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DOES OFF-FARM INCOME COMPETE WITH FARM INCOME? EVIDENCE FROM MALAWI

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Does off-farm income compete with farm income? Evidence from Malawi

Master Thesis

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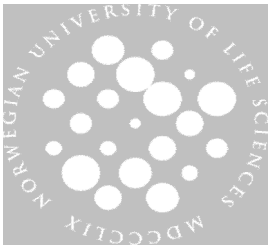

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Dedication

I would like to dedicate my thesis to my beloved family.

Acknowledgment

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Abstract

In rural areas of Malawi, where farmers have small land holding sizes, abundant labour resources and where markets are imperfect; off-farm income has complex but interesting linkages with farm productivity. The question of whether off-farm income competes with or complements farm income is empirical because it has been inconclusive from theories and previous research. This paper examines the impact of off-farm income on farm productivity and household welfare, using panel data collected in central and southern rural areas of Malawi in 2007 and 2009. Two Stage Random Effect Tobit models are used to analyse the data. I find that off-farm income has a complementing effect on land productivity, average labour productivity, input usage and total household income. This implies that the positive effects of off-farm income, through relaxation of the imperfect credit and insurance markets, are significantly dominant over the negative effects of resource competition.

Key words: off-farm income; farm productivity; rural Malawi

Table of Contents

List of Tables

List of Figures

CHAPTER 1: INTRODUCTION

1.1 Problem Statement

Does access to off-farm income[1] compete with or complement agricultural productivity and farm household welfare? Rural households, especially in developing countries diversify their income sources by working off the farm. Empirical studies in rural Africa (Reardon, 1997; Barrett et al., 2001) have revealed that income from off-farm sources may account for as much as 40–45 percent of average household income and seem to be growing in importance. It would also be misleading to see this growth in off-farm activities in isolation from agriculture, as both are linked through investment, production and consumption throughout the rural economy. These income sources also form parts of complex livelihood strategies adopted by rural households (Holden et al., 2004; Davis et al., 2010).

In most developing countries including Malawi, off-farm income can have both positive and negative correlations with farm productivity. Some of the major complementary effects, especially under imperfect credit and insurance markets are: first, off-farm income can provide a better capacity for the farmers to re-invest back in agriculture (Fernandez et al., 2007; Pfeiffera et al., 2009; Davis et al., 2009). Second, access to off-farm income helps households to diversify their income sources, and this can reduce the risk of on-farm innovations (Ellis, 2003; Holden et al., 2004; Davis et al., 2009). Third, rural households use off-farm income as a coping strategy; when the agricultural production is low due to some shocks or the households do not have enough farm income for the whole year, it is an important source of income to stabilize the household income and sustain their life (Whiteside, 2000; Kilica et al., 2009). Therefore, off-farm income can have a positive contribution to farm productivity by reducing early harvest consumption and distress selling at harvest time. Furthermore, participation in off-farm activities prevents rapid or excessive urbanization as well as natural resource degradation through overexploitation. These imply a positive impact on soil fertility and agricultural productivity (Holden et al., 2004; Davis et al., 2002).

On the other hand, off-farm income can compete with farm activities by withdrawing family labour from farm activities. Whiteside (2000) and Alwang and Siegel (1999) conclude that

[1] Off-farm income: Income generated by a household working off the farm (Chang and Mishra 2008). In this study off-farm income includes: income generated from enterprise (business), short-term informal rural labour relationships (in Malawi is called "*ganyu*") and formal employment.

landholding sizes are extremely small, yet many smallholders neglect their own fields as they seek employment off their farm. This neglect leads to low yield on their farms and resulting low returns to labour and land that contribute to households' food insecurity and a vicious cycle of poverty. Holden et al. (2004) also concluded that participation of farmers in off-farm activities can reduce the amount of labour allocation for land conservation that leads to increase in soil erosion and land degradation, suggesting a drop in farm productivity. Off-farm activities can also compete with farm investments by shifting resources (capital, land) from farm to off-farm activities (Davis et al., 2002), which can also lead to a reduction in farm productivity.

The question of whether the positive effects are significant and outweigh the negative effects discussed above, is empirical. If the positive effects significantly outweigh the negative effects, then off-farm income has a positive net impact on farm productivity. This obviously increases the total household income, but the extent is still empirical. However, if off-farm income reduces productivity, then the effect on the total household income will depend on the difference between off-farm income and the reduction in agricultural production. Only few studies (Fernandez et al., 2007; Holden et al., 2004; Maertens, 2009) have looked at both positive and negative effects of off-farm income on farm productivity and household welfare. Hence, this study attempts to investigate the net effect of off-farm income (by combining the positive and the negative effects) on farm productivity and total household income in rural Malawi, where markets are highly imperfect, land is scarce and labour is abundant.

1.2. Malawian Situation and Research Question

Agriculture is the backbone of the Malawi economy; it accounts for 39 percent of GDP, 85 percent of total labour force and more than 80 percent of export revenue. However, nearly 90 percent of the population engages in subsistence smallholder farming (Government and World Bank, 2006). Thus, farmers are commonly characterized by traditional farm technologies, dependence on variable rain fall, high risk, depleted soils, scarce capital and limited access to credit and extension services. In addition, they have very small land holdings such that about 70 percent of the farmers have less than a hectare of land on which to grow the bulk of their food throughout the year (New Agriculturist, 2001). The prevalence of smallholdings within the smallholder sub-sector emanates from population growth. As a result, they are subject to rapidly diminishing return to increased labour input, i.e. the growth of labour cannot be fully absorbed by agricultural sector. Hence, they have a very low land

and labour productivity (Todaro and Smith, 2009; Wendroff, 2004; Malawi Government and World Bank, 2006).

Given the large population, small farm size and depleted soils, it is unlikely that improved access to specialized agricultural machinery would lead to increased in agricultural output. The majority of farmers employ a hoe for tillage and all farm inputs and outputs are moved by head-loading; ox-carts and bicycles are possessed only by a few farmers. In addition, agricultural production is almost exclusively rain-fed and a single rainy season results in pronounced seasonality in factor and product markets. So in poor years the peasants and their family will be exposed to very real danger of starvation. Accordingly, when risk and uncertainty are high a small farmer may be reluctant to shift from traditional technology to improved one (De Young, 2006; Wendroff, 2004).

In order to improve some of these problems, the Malawian government has been promoting subsidies for such products as fertilizers and hybrid seeds, in addition to promoting price incentives and modern methods of farming. However, some researchers (Nsiku, 2008; Ricker - Gilbert and Jayne, 2009) argue that the subsidy will not bring a sustainable solution in the long term except some of its short-term success. This is because the smallholder farmers are unable to respond to the various market incentives, and also when the farmers come to rely on subsidies, their incentives to improve productivity are diminished. Hence, agriculture yields still have been extremely low among smallholders (Nsiku, 2008).

Like in most of developing countries, the majority of Malawi's population remains engaged in agriculture with economies at the very early stages of transformation and with limited growth of off-farm employment (Todaro and Smith, 2009). For many areas in developing countries, agriculture is not a path out of poverty. This can be indicated by the pattern of diversification and changing income levels, such that the poor households showing the strongest move towards rural nonfarm employment (Chapman and Tripp, 2004). Studies from four Asian countries over the past two decades found that households moved out of poverty through diversification of income and creating higher incomes in rural areas. This includes investment in the development of off-farm rural enterprises and opening important new opportunities for rural employment (Gabri-Madhin and Johnston, 1999).

The classical development economic theories of Lewis (1954), Ranis and Fei (1961) and Ranis (2003) presumed that, if agriculture is at the early stage with excessive labour, it is possible to shift the excess agricultural labour from the agricultural sector to other sectors without any reduction in total agricultural output. Therefore under Malawian densely populated and land scarce environment, withdrawal of the excess labour from agriculture and participation in off-farm activities should enable them to earn additional income without affecting the farm income. That may increase the farm productivity and the total household income or welfare.

Does income from off-farm activities increase agricultural productivity and total household income in rural areas of Malawi?

Finding an answer to this question is critical for understanding the ramifications of the rural economic transformation for agricultural competitiveness and the welfare of the rural households.

1.3. Objectives

The general objective of the study is to examine the contribution of income from off-farm activities to farm household welfare and agricultural productivity. The following five specific objectives are postulated in order to reach the general objective (the research question) outlined previously:

- To examine the impact of off-farm income on crop land productivity.
- To investigate the impact of off-farm income on average labour productivity[2].
- To determine the impact of off-farm income on the amount of fertilizer used by farm households.
- To examine the contribution of off-farm income for the total household income[3].
- To examine the impact of off-farm income on household labour productivity[4].

