

Full Length Research Paper

Livelihoods diversification and gender in Malawi

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Scholarly literature portrays rural livelihoods diversification as a continuously occurring phenomenon that results from the increased importance of off-farm wage labor in the household livelihood portfolio or through the development of new forms of on-farm commodities. The fact that women and men particularly in Africa have significantly different roles in the making of livelihoods decisions suggests the need to further understand the differential determinants of livelihoods diversification for the two groups. This study analyses determinants of livelihoods diversification using data from a cross-sectional survey of about 400 households from Malawi. We find that more than 60% of the households combine a number livelihood strategies including agriculture while only 37% of them rely purely on agriculture. Multinomial logit regression results indicate that female-headed households are more like to combine agriculture and *ganyu* than relying purely on agriculture. Moreover households with access to credit are more likely to rely purely on agriculture than to diversify away from agriculture. The low agricultural income realized by female-headed households appears to be a push factor for women diversification into *ganyu*.

Key words: Gender, livelihoods diversification, agricultural productivity, Malawi.

INTRODUCTION

Scholarly literature portrays rural livelihoods diversification as a continuously occurring phenomenon that results from the increased importance of off-farm wage labor in the household livelihood portfolio or through the development of new forms of on-farm commodities. Consistent with this observation, Warren (2002) argues that in either case diversification can be both temporary (occasional diversification) or can be a deliberate attempt to optimize household capacity of the ever changing opportunities (strategic diversification). Livelihoods diversification is important because it can lead to some form of household specialization and also increases the household's ability to cope with risk. Diversified households are said to be more likely to enjoy higher flexibility and resilience capacity than households that are completely dependent on agriculture. Furthermore, the perceived advantages of livelihoods diversification are increasingly becoming important in the light of reiterated environmental, economic and political shocks affecting the rural areas of developing countries.

Based on the arguments stated above, we see a study on livelihoods and its determinants of diversification as relevant in understanding household strategic behavior in the event of risks and shocks, and this information can be important for the formulation of integrated rural

development policies in the developing world. Furthermore, the fact that women and men particularly in Africa, have significantly different roles in the making of livelihoods [for example, Gladwin (2000)] suggests the need to further understand the differential determinants of livelihoods diversification for the two groups. Consistent with this argument, livelihood literature (Ellis, 2000; Hussein and Nelson, 1999) shows that exogenous trends and shocks play an important role in pushing rural people towards a diversified livelihood strategy, however diversification choices are firmly rooted in the micro-economic logic of farming households.

In Malawi, where about half of the population lives below the poverty line, and earns less than US\$ 0.5 per day (National Statistics Office, 2005) the majority of households (more than 75%), live in rural areas and are characterized by small land holdings. Livelihoods diversification for such households is extremely important in the face an increasing vulnerability of agriculture (Malawi's main stay of the economy) to climatic changes and economic shocks. A study on livelihoods and gender is also of great relevance as it falls within the interests and focus of the United Nations Millennium Development Goals (UNMDGs) and more specifically, it is directly related to goal number two of the MDGs which aims at

promoting gender equality. The study is also of relevance to the Malawi Nation, whose gender policy aims at reducing the current gender of disparities through increased participation of women in economic, political, and social-cultural development. Previous studies (for example Gladwin, 2000; Quisumbing, 1996) have shown that in the agriculture sector about 70% of full time farmers in Africa are women and yet access and control of capital resources such as land is predominated by men. Women's access to agricultural support services such as credit, and inputs remains much lower than men. Such studies further report that even in a situation where a woman has accessed credit, they do not have full control over its use because men dominate in decision making at household level.

A study on the situation Analysis of Poverty in Malawi indicates that extension and training services favor men, due to male dominance in the profession and cultural orientation. Malawians mainly derive their livelihoods from agriculture. Livelihoods that depend on agriculture are faced with multiple constraints and are vulnerable to many shocks and stresses, some of which include the lack of land, capital, labour, droughts, floods, diseases and food insecurity. Households, therefore, may fail to make a living from solely depending on agriculture, consequently forcing them to diversify their livelihoods into other off-farm economic activities. Understanding how female-households cope under such seemingly harsh conditions is of particular importance for development experts and indeed any interventionists fighting to raise the status of women.

Gender relations are defined as a social construction of roles and relationships between women and men. The roles are mainly with respect to power, decision-making, control over resources and freedom of action. However the gender aspect of this study focuses on differentiating the livelihoods of female-headed households compared to male-headed households. Thus, the objective of the study is to create a better understanding of the current underlying factors that define the livelihood systems of the households in Malawi, differentiated by the gender of the head of household. This includes an understanding of the current livelihood strategies, activities, the context in which households operate, including their resources at their disposal and the level of their livelihood well-being (livelihood outcomes).

