for the Ashanti, Central, Eastern, and Northern region, whereas most of the regions experienced a reduction in poverty. Only in the Upper West region the proportion of poor people even increased. As learned earlier, the northern regions in Ghana have a stronger rural character, are mainly characterised by savannah woodland, and experience only one dry season each year, making the population more vulnerable to droughts.

3.4.3. Inequality in Ghana

The analysis of the poverty situation has clearly shown that Ghana's northern regions are affected more severe by income poverty than the southern regions. But when talking about poverty one always need to bear in mind inequality, too. For the purpose of analysing the inequality in income distribution in Ghana, the Gini coefficient and the Theil index are utilised (see Table 4).

[8] Note that the green line represents the results for the upper poverty line, whereas the blue line displays the results referring to extreme poverty.

Table 4: Inequality in Ghana (Author's calculations, GLSS 4, GLSS 5)

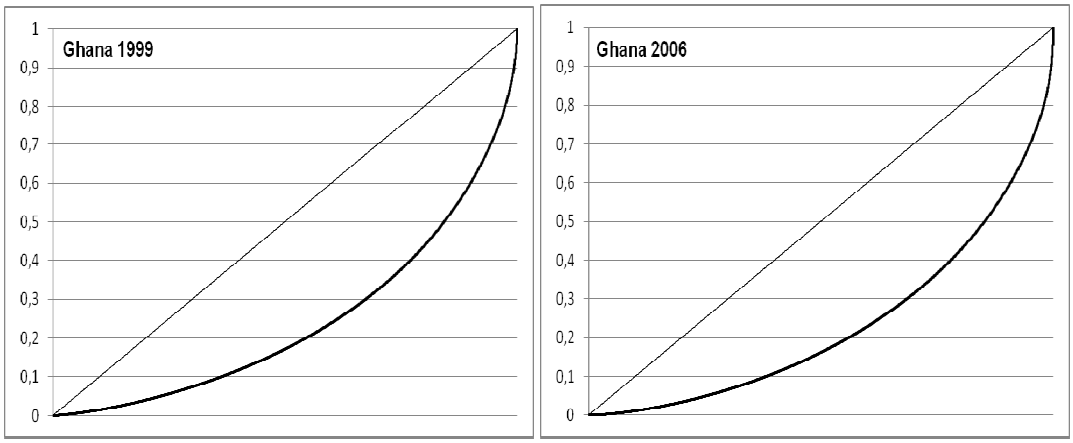
	Gini		Theil		lnN	
	1999	2006	1999	2006	1999	2006
Ghana	0.5121	0.5312	0.5506	0.6246	8.7	9.1
Rural	0.4707	0.5271	0.4326	0.6853	8.2	8.5
Urban	0.4962	0.4719	0.5354	0.4793	7.7	8.2
Ashanti	0.496	0.4722	0.4722	0.4776	7	7.4
Brong Ahafo	0.4473	0.4416	0.364	0.3763	6.3	6.7
Central	0.4368	0.5321	0.3697	0.6955	6.6	6.5
Eastern	0.4899	0.4215	0.4939	0.3275	6.5	6.8
Greater Accra	0.4361	0.4715	0.3583	0.4559	6.8	7.1
Northern	0.6458	0.4466	1.4537	0.3495	5.9	6.7
Upper East	0.4961	0.5364	0.5183	0.7964	5.6	6.4
Upper West	0.4354	0.5061	0.3652	0.5456	4.8	6.2
Volta	0.4606	0.6313	0.5087	1.1422	6.7	6.6
Western	0.4577	0.4393	0.5128	0.3701	6.5	6.7

For Ghana as a whole, compared to other countries in SSA, the Gini coefficient is quite high (World Bank, 2009b) and the inequality across the country even increased between 1999 and 2006. As far as the inequality in rural and urban areas is concerned, it is noticeable that rural incomes are less unequally distributed than urban incomes in 1999. However, in 2006, the income distribution in rural areas shows much higher inequality than urban areas and 7 years before, respectively. These findings also agree with the results of the poverty gap and squared poverty gap analysis presented in section 3.4.1. Remarkably, the Northern region has the highest inequality in income distribution among all administrative regions in 1999, but until 2006, inequality decreased significantly and now the Volta region has the highest income inequality. In general, the inequality analysis does not provide such a clear pattern like the poverty analysis. In 1999, the northern regions are not the regions with the highest inequality, but the distribution of inequality is rather diverse. The region with the second highest Gini coefficient is indeed the northern Upper East region, but the Upper West region is the region with the lowest inequality in income distribution. In 2006, as indicated earlier, the

Volta region is the one with the highest Gini coefficient and the Upper East region again has the second highest inequality in income distribution. The region with the most equal distributed income across the country is the Eastern region and, like in 1999, there is no clear difference in the inequality pattern between the northern and the southern regions.

The outcomes of the Theil Index reveal similar results to those of the Gini coefficient and the values for the lnN are displayed since the Theil Index approaches lnN with increasing inequality. Income in Ghana is more unequally distributed in 2006 and the results for the rural and urban areas correspond to those of the Gini coefficient as well. Additionally, in 1999 the Theil Index for the Northern region is the highest and in 2006, the Volta region is the one with the highest inequality in income distribution according to the Theil Index.

To illustrate the differences in inequality the Lorenz curve serves as an appropriate tool. For the purpose of clarity only the Lorenz curves for Ghana and the rural and urban areas for both years are presented here (see Figure 4). Please find the Lorenz curves for the ten administrative regions in Annex 2, Figure 9.



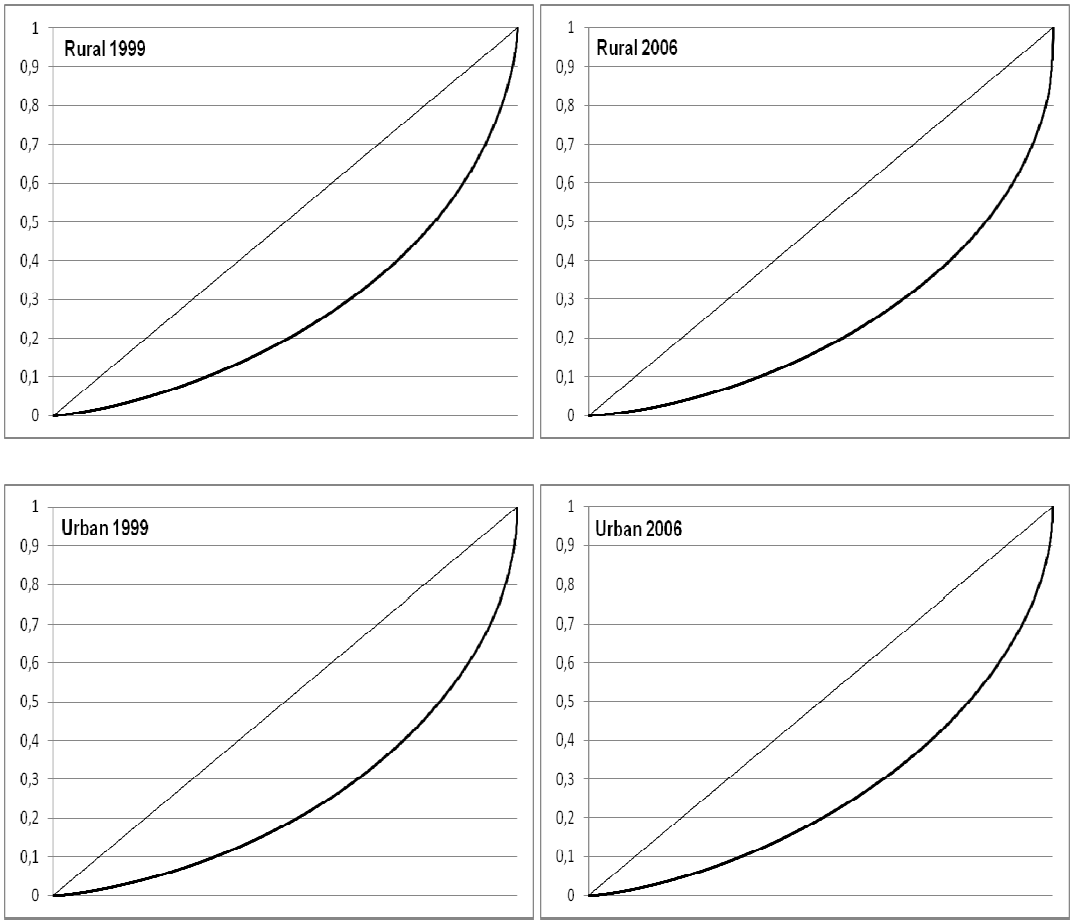


Figure 4: Lorenz curves for Ghana, rural, and urban areas, 1999 and 2006 (Author's calculations, GLSS4, GLSS 5)

Obviously, the Lorenz curve for Ghana in 1999 is quite convex and even gained convexity in 2006, indicating a rather high level of distribution inequality of per-head expenditures in both years. This impression is supported by the country's Gini coefficient, which is fairly high in 1999, compared to the individual regions, and even increased in 2006. In the rural areas the distribution of per-head expenditures were less unequal in 1999, but inequality in distribution increased significantly in 2006, represented by a more convex shape of the rural Lorenz curve in 2006 and a higher Gini coefficient. In contrast, the urban areas experienced a slight reduction of distribution inequality, decreasing the convexity of the Lorenz curve and the value of the Gini coefficient in 2006.

Another way to demonstrate the inequality across the country and between the administrative regions is the Kernel density estimation. The kernel density estimator is an improvement of the presentation of density distributions using a histogram. Histograms are not smooth and strongly depend on the endpoints of the

bins as well as the width of the bins. The kernel density estimator can solve these problems and it additionally enables the comparison of several density functions in one figure.

The Kernel estimator for the density function $f(x)$ at the point x is:

$$\hat{f}(x) = \frac{1}{nh}\sum_{i=1}^{n} K\left(\frac{x-x_i}{h}\right) \quad [7]$$

where $x = x_1, x_2, x_3, \ldots, x_n$ is an independent and identically distributed sample of random variables from a probability density $f(x)$ and $K(\cdot)$ is the standard normal Kernel function with window width h. For $K(\cdot)$ various kernels like the Biweight Kernel, the Parzen Kernel, or the Epanechnikov Kernel can be chosen, but in this analysis the Gaussian kernel is implemented since it is the most commonly used kernel. The formula for the Gaussian Kernel is as follows:

$$K[z] = \frac{1}{\sqrt{2\pi}} e^{-(1/2)z^2}. \quad [8]$$

The window width h, which is also called the bandwidth or the smoothing parameter, influences the size of the interval containing the values used for the estimation of the density at each point. If h is not specified, it is determined as

$$m = min\left(\sqrt{variance_x}, \frac{interquartile\ range_x}{1.349}\right) \quad \text{and} \quad [9]$$

$$h = \frac{0.9m}{n^{\frac{1}{5}}}, \quad [10]$$

where x is the variable for which we wish to estimate the kernel and n is the number of observations (Parzen, 1962, p. 1065; Silverman, 1986, p. 15, 43, 48; Kohler and Kreuter, 2008, p. 174-179). In order to compare the several density functions, one specific bandwidth needed to be chosen. For this purpose, the density functions were calculated using the optimal bandwidth for Ghana, the rural, and the urban areas of 2006 and since the bandwidths differed only slightly, the mean bandwidth was chosen. Afterwards, the density functions for both years were calculated again, setting the bandwidth at h=0.1343. The comparison with the results for the individual optimal bandwidth revealed no significant difference. Additionally, the number of observations used to calculate the density function was raised to 500, since the default is only 50.

Similar to the Lorenz curve analysis, only the density functions for Ghana as a whole and the rural and urban areas are displayed for comparison of the years 1999 and 2006 (see Figure 5). The natural logarithm of the per-head expenditures is implemented since the logarithmised values are easier to display and for 2006, the per-head expenditures have been inflated with the 1999 to 2006 Consumer Price Index to guarantee comparability of the distributions. The density distributions for the administrative regions are explained in Annex 3.

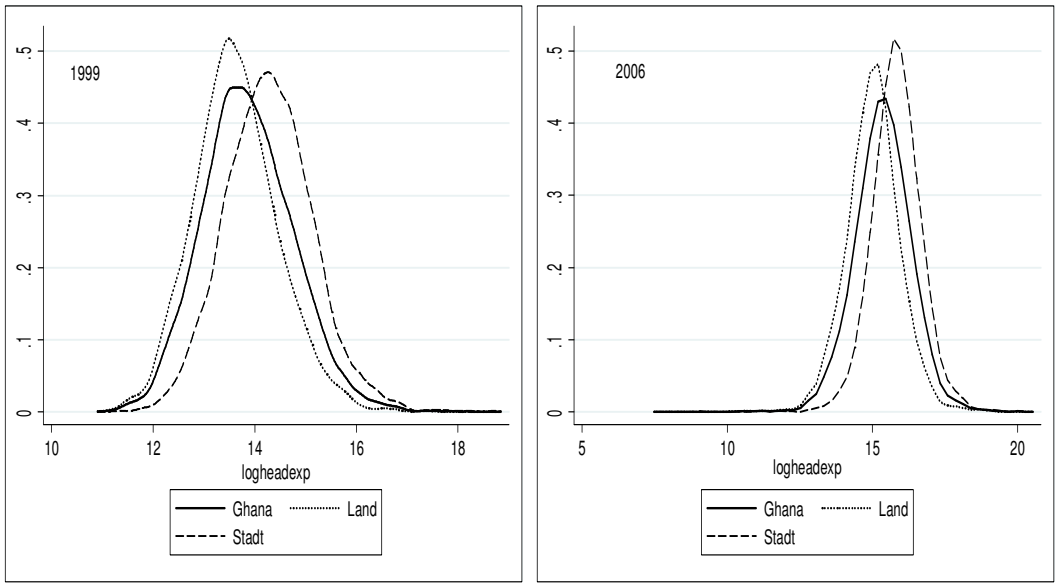


Figure 5: Kernel densities for Ghana and the rural and urban areas, 1999 and 2006 (Author's calculations, GLSS 4, GLSS 5)

The figure on the left presents the Kernel densities for Ghana, the rural, and the urban areas for 1999 and the right figure the results for 2006, respectively. In 1999, the distribution of rural per-head expenditures is more concentrated than in urban areas or in Ghana as a whole and at a lower level. The peaks of the Ghanaian and the urban density function are lower and in general, both distribution functions are more even than the rural density function. This indicates that rural per-head expenditures in general are remarkably lower than in urban areas and in the whole country, respectively. Furthermore, these density distribution functions suggest high inequality in Ghana as a whole, with inequality being lowest regarding rural areas. These findings agree with the inequality analysis by dint of the Gini coefficient and the Theil Index (compare Table 4). In 2006, the density functions slightly shifted to the right with a very flat left end indicating that the per-head expenditures in 2006 are concentrated around a higher value and more diverse in general than in 1999. Remarkably, the peak of the urban function is the highest in

this survey year indicating that the concentration of the distribution of per-head expenditures increased between 1999 and 2006 and the most frequent value is higher than in 1999. Consequently, the distribution of per-head expenditures is the most equal in urban areas in 2006 compared to the rural areas and Ghana as a whole. The peak of the Ghanaian function is the lowest representing a less concentrated and therefore more unequal distribution of per-head expenditures. The rural distribution function suggests that inequality regarding the distribution of per-head expenditures has increased in rural areas compared to 1999. As in 1999, the findings of the kernel density analysis for 2006 accord with the respective inequality analysis using the Gini coefficient and the Theil Index (compare Table 4).

3.4.4. The Influence of Growth and Redistribution on Changes in Poverty

The previous two subsections have dealt with Ghana's development regarding poverty and inequality. Referring to Ghana as a whole, poverty has decreased and inequality has slightly increased, whereas the results for the rural and urban areas and the administrative regions, respectively, are quite mixed. Section 2.1. indicates that Ghana's economic performance is very positive compared to SSA as a whole, since the GDP per capita growth increases constantly and even exceeds the SSA growth of per capita GDP. However, growth does not seem to be completely pro-poor in Ghana, since the incidence of poverty could only be reduced by, referring to the lower and upper poverty line, about 3 and 4 percentage points, respectively.

Referring to absolute poverty measurement, economic growth is regarded to alleviate poverty by enhancing the incomes of probably some of the poor, though this positive effect can still be enforced or even mitigated by redistribution (Baye, 2006, p. 545). Consequently, changes in poverty levels are caused by either income growth or changes in income inequality. In order to get a broader picture about the impact of Ghana's economic performance as well as the effects of redistribution on poverty in the country, the changes in poverty measures have been decomposed into distribution and growth effects by the methodology introduced by Datt and Ravallion (1992).

This procedure is a dynamic decomposition of poverty measures between two points in time, t and $t+n$, that allows to measure the relative importance of

redistribution and growth, whereas a residual is determined as well, capturing the interaction between distribution and growth. Given a fixed poverty line z, a poverty measure can be defined as $P_t = (z/\mu_t, L_t)$. Therefore, the change in poverty can be decomposed as follows:[9]

$$P_{t+n} - P_t = G(t, t+n; r) + D(t, t+n; r) + R(t, t+n; r), \qquad [11]$$

where

$$G(t, t+n; r) = P(z/\mu_{t+n}, L_r) - P(z/\mu_t, L_r),$$

$$D(t, t+n; r) = P(z/\mu_r, L_{t+n}) - P(z/\mu_r, L_t),$$

$$\begin{aligned} R(t, t+n; r) &= G(t, t+n; t+n) - G(t, t+n; t) \\ &= D(t, t+n; t+n) - D(t, t+n; t). \end{aligned}$$

$G(\cdot)$ represents the growth component by measuring the change in poverty due to a change in mean income and keeping the Lorenz curve constant at the reference level L_r. $D(\cdot)$, the distribution component, reflects the impact on poverty of a change in the Lorenz curve, holding the mean income constant at the reference level μ_r. The residual $R(\cdot)$ captures the effect on poverty caused by the interaction between redistribution and growth.

The results are calculated using the *POVCAL* programme written by Shaohua Chen, based on the decomposition methodology introduced by Datt and Ravallion (1992).[10] The programme calculates the poverty measures P_0, P_1, and P_2 as well as the Gini coefficient and two parametric specifications of the Lorenz curve, the general quadratic model of Villasenor and Arnold (1989) and the Beta model of Kakwani (1980). Furthermore, after calculating the Lorenz curves, the programme assesses which Lorenz curve and corresponding estimates should be preferred. In the case of this study, the quadratic Lorenz curve has been recommended and the results of the decomposition procedure (in percentage points) are presented in Table 5. For the purpose of brevity, only the results referring to the upper poverty

[9] r is the reference period, which may be t or $t+n$.
[10] The programme is available for free on http://go.worldbank.org/YMRH2NT5V0 [08.06.2010].

line are displayed here. The results for the lower poverty line and the administrative regions can be found in Annex 4.

Table 5: Decomposition results for the period 1999-2006, upper poverty line (Author's calculations, GLSS 4, GLSS 5)

	Total change	Growth	Redistribution	Residual
	Head Count Ratio (P_0)			
Ghana	-5.1054	-5.84	0.4858	0.2488
Rural	-1.5225	-5.5037	3.7764	0.2048
Urban	-6.3755	-3.2929	-3.2098	0.1272
	Poverty Gap (P_1)			
Ghana	-1.4809	-3.3465	1.7018	0.1638
Rural	0.5229	-3.3862	3.8639	0.0452
Urban	-2.8501	-1.5195	-1.502	0.1714
	Squared Poverty Gap (P_2)			
Ghana	-0.2638	-2.1726	1.8841	0.0247
Rural	1.1829	-2.2413	3.5197	-0.0955
Urban	-1.5384	-0.8538	-0.8206	0.136

National as well as rural and urban poverty have decreased between 1999 and 2006. The national proportion of poor people fell by more than 5 percentage points, whereas the urban poverty could be reduced by even 6.4 percentage points. In contrast, the incidence of rural poverty could only be reduced by about 1.5 percentage points. As can be seen in columns 3 and 4 of Table 5, with a contribution to poverty reduction of about 6 percentage points growth is mainly pro-poor in Ghana and redistribution of income is indeed increasing poverty, but the extent is rather low with an increase of only 0.5 percentage points regarding the Head Count Ratio. The rural areas in Ghana show a quite similar extent of poverty reduction caused by growth, about 5.5 percentage points, but the total change in poverty of 1.5 percentage points is very small due to significant redistribution effects. The poverty increasing impact of redistribution is compensating most of the positive effect of growth in rural areas since income shifts caused an increase in the incidence of poverty by about 3.8 percentage points between 1999 and 2006. However, urban areas show the highest reduction in poverty, although the positive effect of growth is the smallest of all three areas. This is due to the fact that

changes in distribution also contribute to a reduction in the incidence of poverty to almost the same extent. In urban areas, economic growth reduced the incidence of poverty by almost 3.3 percentage points and the redistribution of incomes is responsible for a decrease in poverty of 3.2 percentage points.

When looking at the depth and the severity of poverty, only Ghana as a whole and the urban areas show some positive changes since the depth and the severity of poverty could be reduced by 1.5 and 0.3 percentage points in the whole country and by 2.9 and 1.5 percentage points in urban areas, respectively. In contrast, in rural areas the depth as well as the severity of poverty even increased by 0.5 and 1.2 percentage points, respectively. Although growth has some poverty reducing effect in all areas, redistribution significantly contributed to an increase in poverty in rural areas, meaning that households living just above the poverty line fell below this threshold and already poor households got even poorer because of changes in distribution. However, in Ghana and in the urban areas, the depth and the severity of poverty could be reduced since the poverty decreasing effect of growth exceeds the poverty increasing effect of redistribution in Ghana. In urban areas, growth as well as redistribution even have a decreasing impact on poverty and the reduction in the depth and severity of poverty is largest in the three areas.

These findings indicate that growth is a major driving force for the reduction of poverty, but distributional changes can have a negative impact on poverty reduction. Redistribution to the disadvantage of poorer households and in favour of wealthier households has the potential to compensate the positive effects of growth and even intensify the depth and severity of poverty. In order to guarantee growth to be pro-poor, a suitable change in distribution of income is required. Consequently, on the one hand, politics need to address this major problem of poverty enhancing income redistribution. On the other hand, households need to engage in higher return activities or diversify their income portfolio to improve their economic situation on their own to not only be dependent on the political environment.

4. Income Diversification

This chapter deals with income diversification as a widespread livelihood strategy of households in Sub-Saharan Africa. For this purpose, in chapter 4.1., the issues of risk and vulnerability are explained first. Subsequently, income diversification is analysed as a strategy to cope with risk and the factors determining income diversification regarding its extent as well as the composition of the household's income portfolio are elaborated. With a view to the focus of this study, testable hypotheses are then derived from present findings regarding the potential of income diversification to serve as a risk-coping strategy in rural Ghana. To conclude, income diversification patterns in Ghana are presented to provide a comprehensive insight into the income diversifying behaviour of Ghanaian households.

4.1. Risk and Vulnerability

This section presents the various risks a rural household in developing countries is faced with and the influence of these risks on the households' choice of income generating activities. Furthermore, the issue of a household's vulnerability is introduced since risk and vulnerability are closely connected and a household's vulnerability is an important determinant of the household's capability to cope with an occurring shock.

4.1.1. Risk

A current definition of an individual's risk is that it is related to events that possibly occur (Dercon, 2001, p. 14). In the literature, the opinion that risk is a temporary source of transitory or even chronic poverty is well established by now (Dercon, 2006a, p. 5, 15). In general, risks can be divided into covariate and idiosyncratic risks. Covariate risks threatening for example all households in rural areas include economic instabilities and climatic shocks like floods or droughts causing harvest failures, whereas idiosyncratic shocks like illness or death of family members as well as livestock only have an impact on the household level (Dercon, 2002, p. 141ff; Mukhala and Chavula, 2007, p. 39). Since rural households in developing

countries are often exposed to high income risks, those shocks causing for example illness or even death of a family member or losses in livestock can have long-lasting effects on the household's income generating process forcing it to turn to low-return activities with lower risk (Dercon, 2002, p. 141f; Dercon, 2006a, p. 15). Dercon and Hoddinott (2003), for example, find that young children are adversely affected by shocks like droughts and that these incidents can have long-lasting negative impacts regarding schooling outcomes as well as height.

In order to manage these inevitable risks, households are faced with two alternatives. On the one hand, households are able to practice risk-management strategies aiming at reducing the impact of shocks ex ante. On the other hand, households can pursue coping strategies which, as the name implies, are implemented to cope with the impact of the shock ex post. Widespread strategies to smooth the households' situation ex ante are field and crop diversification, income portfolio diversification towards activities generating incomes at different times of the year, as well as migration to urban areas. Common coping strategies to smooth consumption ex post are for example the consumption of savings, the sale of assets, the use of insurance markets, and the participation in activities not correlated to this risk or with lower risk at all (Dercon, 2002, p. 141ff; Bryceson, 1999, p. 171; Valdivia et al., 1996, p. 1329, 1331; Alderman, Paxson, 1994, p. 49; Kunfaa et al., 2002, p. 28f; Kazianga and Udry, 2006, p. 413). Since subsistence farming is prevalent in Sub-Saharan African countries, households are often incapable to revert to savings in times of hardship and migration to urban areas is a major step requiring a lot of skills, financial resources and courage (Newman and Canagarajah, 2000, p. 2). However, since a household's risk perception is perfectly subjective and highly dependent on the household's attitude towards this risk, a risk-averse household will probably choose a different income portfolio compared to a risk-neutral or a risk-seeking household. In general, the theory of decreasing risk-aversion suggests that poorer households are more risk-averse and therefore their income portfolio is expected to be more diversified, including nonfarm activities which are regarded to be less risky (Barrett et al., 2005, p. 48; Abdulai and CroleRees, 2001, p. 443f). With complete insurance or credit markets mainly absent in developing countries, households with higher risk aversion even may choose lower incomes in order to reduce income variability (Dercon and Krishnan, 1996, p. 851; Alderman and Paxson, 1994, p. 50; Reardon et al., 2001, p. 316). As a consequence, the most widespread households' strategy for risk spreading as well as coping is to diversify income by generating household earnings from

different sources (Dercon, 2002, p. 141ff; Bryceson, 1999, p. 171; Ellis, 1998, p. 11). In this context, Ersado (2005) reports that the diversification in income sources after a shock has occurred is positively correlated with wealth in rural as well as urban areas. In general, it can be generalised that the riskier the agriculture and the weaker the correlation between agricultural and non-agricultural activities, the more diversified is the household's portfolio (Reardon, et al., 1992, p. 268).

In addition to this income smoothing activity, households have, in the absence of insurance and credit markets, the possibility to smooth their consumption as well. Consumption smoothing comprises the adjustment of the household's labour supply, the employment of formal and informal insurance mechanisms if available, saving and borrowing, and the depletion and accumulation of nonfinancial endowments (Morduch, 1995, p. 104). Hence, consumption smoothing is mostly practised by relatively wealthy households since this strategy includes the disposal of household assets built up in better times (Kinsey et al., 1998, p. 89f; Doss, 201, p. 103). In general, the poor's behaviour seems to reveal a high level of risk aversion, but in fact, the failure of insurance markets and the lack of safety nets often force the poor towards low-risk but low-return income generating activities (Dercon, 2006a, p. 9).

To establish a connection between risk and income diversification activities, Barrett et al. (2005) conclude that rural households need to be endowed with several assets like education, skills, contacts and capital in order to overcome possible entry barriers to new income sources. In reverse, this implies that a lack of these endowments can mark a risk for the households since they are incapable to join higher return income generating activities. If this lack of endowments is accompanied by credit market failures, externalities or lack of insurance this situation can constitute a so called poverty trap. In general, a poverty trap exists if a person is not able to get out of poverty by its own efforts (Dercon, 2006a, p. 18ff; Dercon, 2003, p. 7ff).

As a conclusion, research on risk-coping strategies of rural households is important to derive recommendations for potent risk management policies and Zimmerman and Carter (1996) conclude in their study about dynamic portfolio management in Burkina Faso that the provision of ex-post consumption credits for low-income households as well as investments in infrastructure, i.e. roads and irrigation, possess the potential to reduce risk.

4.1.2. Vulnerability

Risk and vulnerability are closely connected, since vulnerability can also be called the risk exposure of the household and can be defined as the product of risk and household conditions and actions and is therefore endogenous. The ex-ante situation, before a shock occurs, can be called the vulnerability to poverty. It is determined by the risks the household faces, its ability to handle it and the options available to the household (Dercon, 2001, p. 14f, 27). Dercon (2006b) describes vulnerability to be "the existence and extent of a threat of poverty and destitution", or "the danger that a socially unacceptable level of well-being may materialise". Adger (2006) defines vulnerability to be the susceptibility to suffering through the exposure to shocks and Calvo and Dercon (2007) describe vulnerability to be the magnitude of the threat of poverty, in other words the probability of a household to fall below the poverty line (Harttgen, Günther, 2006, p. 23).

According to the World Development Report 2000/2001, several household characteristics serve as appropriate indicators for the household's vulnerability expressed by the capability of self-insurance. This ability to self-insurance can be measured by dint of physical assets like livestock or machines, which can be sold in times of hardship to secure subsistence. Furthermore, the household's health status and educational level, the so called human capital, are also important indicators regarding their influence on the household's potential to join credit markets, if possible, or new income sources. As far as these income diversification activities are concerned, their extent and their particular risk level shed light on the risk strategies of the household. Additionally, the household's vulnerability can be reduced by providing formal safety nets as well as social networks (World Bank, 2001, p. 20).

4.2. Income Diversification as a Risk-Coping Strategy

"Income diversification is the norm" (Barrett et al., 2001a, p. 315) and it is the only instrument of livelihood diversification strategies that can be measured directly (Ellis, 2000a, p. 10). Livelihood and income diversification are often used synonymously but they cannot be set equal since livelihood diversification is more than just deriving income from different sources. "A livelihood encompasses income, both cash and in kind, as well as the social institutions (kin, family, compound, village and so on), gender relations, and property rights required to

support and to sustain a given standard of living." (Ellis, 1998, p. 4) Although income can easily be observed, the other outcomes of a household's successfully diversified livelihood are reduced vulnerability, enhanced well-being, improved food security and increased environmental sustainability and are admittedly more difficult to measure (Bryceson, 2002, p. 3). Households decide to diversify their livelihoods for several reasons but in general, household decisions are mainly driven by choice (voluntary) or necessity (involuntary) (Ellis, 2000b, p. 291). If income is diversified voluntarily it can be called 'demand-pull' income diversification. It is mainly a response to new technological or market opportunities and common 'pull factors' are higher wage rates and labour demand in the nonfarm sector, the availability of information, an efficient credit market, adequate infrastructure such as roads and schooling, and an optimistic rural business climate (Davis, 2003, p. 10; Möllers and Buchenrieder, 2005, p. 25; Barrett et al., 2001a, p. 316). In contrast, necessity-driven income diversification is also called 'distress-push' income diversification, with classical 'push factors' comprising risk reduction, reaction to crisis, response to decreasing factor returns, liquidity constraints or high transaction costs forcing households to self-provision in several services and goods (Barrett et al., 2001a, p. 315ff).

In particular, as indicated in chapter 4.1., the occurrence of risk can cause livelihood diversification in order to spread this risk ex ante, but as well to cope with shocks ex post to reduce income instability (Ellis, 2000b, p. 294; Ellis, 1998, p. 11). As a consequence, the most widespread households' strategy for risk spreading as well as coping is to diversify income by generating household earnings from different sources (Dercon, 2002, p. 141ff; Bryceson, 1999, p. 171; Bangura, 1994, p. 792).

Commonly, rural African households are semi-subsistent farmers who are almost always additionally engaged in other activities as well, regardless whether farm or nonfarm activities (Barrett et al, 2005, p. 43). In general, the rural income portfolio comprises earnings from on-farm work, off-farm work (e.g. agricultural wage labour on another farm), income from nonfarm activities such as wage labour or self-employment (for example a small shop or cottage industry), unearned income like pensions, and migration / remittances (Buchenrieder, 2005b, p. 5; Gordon and Craig, 2001, p. 9).

In general, there are several reasons for households to diversify their income generating process. As mentioned above, one major motivation of a household to

diversify its income portfolio is to insure itself against risk since credit and insurance markets are mostly absent in developing countries (Kinsey et al., 1998, p. 89). If a shock has already occurred, income diversification serves as an exp-post risk-coping strategy as well (e.g. Reardon et al., 1992, p. 291; Ellis, 2000b, p. 294; Ellis, 1998, p. 11). Another driving force of income diversification in developing countries are incomplete output markets, forcing households to diversify their income portfolio to smooth consumption (Ersado, 2006, p. 3). Furthermore, incomplete input markets can prevent farm households from specialising their crop production resulting in either agricultural diversification or the engagement in activities off the farm (Barrett et al., 2001b, p. 382). Finally, a positive correlation between activities or aggregation effects can foster income diversification if the assets' returns vary across time (Ersado, 2006, p. 3).

Income diversification comprises agricultural diversification on the one hand, but on the other hand, participating in nonfarm activities is more momentous in Africa (Bryceson, 2002, p. 6). Therefore, in the case of nonfarm activities, households can benefit from the opportunities offered in the nonfarm economy regarding lower risk and higher returns. Thus, it is evident that nonfarm income is an important contributor to the total income of the rural population in developing countries. Several studies show that approximately 30-50% of the income earned in Sub-Saharan Africa and about 40% in Asia as well as Latin America is derived from nonfarm labour (Davis, 2003, p. 8f). As mentioned above briefly, there are a lot of possibilities to earn income in the nonfarm economy. In general, all activities can be assigned to three categories: wage employment, self-employment and non-labour income. Non-labour income is received through pensions, property income or remittances. The difficulty with pensions lies in the household's non-suggestibility of these transfer payments. The household is not able to influence their amount as well as their payment at all since the government is responsible to establish such transfer payments (Bryceson, 2002, p. 8; Ersado, 2005, p. 30ff). As far as remittances are concerned, some difficulties occur as well. Lipton (1980) shows that mainly the young decide to migrate to urban areas or even foreign countries, leaving the elderly, unskilled and unproductive behind. This circumstance eventually turns out to be disadvantageous to the development of the rural villages left. In addition, remittances are often disproportionally received by better-off households since the decision to migrate is dependent on individual skills and the financial potential of the family who sometimes have to support their migrated family member in the beginning (Adams, 2006, p. 12f). Additionally, off-

farm wage labour is an alternative as well. Although it is not a nonfarm activity it is nevertheless income earned away from the own farm. This kind of work mainly absorbs unskilled workers not only in the agricultural sector but also in the nonfarm sector. Barrett et al. (2005) show a negative correlation between higher income households and the participation in unskilled wage labour which indicates that higher income households are less dependent on this kind of wage labour and merely engage in skilled nonfarm wage employment. In general, nonfarm wage labour is provided in the governmental and parastatal domain and in the private formal as well as informal sector (Ersado, 2005, p. 30ff).

The very poor are often unable to engage in other activities than farm labour since they lack necessary assets like skills and financial capital. In contrast, the 'poor' endowed with more assets are capable of engaging in different, higher-return self-employment activities such as cottage industries, small-scale service enterprises like the sale of cooked food, self-caught fish, and crafts like carpentry and brick making (Smith et al., 2001, p. 426). Furthermore, handicraft activities like basket making, pottery, weaving or other small trading activities like beer brewing or groundnut shelling are predominantly run by women and therefore provide an adequate opportunity for the female labour force to contribute to the household's income generating process as well as to not neglect their household duties (Haggblade, Liedholm, 1991, p. 2; Haggblade et al., 1989, p. 1175; Gordon and Craig, 2001, p. 9; Lanjouw and Lanjouw, 2001, p. 9f). Since wage labour is characterised by providing equitable income and, in contrast, the success of self-employment is highly dependent on an individual's creativity and efficiency it is not surprising that Canagarajah et al. (2001) found that wage labour contributed least and self-employment most to income inequality in Ghana and Uganda. However, households with the highest standard of living are additionally able to run service-based enterprises such as restaurants and small hotels (Smith et al., 2001, p. 426) and Bryceson (1999) states that wealthier households are often endowed with superior assets and skills and therefore capable of engaging in high-return activities in contrast to poorer households with less non-agrarian skills, social connections, and means of transport. Additionally, the findings of Vijverberg (1995) in his study about returns to schooling in Ghana support this connection since he reports a nonlinear but positive correlation between higher levels of education and income from self-employment and Jolliffe (1998, 2004) reports that higher test scores in mathematics and English are positively correlated to off-farm income and farm productivity. Furthermore, income diversification sometimes serves more as a

means of accumulation rather than a coping strategy for households with a high level of skills (Bryceson, 1999, p. 174). Concluding, no income diversification activity is run solitarily. Income diversification is always a combination of several activities according to a household's individual assets and skills (Barrett et al, 2005, p. 52f; Bryceson, 1999, p. 172).