[2] Measured as average annual income from crop production per household labour
[3] Measured as the sum of annual income from crop production and off-farm income
[4] Measured as average annual income from crop production and off-farm employment per household labour

CHAPTER 2: BACKGROUND

2.1. Overview of Malawi Economy

Malawi is a landlocked small nation in southern Africa with a population of about thirteen million and ranks among the world's most densely populated. It has 118,484 total km^2 and it is bordered by Tanzania, Mozambique and Zambia (CIA, 2010). Malawi is one of the least developed countries in the world with high poverty levels and very low life expectancy. In 2007, the HDI for Malawi was 0.437, which gives the country a rank of 164th out of 177 countries (World Bank, 2008).

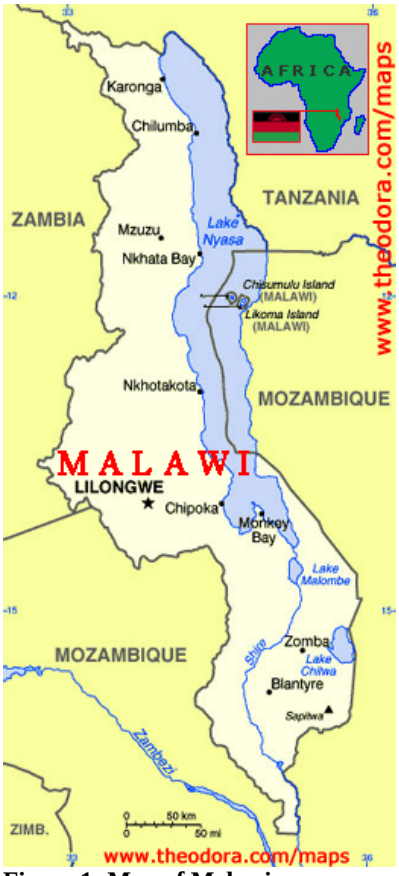

Figure 1: Map of Malawi
Source: CIA, 2010

Based on the 2009 estimates, agriculture in Malawi accounts for approximately one-third of GDP (35.5 percent), industry accounts for 19.9 percent, while services has the highest share (44.6 percent). However, 90 percent of the labour force belongs to agriculture and only 10 percent of the labour force belongs to industry and service (CIA, 2010). The fact that contemporary agriculture employment in developing countries is much higher than agricultural output reflects the relatively low levels of labour productivity compared with those in manufacturing and commerce (De Young, 2006).

In Malawi, the majority of households (38 percent) earn their livelihood only from household farm or fishing activities, while 25 percent of the households combine farming with additional jobs off their farm. Only 11 percent of household heads depend solely on a waged or salaried job and these wage workers found predominantly in urban areas. Finally, about 8 percent of households depend solely on a household enterprise. This is also more common in urban areas than in rural areas. These indicate that most of Malawian households have fewer opportunities to get employment off their farm (Malawi Government and World Bank, 2006).

2.2. Study Area

Malawi is divided into three regions: north, central and south with a total of 28 districts[5]. The northern region has 6 districts; the central region has 9 and 13 districts belong to the southern region (Malawi Government and World Bank, 2006). This study focuses on four districts (Thyolo, Chiradzulu, Zomba and Machinga) in the southern region and two districts (Lilongwe and Kasungu) in the central region of the country. The southern part of Malawi is more densely populated (on average 185 people per km^2) than the central part (on average 154 people per km^2) Average plot sizes per capita in the south and central regions are 0.29 and 0.35 hectares respectively (Malawi Government, 2010; Malawi Government and World Bank, 2006).

Table 1 shows poverty estimates for Malawi in 2005. In southern region the poverty headcount[6] was 64.4 for poor and 31.5 for ultra-poor, whereas in central region it was 46.7 for poor and 16.1 for ultra poor. The poverty gap[7] for the southern and central region was 23.8 and 14.1 for poor and 7.9 and 3.5 for ultra poor respectively. This can also interpreted as, on average the poor survive on 23.8 percent less than the poverty line (MK16, 165)[8] and the ultra-poor survive on 7.9 percent less than the ultra-poverty line (MK10, 029). Hence, the poor are much poorer in the northernmost and southernmost areas of the country, while they tend to be relatively closer to the poverty line in the central region.

Table 1: Poverty Headcount, Income Gap, and Severity of Poverty estimates in 2005

	Headcount	Gap	Severity
Malawi			
Poor	52.4	17.8	8.0
Ultra-poor	22.4	5.3	1.8
By Region			
Poor			
Urban	25.4	7.1	2.8
Rural overall	55.9	19.2	8.6
North	56.3	19.6	8.8
Central	46.7	14.1	5.9
South	64.4	23.8	11.2
Ultra-Poor			
Urban	7.5	1.6	0.5
Rural overall	24.2	5.8	2.0
North	25.9	5.9	1.9
Central	16.1	3.5	1.1
South	31.5	7.9	2.8

Source: National Statistical Office (Malawi Government and World Bank, 2006)

[5] Map of Malawi showing regions and the districts is provided in annexe 2.
[6] The poverty headcount measures the number of people below the poverty line, but does not measure the distance from the poverty line (Malawi Government and World Bank, 2006).
[7] The poverty gap shows how far below the poverty line households are found, on average, expressed as a percentage of the poverty line (Malawi Government and World Bank, 2006).
[8] 1USD=135.96MK (CIA, 2010). MK16, 165=118.9 USD, MK10, 029= 73.76 USD

Table 1 above also shows that in 2005 there was high poverty severity[9] regional difference in Malawi, which is ranging from 11.2 in the south region to 5.9 in the central region. This also confirms that the south holds the highest number of poor and ultra-poor. This table also shows that rural poverty is a much more severe problem than urban poverty (Malawi Government and World Bank, 2006).

2.3. Off-Farm Activities in Malawi

In most developing countries, including Malawi, economic opportunities outside agriculture are limited, yet many rural households are not deriving their livelihood exclusively from agriculture (Dimova et al., 2004). According to my data (focus groups) collected in 2009, farming is the most important and reliable source of income for most of the households. However, off-farm income has also become one of the major sources of income for the rural households.

Figure 2: Off-farm activities in Malawi
Source: Google search

In Malawi, *ganyu* is one of the most important types of off-farm activities and is commonly used as a coping strategy for most poor households in the crucial hungry period between the time when food stores run out and the next harvest (Whiteside, 2000). The word *ganyu* is widely used in Malawi to describe a range of short-term rural labour relationships that is paid either with cash, maize or other food (Anderson, 2002; Whiteside, 2000). Agricultural *ganyu* is the common types of *ganyu* and provided on less poor smallholder's farms (on commercial estates) and this involves preparing fields, seeding, weeding, harvesting and threshing. Other types of *ganyu* include fishing ganyu (helping pull in the nets), digging wells, and collecting water.

[9] The severity takes into account the income gap and the inequality amongst the poor, whereby a dollar of income gap for the extreme poor is given more weight than a dollar of income gap for those who are just under the poverty line (Malawi Government and World Bank, 2006).

Formal-sector employment is an official job paid with a salary or wage and it is also another source of income off the farm (Anderson, 2002). It includes working in governmental organization or restaurants as watch men, messengers, gardeners and others. Small scale businesses are also important sources of income for Malawian rural households. These include making bricks, brewing beer, selling firewood, builders, carpentry.

In Malawi only few households have access to higher-paying types of off-farm work like formal-sector employment and large scale business activities. This is partly because of substantial entry barriers and steep investment requirements to participation in off-farm activities that are capable of lifting them out of poverty. Therefore they participate in the lower-paying informal sector by running small businesses or doing *ganyu* labour (Anderson, 2002; Alwang and Siegel, 1999; Barrett et al., 2001; Dimova et al., 2004).

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CHAPTER 3: LITERATURE REVIEW

3.1. The Role of Off-Farm Activities for Rural Households

The rural economy of developing countries is not based solely on agriculture but rather on a diverse array of activities and enterprises. Hence, the concept of livelihood diversification has been becoming the dominant thinking as a survival strategy of rural households in developing countries (Chapman and Tripp, 2004).

In most African countries including Malawi, farming systems are organized around family units on small farms. There is also high population density and significant deterioration of soil nutrients. In addition, subsistence farmers cannot purchase essential of modern agricultural inputs and methods. Hence, the result can be poverty trap in which farmers must work harder and harder just to stay in place (Todaro and Smith, 2009; De Young, 2006). Under these conditions where incomes are falling and greater pressure on resources, many smallholder farmers are looking for other sources of income. Households with access to high paying off-farm income generating activities are more food secure than households who do not have these benefits. As a result, in both rural and urban areas, local markets have sprawled and small businesses mushroomed. Various initiatives such as trading, small-scale manufacture and eco-tourism are also supporting the off-farm activities (Dimova et al., 2004; New Agriculturist, 2001).

Chang and Mishra (2008) defined off-farm income as income generated by a household working off the farm. In this study off-farm income includes: income generated from enterprise (business), *ganyu* and formal employment.