CONCEPTUAL AND THEORETICAL FRAMEWORK FOR LIVELIHOODS AND LIVELIHOOD DIVERSIFICATION

The sustainable rural livelihoods framework

The rural livelihood framework developed by Chambers and Conway (1992) is the key reference guide for the analysis on livelihoods. The framework defines livelihood

as comprising capabilities, assets (stores, resources, claims and access) and activities required to make a living. The important feature of this livelihood definition is that it links assets and options people possess in practice to pursue alternative activities that generate the income level required for survival. The term capabilities according to Sen (1993) cited in Ellis (2000) refers to the ability of individuals to realize their potential as human beings, in the sense of both being (that is, to be adequately nourished, free from illness) and doing (that is, to exercise choices, develop skills and experience).

Assets in the Chambers and Conway also cited in Ellis (2000) the definition of livelihood contains different types of capital. Five main categories of capital have been identified as contributing to assets and these are natural capital, physical capital, human capital, financial capital and social capital. Natural capital refers to the natural resource base (land, water, trees). Physical capital refers to assets brought into existence by economic production processes such as tools, machines, irrigation infrastructure etc. Human capital refers to the educational level and health status of individuals and populations. Financial capital refers to stock of cash that can be accessed on order to purchase either production or consumption goods. Lastly, social capital refers to the social networks and associations in which people participate and from which they can derive support that contributes to their livelihoods

The framework takes into consideration the context in which institutions operate (that is, macro-economic, social, political, environmental, demographic, historical and infrastructural factors and risks) that influence livelihoods; the livelihood resources available to households and communities (that is, economic, natural, physical, human, social and political capital); the institutional processes and organizational structures that operate in the milieu where communities are found; the livelihood strategies that are pursued by households (that is, productive and exchange activities as well as coping strategies) and the livelihood outcomes derived from these strategies (that is, conditions of well-being, such as household status in terms of access to food, health, education, safety, habitat (Figure 1).

Livelihood diversification framework

Households and individuals can diversify livelihoods portfolios in different ways. Hussein and Nelson (1999) and Ellis (2000) propose the classifications of activities included in rural livelihood portfolios focusing on different criteria that include for example (i) farm versus non-farm; (ii) on-farm versus off-farm activities; (iii) local versus migratory and (iv) self employment versus wage labor. However, Warren (2002) argues that it is the juxtaposition between diversification through wage labor and diversification through development of self-employment