4.3. Determinants of Income Diversification

In the previous section various possibilities to engage in nonfarm activities and differences among income groups have been presented. The aim of this chapter is to analyse the determinants of income diversification and the participation in nonfarm activities, respectively, to better understand the connection between endowments and activities chosen in order to facilitate the development of recommendations for policy makers.

One major determinant of access to nonfarm activities is the main human capital, education. As seen above, a higher level of education is positively correlated with the household's income. Higher-return work often requires a specific level of schooling and therefore, individuals with less than secondary schooling are excluded from particular better-paid activities (Davis, 2003, p. 11; Yang, 1997, p. 629; Abdulai and Delgado, 1999, p. 123f). Additionally, vocational skills are highly recommended since they are positively correlated with productivity and serve as an important criterion regarding the allocation of scarce nonfarm employment (Buchenrieder, 2005b, p. 11). The second major component of human capital, the health status of the household and the individual, respectively, significantly affects the ability to participate in income generating processes as well. Malnutrition or severe diseases such as HIV/AIDS can weaken or even deplete the household's labour force and therefore reduce its income (Gordon and Craig, 2001, p. 19; von Braun and Pandya-Lorch, 1992, p. 41; Maxwell et al., 1999, p. 412f). Additionally, the age of the household members is a determinant for the participation in nonfarm activities. As far as migration is concerned, this diversification strategy is highly dependent on the person's age with younger household members more likely to migrate (Gordon and Craig, 2001, p. 21). Moreover, Abdulai and CroleRees (2001) find that younger households will probably participate more in nonfarm activities than older households. But, gender plays an important role in the process of strategy choice as well. Women are often faced with limitations regarding the

participation in nonfarm employment. Not only because of lower education levels, but also due to tradition or religion and their duties as a housewife women predominantly are engaged in crop farming or in manufacturing. As a conclusion, women's access to high-return wage labour or extensive self-employment is more constrained than men's access to those activities (Davis, 2003, p. 13; Gordon and Craig, 2001, p. 22ff). In contrast to the gender issue, ethnicity is a major determinant as well but does not necessarily have negative effects. Indeed, the Indian caste system is clearly constraining efforts of members of lower castes to improve living conditions and some African ethnic groups in rural areas are still ordinary farmers according to their long tradition. However, some ethnic groups are quite open-minded regarding technical progress and therefore willing to diversify their income portfolio by means of nonfarm employment (Davis, 2003, p. 12).

Furthermore, insufficient productive physical capital, such as livestock or machines, and natural capital, such as land, can be major driving forces for the farm household's decision to participate in nonfarm activities. Poor households lacking substantial assets to operate their farm properly are most likely to try to engage in nonfarm work in order to make ends meet (Barrett et al., 2005, p. 55). In order to invest in nonfarm employment, poor households are, due to their poor assets and endowments, often dependent on credits to launch, for example, a small business. If access to the credit market is limited and the poor are not able to revert to savings they stay excluded from higher-return nonfarm activities. In contrast, the failure of credit markets can even promote the poor's participation in nonfarm work in the context of a risk management strategy since in case of a shock the household would not be able to bridge times of hardship by borrowing (Schwarze and Zeller, 2005, p. 65).

Similar to the credit market constraint, the absence or inefficiency of the insurance market can have significant effects on the household's income generating process. Since an inefficient insurance market enhances the risk faced by farming households due to their inability of overcoming income shortfalls, these households will probably decide to diversify their income portfolio in order to spread risk as they are not able to rely on insurances (Reardon et al., 1992, p. 268). Another component of social capital is also important for the decision to diversify income. Networks are able to enhance opportunities in the nonfarm sector. Households with better social networks have more access to relevant market information as well as the possibility to share resources for production and networks can reduce

transaction costs as well as help to make new contacts and find costumers (Gordon and Craig, 2001, p. 25; Davis, 2003, p. 11; Buchenrieder, 2005b, p. 9). In contrast, Townsend (1994) states that in India, family networks and friend networks can have an income smoothing effect due to transfers and gifts in times of income shortfalls. Furthermore, since borrowing money is also widespread in Ghana to overcome income shortfalls in the short term (Appiah-Kubi et al., 2008, p. 312ff). Abdulai and Delgado (1999) additionally show that the state of population density and infrastructure both have a positive impact on time allocation in and earnings from nonfarm employment since there exist more opportunities to run a small business and due to a sufficient standard of infrastructure the access to markets is assured as well. Family size is also a considerable determinant of nonfarm activity since a household's size and structure influence its ability to join income diversification activities. In general, larger families are capable of supplying more labour to nonfarm employment (Reardon, 1997, p. 743).

Furthermore, successful agricultural development is capable of fostering the development of nonfarm employment and thus to provide nonfarm work to rural farmers willing to diversify their income (Reardon et al., 1992, p. 268). According to Reardon (1997), agroclimate is a major determinant regarding the choice of income diversification strategy. Poor agroclimatic conditions favour migration compared to other nonfarm activities. Additionally, seasonality marks an important determinant for livelihood diversification in general, and income diversification in particular, since seasonality creates the threat of income instability and therefore constitutes a severe risk for poor households. In order to reduce income insecurity poor households are tended to engage in nonfarm activities as an income diversification strategy regarding the income generating process. Seasonal migration, for example, is one adequate income diversification strategy to face up to the seasonality problem (Ellis, 1998, p. 11f; Lanjouw and Lanjouw, 2001, p. 10).

As a conclusion, determinants can be grouped into three categories. Some determinants such as ethnicity or seasonality are given and cannot be changed by poor households. But others like education or social networks can be improved by the poor in order to facilitate the engagement in nonfarm work as an income smoothing strategy and the third category of determinants such as health, infrastructure, the efficiency of credit markets, and education can be meliorated through targeted policies.

4.4. Hypotheses Derived from Present Findings

In the previous sections income diversification has been analysed in detail. Consequently, these findings can be summarised by deriving some important hypotheses which will then be examined in this study (see chapter 7 for the methodology and chapter 8 for the results).

First of all, income diversification seems to occur mainly as 'distress-push' diversification due to its ability to react to decreasing factor returns or liquidity constraints, and to spread risk ex-ante or reduce income instability ex-post (Barrett et al., 2001a, p. 315ff; Ellis, 2000b, p. 294; Ellis, 1998, p. 11). Moreover, income portfolio diversification towards nonfarm activities is prevalent since they are generally accompanied with lower risk (Davis, 2003, p. 8f). Therefore, it can be hypothesised that the incidence as well as the extent of income diversification serves to indicate a risky environment and the severity of an existing threat.

Second, in their study about southern Mali, Abdulai and CroleRees (2001) find that poor farmers not able to resort to insurance arrangements and faced with miscellaneous risks are likely to extend their self-sufficient agricultural production, whereas richer farmers expand their cash crop production. As a consequence, it can be hypothesised that a higher extent of self-sufficient production indicates that poor households are facing a risky environment. In general, de Janvry et al. (1991) state that self-sufficient agriculture occurs only when food market failures are present. Risky transactions, insufficient information, and inadequate infrastructure increase the band between purchase and sales price of the household. If a product's or factor's shadow price falls within this price span, it would be more recommendable to the household to consume its own products to be self-sufficient from the market and no trade would occur.

Income earned in kind can serves as a further indicator for a risky environment. Ito and Kurosaki (2009) find in their study about weather risks and off-farm labour supply that the coefficient of variation of rainfall has a significantly positive impact on agricultural income paid in kind. Therefore, higher risks threatening agriculture seem to increase income paid in kind and as a consequence, it can be hypothesised that a higher amount of income paid in kind suggests a risky environment. Additionally, Bardhan (1984) indicates that payments in kind are closely connected with food price instabilities and different levels of risk aversion of workers as well as employers.

Several studies found out that households with a higher level of education are more likely to achieve higher incomes from nonfarm activities and higher returns in general. But, nonfarm activities such as wage labour or running a small business often require a certain education level or vocational skills. Hence, education can serve as an entry barrier to nonfarm income sources and therefore to higher total income (Vijverberg, 1995, p. 1219f; Jolliffe, 1998, p. 96f; Jolliffe, 2004, p. 303).

Furthermore, age seems to be an important factor influencing the income diversification decision. According to the literature, older households are usually more likely to diversify their income portfolio via nonfarm activities like self-employment as well as migration (Gordon and Craig, 2001, p. 21; Abdulai and CroleRees, 2001, p. 449; Abdulai and Delgado, p. 123). In contrast, Canagarajah et al. (2001) and Lanjouw et al. (2001) find a negative relationship between the household head's age and the engagement in nonfarm employment.

In developing countries, the women's educational level is commonly lower than the male level of schooling. As a result, women are more likely to be excluded from higher-return activities like self-employment or wage labour. In addition, household duties and traditional living often limit the women's access to nonfarm income sources (Davis, 2003, p. 13; Gordon and Craig, 2001, p. 22ff; Ellis, 1998, p. 11). In contrast, Canagarajah et al. (2001) and Jolliffe (2004) report that female headed households are more likely to participate in nonfarm employment. As a conclusion, gender seems to constitute an entry barrier to nonfarm activities for women in developing countries.

The household size and its composition seem to matter as well. For example, Reardon (1997), Lanjouw et al. (2001), Abdulai and CroleRees (2001), and Abdulai and Delgado (1999) show that an increase in household size has a positive effect on the probability of participating in nonfarm employment. Smaller families with a higher proportion of young children seem to be less likely to engage in income diversification activities, whereas larger households with a higher proportion of young adults are able to allocate parts of their labour force to nonfarm activities. In contrast, e.g. Jolliffe (1998) shows that an increase in the household size has a negative impact on the income derived from nonfarm employment since more labour force is allocated to agriculture.

Another strand of the literature on nonfarm income deals with a household's endowments and Abdulai and CroleRees (2001) indicate the importance: "Although

location-specific characteristics such as infrastructure and climate are likely to influence the pattern of income diversification of rural households, the fact that even households living in the same villages tend to have different income portfolios suggests that household characteristics and endowments can be important determinants of portfolio diversification amongst rural households." (Abdulai and CroleRees, 2001, p. 445) On the one hand, researchers argue that households endowed with insufficient natural capital (e.g. land) and physical capital (e.g. livestock) are often forced to engage in nonfarm activities, since it is impossible for them to operate their farm successfully (Barrett et al., 2005, p. 55). Additionally, households with sufficient assets like valuable livestock or land are provided the opportunity to sell parts of their endowments in times of hardship as one risk-coping strategy instead of nonfarm activities (Verpoorten, 2009, p. 82; Dercon, 2002, p. 145; Fafchamps et al., 1998, p. 301). On the other hand, Abdulai and CroleRees (2001) show in their study about income diversification in southern Mali that wealthier households, with wealth measured via landholding, are more likely to engage in nonfarm activities. Consequently, a household's endowment with valuable land or livestock can serve as a risk-coping strategy on its own as well as help overcoming possible entry barriers for nonfarm employment.

Another important household endowment, as learnt in subsection 4.1., is the household's financial capital, i.e. savings. A household can use its savings to smooth consumption and therefore serve as a risk-coping strategy for the household. Additionally, savings can be necessary to initialise a small-scale business and therefore, with credit markets incomplete or missing, non-existent savings can state an eminent entry barrier to nonfarm activities (Reardon et al., 1992, p. 269, 287; Morduch, 1995, p. 104).

As indicated earlier, infrastructure seems to have a positive impact on the extent and success of nonfarm activities (Abdulai and Delgado, 1999, p. 128). Therefore, the remoteness of a household strongly determines the participation in nonfarm income generating processes.

4.5. Income Diversification in Ghana

The previous sections dealt with the theoretical analysis of risk and income diversification as a potential strategy to cope with risk. The following section deals with the different ways of theoretical measurement of diversification as well as the

descriptive analysis of income diversification patterns in Ghana. In subsection 4.5.3., the diversification measures presented in 4.5.1. are implemented and additionally, light is shed on the correlation between a household's economic situation and its extent of income diversification. Furthermore, the definition of 'nonfarm income' used throughout this study is presented.

4.5.1. Diversification Measurement

A common practice to measure income diversification is to simply count the number of income sources in order to address the mitigation of risk (Ersado, 2005, p. 30). Originally, diversification indices were utilised to measure the diversification extent of a company's range of products or to evaluate a business' market shares in order to picture market concentration and therefore the business' market power. However, these diversification or concentration indices serve as appropriate income diversification measures as well.

One adequate tool to measure the extent of income diversification is the Herfindahl index. It simply expresses the squared sum of all shares, for example market shares or, for our purpose the share of nonfarm income in total household income. The Herfindahl index is often also called Herfindahl - Hirschman - Index and can be written as follows, whereas n is the number of all nonfarm activities and x_i is the share of income of a particular nonfarm activity:

$$H = \sum_{i=1}^{n} {x_i}^2 \ . \qquad [12]$$

The Herfindahl index takes values between 0 and 1 whereas accretive values indicate decrescent diversification (Gollop and Monahan, 1991, p. 320; Bebczuk and Berrettoni, 2006, p. 4). To address this intricate correlation, Berry suggested the form

$$DB = 1 - \sum_{i=1}^{n} {x_i}^2. \qquad [13]$$

This Berry index as well ranges between 0 and 1 but now the correlation is rectified: the higher the extent of diversification, the higher the Berry index (Jacquemin and Berry, 1979, p. 360).

4.5.2. Definition of 'Nonfarm Income'

In the underlying study, 'nonfarm income' is defined as income derived from income sources other than farm work. More precisely, nonfarm income comprises income from nonfarm self-employment, wage labour, remittances, unearned income, the sale of water, and renting out land, livestock, or agricultural equipment. Although nonfarm income like the rent of livestock or agricultural equipment is connected to the farm to some extent, this definition is chosen since agricultural equipment rented to other farmers is not produced on the farm and the study aims at clearly differentiating between agricultural and non-agricultural income.

4.5.3. Income Diversification Patterns in Ghana

This section deals with the income diversification patterns in Ghana in 2006 and the development compared to 1999 in order to illustrate the extent of diversification in the country (see Table 6).

Table 6: Income Diversification in Ghana, the rural, and the urban areas, 1999 and 2006 (Author's calculations, GLSS 4, GLSS 5)

	Ghana		Rural		Urban	
	1999	2006	1999	2006	1999	2006
Ø income sources	2.8	2.4	3.2	2.7	2.1	1.9
Ø nonfarm income sources	1.4	1.2	1.3	1.1	1.6	1.5
Herfindahl index	0.855	0.878	0.87	0.898	0.832	0.857
Berry index	0.145	0.122	0.13	0.102	0.168	0.143

Remarkably, the average number of total income sources decreased between 1999 and 2006 across all areas of the country and the mean number of total income sources in rural areas is higher than in urban areas. As far as the number of nonfarm income sources is concerned, the extent of diversification decreased as well, also represented by an increased Herfindahl Index and a depreciated Berry Index. In general, about 26% of all rural households in the sample of 2006 did not generate any income from nonfarm activities, whereas only 3.03% of all urban households do not have any nonfarm income in 2006. Additionally, the average number of nonfarm income sources is significantly higher in urban areas compared to the rural areas and the country as a whole. Numerous and more profitable

possibilities in urban regions are one probable reason for this higher extent of urban income diversification. Another reason for this remarkable difference in the extent of diversification between urban and rural areas has been hypothesised in chapter 4.4. Since rural households in Ghana are mainly affected by poverty compared to the population in urban areas, as shown in section 3.4.2., rural poor households have to face several entry barriers to nonfarm income generating activities and not every rural household is able to overcome them. The fact that rural households on average have more than one source of nonfarm income accords with the statement of Barrett et al. (2005) that "African rural households are commonly semi-subsistence agricultural producers, growing much of their own food but almost always engaged in farm or nonfarm market activities as well." (Barrett et al., 2005, p. 43) As far as the extent of income diversification across the administrative regions is concerned[11], it can be summarised that in the majority of regions the average number of total income sources have been reduced between 1999 and 2006 and the level of the income diversification has decreased as well. Notably, in 2006, the least diversified households regarding nonfarm employment are living in the northern regions of Ghana, where the incidence of poverty is highest across the country, indicating that the hypotheses of poorer households being excluded from nonfarm activities due to several entry barriers can possibly be confirmed. In general, the findings for the administrative regions are diverse regarding the correlation between income diversification and poverty development. For example, the level of income diversification in the Eastern region did not change in this period, but the percentage of people living below the national poverty line could be reduced significantly. In contrast, households in the Brong Ahafo region did not vary their extent of income diversification as well but no noticeable change in the incidence of poverty could be observed. Consequently, possible entry barriers preventing households from participating in nonfarm employment need to be analysed and the effects of this participation decision on the poverty status needs to be examined.

According to the theory of decreasing risk aversion, one would expect poorer households to be more risk-averse and consequently endowed with a more diversified income portfolio (compare e.g. Barrett et al., 2005, p. 48; van Soest et

[11] For detailed information on income diversification across the ten administrative regions in Ghana please refer to Annex 5, Table 32.

al., 2002, p. 276f; Abdulai and CroleRees, 2001, p. 443). Admittedly, this cannot be completely confirmed in this dataset (see Table 7)[12].

Table 7: Average number of income sources, by per-head expenditures[13] (Author's calculations, GLSS 5)

Quartile	Ø Income Sources		Ø Nonfarm Income Sources	
	Ghana	Rural	Ghana	Rural
1	2.35	2.26	0.88	0.75
2	2.63	2.81	1.2	1.02
3	2.51	2.93	1.41	1.14
4	2.11	2.92	1.49	1.32

However, referring to the whole country, the average number of income sources increases among the poorest households, whereas wealthy households are less diversified. Regarding the total number of income sources in Ghana as a whole, the theory of decreasing risk aversion seems to hold. In contrast, in rural areas the number of income sources increases only with higher per-head expenditures, indicating that only wealthier households generate their household income by dint of a diversified income portfolio. As far as income from nonfarm activities is concerned, similar results can be observed. Contrary to the theory, only wealthier households generate their income from multiple income sources in the nonfarm sector, whereas poorer households in Ghana and in rural areas, respectively, are less diversified, suggesting that they are excluded from nonfarm activities. This supposition is even amplified when the composition of the household income across quartiles, calculated by per-head expenditures, is considered. In Table 8, the average income shares of selected activities are presented according to these quartiles, and the composition patterns of Ghana are compared to those in the rural areas. For a comparison of urban areas and Ghana as a whole please see Annex 5, Table 34.

[12] For the summary statistics of the income sources please see Annex 5, Table 33.
[13] Please note that the quartiles have been calculated for the complete dataset and the rural subset, respectively.

Table 8: Selected income shares, by per-head expenditures[14] (Author's calculations, GLSS 5)

	Ghana				Rural			
	1	2	3	4	1	2	3	4
crop share	0.27	0.22	0.14	0.08	0.32	0.28	0.27	0.21
wage share	0.08	0.16	0.24	0.31	0.05	0.09	0.1	0.15
nonfarm self-employment share	0.17	0.25	0.31	0.38	0.14	0.19	0.24	0.3

Obviously, the share of crop income in total income decreases as per-head expenditures increase, in Ghana in general as well as in rural areas in particular. However, even in the highest quartile rural households derive almost one fourth of their income from crop production, supporting the fact that agriculture still plays a major role in rural areas. In general, nonfarm self-employment seems to be more widespread than wage labour and the share of income from wage labour in rural areas is significantly lower than in Ghana as a whole. One obvious reason is the weak availability of wage labour in rural areas. But since rural households in the higher quartiles have remarkably higher shares of wage income in total income than the poorer households, wage labour seems to be hypothetically available for the poor, but non-accessible in practice. As far as the average shares of income from nonfarm self-employment in total income in Ghana and in rural areas are concerned, rural households have a lower initial share of income from nonfarm self-employment and even the wealthiest rural households derive noticeably less income from nonfarm self-employment than Ghanaian households in general. Concluding, although access to wage labour and nonfarm self-employment is admittedly more difficult in rural areas, poorer households appear to be faced with entry barriers to wage labour as well as nonfarm self-employment as well.

To better understand the correlation of poverty and the extent of diversification, the following table will present the number of total income sources and nonfarm income sources, respectively, of the poor and rural poor households, according to their depth of poverty measured by the respective poverty gap (see Table 9).

[14] Please note that the quartiles have been calculated for the complete dataset and the rural subset, respectively.

Table 9: Extent of diversification, by depth of poverty[15] (Author's calculations, GLSS 5)

	Higher Poverty Line				Lower Poverty Line			
	1	2	3	4	1	2	3	4
Ø income source								
Ghana	2.68	2.6	2.57	2.04	2.58	2.63	2.43	1.97
Rural	2.86	2.79	2.56	2.04	2.78	2.73	2.44	1.95
Ø nonfarm income source								
Ghana	1.21	1.07	0.96	0.72	1.07	1.02	0.86	0.71
Rural	1.09	0.98	0.85	0.68	0.99	0.92	0.8	0.66

Contemplating these findings, the average quantity of total income sources and nonfarm income sources, respectively, is remarkably higher for the less poor households in the first two quartiles in both subsamples compared to the complete samples presented in Table 7, indicating that poor households are more diversified than households in general. Furthermore, in the first two quartiles the average number of income sources is even higher in rural areas than in the whole country, whereas in the other two quartiles the average numbers of income sources in the two subsamples are almost equal. Less poor households in rural areas therefore seem to be more diversified than less poor households in Ghana as a whole. In contrast, it is noticeable that the average number of nonfarm income sources is lower than in the whole country, indicating that rural poor households have only restricted access to nonfarm employment for several reasons. Moreover, the average number of total income sources as well as the average number of nonfarm income sources is decreasing with increasing severity of poverty, suggesting that poorer households are even more excluded from nonfarm activities than less poor households. Additionally, as expected according to present findings (e.g. Smith et al., 2001, p. 426), the values for the households living in extreme poverty are lower than for the poor households referring to the higher poverty line.

To deliver a slight insight into the patterns of income diversification in Ghana, Table 10 presents selected household characteristics, grouped by the quartiles of the

[15] Please note that the quartiles have been calculated for the complete dataset and the rural subset, respectively.

shares of nonfarm income in total household income, representing the extent of income diversification.

Table 10: Selected household characteristics, by share of nonfarm income in total income[16] (Author's calculations, GLSS 5)

Quartile	Age		Male		Education		Family Size	
	Ghana	Rural	Ghana	Rural	Ghana	Rural	Ghana	Rural
1	46.4	46.1	82.6%	83.1%	4.3	4	4.99	4.93
2	47.9	47	76.5%	84.7%	6.1	5	4.95	5.32
3	43.5	47.9	65%	73%	9.6	6.1	3.61	4.97
4	.	45.6	.	61.7%	.	7.2	.	3.75

According to the literature (e.g. Abdulai and CroleRees, 2001, p. 449; Gordon and Craig, 2001, p. 21; Abdulai and Delgado, 1999, p. 123), some kind of life-cycle effect can be observed regarding the age of the household head and the household's participation in nonfarm employment. In Ghana as a whole and in the rural areas, respectively, the age of the household head increases as the share of nonfarm income in total income and therefore the extent of diversification accelerates. But in the respective highest quartile, the average age of the household head is smaller than in the first quartile, indicating that only younger households have the highest extent of diversification observed in Ghana. Referring to the gender of the household head, it was hypothesised that women in general are mainly excluded from nonfarm employment due to their level of education or their commitment towards their family (Davis, 2003, p. 13; Gordon and Craig, 2001, p. 22ff). In Ghana, it seems to be primarily the female household heads who diversify their income portfolio towards nonfarm activities since the share of male household heads decreases with increasing extent of diversification. In rural areas, the proportion of households headed by a man first increases with expanding nonfarm diversification, whereas with even more intense income diversification, the proportion of female headed households augments. One explanation for this is the traditional inheritage law in Ghana, according to which the widow does not inherit the land owned by her husband but his male relatives. Therefore, a widowed female household head usually is not able to continue the agricultural production and is forced to turn to activities in the nonfarm sector (UNDP, 2007b, p. 120f). As

[16] Please note that the quartiles have been calculated for the complete dataset and the rural subset, respectively.

far as the correlation of the educational level of the household head and the household's extent of diversification is concerned, the results totally agree with present findings. Additional years in schooling are positively correlated with a higher share of nonfarm income, indicating a higher extent of diversification (Vijverberg, 1995, p. 1219f; Jolliffe, 1998, p. 96f; Jolliffe, 2004, p. 303). However, the findings for the connection between the household size and the diversification intensity do not agree with the literature. According to e.g. Reardon (1997), larger households are more likely to engage in nonfarm employment. As Table 10 indicates, a higher number of family members seems to have a negative impact on the engagement in nonfarm activities. In rural areas, the average household size first increases with higher nonfarm income shares, but significantly decreases with more intense income diversification.

As a conclusion, the patterns of income diversification in Ghana seem to be quite oppositional regarding the hypotheses derived from present findings since less poor households seem to be more engaged in nonfarm employment than households living in more severe poverty. According to the theory of decreasing risk aversion, poorer households are more risk-averse and therefore expected to have a more diversified income portfolio compared to their wealthier counterparts (Barrett et al., 2005, p. 48; van Soest et al., 2002, p. 276f; Abdulai and CroleRees, 2001, p. 443). However, the descriptive analysis presented above indicates the opposite. Poor Ghanaian households seem to have only restricted access to both income portfolio diversifying activities in general and nonfarm income generating activities in particular. Therefore, the households' level of risk aversion does not seem to be the only determinant for the participation in nonfarm employment.

As a result, it is important to discover the effects of income diversification on the welfare of the household, i.e. the household's wealth as well as the poverty level. Therefore, the study attempts to examine possible entry barriers or constraints to nonfarm employment and the causal effects of participating in such activities on the welfare of the household.

5. Theoretical Framework

The previous discussion dealt with the households' observed activity choice, its determinants, and possible driving forces. It has been argued that households in developing countries are diversifying their income portfolio to smooth their income and consumption due to spreading the income risk. In general, households are making their decisions either driven by choice or by necessity (Ellis, 2000b, p. 291). Accordingly, the theory of activity choice states that observed labour allocation regarding particular activities reveals the household's preferences with respect to the rate of return and the associated level of risk, i.e. households aim at maximising their benefit and minimising their costs (Singh et al., 1986, p. 17f; Bardhan and Udry, 1999, p. 8f; Abdulai and CroleRees, 2001, p. 443f; Barrett et al., 2001b, p. 369). Rural households in Africa are indeed predominantly engaged in agricultural production, but they are also partial consumers of their own output and participants in nonfarm activities. Consequently, households need to determine their production, by defining their technology, factor demand, and level of output, and their consumption, by defining their labour supply and their demand of commodities, simultaneously (Barrett et al., 2005, p. 43; Bardhan and Udry, 1999, p. 7). Therefore, this chapter aims at picturing the household's decision making process by first establishing a theoretical household model to picture the household's time allocation subject to utility maximisation and a budget constraint. Additionally, the activity choice of the household will be modeled empirically to understand the impact of several factors on the household's decision.

When defining a theoretical model for a household's time allocation or activity choice, respectively, former studies often assumed complete markets. Under this assumption, the farm household's production decisions are separable from its consumption decisions. In other words, the household maximises profit from its production activities, whereas production decisions only depend on prices and the production technology, and then maximises utility according to a standard budget constraint. This separation property assumes that the household's preferences do not influence its production decisions (Abdulai and Regmi, 2000, p. 310; Bardhan and Udry, 1999, p. 7ff; Benjamin, 1992, p. 290).

However, although this assumption has some advantages since it simplifies the empirical specification, it is not very realistic. Multitudinous studies stress the fact

that a household's endowments and preferences regarding consumption, leisure, and farm or nonfarm work might still have an impact on its production decisions. In his study about the impact of education on the household's labour allocation and returns in rural Ghana, Jolliffe (2004) tests on market imperfections and concludes that labour markets in rural Ghana are not complete. Due to lack of data on hired labour hours in the GLSS 5 a test on the completeness of the labour market in Ghana in 2006 cannot be performed. Therefore, according to the findings of a major strand of the literature on labour allocation, incompleteness of the labour market is assumed. In the presence of market imperfections, such as incomplete labor markets, a household faces transaction costs and as a consequence, its production and consumption decisions are no longer separable and the household no longer maximises its profit. The household's amount of labour demand and labour supply complies a shadow wage influenced by all variables also influencing the household's decision making (e.g. Bagamba et al., 2007; Jaleta and Gardebroeck, 2007; Jolliffe, 2004; Abdulai and Regmi, 2000; Udry, 1999; Skoufias, 1994; Benjamin, 1992; de Janvry et al., 1991).

As a result, a simple agricultural household model is established where the household is assumed to maximise its utility, U, over consumption of goods, C, and leisure, L, and therefore, the household's utility is modeled as a function of leisure and consumption. Z is a vector of household characteristics influencing the household's preferences.

$$\max U = U(L, C; Z) \qquad [14]$$

The household's leisure is the difference between the total stock of potential labour supply, $T(Z)$, and the sum of hours worked in farm, T_f, and nonfarm activities, T_{nf}, and consumption is substituted for the sum of income derived from farm, Y_f, and nonfarm activities, Y_{nf}, and other sources, Y_o, like remittances or unearned income. The utility maximisation function can therefore be expressed as follows:

$$\max U = U\left[Y_f\left(T_f, Z, \varepsilon_f\right) + Y_{nf}\left(T_{nf}, Z, \varepsilon_{nf}\right) + Y_o, L; Z\right], \qquad [15]$$

subject to

$$T_f \geq 0, \;\; T_{nf} \geq 0 \,, \qquad [16]$$

$$T(Z) = T_f + T_{nf} + L \,, \qquad [17]$$

and

$$Y_f + Y_{nf} + Y_o - p_f X_f \geq p_c C \ . \qquad [18]$$

The income derived from farm and nonfarm activities, respectively, is influenced by the time allocated to the particular activity, household characteristics, Z, like age, education, and the asset endowment, which can have a significant impact on the household's preferences. Furthermore, since households are faced with various risks, incomes of the particular occupations can be affected by unforeseen shocks like weather risks regarding farm activities, and illness of a family member engaged in nonfarm employment, ε_f and ε_{nf}, respectively.

Expressing the farm income, Y_f, by dint of the agricultural production function, the budget constraint in [18] can also be expressed as follows:

$$p_c C \leq pQ\left(T_f, T_h, X_f\right) - p_f X_f - w_h T_h + w^* T_{nf} + Y_o \ , \qquad [19]$$

with p_c denoting the price for and C the vector of purchased goods. The total value of commodity consumption, $p_C C$, cannot exceed the sum of the returns from farm work, the returns from nonfarm employment, and nonlabour income. The farm returns are calculated by the farm output, where p is the farm output price and $Q(\cdot)$ is the farm production function, influenced by the amount of the household's labour allocated to the farm and hired labour, T_h, and the sum of variable and fixed agricultural inputs, X_f, less the costs for inputs and hired labour. With respect to e.g. Jolliffe (2004) and Skoufias (1994), it is assumed that household labour and hired labour are not perfect substitutes and therefore, the household's expenditures on hired labour are subtracted from the household's farm income. The input costs are defined by the amount of inputs multiplied by the vector of prices of variable inputs, p_f, and the amount of hired labour is weighted with the wage paid to the hired workers, w_h. The household's nonfarm income is adequate to the time allocated to nonfarm employment multiplied with the nonfarm shadow wage rate, w^*, whereas the shadow wage is influenced by the same variables also influencing the household's production decisions.

Under separability, i.e. complete markets, substituting [16] and [17] into [19] would lead to the so-called 'full-income' constraint which can be written as follows:

$$p_c C + wL \leq pQ\left(T_f, T_h, X_f\right) - p_f X_f - w_h T_h + wT(Z) + Y_o \ , \qquad [20]$$

whereas the value of the household's consumption of goods and leisure cannot exceed the value of the household's endowments including farm profits (Bardhan and Udry, 1999, p. 9).

By utilising [14], [17], and [19], the optimisation problem can be expressed as follows:

$$\mathcal{L} = U(L, C; Z) + \lambda\left(T - T_f - T_{nf} - L\right) + \eta\left[pQ\left(T_f, T_h, X_f\right) - p_f X_f - w_h T_h + wT_{nf} + Y_o - p_c C\right] . \qquad [21]$$

In order to optimise the household's utility, the Lagrangian function is maximised with respect to $T_f, T_{nf}, T_h, X_f, \lambda,$ and $\eta,$ whereas λ is the Lagrange multiplier associated with the inequality constraints on the work of each labour type and η is the Lagrange multiplier associated with the income inequality constraint.

$$\frac{\partial \mathcal{L}}{\partial T_f} = -\lambda + \eta p \frac{\partial Q}{\partial T_f} = 0 \ . \qquad [21.1]$$

$$\frac{\partial \mathcal{L}}{\partial T_{nf}} = -\lambda + \eta w^* = 0 \ . \qquad [21.2]$$

$$\frac{\partial \mathcal{L}}{\partial T_h} = \eta p \frac{\partial Q}{\partial T_h} - \eta w_h = 0 \ . \qquad [21.3]$$

$$\frac{\partial \mathcal{L}}{\partial X_f} = \eta p \frac{\partial Q}{\partial X_f} - \eta p_f = 0 \ . \qquad [21.4]$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = T - T_f - T_{nf} - L = 0 \ . \qquad [21.5]$$

$$\frac{\partial \mathcal{L}}{\partial \eta} = pQ\left(T_f, T_h, X_f\right) - p_f X_f - w_h T_h + w^* T_{nf} + Y_o - p_c C = 0 \ . \qquad [21.6]$$

The first-order conditions for this maximisation problem, derived from [21.1]-[21.4], are as follows:

$$(a) \qquad w^* = p\frac{\partial Q}{\partial T_f} = \frac{\partial Y_f}{\partial T_f}\,, \qquad if \;\; p\frac{\partial Q}{\partial T_f} - w^* > 0 \;\; T_f > 0, T_{nf} = 0\,,$$

$$if \;\; p\frac{\partial Q}{\partial T_f} - w^* = 0 \;\; T_f > 0, T_{nf} > 0\,,$$

$$if \;\; p\frac{\partial Q}{\partial T_f} - w^* < 0 \;\; T_f = 0, T_{nf} > 0\,.$$

$$(b) \qquad w_h \;=\; p\frac{\partial Q}{\partial T_h}\,.$$

$$(c) \qquad p_f = p\frac{\partial Q}{\partial X_f}\,.$$

In general, the marginal product of labour at the optimum results in the shadow wage, w^*, which is also called the opportunity cost of time. Now, consider a nonfarm employment constraint, H, denoting the maximum of hours a farmer can work off the farm. If the labour market is complete, this constraint on nonfarm work is not binding and the return from nonfarm employment equals the shadow wage. Expressed mathematically, $w^* = w \;\; if \; T_{nf} < H$. If the labour market is incomplete, the constraint is binding and the wage paid for nonfarm activities is higher than the shadow wage, i.e. $w^* < w \;\; if \; T_{nf} = H$. The first-order condition presented in *(a)* states that the household engages in farm work up to the point where the marginal product of farm labour equals the shadow wage, w^*. *(b)* shows that labour will be hired until the marginal product of hired labour is equal to the wage paid to hired workers and *(c)* states that farm input will be utilised until the marginal product of input equals the input price. As a conclusion, the equilibrium condition for the household's utility maximisation is that the marginal rate of substitution between consumption and leisure is equal to the shadow wage rate w^* *(d)*. If the labour market is complete, the marginal rate of substitution would equal the market wage w.

$$(d) \qquad \frac{\partial \mathcal{L}/\partial L}{\partial \mathcal{L}/\partial C} = w^*\,.$$

With respect to nonseparability due to labour market imperfections, [20] can be rewritten as follows:

$$p_c C + w^* L \leq pQ\left(T_f, T_h, X_f\right) - p_f X_f - w_h T_h + w^* T(Z) + Y_o \ , \qquad [22]$$

whereas the value of the household's total expenditures on consumption of goods and leisure cannot exceed the household's 'shadow full-income' (Skoufias, 1994, p. 219).

To illustrate the previous discussion at the beginning of this section about separability and non-separability of the household's production and consumption decision, respectively, both household equilibria are displayed below (see Figures 6 and 7). In Figure 6, the household equilibrium under separability is displayed, whereas $\left(w; X_f\right) = pQ\left(T_f, T_h, X_f\right) - p_f X_f - w_h T_h$, denoting the household's farm profit function. The separation property states that a household's production decisions are only driven by profit maximisation and independent of the household's preferences. Therefore, profits are maximised without considering the household's utility function. The optimal amount of labour time, $T(Z) - L^*$, exceeds the optimal amount of labour allocated to farm work, T_f^*, implicating that the household additionally allocates time to nonfarm work, $T_{nf} > 0$. Consequently, only the wage and the production technology, but not the household's preferences have an impact on T_f^* (Bardhan and Udry, 1999, p. 10; Benjamin, 1992, p. 290).