3.2. Positive Linkage between Off-Farm and On-Farm Activities

There are many potential reasons for a rural household to diversify into the rural nonfarm economy. One of the major reasons is to minimize risk: under imperfect insurance market, off-farm income has a great role to minimize the risk of farm activities. Nonfarm earnings may lead to a decline in households' relative degree of risk aversion and enable them to undertake high-risk/high-return options (Kilica et al., 2009; Osenia and Wintersb, 2009). Pfeiffera et al. (2009) also concluded that off-farm income might serve as a good risk management tool. Farm households also undertake non-farm activities as a way of avoiding risks from agriculture (Ellis, 1999).

Off-farm income has a great role in providing households with income security and liquidity to invest in new production activities or technologies especially under imperfection of credit market (Pfeiffera et al., 2009). Participating in nonfarm activities could increase overall cash income. If the income from off-farm activities used to finance farm input purchase or long-term capital investments, it can be an important source of cash that potentially used to improve farm productivity (Osenia and Wintersb, 2009; Pfeiffera et al., 2009).

Several articles show a positive effect of off-farm income on the use of purchased inputs, for instance: Davis et al. (2009) from Kenya; Hertz (2009) from Bulgarian; Maertens (2009) from Senegal and Holden et al. (2004) from Ethiopia. Hence, in most developing countries farm households highly reliant on off-farm income and that can have good implications to be considered by agricultural research and extension. Reinvestment of off-farm profit back into farm production can be expected to improve farm productivity and household food security. However, it is not clear to what extent income generated by non-farm activities is reinvested back in agricultural production. It is generally believed that the surplus income which is generated from off-farm activities can provide high security to the farmers and that enables greater on-farm innovation (Chapman and Tripp, 2004).

The major push factors that drive people to seek employment opportunities off the farm are low and unstable farm income. Especially under imperfect insurance and credit market, households use off-farm income as a coping strategy. If the agricultural production is low (crop failure) due to agro climatic shocks and/or market failures, farm households may utilize off-farm income to stabilize aggregate income flows and secure food access. In addition, most poor households' income from farm is not enough for the whole year consumption, and they use off-farm income in the crucial hungry period between food stores running out and the next harvest (Whiteside, 2000; Kilica et al., 2009). Therefore, off-farm income can be used as a mechanism to stabilize the household income and reduces early harvest consumption or distress selling at early harvest time.

Moreover, working off the farm could reduce the labour use in agriculture and this could mean less pressure on the natural resource base and that has positive impact on soil fertility and agricultural productivity (Holden et al., 2004). Furthermore, under scarce land and imperfect land market it enables to create more job opportunity for some rural household members and this contribute for the reduction of rural unemployment (Davis et al., 2002).

3.3. Negative Linkage between Off-Farm and On-Farm Activities

The loss of family labour to off-farm work and access to off-farm earnings, in turn, can influence agricultural production in complex ways (Pfeiffera et al., 2009). Participating in nonfarm activities may take family labour away from agricultural activities, thereby potentially reducing family labour in production that can cause their own farm productivity to stagnate or fall (Osenia and Wintersb, 2009). Especially under imperfect labour market the households couldn't perfectly substitute the family labour lost with hired labour force. So these shifts in labour from farm to nonfarm employment can lead to farm production inefficiency (Chavas et al., 2005).

Income earned off the farm might not be used for agricultural production, but rather, to increase consumption, finance investments in non-agricultural production or education, or migrate out of the rural sector entirely (Pfeiffera et al., 2009). From a policy perspective, the findings suggest that unless more propitious conditions are created, nonfarm earnings are not likely to be invested in agriculture. In addition to that when agricultural investment is risky, nonfarm employment and investment options may compete for household labour and capital that could be allocated to agricultural land and technology improvements (Kilica et al., 2009).

Direct transfer of income/profit from farm activity to off-farm activities is also one of the linkages between farm and off-farm activities. Such that withdrawal of capital resource away from farm activity and invest in off-farm activities, leads to lower level of farm investment and reduction in farm productivity (Davis et al., 2002).

Some findings (Osenia and Wintersb, 2009; Kilica et al., 2009) show that household off-farm earnings are negatively related with productivity-enhancing crop input expenditures. Furthermore Holden et al. (2004) indicate that access to rural nonfarm activities may reduce the amount of labour allocated for soil conservation practice. This can also leads to increased soil erosion and land degradation, suggesting a drop in agricultural productivity.

3.4. Net Effects of Off-Farm Income on Agricultural Productivity

The net effect of off-farm income on agricultural productivity is empirical and it depends on the dominance of either positive or negative linkage. Imperfection of labour market may cause the linkages to be negative while credit market imperfections may lead them to be positive (Holden et al., 2004). Depending on which effect dominates, participating in off-farm activities can then be viewed as a complement or substitute to agricultural production. If the lost-labour effects seem to outweigh any increase in efficiency and purchased input use, thus leading to an overall decrease in agricultural output (Pfeiffera et al., 2009).

Some research from Mexico, Albania and Ethiopia show that off-farm income competes with agricultural production (Pfeiffera et al., 2009; Kilica et al., 2009 and Holden et al., 2004). On contrary, others find the complementary effect of off-farm income with agricultural productivity, for instance a household survey undertaken in Senegal (Maertens, 2009).

3.5. The Contribution of Off-Farm Income to Household Welfare

Off-farm activity has been found to be positively correlated with income and wealth and may offer a pathway out of poverty. If the households have better access to non-farm sources of income, that is likely to be good for household welfare and food security (Holden et al., 2004). Off-farm income can also improve efficiency and performance of farm households (Fernandez et al., 2007). Pfeiffera et al. (2009) also found as total income is significantly higher for rural households that have access to off-farm income.

In addition, Dimova et al. (2004) indicates that households' labour allocation decision merely depends on the productivity and respective wages in the two sectors (farm and off-farm). Households would be expected to engage in off-farm activity, whenever the wage received from off-farm activities exceeds the (shadow) wage received for farm production. This should lead to an overall efficient allocation of labour into the most productive activities and this result a positive effect on the overall welfare of the rural community.

On the other hand participation in off-farm activities can reduce the total household income, where the reduction in agricultural productivity outweighs the off-farm income. Whiteside (2000) and Alwang and Siegel (1999) indicated as participation in off-farm activities leads the household to be trapped by vicious cycle of poverty and food insecurity.

CHAPTER 4: METHODOLOGY AND THEORETICAL BACKGROUND

4.1. Theoretical Background and Prior Expectation for Estimating the Impacts of Off-Farm Income on Productivity Insisted

One of the best known early theoretical models of development that focus on the structural transformation is the Lewis theory of development. The Lewis two-sector model has become the general theory of development process in surplus labour third world nation (Todaro and Smith, 2009). It said that the underdeveloped economy consists of a high productivity modern sector and a traditional overpopulated rural subsistence sector characterized by zero marginal labour productivity. This surplus labour can be withdrawn from the traditional agricultural sector without any loss of output to other sectors into which labour from subsistence sector gradually transferred (Lewis, 1954).

This theory has been subjected to much criticism over the past several decades. It has also been modified or extended by several economists like Ranis and Fei (1961) and Sen (1966). Recently, Ranis (2003) concluded that when the agriculture and non agricultural sectors resides at early stage of development, dualism especially which focused on its labour market dimension, continues to offer a theoretically valid, empirically relevant, and practically useful explanations.

Most of the Malawian rural areas are characterized by smallholder, low productive and subsistence farming. The rural areas are densely populated with a very high population growth rate, thus the farmers have very small and fragmented plots of land and scarce capital. Based on the above theories we can transfer the excess labour from farm activities to other off-farm activities without reducing output or productivity. In addition, if the farmers reinvest some of the off-farm income into farm activities, productivity may increase.

On the other side, if marginal productivity of labour in agriculture is not equal to zero, participation in off-farm activities will compete for household labour and capital (the farmers may ignore their fields while chasing off-farm income). Furthermore, income from off-farm activities may not be reinvested back into the farm. Under these conditions off-farm income has negative effects on farm productivity.

From the above theory and explanations, off-farm income can either have a positive or negative prior expectation on land or labour productivity for rural households in Malawi. If the farm productivity is constant or increased, the additional income from off-farm activities definitely increases the total household income and household labour productivity. However, if the farm productivity decreases, the net impact on total household income depends on the amount of the reduction in farm income relative to the increase in off-farm income. If the reduction in on-farm income outweighs the off-farm income it will have a negative effect on the welfare of the household and vice-versa.