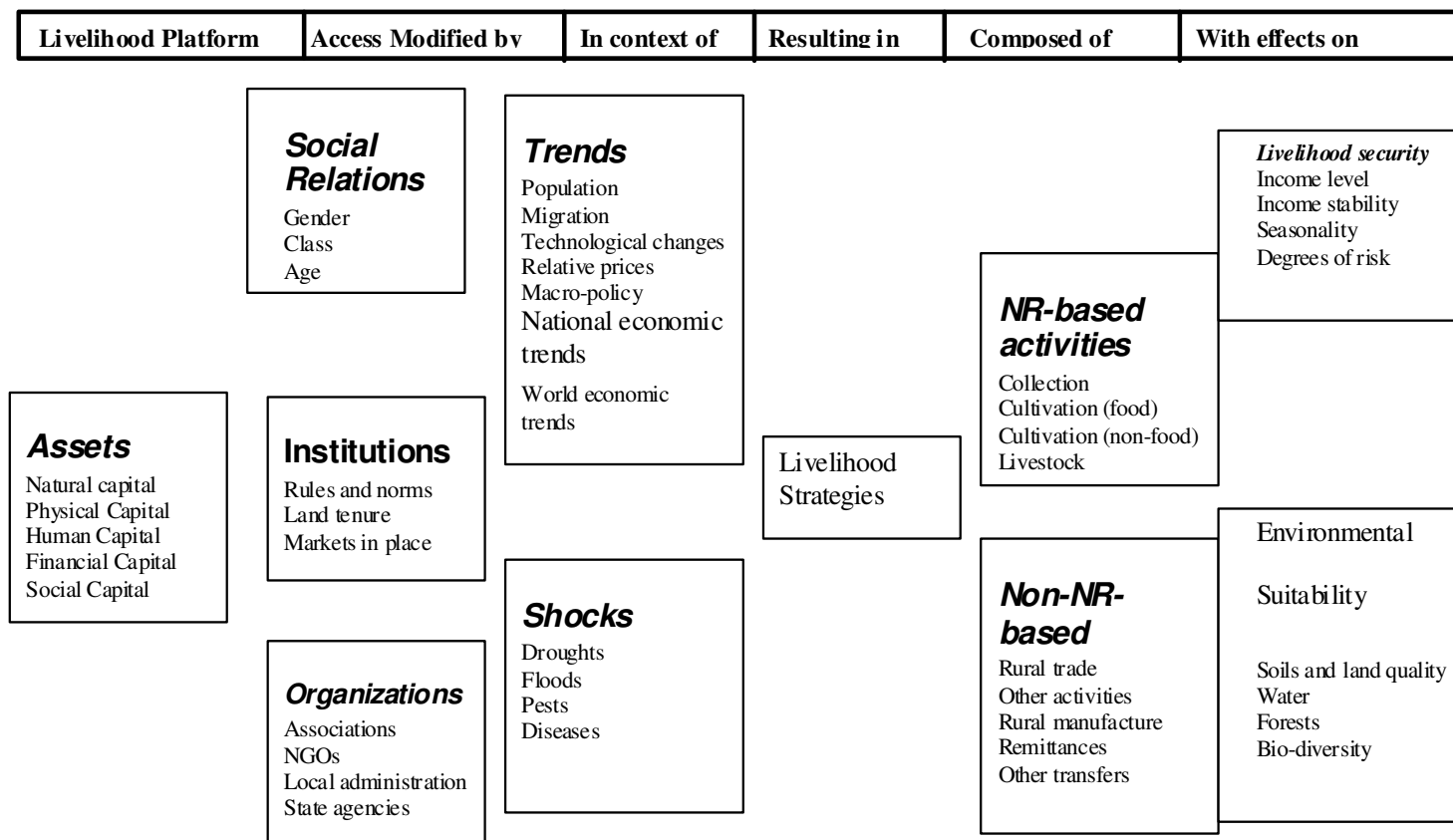


Figure 1. The sustainable rural livelihoods framework. Source: Frank Ellis, 2000: Rural Livelihoods and Diversity in Developing Countries.

enterprises that better captures the basic socio-economic disjunction.

Warren, therefore, argues that the basic alternatives in rural livelihood strategies can be classified into two paths, namely the wage path and the self employment path. In this study and based on the households under study, we classify livelihood strategies into the wage and self-employment paths, however as a digression from Warren (2000) the wage path is further split into casual employment and permanent employment, excluding migratory wage. This is fairly realistic considering that migratory wage is a rare occurrence in the study area. The self employment path proposed in our study is fairly consistent with the proposition by Warren (2002). Figure 2 depicts the diversification pathways and the distribution of households in the sample that followed each of the pathways. About 97% of the households are self employed (85% in agriculture and 32% in non-farm activities which dominated by fish trading. About 29% of the households participate in wage employment, the majority of whom (27%) are daily wage laborers (*ganyu*). Only 2% have formal or long term employment.

Wage labour refers to the provision of work force to agricultural or non-agricultural enterprises owned by non-household employers. This can be both local in the case

where employment opportunities are available locally or migratory wage labor in the case where jobs are spatially distant from the place of residence. Warren reports that if practiced as a part of rural livelihood diversification strategy, both types of wage labor entail a fully "proletarianization" of the rural workers. Income from wage labor can complement insufficient household's agricultural incomes and smooth consumption.

The rural self employment enterprise refers to activities undertaken by mobilizing labour and other household capital assets. These can be either agricultural and or non-agricultural. There are profound differences regarding the way the wage labor and self employment impact on rural livelihood strategies. As argued by Woldehanna and Oskam (2001) cited in Warren (2002). Self-employment through rural enterprises is potentially more profitable than wage labour, although rural self employment requires that a higher capital risk is taken (Bryceson, 1999: 47) for a further reading on the differences between the wage labor and self-employment diversification pathway. In Malawi, casual wage labor, also known as *ganyu* is one of the common forms of livelihood strategies undertaken by poor households. As explained by Whiteside (2000) *ganyu* is a term that refers to any off-own-farm work done by rural people on a