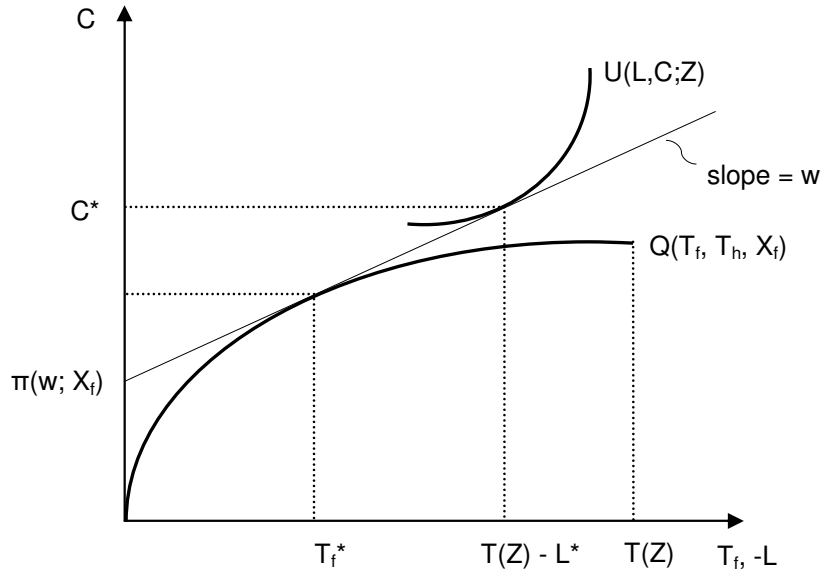


Figure 6: Household equilibrium under separability (Author's illustration, based on Benjamin, 1992, p. 290; Bardhan and Udry, 1999, p. 10)

In contrast, in Figure 7, the household equilibrium under nonseparability is displayed. The household works H hours nonfarm, earning wH, whereas the remaining time is allocated to farm work, T_f. If the nonfarm labour constraint H, as introduced above, is binding, the total amount of time allocated to labour, $T_f + H$, depends on the production technology as well as the household's preferences and consequently, the household consumes $C^* = Q(T_f, T_h, X_f) + wH$ units of the good. The wage that influences the amount of T_f is the shadow wage w^* and if the nonfarm employment constraint was not binding, the household would allocate the optimal amount of time to farm work, T_f^* (Bardhan and Udry, 1999, p. 12f; Benjamin, 1992, p. 293f).

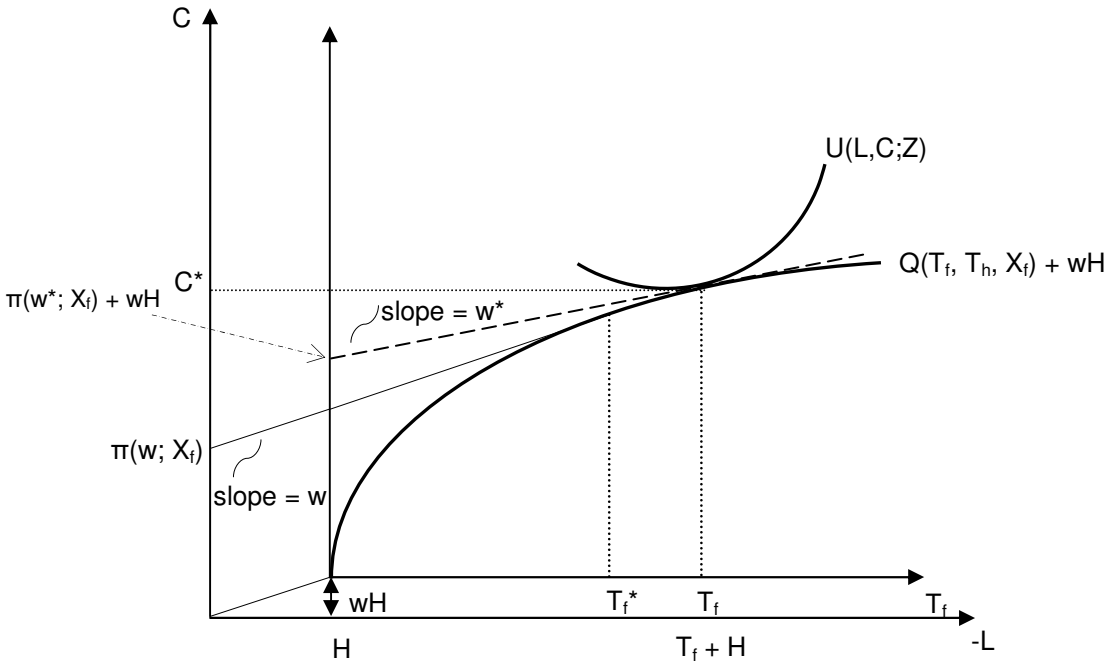


Figure 7: Household equilibrium under nonseparability (Author's illustration, based on Benjamin, 1992, p. 293; Bardhan and Udry, 1999, p. 12)

Empirical Model

As learnt in equation [14], the household aims at maximising its utility over consumption of goods and leisure and the household's preferences are influenced by the household's characteristics, Z, like age of the household head, the household's composition, or the household's endowment with assets. Since the household faces a budget constraint, the value of consumption can only be less than or equal to the amount of returns. Household income is derived by allocating time to a certain activity and the decision regarding the amount of time is

influenced by the household's characteristics, Z, the time constraint, $T(Z)$, and unforeseen shocks like weather risks or the illness of a family member, ε_f and ε_{nf}, respectively (compare equations [15] and [17]). In order to examine the determinants and driving forces for the decision towards nonfarm employment, the income derived from these activities serves as an indicator for the household's observed activity choice.

Since the analysis of wages is not includes in this study, separability can still be assumed to simplify the empirical specification. Therefore, it may be assumed that, in deciding whether to participate in nonfarm income generating processes or not, the household (head) weighs up the expected marginal utility of wealth from participation represented by $E\left[U_P^{'}(Y)\right]$ and the expected marginal utility of wealth from non-participation represented by $E\left[U_N^{'}(Y)\right]$, and participation occurs if $E\left[U_P^{'}(Y)\right] > E\left[U_N^{'}(Y)\right]$. This is under the assumption that the household's total income, Y, represents wealth. Usually, the parameters of decision are not observable but can be represented by a latent variable $U(Y)$, with

$$U(Y) = 1 \qquad if \;\; E[U_P'(Y)] > E[U_N'(Y)] \quad \text{and} \tag{23}$$

$$U(Y) = 0 \qquad if \;\; E\left[U_P^{'}(Y)\right] \leq E\left[U_N^{'}(Y)\right]. \tag{24}$$

With regard to the theoretical model and the influence of household characteristics, Z, on the household's time allocation and activity choice, respectively, expected marginal utility of participation in a certain activity can be related to a set of explanatory variables, Z, as follows:

$$E[U'(Y)] = \beta' Z_i + \varepsilon_i \;, \tag{25}$$

where β is a vector of parameters to be estimated and ε is an error term with mean zero and variance σ_ε^2. The error term includes measurement errors and factors known to the household like the household's attitude towards risk but unobserved by the researcher. Since the income derived from nonfarm employment is the observable outcome of the household's activity choice, equation [25] can also be expressed as

$$Y_{nf} = \beta' Z_i + \varepsilon_i \tag{26}$$

in order to examine the determinants for nonfarm employment.

Variables in Z include household characteristics like the age, gender, and educational level of the household head, the composition of the household, its region of living, and its extent of remoteness captured by proxies due to lack of explicit information. Furthermore, the household's resource characteristics like the household's endowment with savings, valuable agricultural assets, farm land, and livestock are also covered by Z. Additionally, the amount of kind income as well as the value of self-sufficient agriculture are included to picture the household's risk perception.

The age of the household head is included to test whether household headed by younger persons are participating in nonfarm employment to a larger extent due to lack of experience in agriculture and since women in Ghana are hypothesised to intensely participate in the nonfarm sector, the gender of the household head is included as well. Across the literature, education is regarded to state one major entry barrier to higher-return and less risky nonfarm activities. Nonfarm work like wage labour often requires a certain level of schooling and therefore it is tested whether the educational level of the household head has a positive impact on the household's income diversification. Additionally, the composition of the household may also have an impact on the extent of diversification since additional adult labour force contributes to the household income and can be allocated to nonfarm employment, whereas additional children are even more care intense. The household's locality in rural areas and its remoteness are also mainly hypothesised to have a negative impact on the extent of participation due to lack of availability and access, respectively. As far as the household's amount of savings is concerned, it is expected to have a positive impact on income diversification since due to insufficient credit markets savings are regarded to be a major source of seed capital to start a small business. However, the value of the household's agricultural assets, farm land, and livestock is expected to have a negative influence on the participation in nonfarm employment. If the household possess valuable agricultural physical capital, it would be recommendable to allocate most of the time and labour force to agricultural production rather than to nonfarm activities. Finally, in the presence of food price instabilities parts of the income is paid in kind and self-sufficient agriculture is extended. Since nonfarm employment is regarded to be less risky, households receiving income in kind and expanding their self-sufficient agricultural production are expected to have a higher extent of participation in nonfarm activities to spread their income risk.

In the following chapter, the research questions are explained and the methods implemented to answer these questions are introduced. Subsequently, the results of the calculations will be presented in chapter 7.

6. Methodology of the Study

According to the focus and objectives of this study, three analytical methods are employed to address the relationship of income diversification and household welfare. First, Powell's Censored Least Absolute Deviations (CLAD) estimator is implemented to examine the effect of several household characteristics hypothesised in chapter 4.4. on the household's income diversification. This first step of the empirical analysis aims at identifying the determinants and driving factors of income diversification and whether generating income from nonfarm employment is an appropriate tool to cope with risks rural households in Ghana are faced with. The endogenous variable, i.e. the extent of income diversification measured by the share of nonfarm income in the total household income, reflects the household's activity choice described in equations [23] and [24], respectively, since only households engaged in nonfarm employment show a positive share of nonfarm income in total income. The exogenous variables used are the household's characteristics like the age of the household head, the value of the livestock owned by the household, or the remoteness of the household.

In addition to the evaluation whether nonfarm employment can serve as a risk-coping strategy in rural Ghana, the CLAD results hint at some entry barriers households are confronted with when deciding to engage in nonfarm employment as well. Therefore, the Heckman two-stage method is used to examine the household characteristics influencing the extent of participation. In detail, the Heckman two-stage method first allows calculating the impact of several household characteristics on the probability of participating in nonfarm activities, i.e. the probability of the household's activity choice towards nonfarm employment, and additionally, factors influencing the participation intensity as well as the household's total expenditures can be reported. Since only households participating in nonfarm employment are included in the second stage of the Heckman method, the effect of these factors on the household's wealth can potentially be ascribed to income diversification to some degree.

However, to explicitly analyse the causal effect of participation in nonfarm employment on the household's wealth and poverty status, respectively, the Propensity Score Matching (PSM) approach is finally implemented. Some studies place emphasis on the fact that under certain asset preconditions households are

able to generate a higher total income through nonfarm employment than less endowed households (e.g. Bryceson, 1999, p. 174; Smith et al., 2001, p. 426; Jolliffe, 2004, p. 303). Consequently, the third step of this study comprises the impact analysis of participation on the households' welfare. Therefore, the outcome of the fact that a household participates in nonfarm employment is measured by the household's per-head expenditures, the change in the depth of poverty represented by the poverty gap and the change in poverty status, i.e. if the household manages to overcome poverty at all. Furthermore, several subsamples like the rural or the female subsample will be analysed to examine differences in the effect of nonfarm employment on welfare among particular social groups.

In the following, these three analytical tools implemented in the study will be presented, whereas section 6.1. deals with the econometric specification for income diversification as a risk-coping strategy, section 6.2. shows the empirical model for the participation decision regarding nonfarm employment, and section 6.3. presents the PSM method for the income diversification and the causal effect of participation on wealth and poverty reduction.

6.1. The CLAD Estimator

The method used is a quantile regression using Powell's CLAD estimator and bootstrapping is implemented to compute robust standard errors (Jolliffe, 2004, p. 300; Jolliffe, 1998, p. 102; Rogers, 1993, p. 18). With respect to equations [23], [24], and [25], the general econometric model can be formulated as follows:

$$y_i^* = \beta_0 + \beta_i Z_i + \varepsilon_i \qquad \begin{cases} y_i = y_i^* & if \quad y_i^* > 0 \\ y_i = 0 & if \quad y_i^* \leq 0 \end{cases}, \qquad [27]$$

where y_i^* is the latent extent of nonfarm diversification. If y_i^* is positive, it equals the actual extent of diversification, y_i , and if the latent extent of diversification is equal to or less than zero, y_i is equal to the censoring point, zero. The censored regression model for the actual extent of nonfarm diversification can then be written:

$$y_i = max(0, \beta' Z_i + \varepsilon_i) \, . \qquad [28]$$

The CLAD estimator is a median estimator for the quantile regression and therefore, a minimisation problem is realised (Powell, 1984, p. 305; Berg, 1998, p. 8; Tobin, 1958, p. 26).

$$\beta_{CLAD} = min \sum_{i=1}^{n} |y_i - max(0, \beta' Z_i)| \,, \qquad [29]$$

whereas n is the sample size, y_i denotes the share of nonfarm income in total household income, and Z_i is the correspondent vector of regressors including the household's basic and resource characteristics.

The computation of the CLAD estimator is executed by using Buchinsky's iterative linear programming algorithm (ILPA), whereas a quantile regression is conducted and all observations for which the predicted value of y_i is less than zero are dropped. This procedure is then repeated until there are no predicted values of y_i lower than zero in two successional iterations (Buchinsky, 1994, p. 412).

Equation [27] reveals that zero is the censoring point resulting in a concentration of values at this threshold and as a consequence, explanatory variables are only observed for positive values of y_i^* resulting in a biased sample. Although the CLAD estimator does not control for this selection bias, this approach incorporates several advantages. On the one hand, the estimator is a semi-parametric econometric model and therefore, unlike e.g. the Tobit model, no assumptions on the error terms are needed (Berg, 1998, p. 2, 4). As a consequence, the estimator is robust to heteroskedastic and non-normal distributed error terms and still consistent and asymptotically normally distributed even in the case of non-normally distributed or heteroskedastic residuals (Berg, 1998, p. 8). The latter attribute is quite important since heteroskedastic error terms are common in cross-sectional data sets, resulting in underestimated standard errors and therefore, misleadingly interpreted OLS results. However, although the Symmetrically Censored Least Squares (SCLS) estimator is regarded to be more efficient than the CLAD estimator, the CLAD estimator is more robust to outliers, which arise very frequently in the case of survey data due to erroneous responses, since the median regression is not affected by the observation's distance from the median but only whether the observation falls below or above the median (Jolliffe, 2004, p. 299; Falk, 2001, p. 7). On the other hand, another major advantage of this approach is that the quantile regression allows analysing the effect of the household's characteristics on the nonfarm diversification according to the extent

of diversification. Therefore, possible differences between the various degrees of diversification can be examined and this utile information can be helpful to derive more effective policy implications.

6.2. The Heckman Two-Stage Method

In the first step of the Heckman two-stage method, a probit model is estimated to explain the impact of several factors on the probability of participating in nonfarm employment. According to equations [23] and [24], the dependent latent variable $U(Y)$ is equal to 1 if the household engages in nonfarm activities, i.e. $E\left[U_P^{'}(Y)\right] > E\left[U_N^{'}(Y)\right]$, and $U(Y)$ equals zero if the household does not derive any income from nonfarm employment, i.e. $E\left[U_P^{'}(Y)\right] \leq E\left[U_N^{'}(Y)\right]$:

$$Pr(U(Y) = 1) = Pr(E[U_P'(Y)] > E[U_N'(Y)]) = Pr(\varepsilon_i > -\beta' Z_i) = 1 - F(-\beta' Z_i), \quad [30]$$

whereas F is the cumulative distribution function for ε_i. Since the Heckman two-stage method demands a probit model, a normal distribution of ε with mean 0 and variance σ is assumed (Greene, 2008, p. 772; Faltermeier and Abdulai, 2009, p. 366; Abdulai and Binder, 2006, p. 204).

In the second step of the Heckman model, equations for the extent of participation as well as for the household's wealth are carried out, calculating the impact of several household characteristics on the household's share of nonfarm income in total income as well as the household's economic outcome, i.e. the household's total expenditures. Since this two-step procedure results in heteroskedastic standard errors for the second-stage equation, heteroskedastic robust residuals are calculated using White's formula (Abdulai et al., 2008, p. 448; White, 1980, p. 819). Noticeably, a positive nonfarm income share in the first step is only observed for those households really engaged in nonfarm activities, and therefore, the second-stage equation is only calculated for households participating in nonfarm employment. As a consequence, households deriving income from nonfarm activities possibly select themselves into this group, resulting in a biased sample and biased parameter estimates. As mentioned in the previous section, the analysis with the CLAD estimator results in a concentration of values at the censoring point zero and, as a consequence, in a biased sample as well. Although

several advantages of the CLAD estimator have been stressed out in the previous section, there is also one major disadvantage since the CLAD estimator does not control for this sample selection bias. However, the Heckman two-stage method accounts for this problem as it controls for this possibly occurring sample selection bias by calculating the inverse Mills ratio, λ_i, and estimating the second-stage equation with the inverse Mills ratio as an additional explanatory variable. According to Heckman (1976), the inverse Mills ratio is calculated as follows:

$$\lambda_i = \frac{PDF}{1-CDF} = \frac{\phi((-\beta' Z_i)/\sigma_\varepsilon)}{1-\Phi((-\beta' Z_i)/\sigma_\varepsilon)}\,, \qquad [31]$$

whereas $\phi(\cdot)$ is the probability density function of the standard normal distribution and $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. The Mills ratio, λ_i, indicates the selectivity problem. The higher λ_i is, the lower is the probability that all potential observations are sampled. If the selection bias is marginal, the λ_i is negligible and a simple OLS regression would lead to consistent estimates. But since this possible selection bias is not known, λ_i is added to the OLS regression as an additional explanatory variable:

$$y_i = \beta_0 + \beta_i Z_i + \gamma_i \lambda_i + u_i \qquad if \quad U(Y) = 1\,, \qquad [32]$$

whereas y_i is either the extent of participation measured by the share of nonfarm income in total income or the household's wealth measured by the household's total expenditures. The error term u_i is normally distributed with mean 0 and variance 1. The inverse Mills ratio can also be expressed as $\lambda = \rho\sigma$, whereas $corr(\varepsilon_i, u_i) = \rho$ and σ denotes the standard deviation of u.

If there is no selection bias, $\rho = 0$, and $\lambda = 0$ as well, and the second-stage equation results in consistent estimates due to no selectivity. But if the inverse Mills ratio is not included in the second-stage equation in the case of a selection bias, ε_i and u_i would be correlated and therefore, the Gauss-Markov assumption that the independent variables and the error term are not correlated would be violated, resulting in inconsistent OLS estimates (Heckman, 1976, p. 479; Greene, 2008, p. 866). This implies that the Heckman two-stage method also controls for unobservables (Moffitt, 2004, p. 1).

Concluding, the Heckman two-stage method is a viable tool to identify possible entry barriers to nonfarm employment by revealing the influence of several household characteristics on the extent of participation. Additionally, this method successfully accounts for the eminent problem of sample selection bias, guaranteeing consistent OLS results in the second-stage equation.

6.3. Propensity Score Matching

Finally, the non-parametric Propensity Score Matching (PSM) method suggested by Rosenbaum and Rubin (1983, 1985) and utilised in this study will be introduced. For this purpose, the evaluation framework, the matching procedure, and the assessment of the matching quality and the sensitivity of the subsamples regarding hidden bias will be explained in the following.

6.3.1. Evaluation Framework

To evaluate the impact of the treatment, programme, or activity, respectively, researchers generally are interested in the difference between the participants' outcome with and without treatment and matching is an appropriate approach to estimate this causal treatment effect. The so-called treatment in this study is the participation in nonfarm employment in contrast to non-participation, and the binary treatment indicator, D_i, equals 1 if the household derives income from nonfarm activities, and D_i equals 0 if the household does not engage in nonfarm activities at all. According to the potential outcome approach, or Roy-Rubin model, the potential outcome is generally defined as $Y_i(D_i)$ for each household i and the treatment effect for one household can therefore be written as

$$\tau_i = Y_i(1) - Y_i(0), \qquad [33]$$

whereas, according to equation [30], the probability of participating in nonfarm employment can be formulated as follows:

$$Pr(D = 1) = Pr(E[U_P'(Y)] > E[U_N'(Y)]) = Pr(\varepsilon_i > -\beta' Z_i) = 1 - F(-\beta' Z_i). \qquad [34]$$

As argued earlier, the household aims at maximising its utility and therefore participates in nonfarm employment only if its expected marginal utility of wealth from participation is higher than from non-participation. The household's wealth can be measured either by the household's income, its expenditures, or its poverty level, i.e. the depth of poverty. The basic relationship between participation in nonfarm employment and the outcome, i.e. the household's welfare, can therefore be expressed as a linear function:

$$y_i = \beta' Z_i + \delta' D_i + \varepsilon_i \ , \qquad [35]$$

whereas y_i is either the household's per-head expenditures, the household's poverty gap or a binary variable to examine the household's poverty status, i.e. poor or non-poor. The household's characteristics are captured in the vector Z_i, D_i is the participation dummy variable already mentioned above, and ε_i denotes the error term.

However, there are two major problems researchers are confronted with when evaluating this treatment effect. On the one hand, for the same household both outcomes cannot be observed at the same time and therefore the treatment effect for each household, τ_i, cannot be calculated. Only $Y_i(1)$ or $Y_i(0)$ are observed for each household and the unobserved outcome is called the counterfactual outcome. One solution would be to take the average outcome of the non-participating households as an approximation for the counterfactual outcome. But since participating and not participating households already differ even when there is no participation decision at all, selection bias additionally states a problem. In order to address this selection problem, the basic idea of the PSM method is that a specific outcome of those households participating in nonfarm employment, i.e. the so-called treatment group, is compared with the specific outcome of households not participating in nonfarm employment, i.e. the so-called control group (Dehejia and Wahba, 2002, p. 152). In detail, the aim of the matching approach is to find those households in a large group of not participating households who are similar to the participating households regarding all relevant pretreatment characteristics Z. This process results in an appropriate control group and therefore, differences in the outcome between treatment and control group can only be ascribed to the participation in nonfarm employment.

The two parameters of main interest are the population average treatment effect (ATE) and the average treatment effect on the treated (ATT). The ATE is given as

$$\tau_{ATE} = E(\tau) = E[Y(1) - Y(0)] \, . \qquad [36]$$

τ_{ATE} simply describes the difference between the expected outcomes after participation and non-participation, representing the expected effect on the outcome if households were assigned into nonfarm employment randomly (Caliendo and Kopeinig, 2008, p. 31-34). Noticeably, the estimation of average treatment effects requires that the treatment effect of each household i is independent of the treatment participation of the other households. This assumption is called the 'stable unit treatment value assumption' (Sianesi, 2004, p. 136; Caliendo and Kopeinig, 2008, p. 66). Since the ATE includes the impact of participation on households who are not intended to participate, the ATE does not offer much information to policy makers. As a consequence, the ATT is the most frequently calculated parameter for this evaluation as it only takes into account those households really participating in nonfarm employment. The ATT is the difference between the expected outcomes with and without participation for those households actually engaging in nonfarm activities. The ATT can therefore generally be written as

$$\tau_{ATT} = E(\tau|D = 1) = E[Y(1)|D = 1] - E[Y(0)|D = 1]. \qquad [37]$$

As mentioned earlier, the counterfactual outcome, $E[Y(0)|D = 1]$, cannot be observed and the use of the mean outcome of non-participants, $E[Y(0)|D = 0]$, is not an adequate substitute since it leads to a selection bias. If the mean outcome of non-participants would be used as an approximation for the counterfactual, the ATT could be rewritten as

$$E[Y(1)|D = 1] - E[Y(0)|D = 0] = \tau_{ATT} + E[Y(0)|D = 1] - E[Y(0)|D = 0], \qquad [38]$$

whereas $E[Y(0)|D = 1] - E[Y(0)|D = 0]$ is the so-called selection bias and the true τ_{ATT} is only identified if the selection bias is zero. In experiments where the assignment to treatment is totally random, the selection bias is zero and therefore the τ_{ATT} is identified. However, to solve the problem in [38] in the case of non-experimental datasets, some identifying assumptions have to be relied on.

One important assumption is the conditional independence assumption (CIA) which implies that potential outcomes are not correlated with participation and therefore, differences between treatment and control households, who have the same covariates' values, can only be assigned to the participation in nonfarm employment. As a consequence, the CIA, which is also called 'strong unconfoundedness' assumption, can be defined as

$$Y(0), Y(1) \perp\!\!\!\perp D|Z \ , \qquad [39]$$

where $\perp\!\!\!\perp$ represents independence (Caliendo and Kopeinig, 2008, p. 35).

Furthermore, the overlap or common support condition is required for the implementation of the propensity score matching. According to Heckman et al. (1998), the common support condition guarantees that the probability of being either participant or non-participant in nonfarm employment is positive for households with the same Z values (Heckman et al., 1998, p. 266). This overlap condition is given by

$$0 < P(D = 1|Z) < 1 \ . \qquad [40]$$

Heckman et al. (1997) state that comparable observations can only be matched in the overlapping subset of the treatment and control groups. Therefore, matching is only justified when it is performed over the region of common support. If this condition is ignored, incomparable households would be compared, resulting in an eminent bias. As a consequence, the ATT can only be estimated for households within the common support region and households outside this region have to be excluded from estimation (Bryson, 2002, p. 12; Smith and Todd, 2005, p. 313; Li and Zhao, 2006, p. 369).

Both assumptions, the CIA and the common support assumption, are referred to as 'strong ignorability' by Rosenbaum and Rubin (1983) and if both assumptions hold, the impact of participation in nonfarm employment on the outcome variables can be expressed as

$$\tau_{ATT}(Z) = E[Y(1)|D = 1, Z] - E[Y(0)|D = 0, Z]. \qquad [41]$$

According to Dehejia and Wahba (2002), one approach to estimate [41] is to match households by conditioning on their covariates Z. But, as the number of variables increases, the finding of exact matches becomes more difficult. Rosenbaum and

Rubin (1983) suggest implementing the propensity score as a balancing score to deal with the stated problem, whereas the propensity score denotes a household's probability to participate given its observed covariates Z. They show that if the CIA holds, outcomes are independent of participation conditional on the propensity score $P(Z)$ as well. As a consequence, bias due to observable covariates can be removed since participation and covariates are not correlated and therefore, households with similar probabilities of participating in nonfarm employment are compared with respect to Z (Dehejia and Wahba, 2002, p. 153; Imbens, 2004, p. 8f; Heckman et al., 1997, p. 611; Caliendo and Kopeinig, 2008, p. 36; Faltermeier and Abdulai, 2009, p. 368). Consequently, the conditional probability of participation, given the observed covariates Z, can be written as

$$P(D = 1|Z) = P(Z)\ , \qquad [42]$$

and the extension of the CIA given the propensity score is defined as follows (Caliendo and Kopeinig, 2008, p. 36; Imbens, 2004, p. 9; Heckman et al., 1997, p. 611; Lee, 2008, p. 19):

$$Y(0), Y(1) \coprod D|P(Z)\ . \qquad [43]$$

Under these preconditions, the average treatment effect on the treated can be calculated as follows (Becker and Ichino, 2002, p. 359; Caliendo and Kopeinig, 2008, p. 36):

$$\tau_{ATT} = E\{E[Y(1)|D = 1, P(Z)] - E[Y(0)|D = 0, P(Z)]\}\ , \qquad [44]$$

whereas the estimator for the ATT is the average difference in outcomes over the common support weighted by the propensity score distribution of participating households (Becker and Ichino, 2002, p. 359; Caliendo and Kopeinig, 2008, p. 36).

6.3.2. Implementation of Propensity Score Matching

Model Choice

The first step of implementing the PSM method is the estimation of the propensity score, whereas the decision is between the logit and the probit model. In a binary treatment case, as is evaluated in this study, both models show similar results and finally, the probit is implemented for this study. As far as the choice of variables is

concerned, researchers need to be aware that only variables simultaneously influencing participation decision as well as the outcome variable should be included in the model. At the same time, variables affected by the participation or non-participation decision should not be included in the model. To meet these demands, economic theory, information about institutional settings, and findings of previous research should be the basis for the choice of variables included in the model. However, over-parameterised as well as under-parameterised models should be avoided (Sianesi, 2004, p. 137; Smith and Todd, 2005, p. 309; Caliendo and Kopeinig, 2008, p. 38).

Choice of Matching Algorithm

Subsequent to the estimation of the propensity score, an appropriate matching algorithm has to be chosen. In general, matching estimators pair each participant with a similar non-participant and the difference in their outcomes is interpreted as the effect of participation (Smith and Todd, 2005, p. 312). In the literature, several matching algorithms are discussed: Nearest Neighbour Matching – with and without replacement, Caliper and Radius Matching, Mahalanobis Metric Matching, Stratification and Interval Matching, and Kernel and Local Linear Matching. Every matching algorithm utilises different methods to find the most similar non-participant for comparison and every algorithm has its advantages and disadvantages regarding the balance of the relevant covariates and regarding efficiency. Thus, the choice of the matching algorithm always constitutes a trade-off between bias and efficiency, i.e. variance. In the underlying study, the Mahalanobis Metric Matching (MMM) combined with the propensity score is implemented since it yielded the most efficient and reasonable results compared to the other algorithms and therefore, the only algorithm described below. The combination of these two approaches is advisable since matching on the propensity score is able to minimise the discrepancy along the propensity score and the Mahalanobis distance minimises the distance between individual coordinates of Z (Sekhon, 2008, p. 278). For a sound overview of the other matching algorithms see, for example, Caliendo and Kopeinig (2008) and Smith and Todd (2005).

The MMM is a bias reducing extension of the Nearest-Neighbour algorithm, attempting to find pair matches close on all matching variables. First, households are ordered randomly and subsequently, the distances between the first participating household and the sum of controls are calculated.

The Mahalanobis distance, $d(i,j)$, is given by

$$d(i,j) = (u - v)^T C^{-1}(u - v), \quad [45]$$

whereas *u* and *v* denote the values of the matching variables for the participating household i and the non-participating household j, and C is the sample covariance matrix of the matching variables from the complete set of non-participating households. Matching variables are selected variables of the covariates to guarantee accurate matching between participants and non-participants regarding these variables. In this study, the household head's age, gender, educational level and whether the household lives in a rural or urban area are implemented. The least distant non-participating household j is chosen as the match for the participating household i and matching for this participant is finished. The matching procedure is completed when a match is found for every participating household i (Rubin, 1980, p. 293f; Guo et al., 2006, p. 364f; Sekhon, 2008, p. 277f). However, the MMM has one major shortcoming. Since it is not based on a one-dimensional score, the MMM does not perform well in the case of a high number of covariates. To overcome this drawback, only a small number of covariates are added to the propensity score and calipers are implemented to reduce the number of households not participating in nonfarm employment and included in the calculation of the Mahalanobis distance. Calipers are predetermined ranges and only non-participants within this range are used to calculate the distance in order to avoid bad matching partners. According to Rosenbaum and Rubin (1985), the addition of calipers to the MMM yields the best balance between the covariates in the participants and non-participants groups, and the best balance of the covariates' squares and cross-products between the two groups (Guo et al., 2006, p. 364f).

Assessing the Matching Quality

Matching quality is assessed by testing the matching procedure's ability to balance the distribution of the relevant variables in the treatment as well as the control group (Caliendo and Kopeinig, 2008, p. 47). PSM is not able to completely eliminate the bias generated by these differences, but to reduce it, and the success of reduction is dependent on the quality of the variables used to calculate the propensity score and to perform matching (Becker and Ichino, 2002, p. 358). For this reason, a balancing test is conducted after matching to evaluate the extent to which differences in the covariates in the two groups in the matched sample are

eliminated. If these differences have been significantly reduced, the matched control group can be regarded as a reliable counterfactual (Lee, 2008, p. 8). In the literature, several procedures are discussed (see e.g. Caliendo and Kopeinig, 2008, p. 47ff) and one adequate approach used in this study is the standardised mean difference between participation and control group suggested by Rosenbaum and Rubin (1985). This indicator quantifies the bias between the participation and control groups by computing the mean standardised difference of covariates before and after matching (Rosenbaum and Rubin, 1985, p. 36; Caliendo and Kopeinig, 2008, p. 48; Faltermeier and Abdulai, 2009, p. 369). The bias before matching is defined as

$$b(Z)_{before} = 100 \frac{\bar{Z}_P - \bar{Z}_N}{\sqrt{0.5\left(V_P(Z) + V_N(Z)\right)}} \quad [46]$$

and the bias after matching is given by

$$b(Z)_{after} = 100 \frac{\bar{Z}_{Pm} - \bar{Z}_{Nm}}{\sqrt{0.5\left(V_{Pm}(Z) + V_{Nm}(Z)\right)}}, \quad [47]$$

whereas $\bar{Z}_P$ and $\bar{Z}_N$ are the sample means for the participants and nonparticipants before matching, and $\bar{Z}_{Pm}$ and $\bar{Z}_{Nm}$ after matching, respectively. $V_P(Z)$ and $V_N(Z)$ denote the variance in the treatment and control group before matching, and $V_{Pm}(Z)$ and $V_{Nm}(Z)$ denote the corresponding variances after matching. The total bias is then computed as the unweighted mean of all covariates and the reduction in bias, br, is calculated as follows:

$$br = 100 \left(1 - \frac{b_{after}}{b_{before}}\right). \quad [48]$$

According to Rosenbaum and Rubin (1985), an average initial bias of 20% can be regarded as large, and referring to previous empirical findings, Caliendo and Kopeinig (2008) consider a bias less than 3% or 5% after matching as satisfactory (Rosenbaum and Rubin, 1985, p. 36; Caliendo and Kopeinig, 2008, p. 48; Faltermeier and Abdulai, 2009, p. 369). Sianesi (2004) additionally suggests assessing the pseudo-R^2s before and after matching since the pseudo-R^2s indicate how well the participation probability is explained by the covariates. By reestimating the propensity score on the matched sample, the pseudo-R^2 after matching is obtained and should be quite low. Supplementary, a likelihood ratio

test on the joint significance of all regressors is conducted to test the hypothesis that the mean of covariates of the participation group equals the mean of covariates of the control group, implying that both samples are statistically similar. H_0 should not be refused after matching indicating that the two samples are balanced in the distribution of the observables after the appropriate matching algorithm has been applied to obtain the counterfactual for each participating household (Sianesi, 2004, p, 154; Caliendo and Kopeinig, 2008, p. 49).

Sensitivity Analysis

As mentioned earlier, only variables simultaneously influencing the participation decision and the outcome should be included in the calculation of the propensity score. This recommendation assumes that all variables to which this property applies can be observed. However, if there are unobserved variables affecting the participation decision and the outcome simultaneously as well, a hidden bias may arise indicating that two households with the same observed covariates Z have different probabilities of participation. Since matching estimators are not robust to hidden bias, the inferences about treatment effects are affected in the presence of this unobserved heterogeneity. For this reason, it is necessary to test the robustness of results by measuring the degree of departure from a sample free of hidden bias (Rosenbaum, 2002, p. 88f; Caliendo and Kopeinig, 2008, p. 56f). A commonly implemented approach is the bounding approach suggested by Rosenbaum (2002) which serves to evaluate the sensitivity of the sample. For this purpose, Rosenbaum (2002) suggests the computation of test statistics in the family of sign-score statistics, particularly Wilcoxon's signed rank test, for matched pairs. The Wilcoxon signed rank statistics have the form

$$T = t(X, r) = \sum_{s=1}^{S} d_s \sum_{i=1}^{2} c_{si} X_{si} \ , \qquad [49]$$

whereas X is the variable that registers which of each of the s pairs has participated and r captures the outcome for each case in the S pairs. X_{si} equals 1 if a household participates in nonfarm employment and 0 otherwise. d_s is the rank of $|r_{s1} - r_{s2}|$ and c_{si} is defined as follows:

$$c_{s1} = 1,\ c_{s2} = 0 \quad if \quad r_{s1} > r_{s2} \ ,$$

$$c_{s1} = 0,\ c_{s2} = 1 \quad if \quad r_{s1} < r_{s2} \ ,$$

$$c_{s1} = 0,\ c_{s2} = 0 \quad if \quad r_{s1} = r_{s2} \ . \qquad [50]$$

Basically, due to the product of c and X variables, only pairs are selected where the outcome for participation is greater than the outcome for the control. The ranks of these cases are summed and compared with the distribution of the test statistic under the hypotheses H_0 that participation in nonfarm work does not have any effect on the outcome variable.