Even though I cannot tell from theory whether or not the positive impacts are dominant over the negative impacts, I choose to pose my research questions as the following testable hypotheses:

Hypothesis 1: Off-farm income leads to increased crop land productivity
Hypothesis 2: Off-farm income leads to increased labour productivity in crop production
Hypothesis 3: Off-farm income leads to increased total household income
Hypothesis 4: Off-farm income leads to increased total household labour productivity

4.2. Theoretical Background and Prior Expectations for Estimating the Impact of Off-Farm Income on the Adoption of Modern Agricultural Inputs

The theory of risk-averse peasant states that peasant risk aversion inhibits the adoption of innovation which could improve the output and income of peasant farm families. Risk aversion declines as wealth or income increases. Higher income or wealthier farm households are better able to withstand the losses which might result from taking risky decision (Ellis, 2003).

Off-farm income may have a positive impact on household total income or welfare. In relation to the above theory, when the farmers' income or wealth increases, affordability and risk taking behaviour of the farmers' also increases. That might enhance the probability of the farmer to use more modern agricultural inputs. In addition, the participation in off-farm activities can be seen as diversifying the livelihood system. This may increase the risk taking behaviour of the farmers and the probability of the farmers to adopt the new agricultural technologies. All these imply that when farmers participate in off farm activities their adoption to modern agricultural technologies may increase.

However, if off-farm income has a negative effect on the household total income, the capacity and risk taking behaviour of the farmers decrease; that may reduce their adoption of modern agricultural inputs. On the other way, if the household is more attracted by the off-farm activities than the farm activities, they may not spend more on the farm. Therefore, from the above theory and explanation off farm income can have either a positive or negative effect on the amount of chemical fertilizer applied by the rural household in Malawi; so I choose to test the following hypothesis:

Hypothesis 5: Off-farm income leads to increased in the amount of fertilizer used by farm households.

Table 2: Description of control variables and a *priori* expectation of the impact of off-farm income on land and labour productivity, fertilizer usage and total household income

Explanatory variables							
Variable	**Description and type of variable Expected**	**Discussions on prior expectations**	**H 1**	**H 2**	**H 3**	**H 4**	**H 5**
x_1	Off-farm income (continuous)	Detailed DISCUSSION above	+/-	+/-	+/-	+/-	+/-
x_2	Age of the household head in years: (Continuous)	The age variable can be used as a proxy for farmer's experience and efficiency. When the age increases experience and efficiency will increase but efficiency will decrease after some level.	+	+	+	+	+
x_3	Sex of the head (categorical: 1= male, 0= female)	This variable may indicates gender difference in productivity. In Malawi both women and men are active participant in all agricultural and social activities.	+/-	+/-	+/-	+/-	+/-
x_4	Schooling level of the household head (continuous)	The level of formal education attained will be used as a proxy to farmer's ability to acquire and effective use of information. In addition to that human capital is an important asset for adoption of new technology.	+	+	+	+	+
x_5	Size of land holding in hectares (Continuous)	If the farm households have large size of land, they may get large farm income and that may increase the households' total income. However, because of imperfect markets the inverse farm size ratio may happen and productivity may not increase. The larger the farm size, the more likely that a farmer can afford to set aside an extra piece of land to try new technologies.	+/-	+/-	+	+	+

x_6	Household labour (labour units)[10]: (continuous)	This variable determines the availability of household labour supply. When the labour size increases the land productivity increases. However, if the labour force is in excess, the marginal productivity of every additional labour starts to decline and finally may get to be zero.	+	-/+	+/-	+	+/-
x_7	Tropical livestock units (continuous)	This is an indicator of wealth in most communal areas of Malawi. Wealth may enhance risk-taking and affordability to apply modern agricultural technologies that improves productivity.	+	+	+	+	+
x_8	Market information about crop (categorical; 1= yes, 0= no)	If farmers have more information about prices, buyers and grading, they may sell their harvest at a good price that increases the household income, input usage and productivity.	+	+	+	+	+
x_9	Plot distance from home in kilometre (continuous)	If the plot is far away from residence area, the farmers' effort on the plot may decline.	-	-	-	-	-
x_{10}	Soil fertility: (categorical: 1= fertile, 2=medium fertile 3= unfertile)	If the soil is more fertile the productivity and household income may increase but fertilizer usage may decrease.	+	+	-	+	+
Instruments							
z_1	Adult literacy (Number of household members who are older than 16 years old and have at least 5 years schooling excluding the household head).	These individuals expected to read and write at least the local language. Ability to write and read is important for participation in off-farm employment. However, I expect lower effect on farm productivity because in most developing countries most of the farm decisions are made by the household head.					
z_2 and z_3	Village distance from the nearest market and village distance from the nearest high school: continuous (in Kilometre)	These variables can be used as a proxy for rural urbanization. The more urbanized the area, the more opportunity to get off-farm employment. However, these variables might have smaller effect on farm productivity relative to farm activities.					

[10] Using Malawian conversion factor the household labour converted into adult male equivalent labour unit. Such that children below 8 years excluded from the workforce and children (8-15), women(16-64) and old age person (>65) included in the workforce by using conversion factor 0.4, 0.8, and 0.5 respectively.

4.3. Data Collection Methods

The data used in this study is from six districts; Thyolo, Chiradzulu, Zomba and Machinga in the southern region, and Lilongwe and Kasungu in the central region. These districts were purposively selected to capture varying land issues which are also related to off-farm employment. Thyolo, Chiradzulu, Zomba and Machinga are densely populated districts in southern region of Malawi. Lilongwe and Kasungu have relatively low density as compared to the southern region districts (Lunduka, 2010).

"The primary sampling units (PSU) were the enumeration areas (EAs) following the integrated household survey of 2004 by the National Statistical Office, Malawi. The household population figures used for the EAs are those from the 1998 Population census. In Thyolo, Chiradzulu and Machinga districts two EAs were randomly selected and in Zomba, Kasungu and Lilongwe districts three EAs were randomly selected. In each EA, 30 households were randomly selected giving a total of 450 households. Table 3 below shows the districts and the main villages in the EAs selected for the study" (Lunduka, 2010).

Table 3: Districts, main villages in enumeration area and number of households sampled

Region	***District***	***No of Enumeration areas***	***Main Village in enumeration area***	***No of households***
Southern	Thyolo	2	Chimbalanga	30
			Kapyepye	30
	Chiradzulu	2	Kasani	30
			Matikiti	30
	Zomba	3	Mtutuma	30
			Mayaka	30
			Chirombo	30
	Machinga	2	Kawinga	30
			Namanja	30
Central	Lilongwe	3	Mpingu	30
			Mtengenji	30
			Mpingira	30
	Kasungu	3	Kadifula	30
			Kankhande	30
			Kwengwere	30
Total				**450**

Source: Lunduka, 2010.

Household surveys were conducted in the years 2007 and 2009 growing seasons. These were done at the end of each agricultural season in June, visiting the same households in both years. Two data collection methods were used. First, focus group discussions were conducted

with randomly selected groups in each of the enumeration areas. The second method was a detailed questionnaire which was administered to the 450 households on household and plots information (Lunduka, 2010). The 2007 data was collected by Lunduka (PhD student) and the 2009 data was collected by students in NOMA[11] program. This was done using the same questionnaire which was administered to the same households to create a panel data.

Like most of the survey data, this data have some quality problems. Most of the variables were measured based on the farmers' perceptions. For instance; income (farm, off-farm etc), input costs, soil qualities (slope, texture and fertility), distances (plot distance, market distance) and so on. This may have compromised the quality of the data. In order to improve the quality of the data, physical measurement of the plot size was done using Geographical Positioning System (GPS) equipment.

4.4. Methods of Data Analysis and Model Specification

The objective of the empirical analysis is to measure the impact of off-farm income on farm productivity, input use and total household income. The potential endogeneity of off-farm income is the major econometric problem that arises in attempting to identify these impacts. This is because some household characteristics such as general ability or entrepreneurship that are absent from the survey data, are expected to exert a positive impact (upward bias) on household off-farm earnings, land and labour productivity as well as adoption of modern agricultural inputs. In addition, risk aversion may also have a positive bias by diverting labour and capital resources from farm activities to off-farm investment and a negative bias by encouraging households to invest more in modern agricultural inputs. Hence, this unobserved heterogeneity and biases could affect the results (Pfeiffera et al., 2009; Kilica et al., 2009). So I deal with this problem by using an instrumental variable estimation approach.

Hence, I introduce three instruments that are relevant to specific components of household off-farm income and more or less exogenous to farm productivity and input use. One of the instruments used in this analysis is adult literacy; this variable represents number of household members who has at least five years schooling and older than 16 years old excluding the household head. These individuals expected to write and read at least the local language. Ability to write and read is important for participation off-farm employment (Yang,

[11] MSc program that has been conducted in collaboration with five partner universities i.e. Mekelle University and Hawassa University in Ethiopia, Makerere University in Uganda, University of Malawi, Buda College, in Malawi, and the Norwegian University of Life Sciences (UMB) in Norway (Mekelle University, 2010).