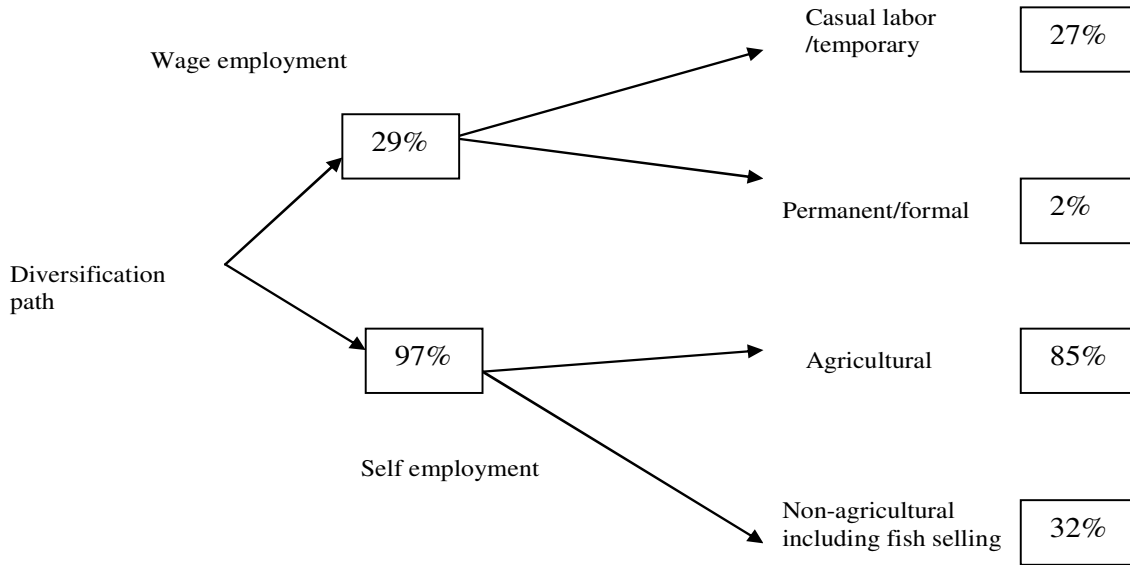


Figure 2. The livelihood diversification pathways. Source: Author.

casual basis. Usually covering a period of days or weeks, remuneration may be in cash or in kind (such as food), and is often, but not exclusively, calculated as piecework. *Ganyu* may be done for relatives, neighbours, smallholders further a field, for estates or even in neighboring countries. The work is often, but not exclusively relatively unskilled and agriculturally based. Men, women and children can all do *ganyu*.

We adopt Warren’s definition of rural self-employment enterprises as activities undertaken by mobilizing labor plus other household capital assets (savings, land, etc.). Rural agricultural enterprises are often based on innovative on-farm agricultural activities (in the form of independent commercial production or contract farming). Also in this study we focus on rural non-agricultural enterprises such as processing of agricultural or forestry commodities, petty-trading, handicraft, home-based piecework manufacturing, or delivery of particular services to the community or to outsiders.

The empirical model for estimating determinants of livelihood diversification

The empirical estimation of the determinants of livelihoods diversification is guided by the random utility model. We assume a decision maker *i* who must choose from a set of mutually exclusive alternatives, $n=1, \dots, n$. The decision maker *i* obtains utility U_{in} from each choice made. In general, given a set of alternatives as stated above a rational individual will chose an alternative that provides the highest utility.

The model is constructed on the premise that the decision maker chooses the choice that maximizes utility.

The utility is not directly observed, but instead only attributes of the available alternatives are observed. Thus the random utility function may be expressed as follows:

$$U_{in} = V_{in} + \epsilon_{in} \quad \forall n \tag{1}$$

Where; V_{in} is the deterministic component which can be calculated based on observed characteristics and ϵ_{in} is the unobserved random or stochastic error component. The error component is never observed which makes it difficult to have enough information that would allow us to predict a specific individual’s choice at each occasion. We can however use a regression to make predictions about the patterns of choices over many individuals and many choice occasions.

The probability of a decision make *i* choosing alternative *k* among *n* alternatives is expressed as follows;

$$\begin{aligned} P_{ik} &= \Pr(U_{ik} > U_{in} \quad \forall n \neq k) \\ &= \Pr(V_{ik} + \epsilon_{ik} > V_{in} + \epsilon_{in} \quad \forall n \neq k) \end{aligned} \tag{2}$$

The utility specified above under a random utility modeling framework can be extended as follows:

$$V_{ik} + \epsilon_{ik} = \chi_{ik} \beta + \epsilon_{ik} \tag{3}$$

Where; χ is a vector of characteristics which influence the choice of a livelihood strategy, β is the coefficient vector and as stated earlier ϵ_{ik} is the term for random