According to Rosenbaum (2002), it is assumed that the probability of participation is modeled

$$\pi_i = Pr(D_i = 1|Z_i) = F(\beta Z_i + \gamma u_i) \ , \qquad [51]$$

whereas Z_i is the vector of observed variables influencing the participation decision as well as the outcome and u_i is an unobserved variable, with γ denoting the effect of u_i on the probability of participating in nonfarm employment. It is further assumed that F is the logistics distribution and thus, the odds that household i participates is given as

$$log\left(\frac{\pi_i}{1-\pi_i}\right) = \beta Z_i + \gamma u_i \ . \qquad [52]$$

To follow Rosenbaum (2002), we suppose that we have two households, *1* and *2*, with the same Z but with possibly different probabilities to participate. Then the odds that households *1* and *2* participate are $\pi_1/(1-\pi_1)$ and $\pi_2/(1-\pi_2)$, respectively. The odds ratio is then given as

$$\frac{\pi_1(1-\pi_2)}{\pi_2(1-\pi_1)} = \frac{exp(\beta Z_1+\gamma u_1)}{exp(\beta Z_2+\gamma u_2)} = exp[\gamma(u_1 - u_2)] \qquad [53]$$

for all households with $Z_1 = Z_2$, whereas *1* and *2* are different households within one stratum. The vector of covariates cancels since it is approximately equally distributed for all households within each stratum. [53] states that if two households have different values of an unobserved variable, u, the difference in the odds of participation comprises the parameter γ and the difference in u. If unobserved variables do not influence the participation probability or if there are no differences in the unobserved variables, the odds ratio is 1, connoting no unobserved selection bias. The sensitivity analysis then aims at determining the effect of changing the values of γ and $(u_1 - u_2)$ on the inference of the treatment effect.

In general, the odds ratio can be rewritten as

$$\frac{1}{\Gamma} \leq \frac{\pi_1(1-\pi_2)}{\pi_2(1-\pi_1)} \leq \Gamma \,, \qquad [54]$$

whereas $\Gamma = exp(\gamma)$. This implies that households who appear similar in terms of Z may differ in their odds of participating in nonfarm employment. For example, if Γ*=2*, one of two households who have the same Z would be twice as likely as the other household to participate in nonfarm employment, i.e. these two households could differ in their odds of participation by as much as a factor of 2.

Under the assumption that a confounding variable u exists, equation [49] results in the sum of S independent random variables where the *s*th pair equals d_s with probability p_s, given as

$$p_s = \frac{c_{s1}exp(\gamma u_{s1}) + c_{s2}exp(\gamma u_{s2})}{exp(\gamma u_{s1}) + exp(\gamma u_{s2})} \,, \qquad [55]$$

and equals 0 with probability 1-p_s. With $\Gamma = exp(\gamma)$, p_s^+ and p_s^- are defined as follows:

$$p_s^+ \begin{cases} 0 & if\ c_{s1} = c_{s2} = 0, \\ 1 & if\ c_{s1} = c_{s2} = 1, \\ \frac{\Gamma}{1+\Gamma} & if\ c_{s1} \neq c_{s1}, \end{cases} \quad \text{and} \quad p_s^- \begin{cases} 0 & if\ c_{s1} = c_{s2} = 0, \\ 1 & if\ c_{s1} = c_{s2} = 1, \\ \frac{1}{1+\Gamma} & if\ c_{s1} \neq c_{s1}. \end{cases} \qquad [56]$$

Though the null distribution of $t(Z,r)$ is unknown, for each fixed γ, the null distribution is bounded by two known distributions T^+ and T^-, where

$$E(T^+) = \sum_{s=1}^{S} d_s p_s^+ \,, \qquad [57]$$

$$E(T^-) = \sum_{s=1}^{S} d_s p_s^- \,, \qquad [58]$$

$$Va(T^+) = \sum_{s=1}^{S} d_s^2 p_s^+ (1 - p^+) \,, \qquad [59]$$

$$Va(T^-) = \sum_{s=1}^{S} d_s^2 p_s^- (1 - p^-) \,. \qquad [60]$$

The formulas [57]-[60] can then be utilised to calculate the significance level of H_0, i.e. no effect of participation.

For any specific Γ, the bounds of the significance level of a one-sided test for no effect of participation are given as

$$\left(T - E(T^+)\right)/\sqrt{Var(T^+)} \quad \text{and} \quad [61]$$

$$\left(T - E(T^-)\right)/\sqrt{Var(T^-)}\,. \quad [62]$$

If the underlying sample is sensitive, the odds ratio for households with the same covariates, Γ, is close to 1, indicating that an unobserved variable influencing the participation decision alters the inference about the treatment effect. Insensitive samples require extreme values of the odds ratio to have the inference of the treatment effect influenced by an unobserved variable (Rosenbaum, 2002, p. 105ff; Aakvik, 2001, p. 129-132; DiPrete and Gangl, 2004, p. 304-306).

Finally, the PSM is not very restrictive due to its non-parametric setting and an appropriate approach for huge data sets (Guo et al., 2006, p. 367). This is an important advantage with respect to the other impact evaluation method, i.e. the Heckman two-stage model, since this is a parametric approach and therefore, some functional restrictions are requested and the normal distribution of the error terms needs to be assumed. Moreover, the PSM method accounts for both participants and non-participants and evaluates their differences in outcomes. However, this approach only controls for observables, whereas the Heckman two-stage method also controls for unobservables (Moffitt, 2004, p. 1). Although both approaches control for sample selection bias, only the PSM method also controls for bias reduction and hidden bias which is a major advantage relative to the Heckman two-stage method.

Another approach for analysing causal inference is the implementation of instrumental variables. Like the PSM method, the instrumental variable approach assumes that selection into treatment is random. Since the PSM method does not control for unobservables, this method is recommendable to account for possible unobservable variables influencing the model as well as in the presence of correlation between the exogenous variables and the error term or measurement errors regarding the covariates. Exogenous variation is therefore identified using a third variable, whereas this 'instrument' influences the participation decision but does not have an impact on the outcome given participation. This is the so-called 'exclusion restriction'. However, a major disadvantage of the instrumental variable approach is that the identification of valid instruments may be difficult and the

implementation of only weak instruments can cause problems and lead to inconsistent OLS estimates. Additionally, the exclusion restrictions are often questionable and due to the parametric design assumptions on the functional form are required, whereby the instrumental variable approach is more restrictive than the PSM approach (Greene, 2008, p. 314ff; Kennedy, 2008, p. 137ff; Jalan and Ravallion, 2003, p. 159).

7. Results of the Study

All estimations included in the study have been conducted using the STATA statistical package, version 10.1, and the data used is the GLSS 5.

7.1. Nonfarm Employment as a Risk-Coping Strategy

In this section, the results for the quantile regression utilising the CLAD estimator are to be presented. The research question underlying these calculations is whether income diversification, i.e. generating income from nonfarm activities, is an appropriate tool for rural households in Ghana to spread their income risk. Therefore, variables representing a risky environment are included in the model.

The explanatory variables included in the model are listed in Table 11.

Table 11: Explanatory variables included in the CLAD model

	Description	Mean	Std. Dev.
age	age of household (hh) head, in years	46.63	15.9
age^2	squared age of hh head, in years	2427	1649.28
gender	gender of hh head, 1=male, 0 otherwise	0.76	0.43
education	school years completed of hh head	5.53	5.74
under 16 yrs	number of hh members under 16 years	1.86	1.9
16 to 64 yrs	number of hh members between 16 and 64 years	2.23	1.46
over 64 yrs	number of hh members over 64 years	0.2	0.46
savings	amount of savings of the hh, in GHC	589730.7	6850194
income in kind	hh income in kind, valued in GHC	64094.57	764551.7
home production	value of self-sufficient production, in GHC	4197895	2.89e+07
livestock	value of livestock, in GHC	399649.7	1201061
farm land	value of farm land, in GHC	1.41e+07	9.22e+07
agricultural assets	value of agricultural assets, in GHC	75771.02	1997405
distance to school	distance to school, in minutes	11.05	25.65
distance to water	distance to water source, in metres	1992.45	20020.43

All calculations presented here have been conducted using the 'clad' command written by Jolliffe et al. (2000). Following the suggestion of Rogers (1993), residuals robust to violations of the assumption that the standard errors are identically distributed are computed using 10,000 bootstrap samples and the estimation is run for the rural subset of the GLSS 5 only since the focus of this research is the rural areas in Ghana. The McFadden R^2s reported are those of the last ILPA iteration with the final samples comprising 1,579, 4,241, and 5,005 observations, respectively, indicating the goodness of fit. The results of the CLAD estimator are presented in Table 12.

Table 12: Results for the CLAD estimator for rural households in Ghana (Author's calculations, GLSS 5)

share of nonfarm income	25%		50%		75%	
	Observed	t-Statistics	Observed	t-Statistics	Observed	t-Statistics
age	-0.0388404	(-4.88) ***	-0.0193257	(-4.86) ***	-0.0076319	(-2.35) **
age^2	0.0004148	(4.93) ***	0.0002183	(5.50) ***	0.0000937	(2.84) ***
gender	-0.4943292	(-7.13) ***	-0.3613482	(-10.54) ***	-0.1616475	(-7.10) ***
educational level	0.0499437	(5.35) ***	0.0378476	(14.74) ***	0.0192796	(8.83) ***
under 16 yrs	-0.0382381	(-1.60)	-0.0216983	(-1.78) *	-0.0189288	(-3.21) ***
16 to 64 yrs	-0.013589	(-0.35)	-0.0163	(-1.32)	-0.0168973	(-1.65) *
over 64 yrs	-0.0223907	(-0.25)	-0.0180524	(-0.44)	-0.0140743	(-0.40)
income in kind	0.0000000512	(3.41) ***	0.0000000451	(4.30) ***	0.0000000145	(2.65) ***
home production	0.00000000218	(0.005)	0.00000000139	(0.07)	0.000000000631	(0.14)
savings	0.00000000218	(0.60)	0.00000000375	(1.56)	0.000000000705	(0.43)
agricultural assets	0.0000000113	(0.14)	0.0000000116	(1.50)	0.00000000408	(0.48)
farm land	-0.0000000503	(-0.46)	-0.0000000123	(-2.15) **	-0.00000000298	(-2.48) **
livestock	-0.0000000426	(-0.19)	-0.0000000524	(-1.05)	-0.0000000294	(-2.88) ***
distance to school	0.0007237	(2.12) **	0.000159	(0.39)	0.0003834	(1.29)
distance to water	0.000000806	(0.78)	0.00000106	(1.41)	0.000000759	(2.49) **
McFadden R^2	0.1075		0.1425		0.1026	
Initial sample	5018		5018		5018	
Final sample	1508		4025		4976	

Notes: ***, **, and * denote the statistical significance at the 1%, 5% and 10% level. The t-statistics are given in parentheses.

Table 12 is organised as follows: In the first column, the explanatory variables are given and columns 2 and 3, 4 and 5, and 6 and 7, respectively, present the coefficient estimates, the t-statistics and the significance levels for the 25%, 50%, and 75% quartiles regarding the share of nonfarm income in total household income. Households in the 25% quartile can be regarded to have a slightly diversified income portfolio as far as the extent of nonfarm income compared to farm income is concerned, whereas households in the second quartile can be classified as mean diversified, and households in the third quartile have an extensively diversified income portfolio regarding nonfarm employment. The quantile regression analysis is a useful extension of previous research using the CLAD estimator (e.g. Jolliffe, 2004) since it allows to identify potential discrepancies regarding the impact of several factors between different extents of income diversification. Therefore, these findings are helpful to develop more efficient policy recommendations since the specific requirements among households with different participation intensities can be taken into consideration more effectively.

As mentioned above, activities in the nonfarm sector are less risky since they are not dependent on, for example, the weather or variances in input prices. But, according to the literature, households seem to face some entry barriers to nonfarm employment and other household characteristics seem to influence the diversification of the household's income portfolio as well. In this estimation, the impact of several household characteristics on the share of nonfarm income in total household income is examined to picture the effect of different factors on the extent of diversification. Additionally, factors associated with a risky environment have been emphasized and it is going to be tested whether such a risky environment forces households to engage in nonfarm employment, indicating that nonfarm activities can serve as a risk coping strategy for rural households in Ghana. Since the dependent variable is the share of nonfarm income in total household income ranging from 0 to 1, the coefficients for the explanatory variables are quite small, ranging from 0 to 1 as well.

According to subsection 6.1., the implementation of the CLAD estimator is an adequate approach in the presence of the common problem of heteroskedasticity in cross-sectional data, since the CLAD estimator is still consistent and asymptotically normally distributed even in the case of heteroskedastic or non-normally distributed error terms. To check whether heteroskedasticity is present,

the White test is performed to test the null hypotheses H_0 of homoskedasticity of residuals (White, 1980, p. 822). The result for White's general test statistic is $\chi^2(101) = 417.5374$ against a critical value of $\chi^2(150) = 193.21$ (see Table 13).

Table 13: Result for the White test of homoskedastic residuals (Author's calculations, GLSS 5)

White's Test Statistic	Degrees of Freedom	Critical Value
417.5374 ***	101	193.21

Note: *** denotes the statistical significance at the 1% level.

The H_0 of homoskedastic residuals can therefore be rejected at the 1% level indicating that the error terms of the underlying model are heteroskedastic and would lead to inconsistent estimates if the CLAD estimator is not implemented.

As far as the age of the household head is concerned, it is obvious that households in rural Ghana headed by older persons have a significantly lower share of nonfarm income in total income but this effect is diminishing as nonfarm diversification is intensifying. This finding contradicts results of previous research of e.g. Abdulai and CroleRees (2001), Gordon and Craig (2001), and Abdulai and Delgado (1999) but supports the work of e.g. Canagarajah et al. (2001) and Lanjouw et al. (2001) who also find a negative impact of older household heads on the household's nonfarm income. Younger household heads seem to be more willing to engage in nonfarm activities, whereas older households tend to remain with their habitual activities, i.e. agriculture, and therefore seem to be more bounded to their traditional activities. Furthermore, a life-cycle effect can be observed since an additional year of the household head decreases the extent of participation in nonfarm employment until the age of 46.8 years for slightly diversified households. Households headed by a person older than this threshold increase their extent of participation as far as moderate participation intensity is concerned. However, the extent of the age effect decreases as the share of nonfarm income increases, indicating that the impact of the household head's age is higher as long as the share is small. When households are already engaged in nonfarm employment, the influence of the household head's age on the decision to intensify the nonfarm activities is smaller and the threshold age also declines as the extent of participation increases. Among mean diversified households, households headed by a person older than 44.3 years and household heads of

extensively diversified households older than only 40.7 years are intensifying their engagement in nonfarm employment. Concluding, the age of the household head seems to play an important role especially as far as the initial decision to participate in the nonfarm sector is concerned and households already participating in nonfarm employment expand their participation intensity already at younger ages.

In subsection 4.3., it has been hypothesised that women are more likely to be excluded from nonfarm employment due to their usually lower educational level, their household duties, and traditional ways of living (e.g. Davis, 2003; Gordon and Craig, 2001). By contrast, this study reveals that households headed by a woman have significantly higher shares of nonfarm income in total income than male headed households, supported by findings from e.g. Canagarajah et al. (2001) and Jolliffe (2004). In Ghana, gender does not produce an entry barrier to nonfarm employment, but to agriculture. As mentioned in subsection 4.5.3., according to the traditional heritage law in Ghana, widows are disadvantaged since they do not inherit the land formerly owned by their husbands. The land, the livestock, and the agricultural equipment are given to the male relatives of the departed and the widow has to turn to activities outside the farm sector to generate income (UNDP, 2007b). The decreasing effect suggests that the gender of the household head, similar to the household head's age, is of greater importance at the beginning of nonfarm engagement than as far as the expansion decision is concerned.

A huge amount of literature deals with the impact of the educational level on the engagement in nonfarm activities. The majority emphasizes the character of education to state an entry barrier to nonfarm employment in general and high-return activities in particular. Since the household head is regarded to be responsible for the decision making process within the household, the household head's years of schooling are utilised to picture the impact of the educational level on the share of nonfarm income in total household income. An additional year of education significantly increases the share of nonfarm income in total income and therefore this finding agrees with the existent literature on education as an entry barrier to nonfarm employment (e.g. Vijverberg, 1995; Jolliffe, 1998; Jolliffe, 2004). Higher levels of education enable the household to engage in less risky and higher return activities like wage labour since these activities often require a certain level of education. Furthermore, better educated households are probably more successfully engaged in self-employment due to better skills. As a consequence,

households with less years of schooling probably are excluded from nonfarm employment or cannot run their business successfully. Therefore, these households are incapable to smooth income and cope with risk. In accordance with the previous findings regarding age and gender, the impact of an additional year of schooling is decreasing as the share of nonfarm income in total income is increasing, indicating that the marginal utility of an additional year of education is decreasing in already diversified households.

It has been hypothesised earlier that an additional household member decreases the extent of participation but the empirical evidence is quite mixed and the importance of the household composition has been stressed out. Therefore, the household has been decomposed into three age groups to identify possible differences in the impact among age groups. The number of persons under 16 years pictures the amount of care intense household members not belonging to the household's labour force. The elderly, i.e. over 64 years, also do not contribute to the labour force or are less efficient, whereas the amount of household members between 16 and 64 represent the possible labour force. Remarkably, the effect of all three age groups is not significantly different from 0 among slightly diversified households, indicating that the household's composition is not important regarding the initial decision to participate in nonfarm employment. As far as households with a mean extent of participation are concerned, only the number of children negatively impacts an additional intensification decision. In the case of an additional child, the need for care is higher obliging the mother to stay at home and the household's participation in nonfarm activities cannot be extended. However, regarding households extensively engaged in the nonfarm sector, the number of children as well as the number of adults representing the household's labour force significantly decrease the household's extent of participation. These findings are in accordance with e.g. Jolliffe (1998) but contradict the work of e.g. Reardon (1997) and Lanjouw et al. (2001) who argue that larger households are able to allocate a fraction of their labour force to nonfarm activities. An additional household member of the age group 16 to 64 years therefore seems to engage in farm activities. Since the effect of the household's composition is higher in the lower quartile, the presence of different age groups is mainly relevant for the expansion of diversification as long as the household has only mean levels of participation.

One indicator for a risky environment mentioned in 4.4. is income earned in kind instead of cash income. The amount of income paid in kind significantly increases

the extent of nonfarm employment. According to the literature, risk due to possible food price variability increases payments in kind (Bardhan, 1984, p. 69). Income paid in kind therefore indicates a risky environment and it is positively correlated with the engagement in nonfarm employment. As a consequence, it can be argued that nonfarm activities can serve as a risk-coping strategy since households perceiving their environment as risky will turn to nonfarm activities to manage these risks. The decreasing coefficient in the higher quartiles suggests that already diversified households are certain to be assured against risk due to their extent of nonfarm employment and the amount of kind income affects the initial decision to engage in nonfarm activities more intensely.

One further indicator for prevailing risk is the amount of self-sufficient agriculture. If households are faced with risk and not able to revert to insurance mechanisms, they tend to consume their own produced goods to save money (Abdulai and CroleRees, 2001; de Janvry et al., 1991). The value of the own production consumed by the household itself has a positive sign but no significant influence on the extent of nonfarm employment. This indicates that in the presence of, for example, food market failures households tend to expand their self-sufficient agriculture to smooth consumption and relocate their income portfolio towards nonfarm activities as a reaction to this risky environment.

As far as risk-coping is concerned, savings constitute an important household endowment. According to the literature, a household's financial capital plays a major role in enabling the household to smooth income and cope with risk. Savings can be used to start a small business or they are depleted for subsistence in times of shocks. In rural households in Ghana, savings do not seem to play a significant role regarding their effect on the extent of nonfarm employment[17]. However, consistent with e.g. Reardon et al. (1992), Morduch (1995), Reardon et al. (2000), and Abdulai and CroleRees (2001), the coefficients show a positive sign, indicating that the household's endowment with savings increases the share of nonfarm income in total income. Savings could therefore be used to start a nonfarm activity and cope with prevailing income shortfalls. The coefficient might not be significant since the levels of saving are not very high among rural households. In urban

[17] We are aware of possible endogeneity when using the household's savings as an exogenous variable. To test whether this possible endogeneity causes biased results, a robustness test can be conducted by excluding all households endowed with savings and rerunning the regression to check for possible sign reversals (see e.g. Jonasson and Helfand, 2009).

areas, a household's average amount of savings is 2.5 times higher than in rural areas.

The value of the household's endowments, i.e. livestock, farm land, and agricultural assets, also represents the household's ability to cope with risk since these factors are closely connected to the household's wealth and its level of risk aversion. According to the literature, valuable physical assets can have both an enhancing as well as reducing impact on nonfarm employment. On the one hand, households possessing valuable farm land, agricultural assets, and livestock tend to continue their agricultural production because of its effectiveness and since these assets also represent the household's wealth, the theory of decreasing risk aversion is confirmed. On the other hand, valuable assets can enable households to participate in the nonfarm sector, since they can serve as start-up capital requested to start a small business or as a guarantee for credits. Additionally, these assets can be sold in times of income shortfalls to smooth income and therefore serve as a risk-coping strategy (Barrett et al., 2005; Abdulai and CroleRees, 2001; Verpoorten, 2009; Dercon, 2002; Fafchamps et al., 1998). It has been concluded earlier that valuable physical capital can help overcoming possible entry barriers to nonfarm employment as well as serve as a risk-coping strategy on its own due to sales in times of income shortfalls. As far as agricultural assets are concerned, the estimation does not yield significant results, but the positive coefficient hints at a nonfarm employment enhancing effect of valuable agricultural equipment. This indicates that a household's endowment with valuable agricultural assets possibly enables it to overcome potential entry barriers to nonfarm employment. Noticeably, the value of the farm land possessed by the household negatively impacts only the share of nonfarm income in total income in the quartiles representing mean and extensive income diversification. This finding indicates that households with a mean or extensive share of nonfarm income in total income reduce this share if they possess valuable farm land. Therefore, the endowment with valuable farm land is a viable risk-coping strategy on its own, since land can be sold to smooth income and households not possessing valuable land need to turn to nonfarm activities to overcome income shortfalls. Additionally, the value of livestock owned by the household negatively impacts the extent of income diversification only in the quartile with the highest shares of nonfarm income in total household income. This finding is consistent with the result for farm land, suggesting that the endowment with valuable livestock can serve as a risk-coping strategy on its own since livestock can be sold in hard times. Moreover,

according to the theory of decreasing risk aversion, household's endowed with valuable physical capital, i.e. wealthy households, are less risk-averse and do not need to additionally engage in nonfarm employment. As a result, when a shock has occurred, households not endowed with valuable livestock need to engage in nonfarm employment to smooth their income. Households with moderate or mean diversification levels do not seem to possess valuable livestock and therefore the value of their livestock does not have an impact on their extent of nonfarm diversification. In contrast, households intensely engaged in nonfarm employment seem to be endowed with valuable livestock as well and therefore do not need to further expand their nonfarm activities. They are able to reduce risk by generating nonfarm income as well as selling livestock in times of income shortfalls. However, the endowment with valuable physical capital does not seem to influence households with only moderate levels of income diversification. When reminiscing about the findings regarding the household head characteristics, factors like age, gender, and the household size may be more dominating in the decision-making process.

Finally, the remoteness of a household also plays a major role regarding the household's extent and success of nonfarm activities. Households not having any sufficient access to infrastructure seem to be restricted from nonfarm employment (Abdulai and Delgado, 1999). Since information on the remoteness of households like the distance to the market, the distance to the next bigger settlement or the road density are not available in the dataset, the distance to the school, measured in minutes, and the distance to the next water source, measured in metres, have been utilised as proxies for the household's remoteness. Contradictory to the literature, households seem to expand their nonfarm employment as remoteness increases, indicating that more remote households seem to be excluded from markets for their agricultural products. As a consequence, it is important for the household's livelihood to be engaged in nonfarm activities. The distance to the water source and the distance to school both show positive coefficients but are significant for households intensely engaged and only slightly engaged in nonfarm activities, respectively. Therefore, only households living in remote areas are significantly dependent on income generated from nonfarm employment. These findings indicate that the household's remoteness has an impact on the initial participation decision as well as on the intensification decision. If remoteness is regarded as a risk for the household due to restricted access to agricultural markets, nonfarm employment seems to serve as an appropriate tool to spread

risk. However, it has to be noted that these two variables are only proxies for the household's remoteness and due to the contradictory results, they may be questionable.

To conclude, the engagement in nonfarm activities can be regarded as a risk-coping strategy for rural households in Ghana. This conclusion is supported by the fact that factors representing a risky environment like the amount of income earned in kind, the consumption of self-produced products, and the remoteness of the household have a nonfarm employment enhancing effect. Additionally, valuable physical capital like livestock and farm land seem to serve as a risk-coping strategy on their own, since they can be sold in times of income shortfalls to smooth income. But, in the absence of valuable assets, rural households need to turn to nonfarm activities to spread risk. However, the results also hint at the existence of entry barriers rural households are faced with when deciding to participate in nonfarm employment. An additional year of schooling of the household head is remarkably influencing the extent of nonfarm income generating processes and the household's endowment with savings and valuable agricultural equipment also seems to have a positive effect on the share of nonfarm income in total income. This is in accordance with the hypothesis formulated by Reardon et al. (1992) and Morduch (1995) that households lacking sufficient seed capital are more likely to be excluded from participating in the nonfarm sector. Finally, basic characteristics of the household like the age and gender of the household head and the household composition have a major impact on the extent of nonfarm employment, measured by the share of nonfarm income in total household income.

As initially mentioned, a quantile regression has been implemented to examine possible differences in the impacts between different extents of income diversification. Since most of the examined variables showed a higher impact among households with only moderate income diversification compared to mean or intense income diversification, they seem to be more important in the decision-making process regarding initial nonfarm employment than regarding the expansion of already established nonfarm activities. As a consequence, policy makers need to mainly focus on the promotion of initial participation in nonfarm employment. In order to provide the opportunity of participating in nonfarm employment to all and especially less wealthy households to spread risk, an enhancement of the household head's educational level should be targeted by increasing the enrolment ratio as well as the quality of schooling. Furthermore, as

the findings regarding the household's endowment with savings and valuable assets indicate, the access to credits as well as the provision of insurances needs to be improved. On the one hand, microcredits could enable the rural population not endowed with sufficient savings to engage in the nonfarm sector and on the other hand, efficient insurance mechanisms could serve as a substitute for valuable assets if participation in nonfarm employment is not realisable for households not endowed with valuable assets due to potentially insufficient availability. Moreover, the findings regarding basic household characteristics show that the gender of the household head significantly influences the extent of nonfarm engagement in general and the initial participation decision in particular. As already mentioned, the national heritage law is mainly responsible for this fact and therefore, policy makers need to primarily focus on improving the nonfarm activities' availability and facilitate the access to these income sources to alleviate the initial participation decision as well as to enable remote households to participate in the nonfarm sector. Furthermore, since households headed by males or older persons below a certain threshold are less engaged in nonfarm employment, the provision of information about nonfarm income sources as a risk-coping strategy could target these households and therefore enhance the engagement in these activities and consequently the spreading of risk.

Due to possible sample selection bias, the results for the Heckman two-stage method are presented in the next section to back up the CLAD results. First, a participation decision equation is estimated to analyse factors negatively influencing the participation probability serving as entry barriers. Furthermore, a participation intensity equation as well as a wealth equation are estimated to analyse the impact of several factors on the extent of participation as well as the household's wealth among households engaged in nonfarm employment.

7.2. Entry Barriers to Nonfarm Employment

On the one hand, the previous estimation implementing the CLAD estimator indicated differences between households with different levels of income diversification and on the other hand, some possible entry barriers have been revealed. Since the problem of sample selection bias is always present in estimations where values are censored and therefore resulting in a concentration at one value, it is recommendable to additionally implement the Heckman two-

stage method. As explained earlier, this model accounts for this possible sample selection bias by estimating λ, an additional explanatory variable included in the second-stage equation. Since λ is the product of $\rho = corr(\varepsilon_i, u_i)$ and σ, the second-stage OLS estimation would not lead to consistent estimates in the presence of selectivity and λ not included. In addition to this important feature, the Heckman two-stage method allows to examine the probability of participation in nonfarm employment and the factors influencing this probability, respectively. The following table summarises the variables included in the Heckman two-stage method (see Table 14).

Table 14: Explanatory variables included in the Heckman two-stage method

	Description	Mean	Std. Dev.
age	age of household (hh) head, in years	45.36	15.58
age^2	squared age of hh head, in years	2299.91	1588.57
gender	gender of hh head, 1=male, 0 otherwise	0.72	0.45
education	school years completed of hh head	7.38	6.14
under 16 yrs	number of hh members under 16 years	1.86	1.9
16 to 64 yrs	number of hh members between 16 and 64 years	2.23	1.46
over 64 yrs	number of hh members over 64 years	0.2	0.46
locality	locality of the hh, 1=rural, 0 otherwise	0.6	0.49
savings	amount of savings of the hh, in GHC	946681.7	8279213
home production	value of self-sufficient production, in GHC	2738513	2.25e+07
livestock	value of livestock, in GHC	263442.8	971179.9
farm land	value of farm land, in GHC	9878517	7.42e+07
distance to school	distance to school, in minutes	10.71	23.93
distance to water	distance to water source, in metres	1652.26	17631.55
education*land	interaction term	719.87	14684.02
household size*land	interaction term	680.93	10955.19

One the one hand, the Heckman two-stage method has been implemented to estimate the probability of participation. Moreover, the influence of selected factors on the extent of participation, i.e. the share of nonfarm income in total income, as well as on the household's total expenditures as a proxy for the household's wealth is to be analysed for participating households.

The Participation in Nonfarm Employment

Table 15 shows the probit estimates for the nonfarm employment participation and the additionally calculated marginal probabilities. The McFadden R^2 is 0.1743, indicating the goodness of fit of the probit model implemented. The likelihood ratio is 1371.82 and significant at the 1%-level against a critical value of $\chi^2(16) = 32.00$. This suggests that the H_0 that all exogenous variables are 0 can be rejected and therefore the model implemented is reasonable.

Table 15: Probit estimates for the nonfarm employment participation (Author's calculations, GLSS 5)

	Coefficients	t-Value	Marginal Probability
age	-0.0218925 ***	-3.14	-0.0044204
age^2	0.0002389 ***	3.32	0.0000482
gender	-0.4095536 ***	-8.98	-0.0743231
education	0.05531226 ***	15.76	0.0111683
under 16 yrs	-0.0002856	-0.03	-0.0000577
16 to 64 yrs	-0.0086123	-0.60	-0.0017389
over 64 yrs	0.0596968	1.13	0.0120535
locality	-1.033237 ***	-21.21	-0.1888839
savings	0.0000000337 ***	3.27	0.00000000680
home production	0.00000000212 *	1.95	0.000000000428
livestock	-0.00000000283	-0.18	-0.000000000572
farm land	-0.000000000838 ***	-3.67	-0.000000000169
distance to school	0.0027217 ***	2.75	0.0005495
distance to water	0.00000157	1.41	0.000000317
education*land	-0.000021 ***	-3.88	-0.00000424
household size*land	0.0000631 ***	4.53	0.0000127
number of observations	8385		
McFadden R^2	0.1732		
Likelihood ratio	1371.82		

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

In accordance with the CLAD results and in contrast to former studies by e.g. Abdulai and CroleRees (2001) and Lanjouw et al. (2001), the age of the household head negatively impacts the probability of participating in nonfarm employment.

Households headed by a younger person are more likely to engage in nonfarm activities, whereas households with older household heads are less likely to participate in the nonfarm sector, indicating that they are more likely to remain with their traditional occupation, i.e. agriculture. The life-cycle effect revealed states that an additional year of the person heading the household decreases the probability of participation with the maximum effect at the age of 45.8 years, whereas older household heads increase the probability of participating in nonfarm employment. As a consequence, households headed by younger as well as older persons are more likely to engage in nonfarm employment and households headed by persons under 45.8 years tend to remain with their habitual farming activities. Younger household heads possibly lack the experience or the assets to successfully engage in agriculture and senior household heads potentially are not able to run their farm properly anymore due to illness or physical infirmity. However, the probability reducing effect of age is higher than the life-cycle effect, indicating that mainly the young households are likely to participate in nonfarm employment.

As far as the gender of the household head is concerned, the probit results correspond with the CLAD results and the study of Corral and Reardon (2001), suggesting a higher probability of participating in nonfarm activities for female headed households. The majority of households is headed by males and female household heads are mostly caused by the death of the husband. Since the traditional Ghanaian heritage law disadvantages the widows regarding the inheritance of livestock and farm land, households headed by a female are pushed towards nonfarm employment to generate the household's income (UNDP, 2007b).

According to e.g. Vijverberg (1995), Corral and Reardon (2001), Lanjouw et al. (2001), and Jolliffe (1998, 2004), the educational level of the household head significantly increases the household's participation decision since most of the activities in the nonfarm sector like wage-labour or running a small business require a certain level of education. The findings presented here agree with these studies and therefore the education of the household members, represented by the household head's years of schooling, serves as an entry barrier to nonfarm employment. Households without well-educated household heads are therefore consequently excluded from nonfarm activities often regarded to offer higher returns and to be less risky (compare subsection 4.2.).

In contrast, the composition of the household does not seem to determine the participation probability at all. Neither the number of children, nor the number of

household members in the working age or the number of elder household members have a significant influence on the household's probability to participate in nonfarm employment. This may be explained by the fact that a lot of nonfarm activities like handicrafts can be done at home. However, the coefficients, although insignificant, indicate that children and adults might have a negative impact on the probability of participation, supporting the findings for age and hypothesis that women are excluded from nonfarm employment due to child care.

Since this estimation also includes the urban households, the binary variable for locality is included to examine the influence of the fact that a household is located in a rural area on the participation probability. Obviously, urban households are significantly more likely to engage in nonfarm activities. The most evident explanation for this finding is the superior availability of nonfarm employment in urban areas, whereas in rural areas activities like wage labour are not or only barely available. Furthermore, due to the lack of sufficient infrastructure in rural areas, launching a small business is quite difficult (Abdulai and Delgado, 1999). The location in rural areas therefore states an important entry barrier to nonfarm employment and since the main occupation available is agriculture, rural households are exposed to the risks connected with the farm sector like weather shocks or harvest shortfalls due to illness.

In the CLAD model, the household's endowment with savings did not show a significant influence on the share of nonfarm income in total income, although the coefficient indicated some entry barrier overcoming effect. In this analysis, the amount of savings significantly increases the probability of participating in nonfarm employment. Households in possession of saved money are more likely to engage in nonfarm activities than households without savings. Since savings are hypothesised to be necessary start-up capital to start a small business, not being endowed with savings obviously states an entry barrier to nonfarm and therefore to higher-return and less risky activities (Reardon et al., 1992; Morduch, 1995).

In section 4.4., the extent of self-sufficient agriculture has been hypothesised to represent a risky environment since poor farmers tend to expand their consumption of self-produced goods in the absence of alternative insurance mechanisms or efficient food markets (Abdulai and CroleRees, 2001; de Janvry et al, 1991). Thus, the value of consumed goods produced on the own farm significantly increases the probability of participating in nonfarm income generating processes. It can therefore be affirmed that households perceiving their environment as risky are

more likely to engage in nonfarm activities and as a consequence, nonfarm employment can be regarded as a strategy to cope with risk.

However, households endowed with valuable physical capital like livestock or farm land are less likely to participate in nonfarm activities. As already mentioned in section 7.1., households often capitalise their valuable assets in order to smooth consumption in times of income shortfalls (Barrett et al., 2005; Abdulai and CroleRees, 2001; Verpoorten, 2009; Dercon, 2002; Fafchamps et al., 1998; Corral and Reardon, 2001; Lanjouw et al., 2001). Consequently, valuable agricultural assets can be regarded as some kind of entry barriers, since well endowed households are able to run their farm properly and are not dependent on nonfarm activities to generate the household's income or to spread risk. In the absence of valuable endowments, however, households seem to be forced into nonfarm employment since farming would not be successful due to low quality of assets. Since the endowment with valuable assets also represents the household's wealth, these findings also support the theory of decreasing risk aversion. Households endowed with valuable physical capital are less risk-averse and therefore less likely to participate in nonfarm employment.