1995). However, I expect lower effect on farm productivity because in most developing countries most of the farm decisions are made by the head of the household. The other instruments are village distance from the nearest market, and village distance from the nearest high school. These variables can be used as an indicator of modernization of the rural area and better off-farm employment opportunities (New Agriculturist, 2001). However, these variables expected to have lower impact on crop production and input use than off-farm employment.

I began the analysis of the impact of off-farm income on the total value of crop production per hectare that is the land productivity. Then, I proceeded to the impact of off-farm income on average labour productivity, total household income, household labour productivity and the amount of fertilizer used. All these impacts can be estimated by comparing off-farm income-recipient households with non-recipient ones, while controlling for a set of other factors.

Moreover, the censored nature of the dependent variables of interest and the nature of the panel data led me to employ the Random Effect Tobit Model. I run the diagnostic test of requirement (instrument relevance) for the instrumental variables and endogeneity of off-farm income in the Random Effect Tobit specification. Then I used the selected instruments in the Two Stage Random Effect Tobit (2SRETobit) specification. The data was analysed with the aid of STATA software. I have done all the regressions manually because I couldn't find direct STATA commands for 2SRETobit model. In the first stage off-farm income is the dependant variable and this variable has a censored nature. Therefore I have regressed off-farm income with instruments and other independent variables using Random Effect Tobit Model. The model expresses the observed response, y_2, in terms of an underlying latent variable:

$$y_{it2}^{*} = \mathrm{X}_{itn}\theta_n + Z_{it1}\theta_k + u_{it}, u / \mathrm{X}, Z \approx Normal(0, \sigma^2)$$

$$y_{it2} = \max(0, y_{it2}^{*})$$

Where y_{it2}* is off-farm income for household i at time t, x_{itn} are n explanatory variables for household i at time t and z_{itk} are k instrumental variables for household i at time t. The latent variable y_{it2}* satisfies the classical linear model assumption; in particular it has a normal homosckedastic distribution with a linear conditional mean. In the above equation the

observed variable y_{it2} equals y_{it2}* when y_{it2}* > 0, but y_{it2} =0 when y_{it2}* =< 0. Because y_{it2}* is normally distributed, y_{it2} has a continuous distribution over strictly positive values. In particular the density of y_{it2} given x_{itn}, z_{itk} is the same as the density of y_{it2}* given x_{itn}, z_{itk} for all positive values (Wooldridge, 2009).

Second stage: Random Effect Tobit Model is used to analyse the effect of off-farm income on land and labour productivity, amount of fertilizer usage, total household income and household labour productivity. The latent variables of the model expressed as:

$$y_{it f}^{*} = \mathrm{X}_{i t n}\beta_n + y_{i t 2}\beta_2 + v_{i t f}, v_{i t f} / \mathrm{X}_{i t f} \approx Normal(0, \sigma^2)$$

$$y_{i t f} = \max(0, y_{i t f}^{*})$$

Where f=a, b, c, d, e

y_{ita} land productivity (annual income from crop production per hectare), for household i at time t

y_{itb} labour productivity (annual income from crop production per household labour) for household i at time t

y_{itc} amount of fertilizer used for household i at time t

y_{itd} total household income (the sum of annual income from crop production and off-farm employment) for household i at time t

y_{ite} household labour productivity (average annual income from crop production and off-farm employment per household labour) for household i at time t.

x_{itn} are n explanatory variables for household i at time t and y_{it2} is predicted off-farm income from the first stage. The latent variable y_{itf}*satisfies the classical linear model assumption; in particular it has a normal homosckedastic distribution with a linear conditional mean. In the above equation the observed variable y_{itf} equals y_{itf}* when y_{itf}* > 0, but y_{itf} =0 when y_{itf}* =< 0. Because y_{itf}* is normally distributed, y has a continuous distribution over strictly positive values. In particular the density of y_{itf} given x_{itn} and y_{it2} is the same as the density of y_{itf}* given x_{itn} and y_{it2} for all positive values (Wooldridge, 2009).

CHAPTER 5: RESULTS AND DISCUSSION

5.1. Summary of Descriptive Statistics and Labeling of Variables

My empirical analysis is based on a panel data set collected from central and southern part of Malawi in 2007 and 2009. The sample includes 708 observations and several variables. The livelihoods of Malawian rural households are more often characterized by complex strategies that involve multiple income-generating activities, and off-farm income is one of the most important sources of income. Figure 3 presents the mean income of crop production and off-farm activities for both south and central region of Malawi, for 2007 and 2009. We can see from the graph that income from off-farm activities has a significant portion of the total household income. For the southern and central regions the mean off-farm income in 2007 was around 40,688MK and 61,813MK respectively and in 2009 it increased to 50,669MK and 67,250MK respectively. Households in the central region have higher mean off-farm income than households in the southern region (figure 3). However, the share of off-farm income to the total household income is higher in southern region than central region.

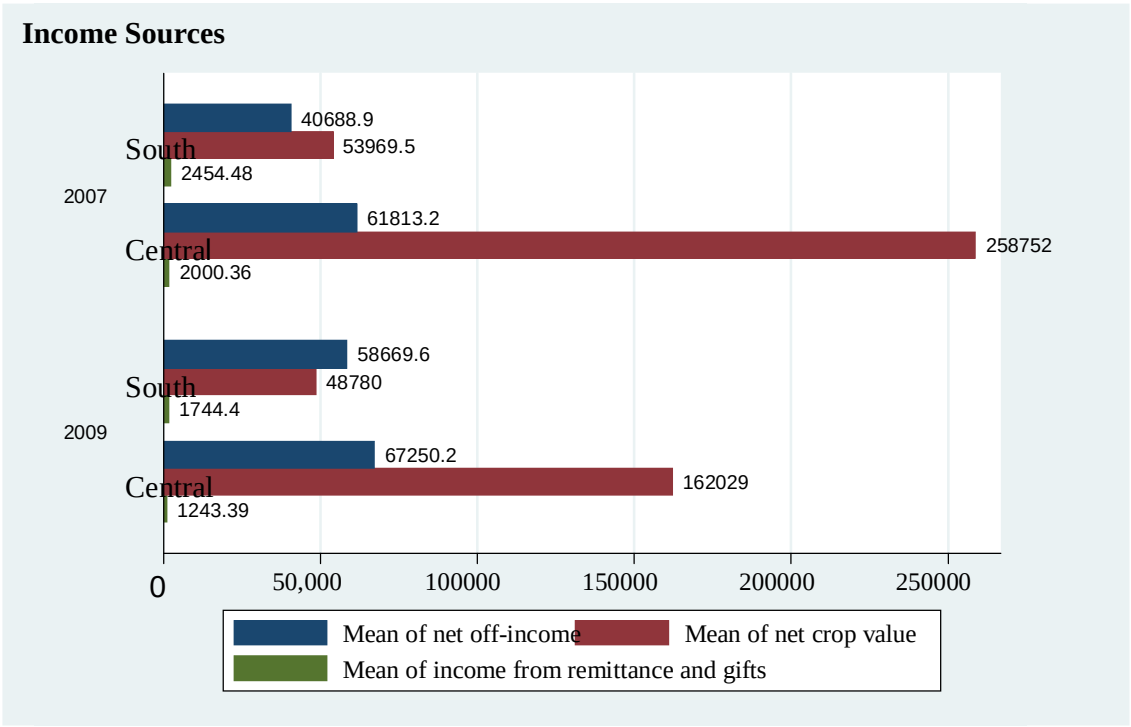

Figure 3: Average income from off-farm activities and crop production (MK)

Table 4 presents summary statistics of participation of rural households in off-farm activities for south and central rural areas of Malawi in 2007 and 2009. In 2007 participation in off-farm activities in south region was around 80 percent and in central region was more than 83 percent while, in 2009 the participation of rural farmers in off-farm activities decreased for both regions. When we look at the same table, the participation of rural households in *ganyu* labor in 2007 was around 61 percent and in 2009 decreased to 53 percent. However, the participation of rural households in formal employment and enterprise (business) activities increased from 14 percent to 16 percent and 34 percent to 36 percent respectively. Therefore, the reduction in participation of off-farm activities resulted from reduction in participation of *ganyu* labor.

Rural households' decision concerning the form and extent of participation in off-farm activities depend on many factors. For instance: incentives offered, such as the relative profitability between farm and off-farm activities and risk of farm; and household's capacity (determined by education, high income, assets level, access to credit etc.) to undertake such activities (Davis et al, 2002). Low and/or unstable farm income is also one of the reasons for participation in off-farm activities especially for households that have small land size (Whiteside, 2000; Anderson, 2002).

Hence, the reduction in *ganyu* participation may also result from reasons related with the above factors. For instance: *ganyu* is generally limited to the low skilled and low wage labour (Whiteside, 2000). Therefore, if the skill and income of the rural households' increases they can shift to other types of off-farm activities such as enterprise and formal employment. The dominant type of *ganyu* labour in Malawi is working in farming activities like seeding, weeding, harvesting and threshing on less poor and relatively larger smallholder's farms (Whiteside, 2000). Therefore, when the size of these larger households' farm land decreases the probability of getting *ganyu* employment in another farm may decrease. Moreover, the farmers may prefer migration to urban area looking for other types of non-farm activities.

Table 4: Summary statistics of participation in off-farm activities

Activities	Region	Year	Freq.	Percent
Off-farm	South	2007	163	80.30
		2009	146	76.04
	Central	2007	125	82.78
		2009	124	77.02
	Overall	2007	288	81.36
		2009	270	76.27
Ganyu	South	2007	119	58.62
		2009	95	49.48
	Central	2007	98	64.90
		2009	93	57.76
	Overall	2007	217	61.30
		2009	188	53.11
Formal employment	South	2007	27	13.30
		2009	26	13.54
	Central	2007	23	15.23
		2009	32	19.88
	Overall	2007	50	14.12
		2009	58	16.38
Enterprise	South	2007	74	36.45
		2009	71	36.98
	Central	2007	45	29.80
		2009	56	34.78
	Overall	2007	119	33.62
		2009	127	35.88

Figure 2 shows participation of farmers in both crop production and off-farm activities. In 2007, 93 percent of farmers in central region participated in crop production and in 2009 increased to 94 percent. This may result from reduction in off-farm employment, decrease in external assistance (gift and remittances) and so on. For the southern region the participation of farmers in crop production in 2007 was around 97 percent and in 2009 decreased to 94 percent. This may be a result of different factors such as: land shortage, shifting to high paying off-farm activities, relying on other sources of income (gift, remittance) and the like. A small percentage of the households (Table 7) participated neither in crop production nor in off-farm activities. These household may sustain their life from livestock production, previous saving, remittance, gifts and so on.

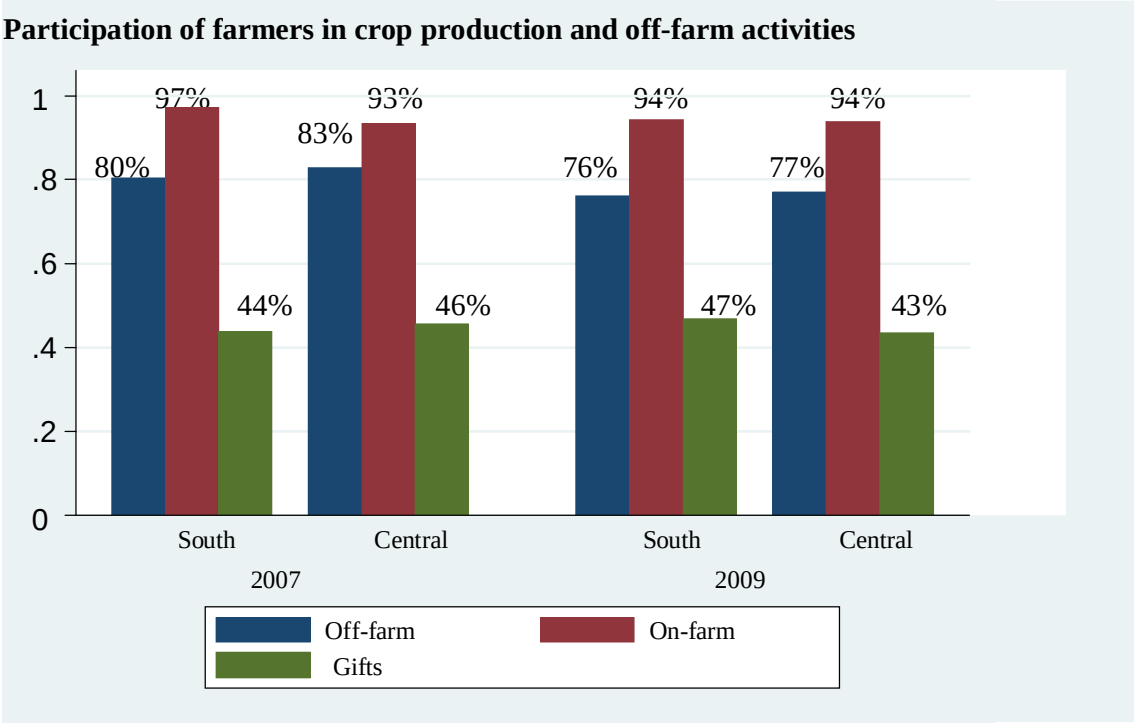

Figure 4: Participation of farmers in crop production and off-farm activities

5.2. Regression Analysis

Two Stage Random Effect Tobit Models (2SRETobit) are used for analyzing the impact of off-farm income on land and average labour productivity, input usage and total household income. Table 8 in annex 1 presents the summary statistics of all variables in the regression. Table 5 presents the result of the First Stage Random Effect Tobit regression of off-farm income equation. Size of operational farm land affects off-farm income negatively and significantly. This may be because when the sizes the farm land increase the household spent more of their time on their farm. This indicates that land is a constraining variable and if the household have more farm land, they spend much of the time on their farm than doing off-farm activities. This can also gives an insight about the relative wage rate between farm and off-farm, such that the average benefit (shadow wage) of the farm is higher than the average wage rate in off-farm activities.

Household labour does not significantly affect off-farm income. This indicates that household labour is not a constraining variable for off-farm income. Such that if more labour added there is no significant change in off-farm income and this implies very low off-farm employment opportunities. Plot distance affects off-farm income positively and significantly. Having a farm land far away from home discourages working on the farm, so the household start looking for off-farm employment. Market information about crops affects off-farm income negatively and significantly. This can be because if the farmers have more information about crops they may focus on their farms rather than looking for off-farm activities. Variable region affects off-farm income positively and significantly, this implies off-farm income in central region is significantly higher than the southern region.

Table 5: First Stage Random Effect Tobit Regression Results for Off-Farm Income Equation

Explanatory Variables	Coefficient	Std. Error
Headsex	0.338	0.23
Agehead	0.033	0.04
Agehead2	-0.001	0.00
Schoolyears	-0.034	0.03
Hectare	-0.247***	0.08
HHlabour	0.009	0.09
Tlunits	-0.066	0.04
Asset (log)	0.019	0.01
Plotdistance	0.221***	0.07
Marketinfo	-0.368*	0.21
Plotfertility2	0.170	0.23
Plotfertility3	0.050	0.26
Slope2	-0.194	0.21
Slope3	-0.193	0.45
Soiltype2	-0.180	0.20
Soiltype3	-0.387	0.29
Region2	0.360*	0.22
Year2009	0.058	0.14
Adultlitracy	0.258**	0.11
Mktdistance	0.006	0.01
Highschooldst	-0.002	0.01
Constant	8.776****	0.96
sigma_u		
Constant	1.071****	0.12
sigma_e		
Constant	1.671****	0.08
prob>chi2	0.000	
Observation	645 total number of observations 138 left-censored observations 507 uncensored observations 0 right-censored observations	

Significance levels: (*) 10%, (**) 5%, (***) 1%, (****) 0.1%

Adult literacy (number of household members who has at least five years schooling and older than 16 years old excluding the household head) affects off-farm income positively and significantly. Thus, this variable satisfies the instrumental relevance requirement but the instrument exogeneity is not verified. Wooldridge (2009) indicates that instrument exogeneity is difficult to be tested, because it involves the covariance between the instrument and unobserved error, and in majority cases we maintain this requirement by appealing to economic behaviour or introspection. The variable adult literacy can be used as a proxy for

the ability to write and read. The ability to write and read is important for participation in off-farm employment because it increases the ability to acquire and effectively use the available information. However, I expect lower effect on farm productivity because in most developing countries most of the farm decisions are made by the head of the household. So I have used it as a valid instrument. I also tried to use village distance from the nearest market and village distance from the nearest high school as instruments but, they are not significantly affecting off-farm activities in my model.

A likelihood-ratio test indicates that sigma_u and sigma_e are significantly different from zero. These imply the panel-level variance component is important, and the panel estimators are different from the pooled estimators. Therefore, the results from the panel estimator are more efficient than the pooled estimator.

5.2.1. Land and Labour Productivity

The Second Stage Random Effect Tobit Regressions were computed using the predicted value of off-farm income, from the first stage regression, as one of the independent variables. Table 6 presents the results of the second stage regression for land productivity and average labour productivity. Off-farm income affects land and labour productivity positively and significantly. It implies 1 percent increase in off-farm income increases land productivity and average labour productivity by about 0.094 percent and 0.338 percent respectively. These indicate that the positive effects of off-farm income are significantly dominant over the negative effects.