It has been explained earlier that rural households seem to be excluded from nonfarm activities to some extent due to their location and lack of insufficient infrastructure. The distance to school measured in minutes, and the distance to the water source measured in metres, are implemented as proxies for the remoteness of the household to further examine the impact of the household's location on its participation probability. In accordance with the findings for the household's locality, one would expect remote households to be less likely to engage in nonfarm employment. But, increasing remoteness significantly increases the probability of participating in nonfarm employment, supported by e.g. Corral and Reardon (2001). The lack of sufficient infrastructure can exclude remote households to access food markets to sell their agricultural products. As a consequence, other activities off the farm are required to generate the household's income. One possible nonfarm employment defined in this study is renting out agricultural equipment or livestock and the sale of water. These are activities a remote household could engage in to not be dependent on agriculture as well as nonfarm activities requiring sufficient infrastructure and access to the market. However, since these measures are only proxies for the remoteness of the household, it is not quite sure if these results are reliable.

To further stress the impact of several entry barriers to nonfarm employment, interaction terms are included in the model. On the one hand, the educational level in years is multiplicated with the value of the farm land, whereas the value of land is a proxy for the household's wealth. In contradiction to e.g. Abdulai and CroleRees (2001), this interaction term has a significantly negative impact on the probability of participating in nonfarm employment. Therefore, households with the same educational level of the respective household head but with more valuable farm land and households with the same level of wealth but with a better educated household head are less likely to engage in nonfarm activities, respectively. Well-educated households endowed with valuable farm land seem to engage more intensely in their agricultural production since they can benefit from their education to run their farm successfully. Furthermore, their valuable assets seem to serve as a sufficient insurance mechanism and it is not necessary to additionally participate in the nonfarm sector. Consequently, if no such insurance mechanisms are available to households, education is a major constraint regarding the participation in nonfarm employment.

The second interaction term includes the household size and again the household's wealth represented by the value of the farm land. Corresponding to e.g. Abdulai and CroleRees (2001), households with the same wealth level but a higher amount of family members and households of equal size but with more valuable farm land, respectively, are more likely to participate in nonfarm activities. This finding is quite surprising since, as shown earlier, the composition of the household did not have any significant impact on the probability of participating in nonfarm employment and wealthier households are less likely to participate in nonfarm employment. However, the fulfillment of the needs of a larger household, i.e. consumption smoothing, seems to overweigh the household's perceived wealth represented by the value of the household's farm land endowment and households seem to be more risk-averse. Therefore, as the number of household members increases, the household head's opinion that the agricultural income is sufficient and the capitalisation of physical capital is a useful consumption smoothing strategy seems to change and the household additionally participates in nonfarm activities.

The Extent of Participation

The results for the participation intensity equation are presented in Table 16. Since the estimation of the extent of participation requires the deletion of at least one variable used in the participation equation, two variables of the initial set of variables are left out in the second stage. This deletion is necessary to allow for the identification of the model and the variables left out therefore serve as identifying instruments. Here, the two interaction terms are left out. The Wald test statistic for the joint significance of these variables is 20.75 and is significant at the 1%-level against a critical value of $\chi^2(2) = 9.21$. These variables can therefore be regarded as appropriate instruments. The adjusted R^2 is 0.31, indicating that the variables implemented are reasonable, and the Wald test also confirms this fact. The Wald test statistic is 364.10 and significant at the 1%-level against a critical value of $\chi^2(14) = 29.14$. Therefore, the H_0 that all independent variables are 0 can be rejected. Additionally, as mentioned earlier, White's formula was used to calculate robust residuals due to heteroskedasticity of the standard errors.

Table 16: Parameter estimates of the extent of participation in nonfarm employment (Author's calculations, GLSS 5)

	Coefficients	White's t-Value
age	-0.0074597 ***	-5.08
age^2	0.000075 ***	4.86
gender	-0.0831854 ***	-7.89
education	0.0069943 ***	6.03
under 16 yrs	-0.014187 ***	-6.19
16 to 64 yrs	-0.0034825	-1.17
over 64 yrs	-0.0323936 ***	-2.74
locality	-0.2078315 ***	-11.87
savings	0.000000000635	1.56
home production	0.000000000196	1.28
livestock	-0.0000000264 ***	-5.87
farm land	-0.000000000227 ***	-4.80
distance to school	-0.0000377	-0.25
distance to water	0.000000258	1.29
λ	-0.1826196 ***	-3.45
$\bar{R}^2$	0.31	
Wald statistics	364.10	

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

The selectivity term λ is significantly different from 0 at the 1%-level, indicating that the error terms of the first-stage and second-stage equations are correlated and the participation intensity equation would have resulted in biased results if the selectivity term had not been included in the estimation. The negative sign indicates that the error terms in the participation probability and the participation intensity equations are negatively correlated.

The findings agree with the findings of the quantile regression using the CLAD estimator and therefore support the findings of e.g. Canagarajah et al. (2001) and Lanjouw et al. (2001). The age of the household head negatively impacts the share of nonfarm income in total income, indicating that among participants households headed by younger persons have a higher probability of diversifying their income portfolio. Households headed by older persons often are more connected with their

traditional occupation, agriculture, and they engage in nonfarm activities only to spread their income risk. In contrast, younger households are more receptive to new ways of income generating and therefore more likely to engage in nonfarm employment to a larger extent. This life-cycle effect has its maximum at 49.7 years, indicating that as the age of the household head increases up to 49.7 years, the extent of the household's income diversification decreases. In contrast, households headed by persons older than 49.7 years extend their participation in nonfarm employment.

The gender of the household head still plays a significant role among the participants of nonfarm employment. A household headed by a male still has a lower share of nonfarm income in total income, but this effect is much smaller than revealed in the CLAD results (e.g. Canagarajah et al. 2001; Jolliffe, 2004). Due to the restrictions of females to the agricultural sector, it is obvious that mostly female headed households expand their income diversification, whereas male headed households still remain with their agricultural production and utilise the income generated from nonfarm activities only to spread income risk.

In accordance with e.g. Vijverberg (1995) and Jolliffe (1998, 2004), as far as the household head is concerned, an additional year of education significantly extends the household's participation in nonfarm employment. As hypothesised earlier, the level of education is a major entry barrier to nonfarm employment since a lot of nonfarm activities like wage labour or running a small business require a certain level of education to be engaged in successfully.

As far as the impact of the household's composition on the extent of participation on nonfarm employment is concerned, the results correspond with the findings of the CLAD estimation and agree with previous studies by e.g. Reardon (1997), Jolliffe (1998), and Lanjouw et al. (2001). An additional family member under 16 years, i.e. a child, and an additional family member over 64 years, i.e. an old person, have a negative impact on the extent of income diversification among households participating in nonfarm employment. Children as well as elder persons are not participating in the household's labour force and furthermore, small children are more care demanding, probably excluding adults to participate in nonfarm employment.

The result for the locality the household is living in is consistent with the finding for the participation decision (Abdulai and Delgado, 1999). Due to insufficient

infrastructure and restricted availability, households engaged in nonfarm activities have a higher extent of income diversification only if they are living in urban areas. This suggests that rural households are excluded from nonfarm employment to a large extent due to unavailability of such activities.

In contrast to the results for the participation decision probability, the household's amount of savings as well as the value of self-sufficient agriculture do not have any significant impact on the extent of nonfarm employment. Since these factors only influence the participation decision, savings therefore state a major entry barrier to nonfarm employment but not to the extent of participation.

However, the household's endowment with valuable physical capital, i.e. the household's wealth, also negatively impacts the intensity of participation. On the one hand, this finding is in accordance with the results for the CLAD estimator but moreover, these findings strongly support the theory of decreasing risk aversion. Poorer households, i.e. households endowed with less valuable assets, are more risk-averse and therefore extend their participation in nonfarm activities, whereas wealthier households reduce their extent of participation.

Finally, the two variables implemented as proxies for the remoteness of the household do not reveal any significant impact of the household's remoteness on the extent of participation in nonfarm employment. In contrast, the household's remoteness measured by the distance to school in minutes negatively positively influenced the probability of participation. This suggests that the remote households are more likely to engage in nonfarm employment than less remote households but as they are already participating in the nonfarm sector, the extent of participation is not influenced by the extent f remoteness. This may be due to the fact that generally, nonfarm work is less available in remote areas, but if there are some activities accessible the amount seems to be sufficient.

The Household's Wealth

The results for the household's wealth equation, represented by the household's total expenditures, are presented in Table 17. Again, the two interaction terms are left out. The Wald test statistic for the joint significance of these variables is 20.75 and is significant at the 1%-level against a critical value of $\chi^2(2) = 9.21$. These variables can therefore be regarded as appropriate instruments. The adjusted R^2 is 0.4083, indicating that the variables implemented are reasonable, and the Wald

test also confirms this fact. The Wald test statistic is 4169.67 and significant at the 1%-level against a critical value of $\chi^2(14) = 29.14$. Therefore, the H_0 that all independent variables are 0 can be rejected. Additionally, as mentioned earlier, White's formula was used to calculate robust residuals due to heteroskedasticity of the standard errors.

Table 17: Parameter estimates of the household's wealth (Author's calculations, GLSS 5)

	Coefficients	White's t-Value
age	779,689.4 ***	4.71
age^2	-7,648.09 ***	-4.40
gender	815,655.3	0.69
education	709,682.7 ***	5.42
under 16 yrs	1,214,946 ***	4.70
16 to 64 yrs	3,491,942 ***	10.36
over 64 yrs	2,205,437 *	1.65
locality	-7,624,772 ***	-3.84
savings	0.3837207 ***	8.43
home production	0.9857369 ***	57.43
livestock	-0.6058719	-1.18
farm land	0.0318956 ***	6.01
distance to school	53,754.29 ***	3.15
distance to water	0.1034312	0.00
λ	-0.000000148 **	-2.46
$\bar{R}^2$	0.4083	
Wald statistics	4169.67	

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

As mentioned earlier, the wealth equation is implemented to measure the household's wealth, represented by the household's total expenditures, among households participating in nonfarm employment. Again, the selectivity term λ is significantly different from 0 at the 1%-level, indicating that sample selection bias would have resulted if the selectivity term had not been included in the estimation. The negative sign indicates that the error terms in the selection and the wealth equations are negatively correlated.

The age of the household head has a significantly positive impact on the household's total expenditures, suggesting that as the age of the household head increases, the household's total expenditures increase as well. This effect has its maximum at 50.9 years of the household head, suggesting that households headed by persons of 51 years or older have lower total expenditures and are therefore less wealthy. In general, only the amount of money earned can be spent and therefore, this finding indicates that older households earn more than younger households, resulting from their higher degree of working experience, in agriculture as well as in the nonfarm sector (compare e.g. Jolliffe, 1998). But as the age of the household head increases, income seems to fall due to reduced efficiency or illness. This finding is in accordance with the outcome of Jonasson and Helfand (2009) in their study about Brazil.

The total expenditures of male headed households are significantly higher than those of female headed households among households participating in nonfarm employment. A higher educational level may enable households headed by a male to engage in farm as well as nonfarm activities more successfully and as a consequence, female headed households engaged in nonfarm employment seem to be threatened more by poverty than households headed by a male. This is also confirmed by the findings of Jonasson and Helfand (2009). As a consequence, the study will also examine the causal effect of participating in nonfarm employment on the household's wealth and poverty status subject to different social groups (see chapter 7.3.).

In addition to this and agreeing with e.g. Jonasson and Helfand (2009), Reardon et al. (2000), and Vijverberg (1995), an additional year of schooling of the household head significantly increases the household's total expenditures among households engaged in nonfarm work. As already mentioned, nonfarm activities often yield higher returns and only persons with a certain educational level have access to these less risky and higher return activities. Furthermore, a higher level of education of the household head probably enables the household to run their nonfarm activities more efficiently.

Moreover, the household's composition significantly increases the household's total expenditures, whereas the direction of the effect is equal for all three age groups but the extent differs remarkably. The wealth impact is highest for an additional family member of the age between 16 years and 64 years since this age span constitutes the main labour force of the household. The effect of children

under 16 years is lowest since young family members do not contribute to the household's income. Remarkably, the composition of the household has no impact on the probability of participation in nonfarm employment, but among participants the household's composition negatively influences the extent of participation and significantly increases the household's wealth.

In accordance with previous findings of this study and Jonasson and Helfand (2009), rural households engaged in nonfarm activities have lower total expenditures than urban households, suggesting that rural households yield lower incomes as well. Households in rural areas engaged in nonfarm employment seem to be not very successful. As a consequence, rural poverty may even increase despite the presence of nonfarm activities as a substitute for agricultural production since this substitute does not seem to be practicable due to the remoteness of the household. Consequently, the study will also examine the causal effect of participating in nonfarm employment on the household's wealth and poverty status subject to different social groups (see chapter 7.3.).

As far as the initial wealth status of the household is concerned, the amount of savings as well as the value of farm land have an impact significantly different from 0 at the 1%-level on the household's total expenditures. This finding is not surprising since these household characteristics are closely connected and are also confirmed by Bryceson (1999) and Gordon and Craig (2001). However, households participating in nonfarm employment and not endowed with these assets, i.e. poorer households, also have lower total expenditures, indicating that they generate lower income. As already mentioned, these differences in economic performance among participants will be addressed in the next section.

Originally, the value of self-sufficient agriculture captured the household's risk perception due to food price variability. However, among households engaged in nonfarm activities, self-sufficient agriculture seems to positively influence the household's wealth. This is simply due to the reduction of food costs since less food is to be purchased and more money can be spent on other goods.

As far as the remoteness of the household measured by the distance to school in minutes is concerned, more remote households engaged in nonfarm work seem to be wealthier referring to the household's total expenditures. This contradicts the findings of Jonasson and Helfand (2009) and may be due to the fact that nonfarm activities are less accessible in remote areas, but if they are households only

participate if these activities are profitable, whereas this might also include a long distance to work.

To conclude, as far as the probability of participation is concerned, the results are in accordance with the results for the CLAD estimator. The main entry barriers to nonfarm employment are therefore the educational level of the household head, the household's location in rural areas, the household's endowment with savings and the remoteness. Additionally, the examination of the impact of several factors on the total expenditures among households participating in nonfarm employment indicates that nonfarm activities do not seem to be identically profitable for every participating household. As a consequence, the results of the PSM method will be presented in the next section to analyse the causal effect of the participation decision on the household's poverty status and differences among several social groups.

7.3. Income Diversification and Poverty Reduction

As indicated in the previous section, households participating in nonfarm employment seem to differ in their outcome regarding total household expenditures. Overall, the question arises whether participation in nonfarm activities, besides the ability to spread risk shown in section 7.2., also can enhance the household's wealth and improve its poverty status, respectively. The PSM method is implemented to compare participating households and not participating households with respect to the causal effects of participating in nonfarm employment on the households' per-head expenditures, as a proxy for the households' wealth, and the households' poverty status. On the one hand, the poverty gap is utilised to evaluate the effect of participation on the depth of poverty, i.e. whether participation in nonfarm employment is capable of reducing poverty, and additionally, the poverty status is measured by a binary variable, equaling 1 if the household's per-head expenditures fall below the poverty line. Thus, the poverty status is implemented to analyse whether the participation in nonfarm activities changes the household's economic situation from poor to non-poor, i.e. whether the engagement in nonfarm employment has the potential to eliminate poverty. In order to evaluate differences among diverse social groups, the PSM is not only conducted for the whole dataset, but also for the rural, male, female, rural male, rural female, poor, non-poor, rural poor, rural non-poor, and the rural poor

female subsamples. The subsamples are achieved by either excluding the urban households, the female and the male headed households, respectively, and the households not reporting per-head expenditures below the poverty line regarding the lower and higher threshold, respectively. To be able to compare the effects on the various outcomes among the social groups, the results for the particular outcomes will be presented for all subsamples. In order to get a first insight in possible differences between participants and non-participants among the different subsamples, Table 18 presents the summary statistics of household characteristics of participants and non-participants for the whole dataset.[18]

Table 18: Household characteristics (sample means) of participants and non-participants, summary statistics for the total dataset (Author's calculations, GLSS 5)

Ghana	Non-Participants	Participants	Difference
age	46.34	45.14	1.19 ***
education	4.13	8.09	-3.97 ***
household size	4.86	4.16	0.69 ***
per-head expenditures	3,709,981	8,499,462	-4,789,481 ***
poverty gap (low)	706,191.1	263,649.8	442,541.3 ***
severity of poverty (low)	0.1432	0.0488	0.0943 ***
savings	202,153.7	1,110,868	-908,714.2 ***
income in kind	0	123,807.1	-123,807.1 ***
home production	3,162,327	2,645,052	517,274.6
livestock	445,008	223,403.3	221,604.7 ***
farm land	14,000,000	8,975,149	4,999,827 **
distance to school	9.22	11.04	-1.82 ***
distance to water	1,345.74	1,719.86	-374.12
number of households	1,515	6,870	8,385

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

The *t*-statistics of the mean difference indicates that participating and not participating households are partly different regarding their household characteristics such as the age and the educational level of the household head, the household size, the poverty level, the wealth represented by the household's

[18] Please find the summary statistics for the other subsamples in Annex 6, Tables 35-49.

per-head expenditures and the value of the livestock and farm land, the perception of risk represented by the amount of income paid in kind, and the remoteness of the household measured by the distance to school. On average, households participating in nonfarm employment therefore seem to be headed by a younger person whose educational level is remarkably higher, and the household size is slightly smaller. Remarkably, households not participating in nonfarm employment show higher poverty levels than their participating counterparts and poverty is more severe. Participants have a higher average amount of savings, a higher amount of income is paid in kind, they are endowed with less valuable physical capital, and they seem to live in more remote areas. Except with respect to the household size and the extent of self-sufficient agriculture, these findings agree with the previous results for the CLAD estimator and the Heckman two-stage method. Consequently, it may be reasoned that households participating in nonfarm employment are systematically different from households not participating and this difference may occur due to the households' self-selection into participation.

As explained in section 6.3., a probit model has been employed to predict the probability to participate in nonfarm employment. The variable choice was based on previous research and only variables simultaneously influencing the participation decision as well as the outcome have been included. As a consequence, a large set of variables has been utilised to reduce the likelihood of excluded unobservables (Caliendo and Kopeinig, 2008, p. 38). Table 19 shoes the probit estimates of the nonfarm employment participation decision.

The McFadden R^2 as an indicator of the goodness of fit is 0.1956 and the Likelihood ratio is 1549.53 and significant at the 1%-level against a critical value of $\chi^2(30) = 50.89$. This suggests that the H_0 that all exogenous variables are 0 can be rejected and therefore the model implemented is reasonable.

In accordance with the findings for the participation decision equation in section 7.2., the probability of participating in nonfarm employment decreases as the age of the household head increases and an additional year of schooling increases the participation likelihood. Female headed households are more likely and households located in rural areas are significantly less likely to participate in nonfarm work. The household's composition does not seem to have any impact on the participation decision, whereas wealthier and better educated households are less likely and wealthier and larger households are more likely to engage in

nonfarm activities. As far as the district fixed effects are concerned, households living in the southern regions Volta and Greater Accra are more likely to participate in nonfarm employment due to the urban character of especially the Greater Accra region. In contrast, households living in the northern regions Brong Ahafo, Upper East, and Upper West have a lower probability of participating in the nonfarm sector. As stressed in sections 3 and 4, the northern regions are the poorest and the least diversified across the whole country.

Table 19: Probit estimates of the nonfarm employment participation decision (Author's calculations, GLSS 5)

Variable	Coefficient	t-Value	Marginal Probability
age	-0.0228205 ***	-3.19	-0.0041634
age^2	0.0002421 ***	3.31	0.0000442
gender	-0.3986863 ***	-8.42	-0.0651637
education	0.0480717 ***	12.27	0.0087703
hh members < 7 years	0.0072193	0.40	0.0013171
hh members 7-15 years	0.0051362	0.31	0.0009371
hh members 16-64 years	0.0030731	0.20	0.0005607
hh members > 64 years	0.0822469	1.53	0.0150053
household size*land	0.0000519 ***	3.75	0.00000946
education*land	-0.0000182 ***	-3.44	-0.00000333
locality	-0.9536999 ***	-18.66	-0.1584574
district fixed effects (dummies)			
Central	-0.046438	-0.56	-0.0086808
Greater Accra	0.9781619 ***	6.71	0.1140598
Volta	0.2599299 ***	3.02	0.0412888
Eastern	0.1296673	1.61	0.022172
Ashanti	-0.0896233	-1.26	-0.016942
Brong Ahafo	-0.3699603 ***	-4.84	-0.0806573
Northern	-0.0902439	-1.11	-0.0172324
Upper East	-0.2143867 **	-2.58	-0.0437299
Upper West	-0.2071849 **	-2.37	-0.0422239

Table 19 *(continued)*

Variable	Coefficient	t-Value	Marginal Probability
savings	0.0000000347***	3.34	0.00000000633
home production	0.00000000167	1.46	0.000000000305
livestock	0.00000000975	0.60	0.00000000178
farm land	-0.000000000704***	-2.99	-0.000000000128
distance to school	0.0026964 ***	2.71	0.0004919
distance to water	0.00000174	1.56	0.000000317
number of observations	8385		
McFadden R^2	0.1956		
Likelihood ratio	1549.53		

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

The household's amount of savings has a positive impact on the participation probability since start-up capital is a frequently mentioned entry barrier to nonfarm employment in general and to nonfarm self-employment in particular. As already shown in section 7.2., poorer and more remote households are more likely to participate in nonfarm employment, indicating that poorer households are more risk-averse.

The overlap assumption requires that matching is performed only in the region of common support, whereas observations from one group are dropped if their p-score is less than the minimum p-score or higher than the maximum p-score of the opposite group (Leuven and Sianesi, 2003; Caliendo and Kopeinig, 2008, p. 45). The distributions of the propensity score and the common support for the p-score estimation for the per-head expenditures as an outcome for the total sample and the rural subsample are presented in Figure 8. The distributions of the propensity score and the common support for the p-score estimation for all outcomes and subsamples are presented in Annex 7, Figures 11 to 15.

Figure 8: Propensity score distribution and common support for p-score estimation regarding per-head expenditures, total and rural subsample (Author's calculations, GLSS 5)

Per-Head Expenditures

The empirical results of the causal effects of participating in nonfarm employment on the household's per-head expenditures are presented in Table 20 and the indicators of the matching quality are shown in Table 21. The notions '(low)' and '(high)' refer to the lower and upper poverty line discussed in subsection 3.4.1., respectively.

Table 20: Average treatment effects and results of the sensitivity analysis, regarding per-head expenditures (Author's calculations, GLSS 5)

per-head expenditures	Caliper	ATT	t-Stat.	Critical Level of Γ	No. of Treated	No. of Controls
Ghana	0.00015	986,866.076	3.02 ***	1.25	272	240
rural	0.001	1,397,768.78	2.64 ***	1.25	460	399
male	0.0015	1,246,061.31	3.22 ***	1.25	484	447
female	0.0015	2,098,519.53	2.37 ***	1.25	60	48
rural male	0.005	714,988.209	3.28 ***	1.3	882	729
rural female	0.001	958,319.439	1.68 *	1.1	72	59
poor (low)	0.009	123,539.316	2.29 **	1.2	494	443
poor (high)	0.001	121,586.638	1.28	-	227	228
non-poor (low)	0.001	3,084,094.26	2.35 **	1.45	114	86
non-poor (high)	0.0015	2,366,282.87	2.27 **	1.2	87	68
rural poor (low)	0.005	179,030.066	2.88 ***	1.35	371	339
rural poor (high)	0.0015	268,248.141	2.92 ***	1.45	241	228
rural non-poor (low)	0.001	2,740,512.07	4.22 ***	1.85	107	87
rural non-poor (high)	0.002	2,298,966.35	3.95 ***	2.2	65	57
rural poor female (low)	0.001	590,952.3	2.11 **	1.5	10	10
rural poor female (high)	0.002	366,842.897	1.46	-	35	28

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

In general, the participation in nonfarm employment has a positive effect on welfare, supporting the findings of e.g. Ersado (2005) and Adjasi and Osei (2007). The causal effect of participation in nonfarm employment on the households' per-head expenditures is significantly positive for all the subsamples, except for the poor regarding the higher poverty line, i.e. the less poor, and the poor females regarding the higher poverty line living in rural areas. The effect is highest for the non-poor households regarding the lower poverty line whose per-head expenditures are higher by 3,084,094.26 GHC due to participation, and the lowest effect is experienced by the households in extreme poverty. For these households, the causal effect of engaging in nonfarm employment only equals 123,539.316 GHC, indicating that the per-head expenditures are higher for participants only by 123,539.316 GHC. Remarkably, the average effect of participating in nonfarm

employment on the household's per-head expenditures is higher for female headed households than for households headed by a male in general as well as in rural areas, and rural households show a higher causal effect than all households in the dataset. Thus, the results of the PSM show that households headed by a female and households located in a rural environment have higher per-head expenditures compared to their respective non-participating counterparts. In detail, the causal effect of participation for the whole country equals 986,866.076, indicating that the per-head expenditures and therefore the wealth of the household is higher for participants than for non-participants by 986,866.076 GHC, whereas the per-head expenditures of participants living in rural areas are higher by even 1,397,768.78 GHC regarding rural non-participants. Compared to their counterparts, females engaged in nonfarm activities have higher per-head expenditures by 2,098,519.53 GHC and among the poor regarding the lower poverty line, participants in nonfarm employment have higher per-head expenditures by at least 123,539.316 GHC compared to the poor not engaged in nonfarm activities.

The critical value of Γ denotes the results for the sensitivity analysis. For the whole dataset, the result for Γ is 1.25, implying that if households with the same Z vector differ in their odds of participation by a factor of 25%, the significance of the participation effect on the per-head expenditures may be equivocal. The significant positive impact of participation on the per-head-expenditures for the rural poor, regarding the higher poverty line, denotes that a hidden bias of Γ =1.40-1.45 would be required to render the positive effect invalid. Consequently, most of the subsamples are sensitive regarding hidden bias, except the non-poor (high), rural poor (high), rural non-poor (low), rural non-poor (high), and the rural poor females (low). This unobserved heterogeneity indicates that there are some unobserved variables contemporaneously influencing the participation decision and the outcome as well. However, it has to be stressed that the Rosenbaum bounds are a worst-case scenario since they do not question the significance of the causal effects, but they show the required extent of a confounding variable's influence on the participation probability to undermine the significance of the average treatment effect. Here, the presence of hidden bias may be due to the separation to various social groups, since the set of variables included in the calculation of the propensity score may not be appropriate for all subsamples. As far as future research is concerned, the problem of hidden bias should be addressed by developing individual variable sets for each social group analysed.

As far as the balancing power of the p-score is concerned, the reduction in the median absolute standardised bias between the matched and the unmatched models is considered (see Table 21). Before matching, the standardised difference in $\mathbb{Z}$ lies between 6% and 16%, and after matching, i.e. after randomisation, the remaining standardised difference in Z ranges from 1% to 8%. Rosenbaum and Rubin (1985) suggested that a remaining standardised bias of 20% would be advisable. In all subsamples, balancing on the p-score caused a reduction in the standardised bias of significantly more than 50%, except in the subsample of the rural females and the rural poor females (high).

Before matching, the null hypothesis of equal covariate means for both groups of households should be rejected, and after matching, the p-value of the likelihood ratio test should be quite high so that the hypothesis of statistically similar samples cannot be rejected anymore. As can be seen in the last two columns of Table 21, for all samples except the rural poor females (high), statistically similar samples regarding participants and non-participants can be assumed after matching, indicating a successful balancing on the p-score.

Furthermore, the Pseudo-R^2 should be quite high for the unmatched samples and quite low after matching is performed. In addition to the p-values, these values indicate that there is no systematic difference in the distribution of covariates between participants and non-participants after matching.

Table 21: Indicators of covariate balancing, before and after matching, regarding per-head expenditures (Author's calculations, GLSS 5)

per-head expenditures	Median Absolute Bias (before)	Median Absolute Bias (after)	Total % |Bias| Reduction	Pseudo-R^2 (unmatched)	Pseudo-R^2 (matched)	*p*-Value of LR (unmatched)	*p*-Value of LR (matched)
Ghana	13.7007%	1.528%	88.86%	0.196	0.029	0.000	0.756
rural	8.421%	1.595%	81.01%	0.077	0.029	0.000	0.094
male	11.453%	1.777%	84.49%	0.193	0.022	0.000	0.317
female	14.109%	6.286%	55.45%	0.197	0.057	0.000	0.999
rural male	6.745%	1.152%	82.92%	0.067	0.015	0.000	0.082
rural female	7.7%	5.274%	33.24%	0.105	0.098	0.000	0.818
poor (low)	8.755%	3.001%	65.77%	0.100	0.027	0.000	0.078
poor (high)	9.02%	2.242%	75.15%	0.111	0.042	0.000	0.394
non-poor (low)	11.834%	1.183%	90%	0.203	0.081	0.000	0.635
non-poor (high)	16.568%	3.404%	79.45%	0.217	0.172	0.000	0.064
rural poor (low)	6.69%	1.882%	71.87%	0.064	0.036	0.000	0.063
rural poor (high)	7.193%	2.564%	64.35%	0.065	0.057	0.000	0.104
rural non-poor (low)	8.83%	0.625%	92.92%	0.079	0.038	0.000	0.996
rural non-poor (high)	10.935%	2.002%	81.7%	0.092	0.118	0.000	0.707
rural poor female (low)	13.606%	4.621%	66.04%	0.100	1.000	0.005	0.119
rural poor female (high)	12.498%	8.409%	32.72%	0.084	0.421	0.000	0.045

The Depth of Poverty

As mentioned earlier, the capability of nonfarm activities to reduce or even eliminate poverty is important to examine in order to derive meaningful recommendations for policy makers. For this reason, the causal effects of participating in nonfarm employment on the depth of poverty are presented in Tables 22 for the lower poverty line, representing households living in extreme poverty, and in Table 23 for the higher poverty line. The indicators for the covariate balancing with respect to both poverty lines are presented in Tables 24 and 25, respectively.

Table 22: Average treatment effects and results of the sensitivity analysis, regarding poverty gap (low) (Author's calculations, GLSS 5)

poverty gap (low)	Caliper	ATT	t-Stat.	Critical Level of Γ	No. of Treated	No. of Controls
Ghana	0.00015	-75,768.7785	-0.9	-	272	240
rural	0.001	-91,574.7399	-1.37	-	460	399
male	0.0015	-94,892.2931	-1.43	-	484	447
female	0.0015	-138,133.219	-1.03	-	60	48
rural male	0.001	-132,799.357	-1.8 *	1.15	406	374
rural female	0.001	-280,975.292	-2.04 **	1.35	72	59
poor (low)	0.008	-106,511.674	-1.92 *	1.15	474	423
rural poor (low)	0.006	-172,207.862	-2.82 ***	1.35	413	370

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

Households participating in nonfarm employment in the whole country, in rural areas, and with respect to the household head's gender do not seem to have different outcomes compared to their respective counterparts. However, the causal effect of participation on the reduction of extreme poverty is significantly positive for rural households headed by a male as well as by a female, for the poor in general, and the rural poor in detail. The effect of participation on the reduction of poverty is highest for female headed households living in rural areas as well as for the rural poor. For rural households headed by a female, the poverty gap regarding the lower poverty line is lower by 280,975.292 GHC than for their not participating counterparts. This suggests that participation in nonfarm employment causes a reduction in the depth of extreme poverty by 280,975.292 GHC compared to female headed households living in extreme poverty and not engaged in nonfarm

activities. As far as the poor households in Ghana are concerned, the reported causal effect of participating in the nonfarm sector on the depth of extreme poverty is -106,511.674 GHC, indicating that poor households engaged in nonfarm activities are able to reduce their depth of extreme poverty by 106,511.674 GHC in comparison to the poor non-participants in nonfarm employment. For poor households living in rural areas, this causal effect on the depth of extreme poverty is even higher. Rural households whose per-head expenditures fall below the lower poverty line manage to reduce their depth of extreme poverty by 172,207.862 GHC actually.

Obviously, the samples for the rural male and the poor are rather sensitive regarding hidden bias. A critical value of Γ =1.15 denotes that if households who have the same vector of covariates differ in their prospects of participating in nonfarm employment by a factor of only 15%, the validity of the causal effect on the reduction of extreme poverty is to be questioned. In contrast, the rural female and rural poor sample, respectively, seem to be quite robust regarding unobserved heterogeneity. For both samples, the odds for participation need to differ by a factor of 35% for households with the same vector of covariates to question the significance of the participation effect on the reduction of extreme poverty.

The results of the matching procedure regarding the poverty gap calculated with respect to the higher poverty line are presented in Table 22. They indicate that the causal effect of participating in nonfarm employment on the reduction of moderate poverty is significantly positive for households headed by males, households generally living in rural areas, as well as rural households headed by males and females, respectively. Additionally, rural poor households regarding the higher poverty line also experience a reductive effect on their depth of moderate poverty due to participating in nonfarm activities.

Table 23: Average treatment effects and results of the sensitivity analysis, regarding poverty gap (high) (Author's calculations, GLSS 5)

poverty gap (high)	Caliper	ATT	t-Stat.	Critical Level of Γ	No. of Treated	No. of Controls
Ghana	0.00015	-100,982.581	-0.89	-	272	240
rural	0.001	-147,707.882	-1.44 *	1.1	460	399
male	0.0015	-160,471.693	-1.82 *	1.15	484	447
female	0.0015	-219,998.708	-1.12	-	60	48
rural male	0.001	-175,723.367	-1.81 *	1.15	406	374
rural female	0.001	-396,755.172	-2.01 **	1.25	72	59
poor (high)	0.001	-121,586.627	-1.28	-	227	228
rural poor (high)	0.001	-249,823.892	-2.62 ***	1.4	219	198

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

The causal effects on poverty reduction are the highest for the rural female and the rural poor subsamples, indicating that nonfarm employment accessible for rural households whose per-head expenditures fall below the higher poverty line and especially for rural households headed by a woman have the potential to reduce moderate poverty in Ghana. In rural areas, households headed by a woman and participating in nonfarm activities manage to reduce their depth of poverty by 396,755.172 GHC compared to their not participating counterparts. For poor households living in rural areas, the causal effect of engaging in nonfarm employment on the poverty gap regarding the higher poverty line is -249,823.892, denoting that the gap between the poverty line and the actual per-head expenditures, i.e. the depth of poverty, can be reduced for those households by 249,823.892 GHC compared to rural poor households not participating in nonfarm activities. As far as male headed households in rural areas are concerned, participants experience a reduction in the depth of poverty by 175,723.367 GHC due to participation in nonfarm employment, and the causal effect of nonfarm participation for male headed households in general is, compared to their counterparts, at least -160,471.693. For rural households, participation in the nonfarm sector causes a reduction of the depth of poverty by 147,707.882 GHC in contrast to rural households not engaged in nonfarm employment.

Again, the samples are quite sensitive regarding unobserved heterogeneity with critical values of Γ ranging from 1.1 to 1.25. Only a small level of hidden bias due

to unobservables also influencing the participation decision as well as the poverty gap would lead to questionable significance of the poverty reducing causal inference. For the rural poor sample, differing odds of participation by a factor of 39% for households with the same Z vector would still result in a significant positive causal effect on the reduction of the depth of moderate poverty.

Since the quality of balancing the covariates' distributions on the propensity score is also very important for the evaluation of the matching results, the respective indicators for the poverty gap regarding the lower and the higher poverty line, respectively, are presented in Tables 24 and 25. The initial median absolute standardised bias regarding the covariates ranges from 6% to 14% for both estimations, whereas the standardised difference in Z only ranges from 1% to 6% after matching. As a consequence, the quality of matching can be considered as satisfactory (Caliendo and Kopeinig, 2008, p. 48) and except of the subsample for the female headed households living in rural areas, the balancing of the covariates caused a total bias reduction ranging from 53% to 88%.

In addition, the values for the Pseudo-R^2 should be quite high before matching and quite low after matching is done, and the p-values of the likelihood ratio test should be low before and high after matching. This is true for both estimations, indicating that the null hypothesis of statistically similar samples cannot be rejected after balancing of the distributions of the covariates is performed. As a consequence, matching has been successful, resulting in systematically identical distributions of covariates in both groups for all subsamples.