In Malawi even though land sizes are very small, the operational size of farm land is not significantly affecting land productivity. This can be explained by the imperfections of markets or the inverse farm size versus productivity ratio. In neoclassical economic theory of farm production there is a parallel argument concerning farm size and economic efficiency. Such that large farms are more efficient than smaller farms in transforming farm inputs into outputs, given the technology at their disposal. However, the imperfection of factor markets, and especially labour markets, results in the inverse relationship such that small farmers being overall more socially efficient agricultural producers than large farmers. The labour market imperfection provides a convincing explanation of various physical productivity relationships which have been observed. Family farms make intensive use of labour at low marginal productivity and thus obtain the highest possible yield per unit area of land (Ellis, 2003). Size

of farm land affects average labour productivity positively and significantly. This can be because when the land sizes increase, total income from farm production increases, that raises the average household labour productivity.

The household labour is not significantly affecting land productivity. This is because under this land scarce and labour abundant environment, when we add more labour, output may not change. However, it affects average labour productivity negatively and significantly. This is because the additional labour may not increase output, since the total output is divided by the total labour, resulting in a reduction of the average labour productivity. This confirms excess labour force in crop production in this community.

Total livestock unit has a positive and significant effect on both land and labour productivity. In most rural areas livestock is an indication of wealth, so that the farmers can adopt modern technology, in addition to using manure for their farm fertility. Asset level can also be used as indicator of wealth and it has a positive and significant effect on land productivity. Plot distance has a negative and significant effect on both land and average labour productivity. When a plot is far away from residence area, it is difficult for farmers to invest more of their effort on it.

Market information about crops has a positive and significant effect on both land and average labour productivity. If farmers have enough information about the market it may encourage them to produce more and earn high farm income. Region affects land and labour productivity positively and significantly. This means that land and average labour productivity is higher in central region than in the southern region. This might partly explained as farmers in central region produce more cash crops than southern region.

For all of the three models in table 6, the likelihood-ratio test is valid; such that sigma_u and sigma_e are significantly different from zero. Hence, the panel-level variance component is important, and the panel estimators are different and more efficient than the pooled estimators.

Table 6: Second Stage Random Effect Tobit Regression for Land Productivity, average Labour Productivity and Fertilizer Usage

	Land productivity (log)	*Labour productivity (log)*	*Fertilizer usage (log)*
	Coefficient/ Std. Error	**Coefficient/ Std. Error**	**Coefficient/ Std. Error**
Offincome_pre	0.094**	0.338**	0.163*
	(0.04)	(0.14)	(0.09)
Headsex	-0.021	-0.023	-0.013
	(0.03)	(0.08)	(0.05)
Agehead	-0.000	0.004	-0.013
	(0.00)	(0.01)	(0.01)
Agehead2	0.000	0.000	0.000*
	(0.00)	(0.00)	(0.00)
Schoolyears	0.001	0.011	0.013**
	(0.00)	(0.01)	(0.01)
Hectare	0.003	0.292****	0.120****
	(0.01)	(0.04)	(0.03)
HHlabour	0.001	-0.157****	0.001
	(0.01)	(0.03)	(0.02)
Tlunits	0.020****	0.082****	0.060****
	(0.01)	(0.02)	(0.01)
Asset (log)	0.003*	0.007	0.006**
	(0.00)	(0.01)	(0.00)
Plotdistance	-0.022*	-0.066*	-0.014
	(0.01)	(0.04)	(0.02)
Marketinfo	0.080***	0.270***	0.107*
	(0.03)	(0.09)	(0.06)
Plotfertility2	-0.013	-0.010	0.017
	(0.02)	(0.08)	(0.05)
Plotfertility3	-0.050*	-0.127	-0.050
	(0.03)	(0.09)	(0.06)
Slope2	0.027	0.041	0.086*
	(0.02)	(0.08)	(0.05)
Slope3	0.118**	0.210	0.176*
	(0.05)	(0.15)	(0.10)
Soiltype2	0.016	0.121*	-0.005
	(0.02)	(0.07)	(0.05)
Soiltype3	0.035	0.156	0.024
	(0.04)	(0.12)	(0.07)
Region2	0.065**	0.242***	-0.151***
	(0.03)	(0.08)	(0.05)
Year2009	0.005	-0.005	-0.017
	(0.02)	(0.05)	(0.03)
constant	11.905****	6.607****	3.559****
	(0.41)	(1.27)	(0.81)
sigma_u			

constant	0.034**	0.234****	0.194****
	(0.05)	(0.06)	(0.03)
sigma_e			
constant	0.232****	0.669****	0.396****
	(0.01)	(0.03)	(0.02)
prob>chi2	0.000	0.000	0.000
Observation	645.000	645.000	644.000
	48 left-censored observations	48 left-censored observations	85 left-censored observations
	597 uncensored observations	597 uncensored observations	559 uncensored observations
	0 right-censored observations	0 right-censored observations	0 right-censored observations

Significance levels: (*) 10%, (**) 5%, (***) 1%, (****) 0.1%

5.2.2. Input Usage

Table 6 also presents the estimated effects of off-farm income on the amount of fertilizer used by the household. Such that one percent increase in off-farm income increases the amount of fertilizer used by the household by about 0.163 percent. This implies that the households are investing some of the off-farm income back to the farm. School years and age of the household head affect input usage positively and significantly. These variables may be used as a proxy to farmer's experience, ability to acquire and effectively use information. Size of operational farm land affects the amount of fertilizer applied positively and significantly. This may be because firstly large size of land is an indicator of the wealth of the household; the adoption of new technologies increases as the households get wealthier. Secondly, when land size increase the more likely that farmers can afford to set aside a piece of land to try new technologies

Asset positively and significantly affects input usage. Market information about crops affects the amount of fertilizer applied positively and significantly. When farmers have more information about crop market, then the incentives to improve productivity will increase. Region affects the amount of fertilizer used negatively and significantly. It indicates that the amount of fertilizer used by the central region is lower than the amount of fertilizer used by the southern region. This may be affected by other external factors like subsidy, relative costs of fertilizer and so on.

5.2.3. Total Household Income and Household Labor Productivity

Table 7 presents the results of the estimated effects of off-farm income on total household income (the sum of income from crop production and off-farm income) and average household productivity (total household income per household labour). Off-farm income has a positive and significant effect on total household income and average household labour productivity. Such that, a one percent increase in off-farm income increases the total household income and average household labour productivity by 0.46 percent and 0.51 percent respectively. It implies that the participation of farmers in off-farm activities improves their welfare level. Farm size affects both the total household income and average household labour productivity positively and significantly. Increase in a hectare of land, increased farm income and total household income but decreased the off-farm income. It implies that the increase in farm income dominates over the reduction in off-farm income, which increases the total household income.

Household labour does not significantly affect total household income. This is because in Malawi there is excess labour and when we increase more labour, the marginal productivity of the additional labour is almost zero in farm productivity and also the off-farm employment opportunity is low. This implies there is idle labour force in this community, such that the additional labour may earn no significant income. Household labour affects the average household labour productivity negatively and significantly. This is because the additional labour is sharing the total income with the rest of the household. This implies, adding another labour just means adding another consumption unit, which reduce the per capita income of each individual.

Table 7: Second Stage Random Effect Tobit Regression for Total Household Income and Household Labour Productivity

	Total income (log)	*Household labour (log)*
	Coefficient/ Std. Error	**Coefficient/ Std. Error**
Offincome_pre	0.460****	0.510***
	(0.13)	(0.16)
Headsex	0.004	-0.007
	(0.08)	(0.10)
Agehead	0.003	0.003
	(0.01)	(0.02)
Agehead2	0.000	0.000
	(0.00)	(0.00)
Schoolyears	0.007	0.010
	(0.01)	(0.01)
Hectare	0.266****	0.297****
	(0.04)	(0.05)
HHlabour	-0.014	-0.225****
	(0.03)	(0.04)
Tlunits	0.082****	0.091****
	(0.02)	(0.02)
Asset (log)	0.010**	0.012**
	(0.00)	(0.01)
Plotdistance	-0.044	-0.051
	(0.04)	(0.04)
Marketinfo	0.205**	0.239**
	(0.09)	(0.11)
Plotfertility2	-0.017	-0.003
	(0.07)	(0.09)
Plotfertility3	-0.084	-0.087
	(0.08)	(0.10)
Slope2	0.048	0.018
	(0.07)	(0.09)
Slope3	0.172	0.158
	(0.14)	(0.17)
Soiltype2	0.117*	0.178**
	(0.07)	(0.08)
Soiltype3	0.267**	0.306**
	(0.11)	(0.13)
Region2	0.205**	0.249**
	(0.08)	(0.10)
Year2009	0.032	0.073
	(0.05)	(0.07)
constant	6.485****	5.241****
	(1.23)	(1.49)
sigma_u		
constant	0.196***	0.225**

	(0.07)	(0.09)
sigma_e		
constant	0.664****	0.808****
	(0.03)	**(0.03)**
prob>chi2	0.000	0.000
Observations	645 total observations	645.000
	19 left-censored observations 626 uncensored observations 0 right-censored observations	19 left-censored observations 626 uncensored observations 0 right-censored observations

Significance levels: (*) 10%, (**) 5%, (***) 1%, (****) 0.1%

Livestock unit, asset value and market information affects the total household income and average household labour productivity positively and significantly. These variables have similar reasoning with land and labour productivity. Region also affects both total household income and average household labour productivity positively and significantly. This implies the central region has better level of income (welfare) than the southern region.

The likelihood-ratio test (for both models in table 7) indicates that sigma_u and sigma_e are significantly different from zero. Hence, the panel-level variance component is important, and the panel estimator is different from the pooled estimator. This can be used as an indication of the panel data estimator is more efficient than the pooled estimator.

CHAPTER 6: CONCLUSION

Although most rural households are involved in the farm sector, the role of off-farm income has become increasingly important for improving the households' welfare and generally for the development of the rural environment. Off-farm income can be correlated with farm activities and household welfare either positively or negatively. Generally speaking, off-farm income is competing with farm activities by sharing resources (labour and capital) and complementing farm activities by relaxing some of the imperfect markets such as credit and insurance markets.

Using panel data collected in southern and central region of Malawi, in 2007 and 2009, I find a positive and very significant effect of off-farm income on land productivity, average labour productivity, amount of fertilizer used, total household income and household labour productivity. This implies that the positive effects of off-farm income on farm productivity are significantly dominant over the negative effects. Therefore, off-farm activities and farm activities are supporting each other rather than competing with each other. The results also show that when farm sizes increase off-farm income decreases; this indicates lower off-farm wage rate than a farm wage (shadow wage rate). In addition, access to more household labour does not significantly affect off-farm income; this can be an indicator of low off-farm employment opportunities in these rural areas of Malawi.

These findings underline the importance of access to off-farm income for farm productivity and welfare of the household for the rural areas of Malawi. Off-farm income is a good policy instrument to increase farm productivity and improve rural household welfare. This is because, in addition to increasing income, it causes farmers' behavioural changes like risk taking behaviour. Additional positive impacts of off-farm income would be expected under better wage rate and improved employment opportunities. Hence, policies which support off-farm activities do not dampen farm activities, rather they support higher farm productivity and reduction in the rural poverty.

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8.0 Annexes

Annex 1:

Table 8: Summary statistics for all variables used in the regression analysis

Variable name	Variable label	Obs	Mean	Std. Dev.	Min	Max
	Endogeneous variables					
Offincome	Annual income from off-farm activities (MK)	708	56,053	168,264	-1,500	2,880,000
Landprod	Annual income from crop production per hectare (MK/Hectare)	708	99,777	278,130	-344,555	5,436,286
Laborprod	Annual income from crop production per household labor (MK/Labor)	708	37,471	83,360	-12,346	1,160,442
Fertlizerqt	Total amount of fertilizer used per year (Kg)	707	112	117	0	960
Totalincome	Annual income from crop production and off-farm activities (MK)	708	176,878	452,866	-42,950	8,094,088
HHlaborprod	Average annual income from crop production and off-farm employment per household labor (MK/Labor)	708	59,213	127,426	-7,166	2,215,385
	Explanatory variables					
Agehead	Age of the household head	708	45.9	15.2	18	85
Agehead2	Age of the household head square	708	2337	1534	324	7225
Headsex	=1 if the sex of the household head is male	708	.75	.43	0	1
Schoolyears	Schooling years of the household head	708	4.8	3.8	0	24
Hectare	Total operational land (hectare)	708	1.2	1.1	.04	10.0
HHlabour	Total household labor (labor units)	708	3.1	1.4	.80	12.1
Tlunits	Tropical livestock units	708	1.3	2.2	0	18.1
Asset	Real asset value (MK)	708	2,740	12,030	-52,874	152,166
Plotdistance	Plot distance from home (Km)	708	.36	1.2	0	13.3
Marketinfo	=1 if the household has access to market information	702	.79	.40	0	1
Plotfertility2	=1 if mean plots fertility is average	708	.47	.50	0	1
Plotfertility3	=1 if mean plots fertility is unfertile	708	.27	.45	0	1
Slope2	=1 if mean plots slope is slight	708	.27	.45	0	1
Slope3	=1 if mean plots slope is steep	708	.04	.20	0	1
Soiltype2	=1 if mean plots texture is loam	708	.47	.50	0	1

Soiltype3	=1 if mean plots texture is clay	708	.14	.35	0	1
Region2	=1 for central region	707	.44	.50	0	1
Year2009	=1 for 2009	868	.50	.50	0	1
	Instrumental variables					
Adultlitracy	Number of household members older than 16 years old and have at least 5 years schooling excluding the household head	708	1.4	1.2	0	6
Mktdistance	Village distance to the nearest market (Km)	717	6.9	7.8	1	28
Highschooldst	Village distance to the nearest high school (Km)	717	5.4	7.3	.1	25

Annex 2:

Map of Malawi showing districts and sites sampled in the study

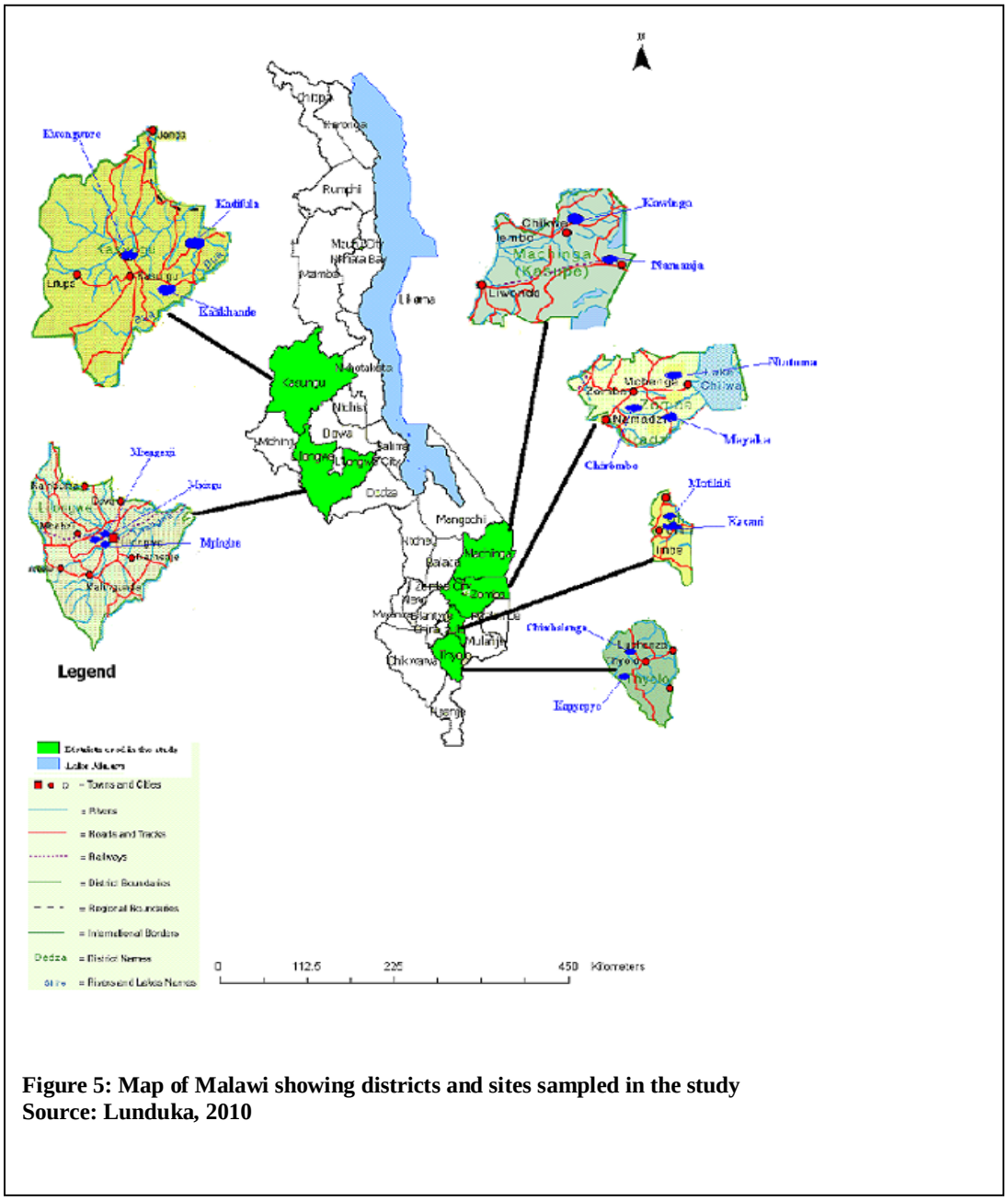

Figure 5: Map of Malawi showing districts and sites sampled in the study
Source: Lunduka, 2010