Table 24: Indicators of covariate balancing, before and after matching, regarding poverty gap (low) (Author's calculations, GLSS 5)

poverty gap (low)	Median Absolute Bias (before)	Median Absolute Bias (after)	Total % |Bias| Reduction	Pseudo-R^2 (unmatched)	Pseudo-R^2 (matched)	*p*-Value of LR (unmatched)	*p*-Value of LR (matched)
Ghana	13.707%	1.528%	88.86%	0.196	0.029	0.000	0.756
rural	8.421%	1.595%	81.07%	0.077	0.029	0.000	0.094
male	11.453%	1.777%	84.49%	0.193	0.022	0.000	0.317
female	14.109%	6.286%	55.45%	0.197	0.057	0.000	0.999
rural male	6.745%	1.431%	78.79%	0.067	0.021	0.000	0.531
rural female	7.9%	5.274%	33.24%	0.105	0.098	0.000	0.818
poor (low)	8.755%	3.188%	63.59%	0.100	0.027	0.000	0.106
rural poor (low)	6.69%	2.684%	59.89%	0.064	0.029	0.000	0.136

Table 25: Indicators of covariate balancing, before and after matching, regarding poverty gap (high) (Author's calculations, GLSS 5)

poverty gap (high)	Median Absolute Bias (before)	Median Absolute Bias (after)	Total % |Bias| Reduction	Pseudo-R^2 (unmatched)	Pseudo-R^2 (matched)	*p*-Value of LR (unmatched)	*p*-Value of LR (matched)
Ghana	13.707%	1.528%	88.86%	0.196	0.029	0.000	0.756
rural	8.421%	1.595%	81.07%	0.077	0.029	0.000	0.094
male	11.453%	1.777%	84.49%	0.193	0.022	0.000	0.317
female	14.109%	6.286%	55.45%	0.197	0.057	0.000	0.999
rural male	6.745%	1.431%	78.79%	0.067	0.021	0.000	0.531
rural female	7.9%	5.274%	33.24%	0.105	0.098	0.000	0.818
poor (high)	9.0199%	2.242%	75.15%	0.111	0.042	0.000	0.394
rural poor (high)	7.193%	3.319%	53.86%	0.065	0.057	0.000	0.104

The Elimination of Poverty

Besides the per-head expenditures as a proxy for a household's wealth, the causal effect of participating in nonfarm employment on the household's poverty status is of major interest for researchers and policy makers. It has already been proofed that nonfarm employment is capable to reduce the depth of poverty. Now it is interesting to examine whether nonfarm activities are even able to completely eliminate the poverty of the households in Ghana. The poverty status is a binary variable denoting whether a household is considered to be poor, i.e. the variable equals 1, or not. The empirical results of the causal effects of participating in nonfarm employment on the household's poverty status are presented in Table 26 for the lower poverty line and in Table 27 for the higher poverty line. The indicators of the matching quality are shown in Table 28 and Table 29, respectively.

Table 26: Average treatment effects and results of the sensitivity analysis, regarding poverty status (low) (Author's calculations, GLSS 5)

poor (low)	Caliper	ATT	t-Stat.	Critical Level of Γ	No. of Treated	No. of Controls
Ghana	0.0002	-0.03	-0.66	-	300	265
rural	0.001	-0.06521739	-1.74 *	1.15	460	399
male	0.0015	-0.08884298	-2.44 **	1.3	484	447
female	0.0015	-0.06666667	-0.69	-	60	48
rural male	0.002	-0.04423077	-1.23	-	520	455
rural female	0.001	-0.15277778	-1.7 *	1.3	72	59

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

For the rural, male, and rural female subsamples, the causal effects show an improvement regarding the households' extreme poverty status. For these three subsamples, the participation in nonfarm employment manages to help the referring households out of extreme poverty, although the samples are quite sensitive with respect to hidden bias.

For the rural subsample, Γ =1.15 indicates that if rural households with the same Z vector would differ in their odds of participating by a factor of 15%, the significance of the participation effect on the poverty status may be questionable. Noticeably, the causal effect of participation on extreme poverty is highest for females living in rural areas, indicating that nonfarm employment available for rural households

headed by a female would be very effective regarding the eradication of extreme poverty.

Table 27: Average treatment effects and results of the sensitivity analysis, regarding poverty status (high) (Author's calculations, GLSS 5)

poor (high)	Caliper	ATT	t-Stat.	Critical Level of Γ	No. of Treated	No. of Controls
Ghana	0.0005	-0.05250597	-1.44	-	419	367
rural	0.001	-0.07391304	-2.14 **	1.25	460	399
male	0.0015	-0.08677686	-2.58 ***	1.4	484	447
female	0.002	-0.17910448	-1.85 *	1.4	67	55
rural male	0.001	-0.06157636	-1.74 *	1.2	406	374
rural female	0.001	-0.125	-1.3	-	72	59

Note: ***, **, and * denote the statistical significance of t-statistic at the 1%, 5%, and 10% level, respectively.

As far as the moderate poverty is concerned, rural households, households headed by males, households headed by females and rural households headed by females experience a positive causal effect of participating in nonfarm employment on the improvement of their poverty status and as far as the alleviation of rural poverty is concerned, these results support the findings of e.g. Gordon and Craig (2001) and Adjasi and Osei (2007). However, the rural and the rural male subsample are quite sensitive regarding unobserved heterogeneity. For households headed by a female, the effect on the poverty status is the highest, indicating that nonfarm employment available for female headed households has the highest effect on poverty elimination. The weakest causal effect is observed for the male headed households living in rural areas, indicating that for these households nonfarm employment is not as important for poverty elimination as for female headed households or rural households in general.

As already indicated, the samples for the rural and the rural male headed households are quite sensitive regarding hidden bias. If the odds of participation of households with the same Z vector differ by a factor of 20% and 25%, respectively, the poverty elimination effect of participation needs to be questioned. For the samples of male and female headed households, respectively, the odds of participation of similar households according to their Z vector could differ by 39%

without changing the significance of the poverty eliminating causal inference of participation in nonfarm employment.

Before matching, the standardised difference in $\mathbb{Z}$ regarding the lower poverty line lies between 6% and 14%, and after randomisation, the remaining standardised difference in Z ranges from 1% to 6% (see Table 28). This indicates that the balancing on the propensity score for both groups has been very successful, achieving high levels of reduction in total standardised bias. The Pseudo-R^2 is quite high for the unmatched sample and quite low after balancing. In addition, the hypothesis of statistically similar samples needs to be rejected before matching and cannot be rejected afterwards. Consequently, the matching procedure results in an appropriate balancing of covariates for both groups regarding the causal effects of participation and non-participation in nonfarm employment on the elimination of extreme poverty.

As can be observed in columns 2 and 3 of Table 29, the standardised difference in Z regarding the higher poverty line takes values between 6% and 14% before balancing on the propensity score, whereas after randomisation, the remaining standardised difference in Z only ranges from 1% to 5%. The significantly high levels of total bias reduction indicate a properly balancing on the p-score and the Pseudo-R^2 and p-values of the likelihood ratio test support this notion. The low initial and high p-values after matching as well as the initial high and low Pseudo-R^2 for the matched samples imply that for all examined samples, the covariates of both groups are systematically differently distributed after balancing on the propensity score.

Table 28: Indicators of covariate balancing, before and after matching, regarding poverty status (low) (Author's calculations, GLSS 5)

poor (low)	Median Absolute Bias (before)	Median Absolute Bias (after)	Total % |Bias| Reduction	Pseudo-R^2 (unmatched)	Pseudo-R^2 (matched)	*p*-Value of LR (unmatched)	*p*-Value of LR (matched)
Ghana	13.707%	1.189%	91.33%	0.196	0.029	0.000	0.631
rural	8.421%	1.595%	81.07%	0.077	0.029	0.000	0.094
male	11.453%	1.777%	84.49%	0.193	0.022	0.000	0.317
female	14.109%	6.286%	55.45%	0.197	0.057	0.000	0.999
rural male	6.745%	0.931%	86.19%	0.067	0.018	0.000	0.471
rural female	7.9%	5.274%	33.24%	0.105	0.098	0.000	0.818

Table 29: Indicators of covariate balancing, before and after matching, regarding poverty status (high) (Author's calculations, GLSS 5)

poor (high)	Median Absolute Bias (before)	Median Absolute Bias (after)	Total % |Bias| Reduction	Pseudo-R^2 (unmatched)	Pseudo-R^2 (matched)	*p*-Value of LR (unmatched)	*p*-Value of LR (matched)
Ghana	13.707%	2.172%	84.16%	0.196	0.023	0.000	0.510
rural	8.421%	1.595%	81.07%	0.077	0.029	0.000	0.094
male	11.453%	1.777%	84.49%	0.193	0.022	0.000	0.317
female	14.109%	5.713%	59.51%	0.197	0.075	0.000	0.973
rural male	6.745%	1.431%	78.79%	0.067	0.021	0.000	0.531
rural female	7.9%	5.274%	33.24%	0.105	0.098	0.000	0.818

To conclude, the engagement in nonfarm activities significantly enhances the household's wealth represented by the household's per-head expenditures. The causal effects are highest for the non-poor subsamples and the causal inference of participating in nonfarm employment on the per-head expenditures is higher for female headed households than for male headed households, compared to their respective counterparts. But, since the main interest lies on the rural population and the poor households in detail, it is noticeable that the participation effect is significantly higher for female headed households living in rural areas than for rural households in general, and the rural poor manage to enhance their per-head expenditures to a larger extent than the poor in general due to their participation in nonfarm activities. Since subsection 3.4.3. shows that inequality in Ghana has even increased between 1999 and 2006 and Canagarajah et al. (2001) state that self-employment has significantly contributed to income inequality in Ghana and Uganda, it is even more important to evaluate the causal effects of participating in nonfarm employment on the household's poverty gap, i.e. the depth of poverty, and on the household's poverty status, i.e. whether a change is taking place regarding the fact that a household is considered to be poor or not. As far as the poverty gap for the lower as well as the higher poverty line is concerned, the causal inference of participation in nonfarm activities is highest for female headed households living in rural areas as well as rural poor households. These two types of households benefit the most from participating in nonfarm employment regarding the reduction of their dimension of poverty. Furthermore, the examination of the causal inference of engaging in nonfarm activities on the household's poverty status reveals a significantly positive effect of the participation in nonfarm employment on the elimination of poverty. For female headed households as well as female headed households living in rural areas, the participation in nonfarm activities positively influences the poverty status, indicating that fewer households of these subsamples are classified as poor in comparison to their respective counterparts due to nonfarm employment.

8. Conclusions

8.1. Summary

The region of Sub-Saharan Africa (SSA) still has the highest proportion of people living on less than $1 a day. In contrast to other regions like Eastern and South-Eastern Asia, SSA is going to fail the first Millennium Development Goal of halving the proportion of people living on less than $1 a day by 2015. Noticeably, the poverty pattern across the region of SSA is rather diverse since the various countries show differences in their poverty development. Countries like Cameroon and Burkina Faso show rather low levels of poverty, and a quite high proportion of people are considered to be poor in countries like Zambia and Ghana. However, Ghana is likely to meet the first Millennium Development Goal until 2015. Nevertheless, in reference to the national expenditure-based poverty lines, more than 40% of the Ghanaian population were considered to be poor in 1999, indicating that the per-head expenditures of far more than one third of the population fell below the upper poverty line. This proportion of poor people decreased slightly until 2006, but in rural areas in Ghana almost no improvement can be observed. Households living in rural areas are still significantly more affected by poverty than households living in urban settlements. Additionally, inequality of income distribution is a major problem in Ghana, since it even increased in the rural areas and Ghana as a whole between 1999 and 2006. As a consequence, strategies to reduce the severity as well as the incidence of poverty need to be developed. To establish successful strategies, natural and institutional preconditions need to be accounted for. About 65% of the population in the region of SSA lives in rural areas and agricultural production is still a major source of household income in these countries. But this dependence on the farm sector also bears some risks for rural inhabitants. Due to weather shocks or seasonality, economic shocks or the illness of a family member or livestock, rural households mainly engaged in agriculture are threatened by income variability. In order to spread these risks and consequently smooth their income, households follow several strategies like crop diversification, migration or the participation in nonfarm employment.

The main objective of the study is to assess whether nonfarm employment can serve as a poverty reduction strategy. Furthermore, the study aims at evaluating

whether nonfarm activities serve as a risk-coping strategy for rural households in Ghana and what kind of entry barriers they are confronted with when planning to participate in the nonfarm sector. In addition, the direct impact of participating in nonfarm employment on the household's wealth, measured by the household's per-head expenditures, as well as on the depth of poverty and the poverty status, respectively, is to be examined.

The results for the quantile regression implementing the CLAD estimator show that the main household characteristics like age and gender of the household head as well as the size of the household significantly influence the extent of income diversification. In contrast to e.g. Abdulai and CroleRees (2001), an additional year of the household head decreases the extent of participation in nonfarm activities. However, a life-cycle effect can be observed since this decreasing effect has its maximum between 46.8 years and 40.7 years, regarding the extent of participation. Female headed households are more engaged in nonfarm employment and this finding supports the strand of the literature showing higher income diversification among female headed households (e.g. Jolliffe, 2001). This can be explained by the traditional heritage law in Ghana, and in small households an additional family member has a negative effect on the extent of nonfarm employment. As far as the variables representing a risky environment are concerned, income paid in kind significantly increases the extent of income diversification and the effect is highest for the slightly diversified households. The extent of self-sufficient agriculture as well as the remoteness of the household additionally seem to positively influence the dimension of income diversification. This indicates that households perceiving that they live in a risky environment turn to nonfarm activities to spread these risks and to smooth income confirming the existing literature of e.g. Ito and Kurosaki (2009), Abdulai and CroleRees (2001), and de Janvry et al. (1991). The sale of valuable physical capital is a widespread strategy aiming at risk spreading and it is also a strategy followed by households living in rural areas in Ghana according to, for example, Verpoorten (2009), Barrett et al. (2005), and Dercon (2002). As the value of the livestock and farm land owned by the household increases, the extent of participation in the nonfarm sector decreases, indicating that the endowment with valuable assets serves as a risk-coping strategy on its own. Furthermore, the results show the indication of entry barriers to nonfarm activities also reported by, for example, Morduch (1995), Abdulai and CroleRees (2001), and Jolliffe (1998, 2004). The household's endowment with savings and valuable agricultural assets tends to enhance the dimension of income diversification since, as suggested in

several studies (e.g. Reardon et al., 1992; Morduch, 1995), start-up capital is required to start a small business. However, most importantly, an additional year of schooling significantly increases the extent of nonfarm employment. Households headed by a well-educated person are participating more intensely in nonfarm activities compared to households with less educated household heads.

As a consequence, the Heckman two-stage method has been utilised to analyse factors influencing the extent of participating, i.e. entry barriers to nonfarm employment. The results for this method show that, in accordance with the findings for the quantile regression, not influenceable household characteristics like the age, a male household head, and the household size have a negative impact on the household's probability of participating in nonfarm employment. The remoteness of a household enhances the probability of participation, which contrasts, for example, Abdulai and Delgado (1999). This might be due to the fact that reliable information like distance to town or road density had not been available in the dataset and therefore, the distance to school measured in minutes and the distance to the water source measured in metres have been applied as proxies for the household's remoteness. Regarding the results, these proxies may be questionable. As far as valuable physical capital is concerned, it is confirmed that they serve as a risk-coping strategy on its own due to sales in times of income shortfalls. However, the main entry barriers to nonfarm employment are the locality of the household, with households living in rural areas being less likely to participate in the nonfarm sector, the household's endowment with savings as important start-up capital as well as the educational level of the household head. Furthermore, well-educated and rich households are less likely to participate in nonfarm employment, whereas rich households with a high number of family members are more likely to participate. On the one hand, this indicates that wealth serves as a risk-coping strategy for itself overweighing the positive impact of a higher educational level but the effect is quite small. Thus, if households are not endowed with sufficient physical capital, education is a major constraint to nonfarm activities. On the other hand, sizeable households are able to allocate parts of their labour force to the nonfarm sector and the endowment with valuable land helps to overcome entry barriers. However, the fulfillment of the needs of a larger household, i.e. consumption smoothing, seem to overweigh the household's perceived wealth represented by the value of the household's farm land endowment and households seem to be more risk-averse.

As a consequence, nonfarm activities seem to be less available in rural areas and mostly require start-up capital and a certain level of education. Since the Heckman two-stage method also examines the effect of selected factors on an outcome variable for households participating in nonfarm employment, it can be stated that, for example, the household's total expenditures increase as the age of the household head increases. Furthermore, households headed by a male as well as small households with an additional family member have higher total expenditures. These findings indicate that households differing with respect to several household characteristics may also differ in certain outcomes due to participation.

To compare the outcomes of participants and non-participants, the Heckman two-stage method is not suitable and therefore, the PSM method is implemented to evaluate the causal inference of participation on the household's wealth, measured by the household's per-head expenditures, the household's depth of poverty, and the poverty status. The results show that, as far as the per-head expenditures as a proxy for wealth are concerned, non-poor households engaged in nonfarm activities experience the highest causal effect of participation in nonfarm employment compared to their counterparts. Among the social groups of major interest, the households benefiting the most from participating in the nonfarm sector are those headed by females, located in rural areas, households living in rural areas and headed by a female, and poor households headed by a female and living in rural areas. With respect to the depth of poverty, poor households living in rural areas as well as female headed rural households experience the highest causal effect of participating in nonfarm employment on the reduction of poverty, i.e. a reduction in the depth of poverty, in comparison to their respective counterparts. Households headed by a female as well as rural households headed by a female even manage to overcome poverty due to their participation in nonfarm activities. As a conclusion, especially rural households headed by a female and female headed households in general benefit the most from participating in nonfarm employment regarding wealth, poverty reduction and poverty elimination, respectively. But, rural households, rural poor households, and rural poor households headed by a female experience the highest causal effects due to participation in nonfarm work in comparison with their respective counterparts.

8.2. Policy Implications

The findings summarised above indicate some implications for policy makers. First of all, due to the great heterogeneity of the nonfarm sector, it is difficult to derive general policy recommendations (Lanjouw and Lanjouw, 2001, p. 19f). But since nonfarm employment has been proofed to serve as a strategy to spread income risk for rural households in Ghana, the entry barriers revealed in this study need to be targeted.

One major constraint is the availability of nonfarm employment in rural areas. The study shows that rural households are less likely to participate in nonfarm activities. Therefore, projects rather than policies need to be implemented and the rural infrastructure has to be improved to establish employment opportunities in the nonfarm sector for the rural population. Contemporaneously, the educational level of the household needs to be improved by enhancing the enrolment ratio as well as the quality of schooling. Furthermore, information about the benefit of higher educational levels needs to be published to encourage parents to keep their children in school. Although they cannot join the household's labour force as soon as usual, this abdication will pay off in the future.

Moreover, a household's amount of savings has been revealed to be crucial for the initial decision to participate in the nonfarm sector, since, for example, starting a small-scale business often requires start-up capital but credit markets are mostly imperfect or even absent in developing countries. Consequently, the access to microcredits needs to be improved, modeled for example on the Grameen Bank in Bangladesh, to enable households to launch a small business. The results for the value of livestock and farm land indicate that in the absence of other insurance mechanisms, households endowed with valuable physical capital use these assets as insurance, selling them in times of income shortfalls. As a consequence, households not endowed with valuable physical capital need to revert to other insurance mechanisms. If they are also excluded from nonfarm activities due to the entry barriers explained above, the access to credits or insurances against, for example, weather risks needs to be meliorated to allow households to overcome income shortfalls.

Finally, since the results of the PSM method reveal that mainly female headed households in general as well as in rural areas are the beneficiaries from the participation in nonfarm employment regarding the enhancement of per-head

expenditures and the reduction as well as the elimination of poverty, these households should constitute the main target groups for nonfarm employment fostering projects. Governmental poverty reduction strategies should therefore address especially rural households headed by a female and poor households living in rural areas to encourage them to engage in nonfarm activities in order to reduce the depth of poverty or even overcome poverty at all.

8.3. Prospects for Future Research

The study clearly shows that nonfarm employment can serve as a viable poverty reduction and even elimination strategy. Furthermore, diversifying the household's income portfolio by generating income in the nonfarm sector also has the potential to spread prevailing income risks. Since the present study was carried out using cross-sectional data provided by the Ghana Statistical Service, it would also be of great interest to examine whether these causal effects of nonfarm activities on the household's wealth and poverty status are varying over time and therefore, panel data would be helpful especially to investigate the dimension of the household characteristics' influence on the extent of income diversification. Additionally, the risk perception could be examined more intensely and maybe the sample could be re-surveyed after, for example, a weather shock had occurred to better understand the households' reaction on income shortfalls.

One major aspect in the literature is the remoteness of the household and many researchers argue that remoteness is a poverty risk since households are excluded from markets and nonfarm employment. The results of this study indicate that more remote households are engaged more intensely in nonfarm activities. Since no sufficient data on the remoteness of the household had been available in the data and could only be measured by proxies, the results may be questionable. For this reason, more detailed data on the household's remoteness, e.g. the distance to the next market or the next bigger settlement, need to be included in future surveys.

Another improvement of the GLSS would be the collection of more detailed and reliable data on the households' time allocation since data contained in the GLSS 5 had been erroneous. If these data were available, the efficiency of household activities in general as well as differences among various types of households in

detail could be investigated and would provide important information for policy makers regarding the implementation of working projects.

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Annex

A1 Tschebyschow's Inequality

Tschebyschow's Inequality specifies a lower limit of the probability that a random variable lies within a certain array around its expected value. The theorem can also be applied to not symmetrically distributed functions and is specified as follows:

Let X be a random variable with the expected value μ and a finite variance σ^2. Then for all real numbers $k > 0$ (Fisz, 1978, p. 98-99),

$$P(|X - \mu| \geq k\sigma) \leq \frac{1}{k^2}. \quad \text{[A1.1]}$$

This can be rewritten as:

$$P(|X - \mu| < k\sigma) \geq 1 - \frac{1}{k^2} \quad \text{[A1.2]}$$

For $k = 2$, at least 75% of all observations are contained in the array $\mu \pm 2\sigma$, and for $k = 3$ at least 88.9% are enclosed. For our purpose at least 93.8% of all observations should be kept after the elimination and therefore, $k = 4$ was chosen. With a sharp right skewed distribution, 285 households generating no income, and 177 households without income also lacking any self-sufficient agriculture, the variable 'total household income' indicated some biased results indicating possible report errors.

Concluding, with μ = 14,000,000 GHC and σ= 21,800,000 GHC, the application of the Tschebyschow Inequality to the GLSS 5 data referring to the 'total household income' can be written as:

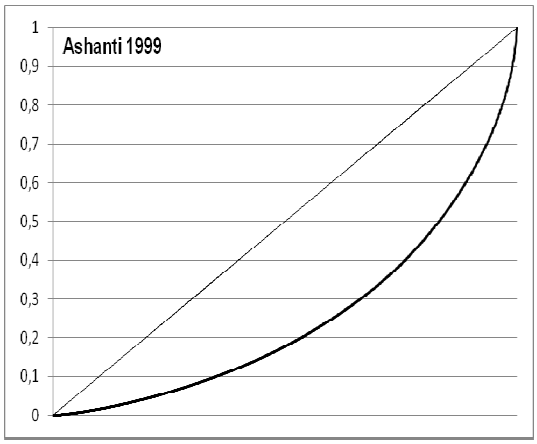
$$P(|X - 14{,}000{,}000| < 4 * 21{,}800{,}000) \geq 1 - \frac{1}{16} \quad \text{[A1.3]}$$

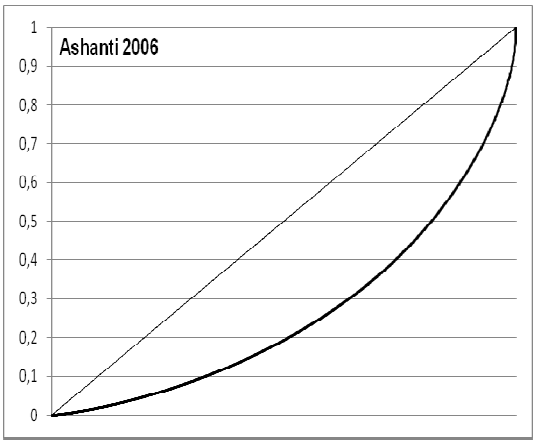
$$\geq 0.9375 \approx 94\% \quad \text{[A1.4]}$$

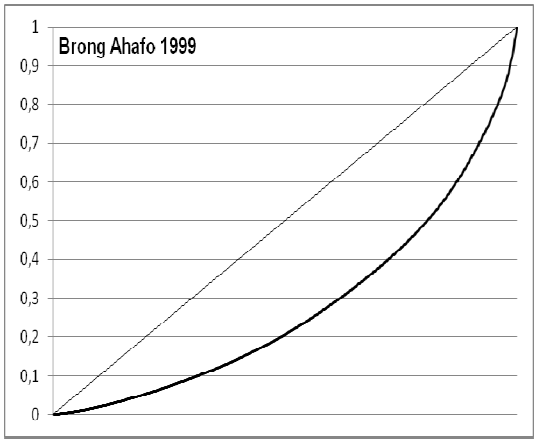
Finally, 302 observations were deleted and a dataset comprising 8385 households was used for the study.

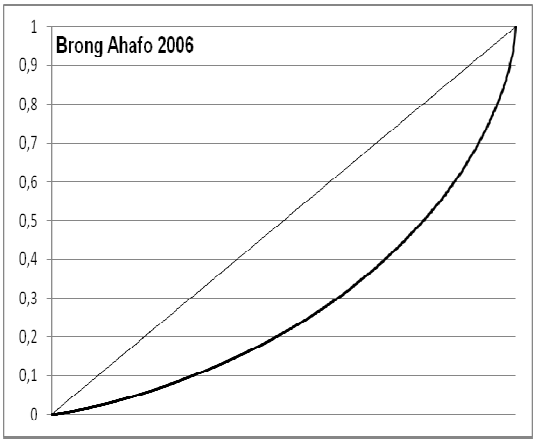
A2 Lorenz Curves for the Administrative Regions, 1999 and 2006

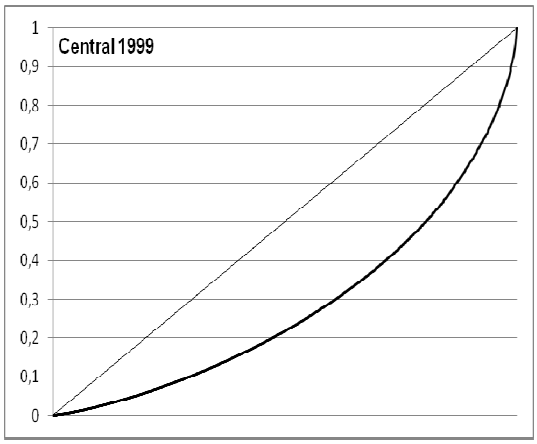
Referring to chapter 3.4.3., the Lorenz curves for the ten administrative regions for both years are displayed in this section (see Figure 9).

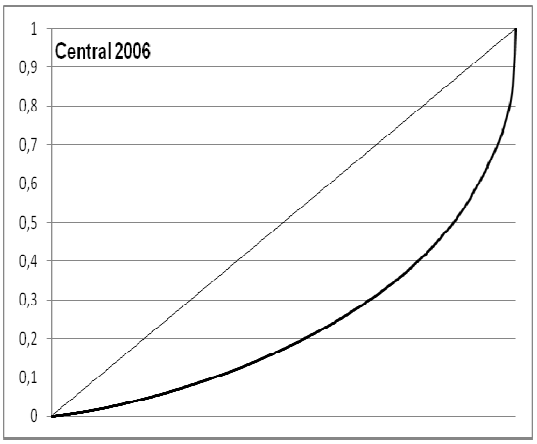


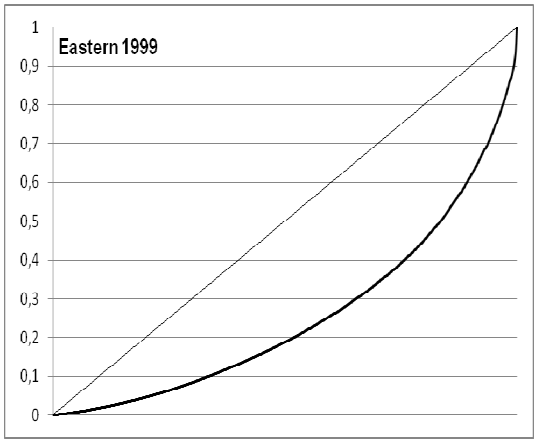








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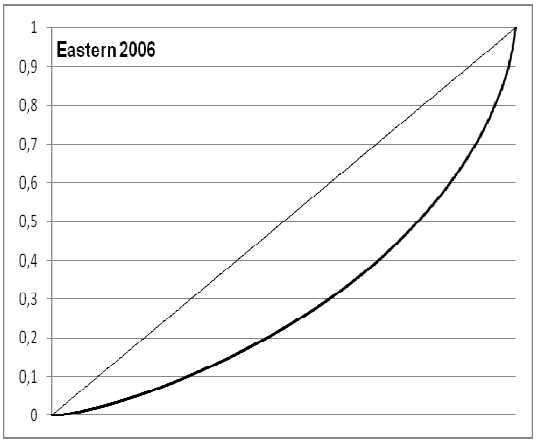
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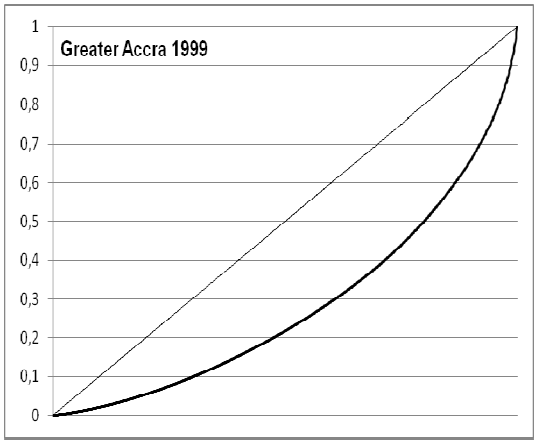
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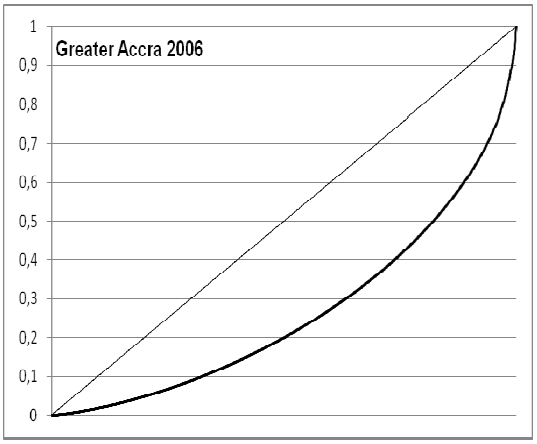
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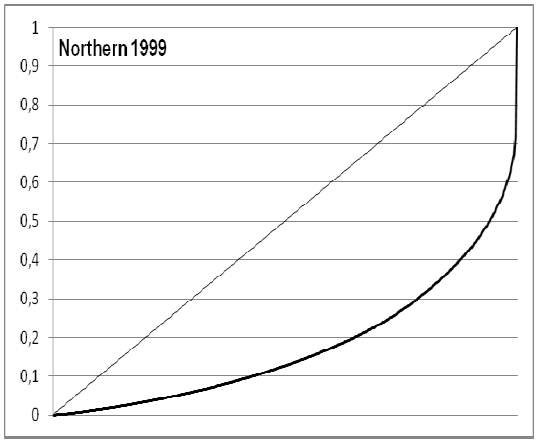
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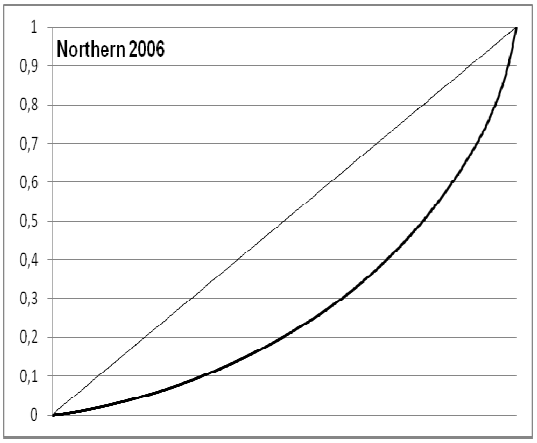
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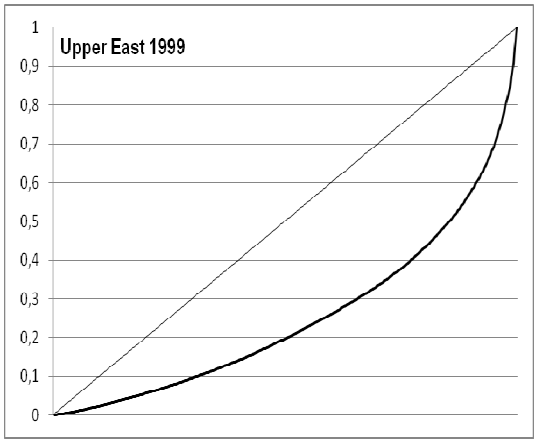
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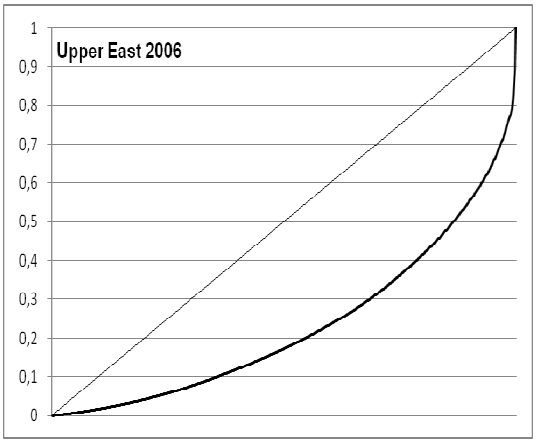
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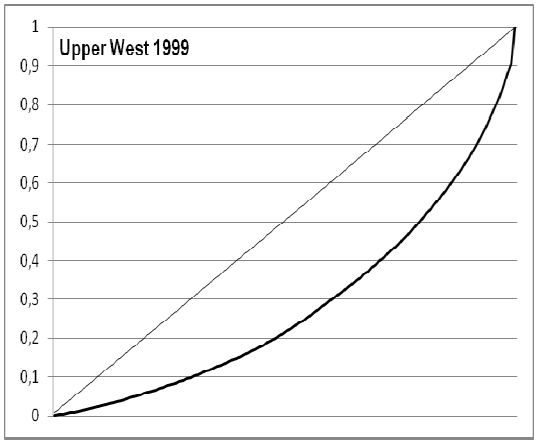
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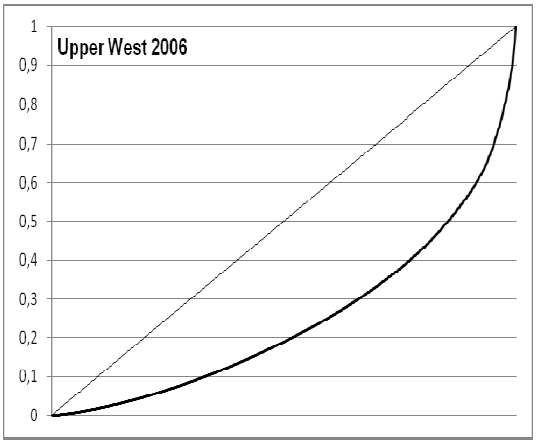
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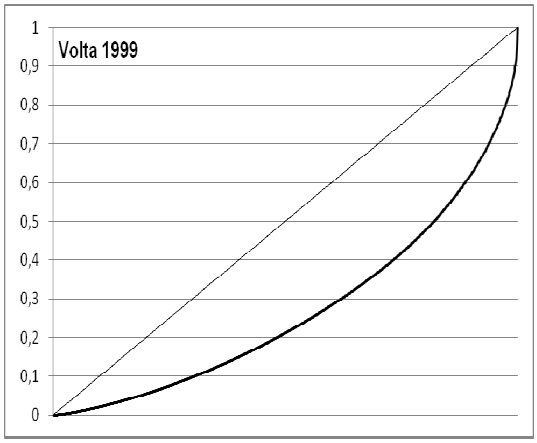
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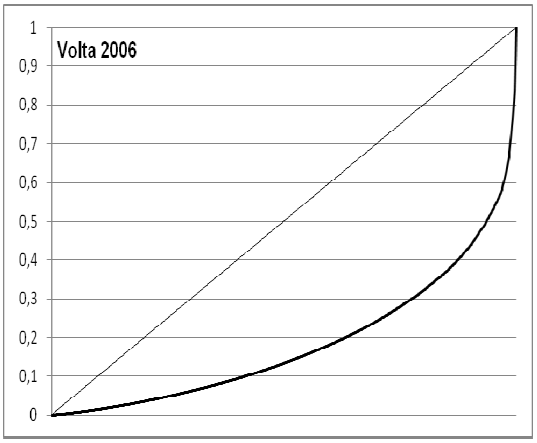
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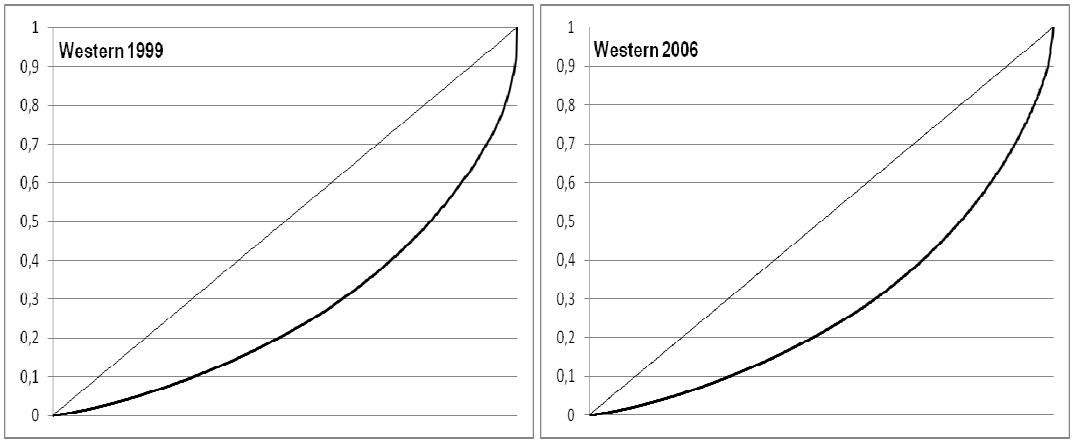


Figure 9: Lorenz curves for the administrative regions, 1999 and 2006 (Author's calculations, GLSS4, GLSS 5)

According to the Gini coefficient, in 1999 the Northern, Ashanti, and the Eastern region had the most unequal distributed per-head expenditures among all ten administrative regions in Ghana. But in 2006, the Northern and the Eastern region had almost the lowest level of inequality compared to the other regions and the Volta, Upper East, Central, and Upper West region had the highest inequality in per-head expenditure distribution. Since the Lorenz curve and the Gini coefficient are closely connected, the Lorenz curves presented above are illustrating the findings of the Gini coefficient analysis.

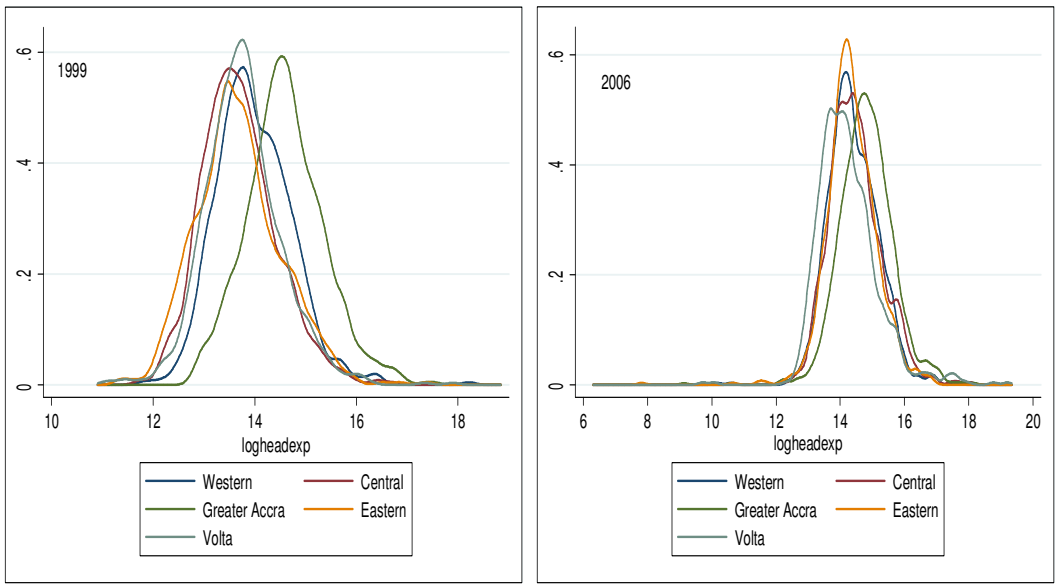
Regarding the Ashanti region, the distribution of per-head expenditures reveals only a small decrease in convexity in the course of time, which is represented by a very slight decrease of the Gini coefficient in 2006 as well. In Brong Ahafo, there is no apparent change of the Lorenz curve, resulting in a barely alleviated Gini coefficient. In 2006, the Lorenz curve of the Central region presents a more convex shape and therefore, the Gini coefficient is significantly higher than in 1999. In the Eastern and the Greater Accra region, the convexity of the Lorenz curve has significantly decreased and increased, respectively, indicating a remarkable decrease and increase in the inequality of per-head expenditure distribution in the particular region, respectively. Remarkably, the Lorenz curve of the Northern region in 1999 is much more convex than the corresponding Lorenz curve of 2006, suggesting a significant decrease in per-head expenditure distribution inequality. In contrast, the Lorenz curves of the Upper East, Upper West, and Volta region show a much more convex shape compared to 1999 which results in significant increases in the particular Gini coefficient representing a substantial increase in

inequality among the population of these regions. Finally, the Lorenz curve of the Western region displays a slight decrease in inequality of per-head expenditure distribution.

As a conclusion, although the northern regions appear to be the poorest regions in Ghana in both years, the results of the inequality analysis are quite mixed. Admittedly, the Gini coefficients for the northern regions are quite high compared to the other regions, but the Northern region managed to reduce inequality significantly and additionally, other regions like the Volta and the Central region show a significantly unequal distribution of per-head expenditures as well.

A3 The Kernel Density Estimation for the Administrative Regions

For the sake of completeness, the density distributions for the ten administrative regions are displayed here (see Figure 10). Each year is divided into two figures, the southern part of the country and the northern part of the country, with five regions each. Since, for the purpose of comparability, the bandwidth used to calculate the density distribution functions for the administrative regions is not the optimal bandwidth appropriate for the regional data but h=0.1343, too, the resulting functions are not as smooth as the functions in Figure 5. Nevertheless, general conclusions can be drawn regarding differences across the country and between both survey years.



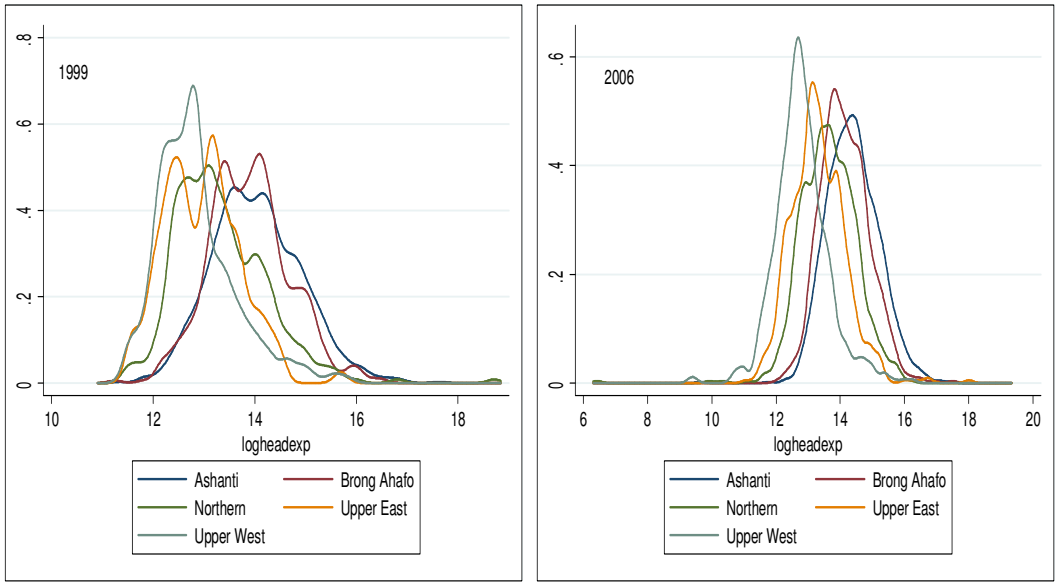


Figure 10: Kernel densities for the administrative regions, 1999 and 2006 (Author's calculations, GLSS4, GLSS 5)

In 1999, in general, the northern regions displayed in the second row show less concentrated distributions of per-head expenditures than the southern regions and the particular distributions seem to be more diverse. In 1999 and in 2006, the highest density but at a comparatively low level is observed in the Upper West region. Furthermore, the density functions of the northern regions concentrate around lower levels of per-head expenditures than the northern regions in the first row. As far as changes in distributions in the period 1999-2006 are concerned, generally the density functions of 2006 slightly moved right compared to 1999, indicating that the per-head expenditures have increased over the years. For example, the density distribution function of the Eastern region shifted its peak from below 14 to over 14, but simultaneously increased the density at this point, suggesting that more people in the Eastern region had higher per-head expenditures in 2006 but inequality increased, indicated by a very flat left end of the distribution function.

These results confirm the findings provided by the poverty, Gini coefficient, and Lorenz curve analysis, with the northern regions being affected more intensely by poverty and inequality.

A4 Gini Decomposition for the Administrative Regions and the Lower Poverty Line

In section 3.4.4., the results of the Gini decomposition have been discussed for Ghana and the rural and urban areas, referring to the upper poverty line. Now, the results for the ten administrative regions are going to be discussed (see Table 30) and in addition, since there are two poverty lines in Ghana, the results for the lower poverty line are going to be presented (see Table 31).

Table 30: Decomposition results for the period 1999-2006 regarding the upper poverty line, according to the administrative regions (Author's calculations, GLSS 4, GLSS 5)

	Total change	Growth	Redistribution	Residual
	Head Count Ratio (P_0)			
Ashanti	-6.7295	-3.264	-3.3194	-0.1461
Brong Ahafo	-0.3908	-0.2479	-0.275	0.1321
Central	-26.5637	-37.2351	8.5704	2.101
Eastern	-23.9208	-15.2003	-7.4464	-1.2741
Greater Accra	2.2847	-0.9155	3.2488	-0.0486
Northern	-18.196	10.3188	-20.9227	-7.5921
Upper East	-8.6913	-7.2024	0.1559	-1.6448
Upper West	9.7883	5.6667	5.4158	-1.2942
Volta	-6.9159	-29.1959	19.0475	3.2325
Western	-8.1024	-7.4565	-0.8702	0.2243
	Poverty Gap (P_1)			
Ashanti	-3.8264	-1.7952	-2.1354	0.1042
Brong Ahafo	-0.7816	-0.0843	-0.7203	0.023
Central	-12.9751	-17.3387	7.4596	-3.096
Eastern	-13.304	-8.7531	-5.6082	1.0573
Greater Accra	1.2346	-0.2263	1.6031	-0.1422
Northern	-13.4098	11.044	-15.5051	-8.9487
Upper East	-9.9931	-11.5834	1.2939	0.2964
Upper West	14.3008	8.4828	6.0648	-0.2468
Volta	-3.051	-12.9387	15.0273	-5.1396
Western	-3.5641	-3.5178	-0.1511	0.1048

Table 30 *(continued)*

	Total change	Growth	Redistribution	Residual
	Squared Poverty Gap (P_2)			
Ashanti	-2.3488	-1.1173	-1.3697	0.1382
Brong Ahafo	-0.6829	-0.0136	-0.6464	-0.0229
Central	-7.294	-9.2681	5.5537	-3.5796
Eastern	-8.1627	-5.5626	-3.7837	1.1836
Greater Accra	0.6205	-0.0726	0.7932	-0.1001
Northern	-9.3083	9.7165	-10.9321	-8.0927
Upper East	-8.0482	-10.9061	2.2197	0.6382
Upper West	13.4968	7.9972	5.2053	0.2943
Volta	-1.8802	-6.898	10.731	-5.7132
Western	-1.8834	-1.9067	-0.0446	0.0679

Across Ghana's administrative regions total changes in poverty measures are quite diverse between 1999 and 2006. The Central and the Eastern region show far the highest reduction in poverty, by about 26 percentage points and about 24 percentage points, respectively. While growth in the Central regions has the potential to reduce the incidence of poverty in this region by more than 37 percentage points, changes in distribution decrease the growth effect significantly. In the Eastern region, changes in income distribution have been in favour of the poor and growth has been pro-poor as well. In the Brong Ahafo region, only a small reduction in poverty can be observed, although growth as well as redistribution have positive effects on the decrease of poverty. This indicates that the basis for effective poverty reduction is good but growth needs to be amplified. In the regions Greater Accra and Upper West, the incidence of poverty has even increased, whereas in the Upper West, growth as well as redistribution have not been pro-poor and therefore led to a significant increase in the amount of poor people. The Volta and the Northern region show outstanding results as well, since both regions indicate a quite high decrease in poverty, but in the Volta region, this reduction is achieved mainly by pro-poor growth which is compensated to a huge extent by poverty increasing distributional changes. In contrast, poverty in the Northern region is mainly reduced by redistribution in favour of the poor and the interaction between growth and redistribution, whereas poverty increasing growth is partly

compensating this positive impact. As a consequence, the regions Central, Eastern, Northern, and Upper East experience the highest reduction in the depth and severity of poverty among all ten administrative regions. This reduction is either achieved by significant pro-poor growth (Central, Upper East), a balanced cooperation between changes in distribution and growth (Eastern), or redistribution in favour of the poor combined with a pro-poor interaction between growth and redistribution (Northern).

Table 31: Decomposition results for the period 1999-2006 regarding the lower poverty line, according to the administrative regions (Author's calculations, GLSS 4, GLSS 5)

	Total change	Growth	Redistribution	Residual
	Head Count Ratio (P_0)			
Ghana	-3.9724	-5.315	0.9555	0.3871
Rural	-1.0479	-5.385	4.043	0.2941
Urban	-5.1873	-2.6566	-2.7516	0.2209
Ashanti	-6.3893	-2.9231	-3.4693	0.0031
Brong Ahafo	-0.7743	-0.2605	-0.6698	0.156
Central	-23.1143	-32.4218	10.3583	-1.0508
Eastern	-22.4419	-14.2586	-8.9258	0.7425
Greater Accra	2.5335	-0.518	3.2602	-0.2087
Northern	-7.8161	12.1799	-23.0266	3.0306
Upper East	-12.1537	-10.8348	-0.1974	-1.1215
Upper West	13.864	8.2423	7.0449	-1.4232
Volta	-4.6241	-23.8642	22.11	-2.8699
Western	-6.5146	-6.3813	-0.2628	0.1295
	Poverty Gap (P_1)			
Ghana	-0.588	-2.6988	1.9917	0.1191
Rural	1.0553	-2.7825	3.8516	-0-0138
Urban	-2.0026	-1.1013	-1.071	0.1697
Ashanti	-3.0308	-1.4199	-1.766	0.1551
Brong Ahafo	-0.8421	-0.0333	-0.7951	-0.0137
Central	-9.5304	-12.2638	6.8748	-4.1414
Eastern	-10.4142	-7.0102	-4.8401	1.4361
Greater Accra	3.899	-0.0851	1.1311	2.853

Table 31 *(continued)*

	Total change	Growth	Redistribution	Residual
Northern	-4.8639	10.9904	-13.62	-2.2343
Upper East	-9.8923	-12.3533	1.6649	0.7961
Upper West	15.0476	8.9432	6.0261	0.0783
Volta	-2.2783	-8.9948	13.4006	-6.6841
Western	-2.4858	-2.535	-0.0364	0.0856
	Squared Poverty Gap (P_2)			
Ghana	0.2606	-1.5982	1.914	-0.0552
Rural	1.4555	-1.6676	3.2948	-0.1717
Urban	-0.94	-0.5472	-0.505	0.1122
Ashanti	-1.6157	-0.7864	-0.9731	0.1438
Brong Ahafo	-0.5959	0.0182	-0.5713	-0.0428
Central	-4.6149	-5.5129	4.4515	-3.5535
Eastern	-5.6506	-3.9897	-2.7912	1.1303
Greater Accra	0.3119	-0.0179	0.399	-0.0692
Northern	-2.7471	8.8394	-8.4553	-3.1312
Upper East	-6.7596	-10.1943	2.7233	0.7114
Upper West	12.703	7.5136	4.6328	0.5566
Volta	-1.3678	-4.1526	8.3479	-5.5631
Western	-1.1155	-1.15	-0.0161	0.0506

The findings for the Gini decomposition referring to the lower poverty line show quite similar results. The national incidence of poverty, regarding extreme poverty, could be reduced by about 4 percentage points, whereas urban poverty decreased by almost 5.2 percentage points and rural areas experienced only a small decrease of about 1 percentage point. Similar to the findings for the upper poverty line, pro-poor growth but poverty increasing redistribution led to a moderate poverty reduction in Ghana. In rural areas, high pro-poor growth has mainly been compensated by distributional changes in favour of the rich and urban areas experienced redistribution in favour of the poor as well as poverty reducing growth. As far as the extent of poverty is concerned, Ghana as a whole and the urban areas achieved a slight reduction in the depth of poverty but only the urban areas could also manage a reduction in the severity of poverty. In contrast, in rural areas

households became even poorer regarding the depth and the severity of poverty. All three investigation areas experienced pro-poor growth but this positive effect has partly been compensated by redistribution.

Regarding the administrative regions, the Central, Eastern, and Upper East regions experienced the highest reduction in poverty between 1999 and 2006, whereas Greater Accra and Upper West are the only regions with an increase in poverty in the same period. The Central region managed the decrease of about 23 percentage points by dint of potential pro-poor growth which was partly compensated by changes in the distribution of income. In contrast, the Eastern and the Upper East regions achieved the improvement of the poverty situation through pro-poor growth as well as redistribution in favour of the poor. Remarkably, the Northern and the Volta region only experienced a moderate reduction in poverty since the regions either experienced redistribution in favour of the poor but poverty increasing growth (Northern), or growth has been significantly pro-poor but changes in distribution have been to the disadvantage of the poor (Volta) and therefore, the poverty reducing effect got mainly compensated. In contrast, in Greater Accra the incidence of poverty increased by about 2 percentage points, caused by slight poverty decreasing growth and redistribution to the disadvantage of the poor, whereas in the Upper West region, the significant increase in poverty by almost 14 percentage points resulted from poverty increasing growth as well as redistribution in favour of the rich. As far as the depth and the severity of poverty are concerned, all regions managed to reduce the extent of poverty, except Greater Accra and the Upper West region.

These findings clearly indicate that growth is a major factor influencing the reduction in poverty, but the importance of redistribution cannot be ignored. Especially in regions like the Volta and the Central region, the direction of redistribution has to be focused, since these regions experience potential pro-poor growth which is partly compensated by changes in distribution. If redistribution focuses more on the poor, these regions would have an even higher potential to reduce poverty in general, and the depth and severity of poverty in particular.

A5 Patterns of Income Diversification in Ghana

This section provides additional information on the patterns of income diversification in Ghana. Table 32 presents the differences in the extent of diversification across the ten administrative regions in Ghana, comparing the situation in 1999 and in 2006.

Table 32: Income diversification across the administrative regions, 1999 and 2006 (Author's calculations, GLSS 5)

	Ø Total		Ø Nonfarm		Ø Herfindahl		Ø Berry	
	1999	2006	1999	2006	1999	2006	1999	2006
Ashanti	3.1	2.5	1.6	1.3	0.825	0.869	0.175	0.131
Brong Ahafo	2.9	2.6	1.1	1.1	0.88	0.895	0.12	0.105
Central	3.2	2.6	1.5	1.3	0.835	0.867	0.165	0.133
Eastern	2.6	2.7	1.4	1.4	0.872	0.876	0.128	0.124
Greater Accra	1.7	1.6	1.6	1.5	0.831	0.864	0.169	0.136
Northern	2.7	2.7	0.99	0.98	0.912	0.913	0.088	0.087
Upper East	3.1	2.1	1.2	0.9	0.841	0.921	0.159	0.079
Upper West	3.1	1.9	0.98	0.8	0.914	0.894	0.086	0.106
Volta	3.2	2.8	1.4	1.4	0.87	0.87	0.13	0.13
Western	2.8	2.5	1.3	1.3	0.876	0.867	0.124	0.133

It is obvious that in almost every region the average quantity of total income sources decreased between 1999 and 2006. In contrast, in the Northern region no change can be observed in the extent of total income diversification and in the Eastern region, the diversification even increased. These findings explain the decrease in the average number of total income sources across the whole country in this period (compare Table 6). Remarkably, the regions in the northern part of the country, which are also among the poorest Ghanaian regions, are the least diversified in 2006 referring to the amount of total income sources as well as the extent of nonfarm diversification. This fact supports the hypotheses that poorer households have only restricted access to diversification activities in general and nonfarm employment in particular. As far as the extent of income diversification in the other regions is concerned, the results regarding the poverty development are

quite mixed, whereas all regions either kept their level of income diversification equal or reduced their extent of diversification towards nonfarm activities. For example, in the Brong Ahafo region the level of nonfarm diversification did not change in this period and the poverty level did not significantly change as well. In contrast, in the Eastern region the extent of income diversification remained constant over time, whereas the incidence of poverty could be reduced remarkably.

In addition to Table 7, the summary statistics for the average number of total income sources and nonfarm income sources are presented below (see Table 33).

Table 33: Summary statistics for income sources (Author's calculations, GLSS 5)

	Obs.	Mean	Std. Dev.	Min	Max
Ghana					
income sources	8385	2.400239	1.376552	0	10
nonfarm income sources	8385	1.242934	0.8658976	0	6
Rural					
income sources	5018	2.727581	1.445757	0	10
nonfarm income source	5018	1.055401	0.8781219	0	6

Referring to Table 8, the comparison of Ghana and the urban areas regarding the average shares of selected activities in total household income according to the particular per-head expenditure quartiles are presented in Table 34.

Table 34: Selected income shares, by per-head expenditures[19] (Author's calculations, GLSS 5)

	Ghana				Urban			
	1	2	3	4	1	2	3	4
crop share	0.27	0.22	0.14	0.08	0.07	0.05	0.04	0.03
wage share	0.08	0.16	0.24	0.31	0.31	0.35	0.38	0.36
nonfarm self-employment share	0.17	0.25	0.31	0.38	0.32	0.37	0.36	0.44

[19] Please note that the quartiles have been calculated for the complete dataset and the rural subset, respectively.

Naturally, the average shares of crop income in total income are significantly lower in urban areas compared to the whole country. However, even urban households derive parts of their income from crop production, whereas the share is decreasing with increasing wealth. Since settlements with 5000 and more inhabitants are classified as urban in the GLSS (compare subsection 2.2.2.), it is possible that urban households in smaller settlements still do some cropping to make ends meet. As far as income from wage labour is concerned, urban households in the poorest quartile have the same average share as the wealthiest households across the country, and the share increases only slightly as per-head expenditures increase. In contrast, average shares of income from nonfarm self-employment increases significantly across quartiles and are remarkably higher than in Ghana as a whole.

A6 Summary Statistics for the Household Characteristics of Participants and Non-Participants

For the sake of completeness, Tables 35 to 49 present the summary statistics of the household characteristics of the households participating and not participating in nonfarm employment for the different subsamples. Obviously, participating and not participating households in the particular subsamples are partly different regarding their household characteristics. Therefore, it can be reasoned that participants may be different compared to their counterparts and this difference may be due to the households' self-selection into nonfarm employment.

Table 35: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural dataset (Author's calculations, GLSS 5)

rural	Non-Participants	Participants	Difference
age	46.1	46.83	-0.73
education	4	6.13	-2.13 ***
household size	4.93	4.66	0.28 ***
per-head expenditures	3,545,863	6,288,498	-2,742,635 ***
poverty gap (low)	732,266	424,302.6	307,963.4 ***
severity of poverty (low)	0.1485	0.0807	0.0678 ***
savings	187,422.4	745,251.4	-557,829 ***
income in kind	0	88,871.67	-88,871.67 ***
home production	3,241,074	4,567,774	-1,326,699
livestock	465,441.1	374,216.6	91,224.49 **
farm land	13,700,000	14,300,000	-596,818.4
distance to school	9.32	11.72	-2.4 ***
distance to water	1,273.8	2,270.26	-996.46
number of households	1,399	3,619	5,018

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 36: Household characteristics (sample means) of participants and non-participants, summary statistics for the male dataset (Author's calculations, GLSS 5)

male	Non-Participants	Participants	Difference
age	45.27	43.97	1.3 ***
education	4.37	8.82	-4.45 ***
household size	5.18	4.53	0.65 ***
per-head expenditures	3,564,428	8,678,977	-5,114,549 ***
poverty gap (low)	764,471.1	289,470.1	475,000.9 ***
severity of poverty (low)	0.1569	0.0549	0.102 ***
savings	221,417	1,277,194	-1,055,777 ***
income in kind	0	138,212	-138,212 ***
home production	3,439,004	3,377,313	61,690.96
livestock	512,463.9	294,269	218,194.9 ***
farm land	14,000,000	11,100,000	2,951,511
distance to school	8.84	10.71	-1.87 ***
distance to water	1,425.86	1,587.82	-161.97
number of households	1,242	2,820	4,062

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 37: Household characteristics (sample means) of participants and non-participants, summary statistics for the female dataset (Author's calculations, GLSS 5)

female	Non-Participants	Participants	Difference
age	51.19	47.89	3.3 ***
education	3.02	6.4	-3.38 ***
household size	3.4	3.3	0.11
per-head expenditures	4,372,168	8,077,384	-3,705,216 ***
poverty gap (low)	441,049.2	202,940.4	238,108.8 ***
severity of poverty (low)	0.0806	0.0345	0.046 ***
savings	114,516.5	719,799.2	-605,282.7
income in kind	0	89,938	-89,938
home production	1,903,598	923,346.2	980,251.4 ***
livestock	138,120.9	56,782.44	81,338.44 ***
farm land	13,700,000	4,023,394	9,688,987 ***
distance to school	10.94	11.82	-0.88
distance to water	981.24	2,030.3	-1,049.06
number of households	273	2,050	2,323

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 38: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural male dataset (Author's calculations, GLSS 5)

rural male	Non-Participants	Participants	Difference
age	45.08	45.55	-0.47
education	4.26	6.76	-2.5 ***
household size	5.24	5.14	0.11
per-head expenditures	3,443,118	6,411,236	-2,968,118 ***
poverty gap (low)	782,199.8	468,585.5	313,614.4 ***
severity of poverty (low)	0.1604	0.0911	0.0693 ***
savings	207,307.1	916,755.4	-709,448.3 ***
income in kind	0	102,120.4	-102,120.4 ***
home production	3,522,625	5,712,666	-2190,041 *
livestock	534,389.1	478,176.8	56,212.29
farm land	13,400,000	17,700,000	-4,303,143
distance to school	9.01	11.54	-2.54 ***
distance to water	1,305.86	1,999.72	-693.86
number of households	1,162	2,630	3,792

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 39: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural female dataset (Author's calculations, GLSS 5)

rural female	Non-Participants	Participants	Difference
age	51.11	50.24	0.87
education	2.76	4.45	-1.69 ***
household size	3.4	3.38	0.02
per-head expenditures	4,049,616	5,962,107	-1,912,490 ***
poverty gap (low)	487,442.8	306,543.4	180,899.4 ***
severity of poverty (low)	0.09	0.053	0.037 ***
savings	89,928.27	289,179	-199,250.7
income in kind	0	53,639.96	-53,639.96
home production	1,860,644	1,523,218	337,426.2
livestock	127,392.4	97,760.36	29,632.04
farm land	14,700,000	4,990,427	9,758,434 ***
distance to school	10.86	12.19	-1.33
distance to water	1,116.6	2,989.71	-1,873.11
number of households	237	989	1,226

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 40: Household characteristics (sample means) of participants and non-participants, summary statistics for the poor (low) dataset (Author's calculations, GLSS 5)

poor (low)	Non-Participants	Participants	Difference
age	46.11	48.68	-2.56 ***
education	2.9	4.38	-1.48 ***
household size	6.02	5.88	0.14
per-head expenditures	1,584,725	1,791,596	-206,870.8 ***
poverty gap (low)	1,299,975	1,093,104	206,870.8 ***
severity of poverty (low)	0.2635	0.2025	0.061 ***
savings	143,818.4	157,678.7	-13,860.26
income in kind	0	44,099.73	-44,099.73 ***
home production	2,313,340	1,823,341	489,999.1 ***
livestock	608,254.1	522,560.5	85,693.6
farm land	5,932,429	6,062,675	-130,245.8
distance to school	10.03	11.43	-1.4
distance to water	1,748.08	2,942.39	-1,194.31
number of households	823	1,657	2,480

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 41: Household characteristics (sample means) of participants and non-participants, summary statistics for the poor (high) dataset (Author's calculations, GLSS 5)

poor (high)	Non-Participants	Participants	Difference
age	46.29	48.25	-1.96 ***
education	3.22	4.99	-1.77 ***
household size	5.79	5.59	0.2 *
per-head expenditures	1,892,724	2,223,914	-331,190 ***
poverty gap (high)	1,816,176	1,484,986	331,190 ***
severity of poverty (high)	0.3021	0.2203	0.0818 ***
savings	152,945.1	344,896.5	-191,951.5
income in kind	0	99,421.3	-99,421.3 ***
home production	2,670,254	1,973,197	697,057 ***
livestock	562,871.5	427,869.5	135,002 **
farm land	7,122,028	7,417,664	-295,635.7
distance to school	10.17	12.05	-1.87 **
distance to water	1,517.08	2,365.25	-848.18
number of households	1,003	2,331	3,334

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 42: Household characteristics (sample means) of participants and non-participants, summary statistics for the non-poor (low) dataset (Author's calculations, GLSS 5)

non-poor (low)	Non-Participants	Participants	Difference
age	46.6	44.01	2.58 ***
education	5.59	9.28	-3.69 ***
household size	3.48	3.62	-0.14
per-head expenditures	6,237,561	10,600,000	-4,394,058 ***
savings	271,532.3	1,413,848	-1,142,316 ***
income in kind	0	149,142.8	-149,142.8 ***
home production	4,172,033	2,906,241	1,265,792
livestock	250,858.4	128,313.4	122,545 ***
farm land	23,500,000	9,900,906	13,600,000***
distance to school	8.25	10.92	-2.67 ***
distance to water	867.23	1,331.26	-464.03
number of households	692	5,213	5,905

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 43: Household characteristics (sample means) of participants and non-participants, summary statistics for the non-poor (high) dataset (Author's calculations, GLSS 5)

non-poor (high)	Non-Participants	Participants	Difference
age	46.43	43.54	2.88 ***
education	5.91	9.69	-3.78 ***
household size	3.03	3.43	-0.4 ***
per-head expenditures	7,269,958	11,700,000	-4,452,307 ***
savings	298,552.7	1,504,232	-1,205,679 ***
income in kind	0	136,330.4	-136,330.4 **
home production	4,126,290	2,990,083	1,136,207
livestock	214,115.2	118,399.8	95,715.42 ***
farm land	27,400,000	9,774,994	17,600,000 ***
distance to school	7.36	10.53	-3.17 ***
distance to water	1,010.09	1,388.42	-378.32
number of households	512	4,539	5,051

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 44: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural poor (low) dataset (Author's calculations, GLSS 5)

rural poor (low)	Non-Participants	Participants	Difference
age	45.95	48.77	-2.82 ***
education	2.9	3.94	-1.03 ***
household size	6.03	6.12	-0.08
per-head expenditures	1,578,016	,1734,474	-156,458.3 ***
poverty gap (low)	1,306,684	1,150,226	156,458.3 ***
severity of poverty (low)	0.265	0.2189	0.0462 ***
savings	147,465	170,709.7	-23,244.77
income in kind	0	36,491.9	-36,491.9 **
home production	2,329,653	2,143,772	185,880.7
livestock	624,155.8	624,392	-236.18
farm land	5,821,606	6,942,975	-1,121,369
distance to school	10.12	11.88	-1.77 *
distance to water	1,825.68	3,286.39	-1,460.71
number of households	784	1,335	2,119

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 45: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural poor (high) dataset (Author's calculations, GLSS 5)

rural poor (high)	Non-Participants	Participants	Difference
age	46.12	48.47	-2.36 ***
education	3.21	4.42	-1.21 ***
household size	5.81	5.81	0.01
per-head expenditures	1,879,874	2,125,002	-245,128 ***
poverty gap (high)	1,829,026	1,583,898	245,128 ***
severity of poverty (high)	0.3048	0.2435	0.0613 ***
savings	157,818	368,905.3	-211,087.3
income in kind	0	63,338.36	-63,338.36 ***
home production	2,698,209	2,391,581	306,627.6 **
livestock	580,541.7	529,095.5	51,446.22
farm land	6,969,762	8,858,136	-1,888,373
distance to school	10.23	12.53	-2.3 **
distance to water	1,591.04	2,624.08	-1,033.04
number of households	951	1,784	2,735

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 46: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural non-poor (low) dataset (Author's calculations, GLSS 5)

rural non-poor (low)	Non-Participants	Participants	Difference
age	46.3	45.7	0.6
education	5.4	7.41	-2.01 ***
household size	3.53	3.8	-0.28 **
per-head expenditures	6,054,467	8,950,329	-2,895,862 ***
savings	238,359.9	1,081,072	-842,711.6 **
income in kind	0	119,487.7	-119,487.7 ***
home production	4,402,952	5,984,605	-1,581,653
livestock	263,112.2	227,988.9	35,123.25
farm land	23,600,000	18,500,000	5,119,211
distance to school	8.3	11.62	-3.32 ***
distance to water	570.27	1,676.34	-1,106.07
number of households	615	2,284	2,899

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 47: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural non-poor (high) dataset (Author's calculations, GLSS 5)

rural non-poor (high)	Non-Participants	Participants	Difference
age	46.07	45.23	0.84
education	5.69	7.79	-2.1 ***
household size	3.06	3.54	-0.48 ***
per-head expenditures	7,082,370	10,300,000	-3,253,908 ***
savings	250,265.6	1,111,138	-860,872.1 **
income in kind	0	113,695.3	-113,695.3 **
home production	4,393,452	6,683,484	-2,290,032
livestock	221,109.4	223,642.4	-2,532.99
farm land	27,900,000	19,500,000	8,354,062
distance to school	7.38	10.93	-3.55 **
distance to water	600.38	1,926.28	-1,325.91
number of households	448	1,835	2,283

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 48: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural female poor (low) dataset (Author's calculations, GLSS 5)

rural female poor (low)	Non-Participants	Participants	Difference
age	47.96	52.69	-4.73 **
education	2.55	2.92	-0.37
household size	4.67	4.32	0.35
per-head expenditures	1,729,461	1,874,129	-144,668.2 *
poverty gap (low)	1,155,239	1,010,571	144,668.2 *
severity of poverty (low)	0.2134	0.1749	0.0385 *
savings	52,830	54,793.33	-1,963.33
income in kind	0	20,200	-20,200
home production	1,416,748	1,090,094	326,653.8 **
livestock	179,520	133,320	46,200
farm land	5,325,700	3,120,633	2,205,067
distance to school	14.16	14.18	-0.02
distance to water	2,238.98	4,650.16	-2,411.18
number of households	100	300	400

Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

Table 49: Household characteristics (sample means) of participants and non-participants, summary statistics for the rural female poor (high) dataset (Author's calculations, GLSS 5)

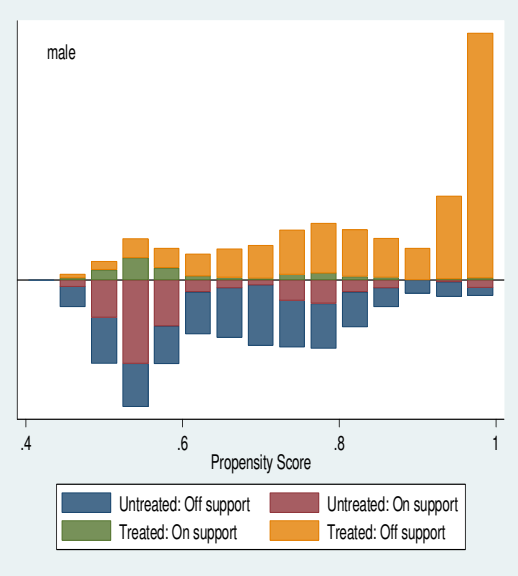
rural female poor (high)	Non-Participants	Participants	Difference
age	49.26	51.99	-2.73 *
education	2.71	3.31	-0.6
household size	4.31	4.11	0.2
per-head expenditures	2,173,248	2,348,941	-175,693.4 **
poverty gap (high)	1,535,652	1,359,959	175,693.4 **
severity of poverty (high)	0.2336	0.1893	0.0443 **
savings	40,891.3	224,319.3	-183,428
income in kind	0	38,669.62	-38,669.62
home production	1,571,053	1,216,296	354,757.4 **
livestock	149,108.7	123,634.1	25,474.55
farm land	5,947,246	4,446,922	1,500,324
distance to school	12.89	13.48	-0.6
distance to water	1,679.58	3,179.6	-1,500.02
number of households	138	451	589

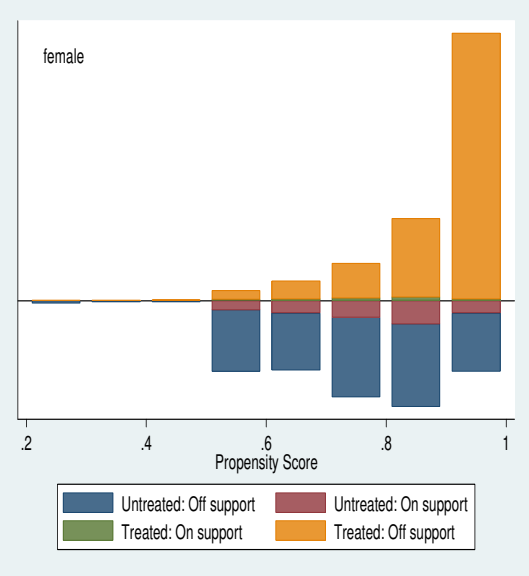
Note: ***, **, and * denote the statistical significance of t-statistic of the mean difference at the 1%, 5%, and 10% level, respectively.

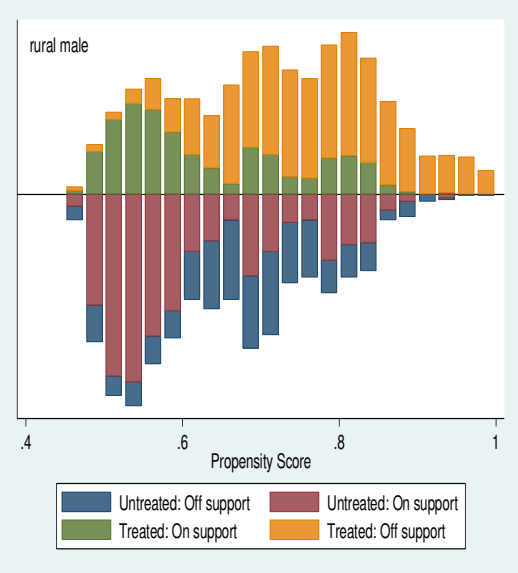
A7 Propensity Score Distribution and Common Support

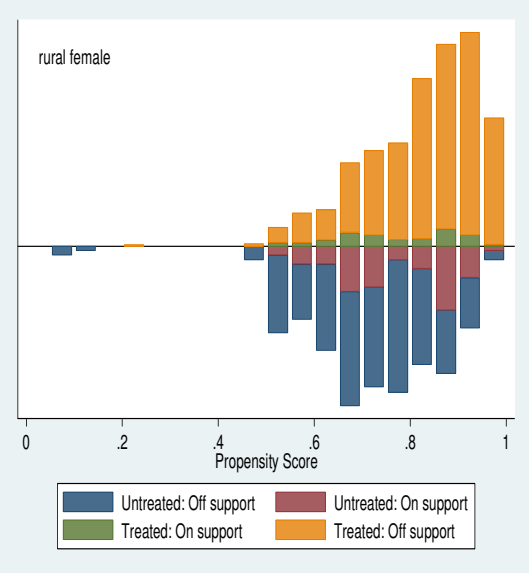
In reference to section 7.3., the distributions of the propensity score and the common support for the p-score estimation are presented below.

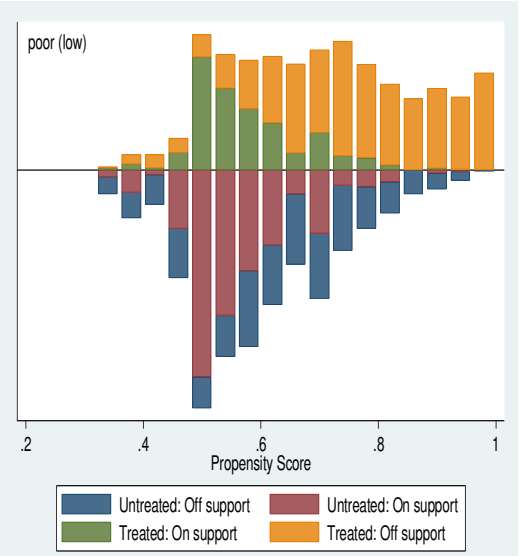
Figures 11 to 15 are organised with respect to the respective outcome variable and the propensity score distribution and the common support for the p-score estimation are then displayed for all subsamples (see Figures 11 to 15).

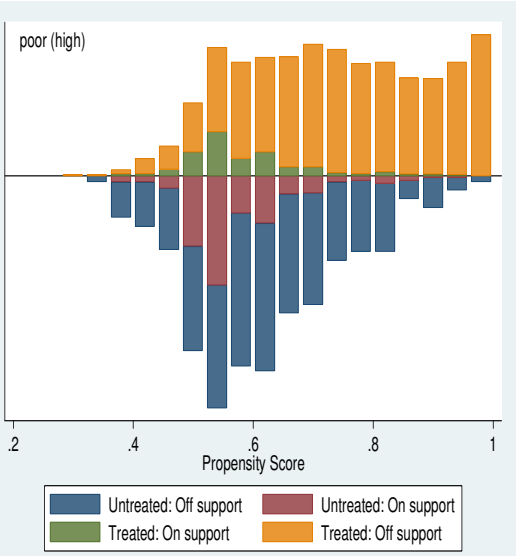


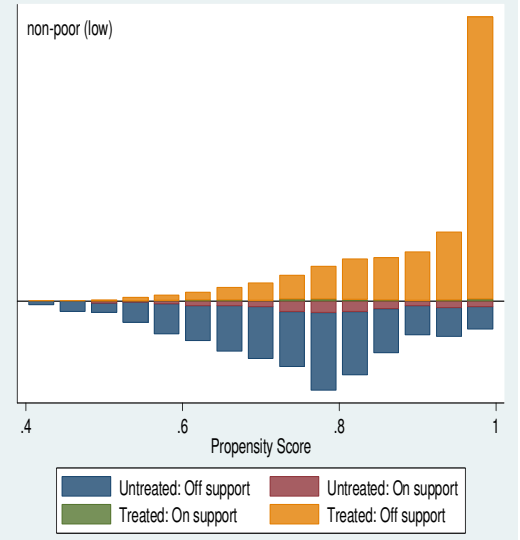


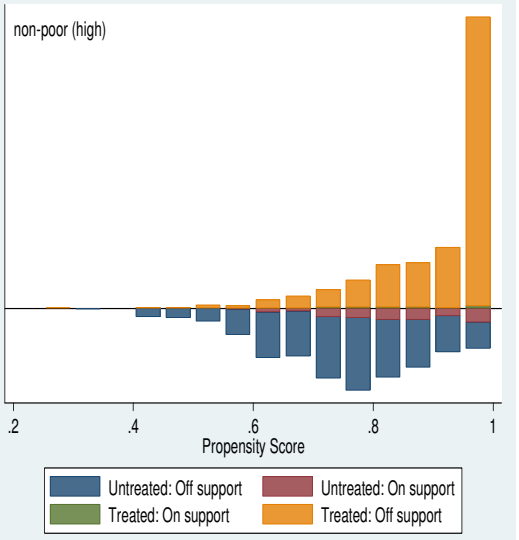


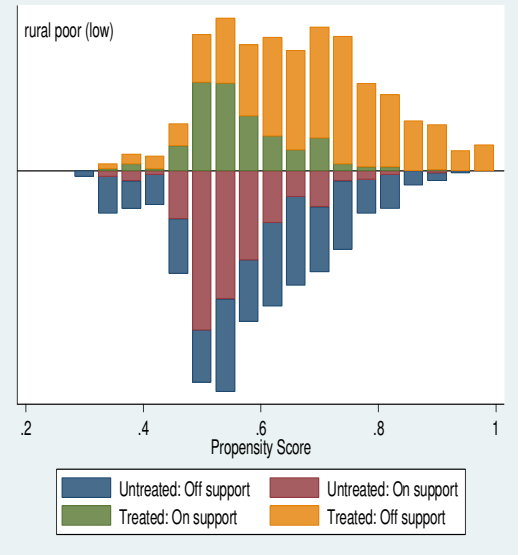


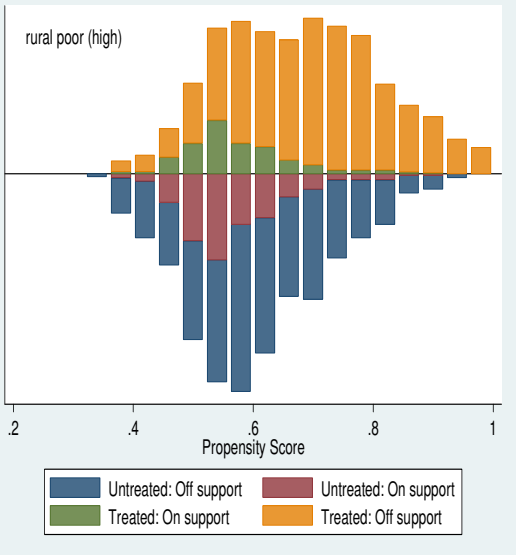

poor (low)
.2
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


poor (high)
.2
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


non-poor (low)
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


non-poor (high)
.2
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


rural poor (low)
.2
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


rural poor (high)
.2
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support

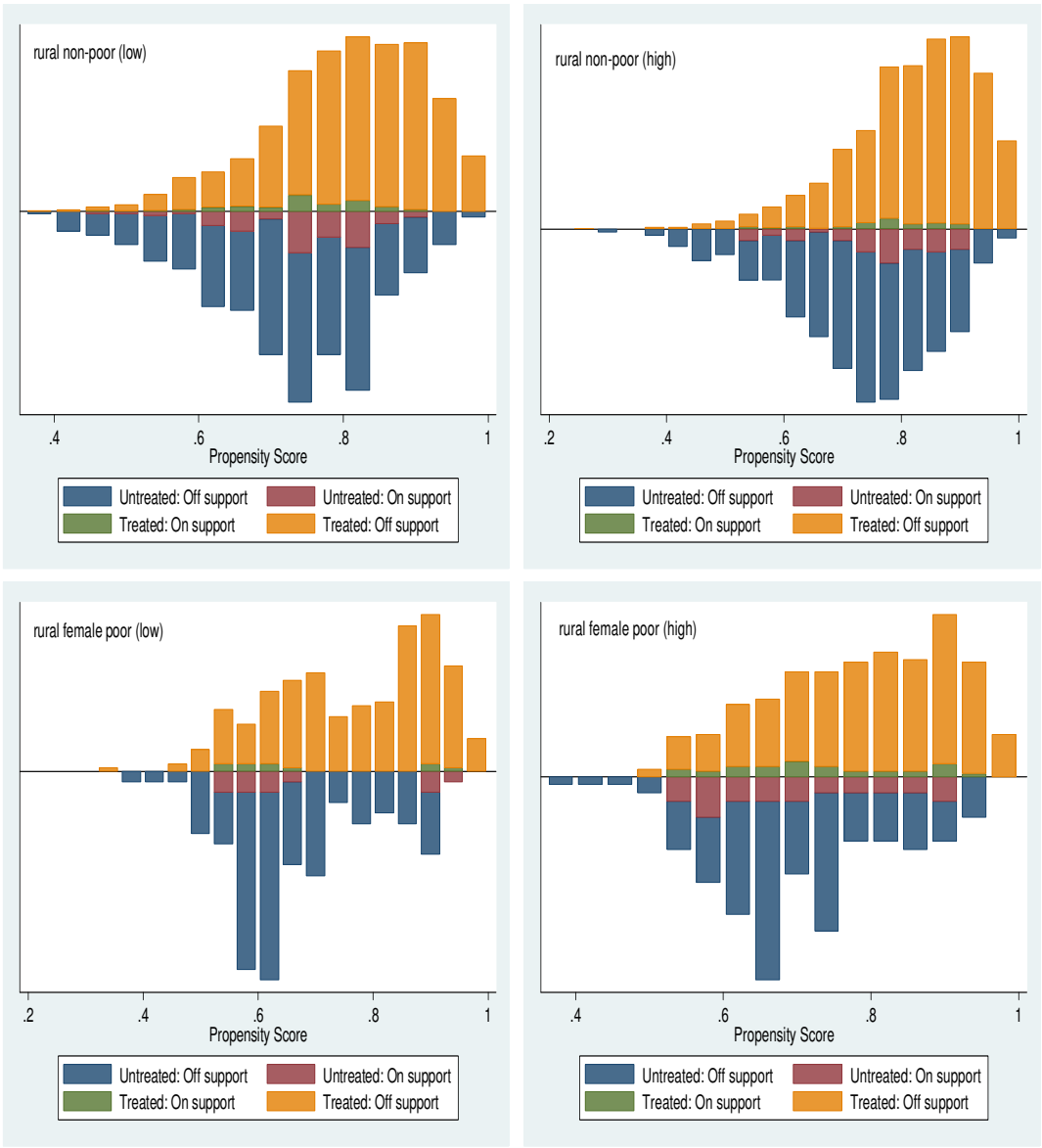
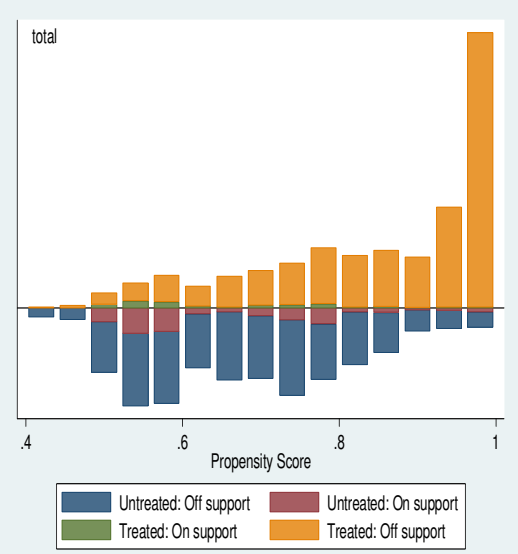


Figure 11: Propensity score distribution and common support for p-score estimation, regarding per-head expenditures (Author's calculations, GLSS 5)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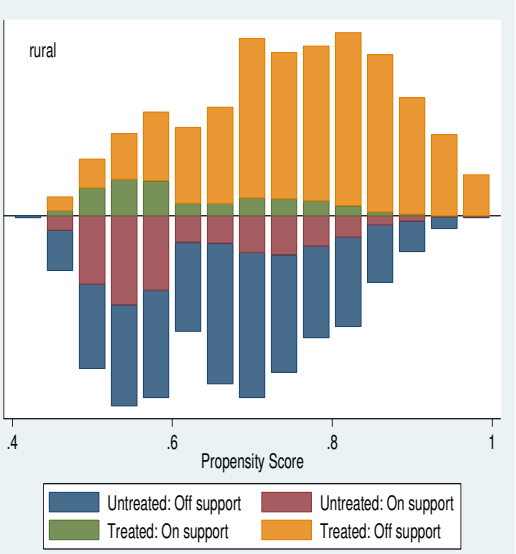
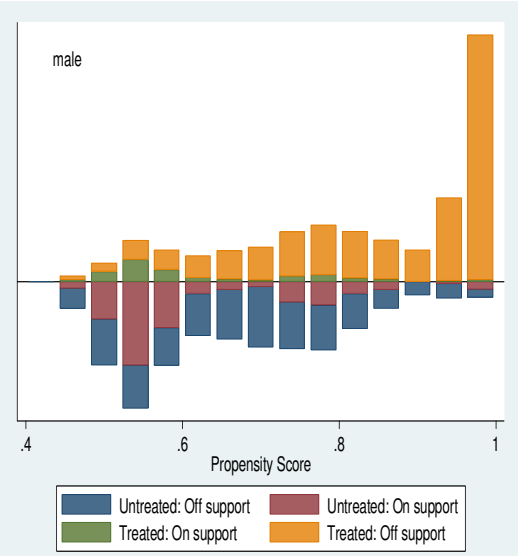
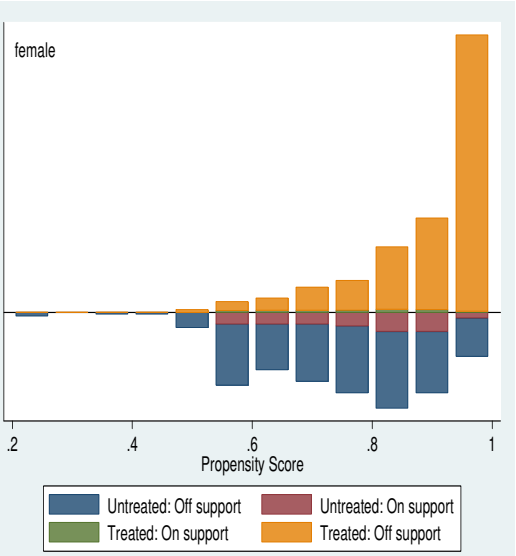
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


rural
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


male
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


female
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.4
.6
.8
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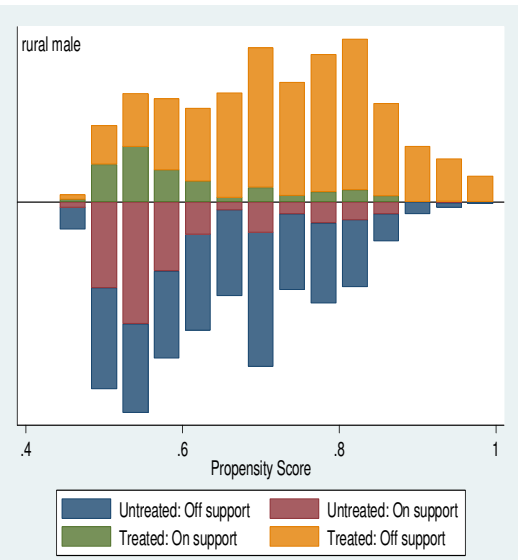
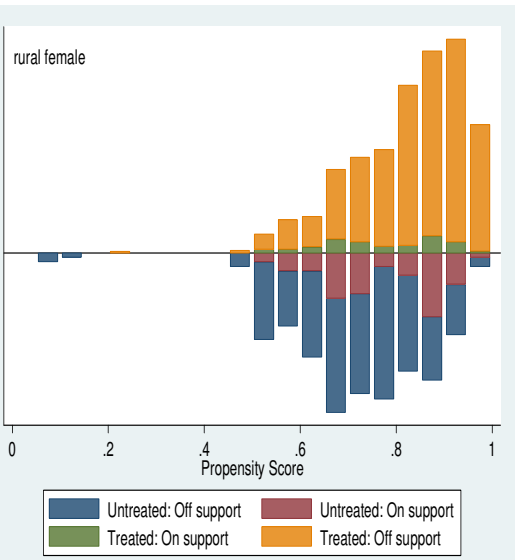
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


rural male
.4
.6
.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support


rural female
0
.2
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.8
1
Propensity Score
Untreated: Off support
Untreated: On support
Treated: On support
Treated: Off support

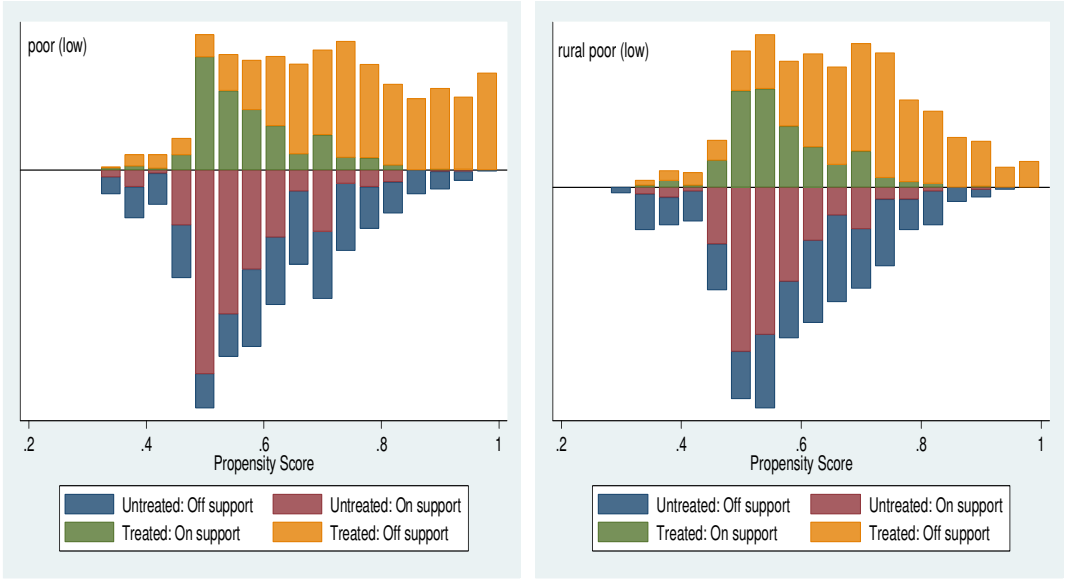
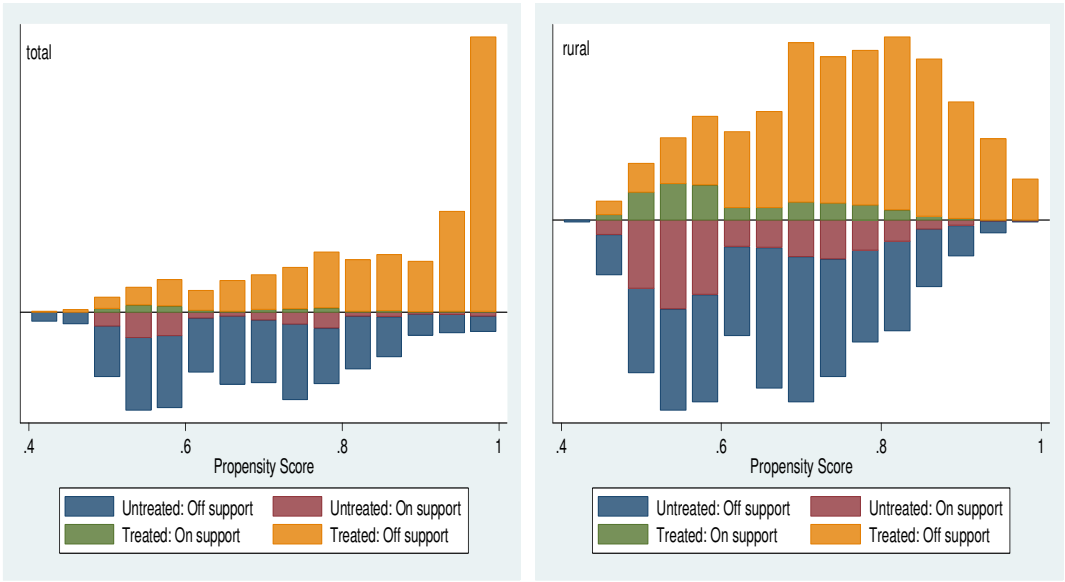


Figure 12: Propensity score distribution and common support for p-score estimation, regarding poverty gap (low) (Author's calculations, GLSS 5)



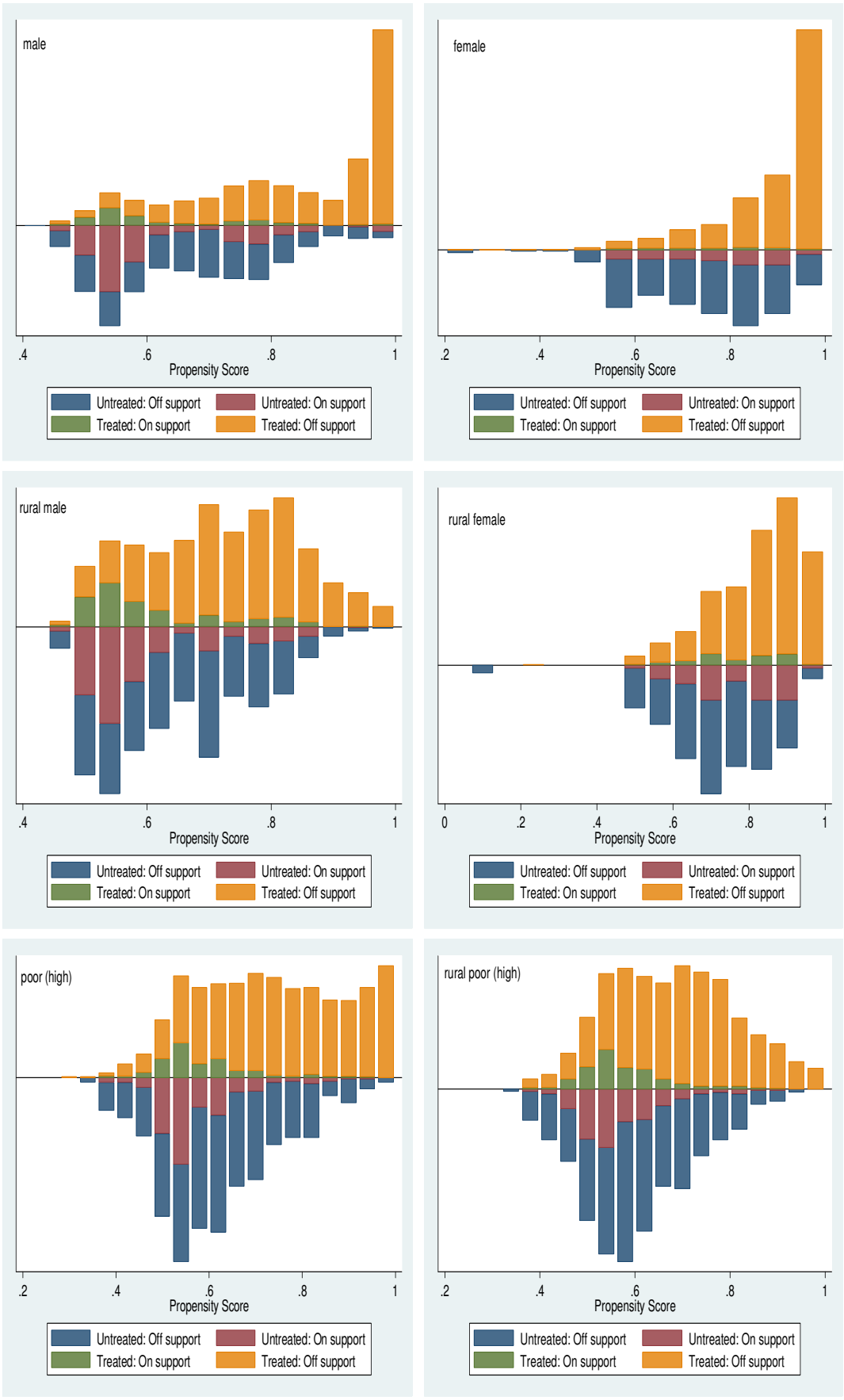


Figure 13: Propensity score distribution and common support for p-score estimation, regarding poverty gap (high) (Author's calculations, GLSS 5)

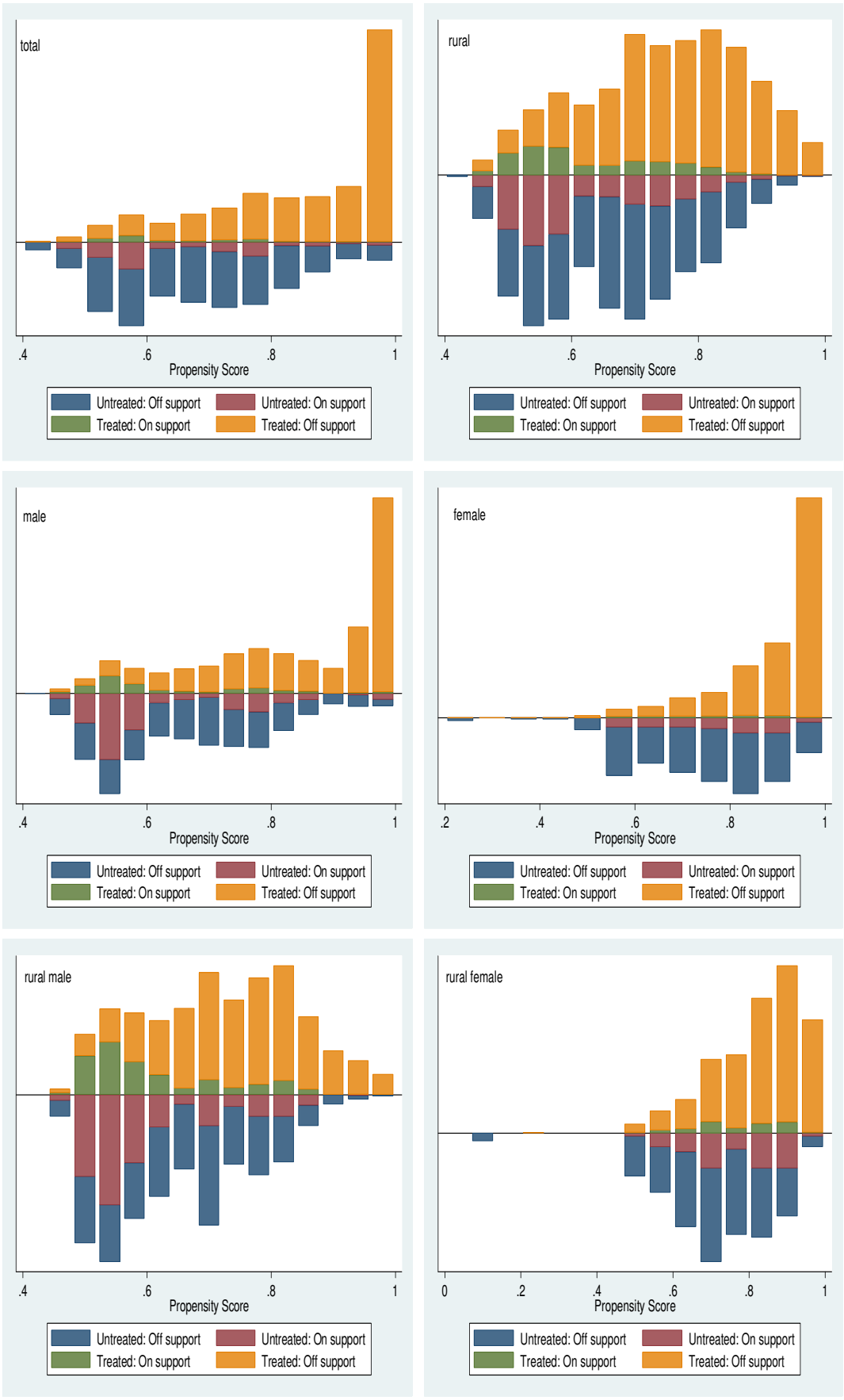


Figure 14: Propensity score distribution and common support for p-score estimation, regarding poverty status (low) (Author's calculations, GLSS 5)

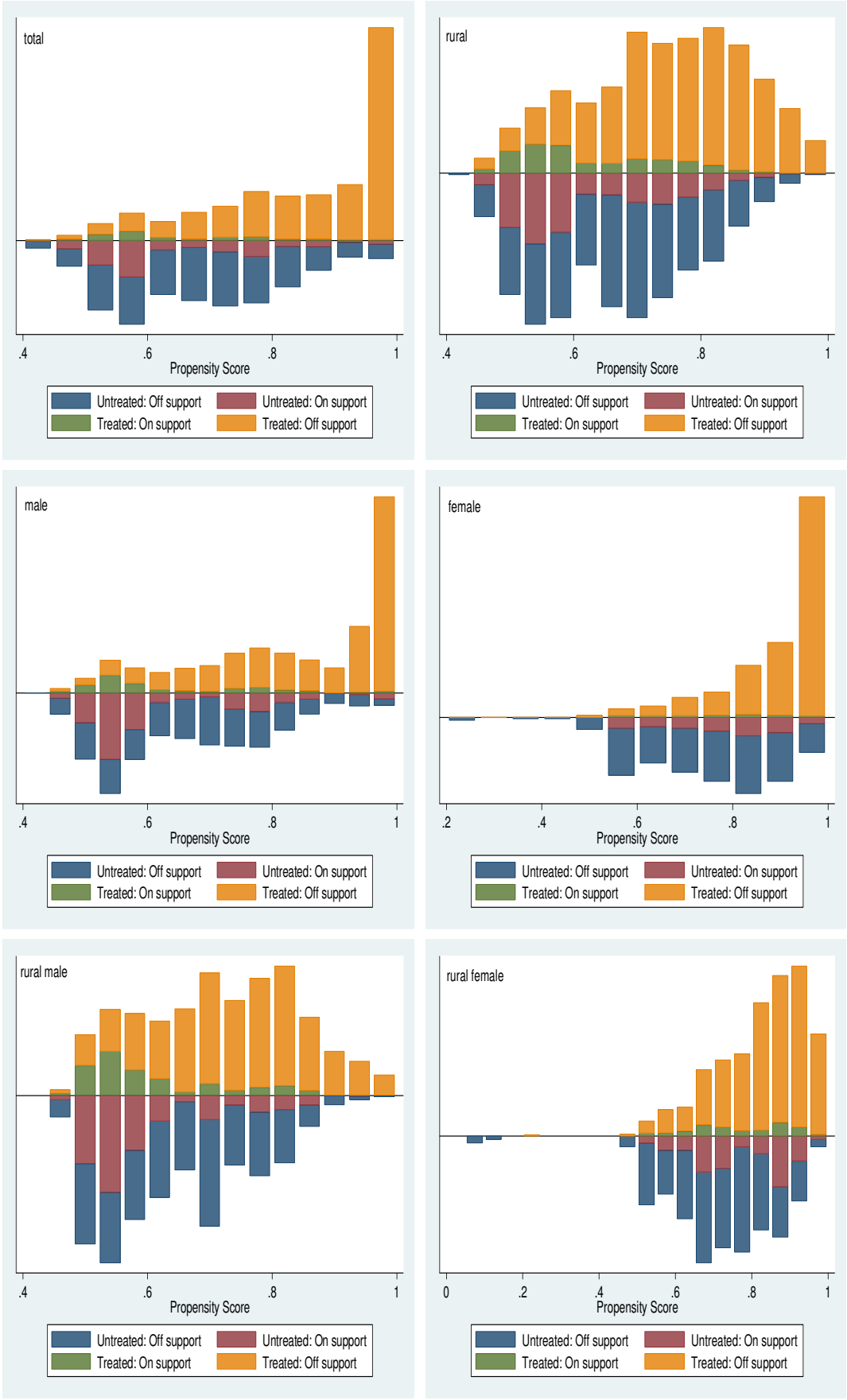


Figure 15: Propensity score distribution and common support for p-score estimation, regarding poverty status (high) (Author's calculations, GLSS 5)

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Professional Education

09 / 1993 – 06 / 2002	Johann-Christian-Reinhart Academic High School, Hof; Degree: Abitur (A Level)
10 / 2002 – 12 / 2005	Bachelor of Science in Home Economics, Focus: Food and Consumer Economics, Christian Albrecht University Kiel Subject of the Thesis: „Die Entwicklung der Haushaltsgröße und des Einkommens und deren Einfluss auf den Außer-Haus-Verzehr im Betrachtungszeitraum 1983 - 2003 “ (‚The Development of Household Size and Income and Their Influence on the Consumption of Food Away from Home between 1983 and 2003‘)
12 / 2005 – 05 / 2007	Master of Science in Home Economics, Focus: Food and Consumer Economics, Christian Albrecht University Kiel Subject of the Thesis: „Economic Development and Poverty: The Case of Ghana “
06 / 2007 – 05 / 2010	Doctorate in the field of ‚Food Economics‘, Christian Albrecht University Kiel

Working Experience

06 / 2007 – 05 / 2010	Research Assistant at the Department of Food Economics and Consumption Studies, Chair of Food Economics (Prof. Dr. A. Abdulai)
10 / 2007 – 05 / 2010	Student Advisor for Food Economics at the Department of Food Economics and Consumption Studies
01 / 2008 – 05 / 2010	ERASMUS-Departmental Coordinator at the Department of Food Economics and Consumption Studies
01 / 2009 – 05 / 2010	Safety Manager at the Department of Food Economics and Consumption Studies