Table 1. Household demographic characteristics

Characteristic	Upland (n = 164)	Railway (n= 268)	Total (n = 412)
Female headed (%)	24.4	28.6	26.9
Age of head of household (yrs)	40.02	39.39	39.64
Household structure			
Total household size (mean)	5.22	5.15	5.18
Aged above 12 years (mean)	3.02	2.89	2.95
Aged 12 years and below (mean)	2.46	2.17	2.28
Occupation			
Agriculture	93.9	74.3	82.2
Agricultural day labor (<i>ganyu</i>)	4.9	2.4	3.4
Non agric. Day labor (<i>ganyu</i>)	8.5	4.5	6.1
Carpenter	1.8	0.8	1.2
Fishing	37.2	37.6	37.4
Weaver	0.6	3.7	2.4
Builder	2.4	1.2	1.7
Other/specify	2.4	5.3	4.2

Source: Nayuchi livelihood assessment (2008).

disturbances with an extreme value distribution. The estimation of equation 2 is done using the multinomial logit model. The multinomial logit (MNL) model, which was first proposed by McFadden (1974), is based on the assumption that each of the random components “*in*” in the utilities is distributed independently which gives rise to a property called independence from irrelevant alternatives, or IIA (McFadden, 1974). In this paper the multinomial logit model is estimated taking into consideration the livelihood strategies undertaken by the households and the household endowment that are presumed to determine the household’s choice of the livelihood strategy.

METHODOLOGY AND DATA

Study area, sampling technique and data

In this study we use data collected by the Center for agricultural Research and Development of the University of Malawi at Bunda College in the year 2004. The data were collected from Nayuchi Area Development Program of the World Vision- Malawi, in Machinga district in Southern Malawi. The district had a population in 1998 of around 369,000 and the population density for the district was 98 persons per square kilometer compared to 105 persons per square kilometer for Malawi (National statistics office, 2005). Nayuchi is located on the eastern side of Machinga district, along the Mozambique boarder and about 100 km from Liwonde Township. The area under study covers an area with more than ten group Villages and a population of 46725, at the time of the study, the majority of whom were Muslims from the Yao ethnic group (NSO, 2005). The area lies between two lakes, namely lake Chilwa and lake Chiuta. Lake Chilwa is one of the most productive lakes in Africa. The lake provides over 20% of all the fish caught in Malawi and economically sustains over 6000 fishers who ply their trade on

its salty waters. An estimated annual income of about 800 millions Malawi Kwacha (US\$10 million) is realized through the fish trade from Lake Chilwa (Maloya, 2000). The lake is home to a dozen fish species but only three are important in the fishery. The area is characterized by two main types of settlement patterns. On the shores, settlements are linear to shores of lake Chilwa and also influenced by the Nacala Railway line which passes through the area to Mozambique. On the upland the settlements are nucleated close to the main centers such as Nampeya, and Chitundu. Villages close to the lake are characterized by sandy soils and water logging dambos. Villages in the upland are characterized by black, clay loamy soils. Households on the lake shore are mainly fishermen or fish traders while those in the upland are largely subsistence farmers with permanent settlements. In addition, the upland area is characterized by fertile loamy soils good for agriculture. Thus based on the remoteness of the area we expect such households to derive most of their livelihood from agriculture and diversify less from agriculture.

The study uses primary data collected through a household survey in Nayuchi. The data was collected as part of the World vision’s routine assessment of livelihoods in the district, and this paper uses only a sub-component of the data. The data were collected using a household questionnaire which captured information various aspects of livelihoods Based on the livelihood assessment protocol, a two stage cluster sampling technique was used to select households that were going to participate in the survey. A total of 412 households were selected from 30 clusters. For analytical purposes and the study area was categorized into upland and railway/lakeshore. This categorization is relevant considering the expected differences in settlement patterns between the two areas.

Household demographic characteristics

Demographic characteristics of the sampled households are depicted in Table 1. About 27% of the households are female-headed. The incidence of female-headed households in the study area is consistent with what has been reported from other surveys

Table 2. Selected household characteristics by gender of household head.

Characteristic	Male headed (n = 300)	Female headed (n = 112)	Overall (n = 412)
Age of household head	39.7	39.6	39.64
Household size	5.23	5.05	5.18
Adults	3.09	2.57	2.95
Children	2.3	2.24	2.28
Dependency ratio	0.88	1.19	0.96
Land ownership (hectares)			
Land owned	1.02	1.07	1.03
Land cultivated	0.91	0.92	0.91

Source: Nayuchi livelihood assessment, 2008.

such as the 1998 Population and Housing Census conducted by the National Statistics Office (NSO) in 2001 which reports that 28% of rural Malawian households are female-headed. The average household size for the study area is 5 persons per household. This is slightly higher than the national average of 4.4 persons per household (National Statistics Office, 2001). The mean age of the household heads is 39.6 years. With regard to age distribution, about 60% of the household-heads are within the economically active age group of 20 to 60 years.

The dependency ratio is defined as ratio of population aged of under 15 or over 64 years to the population aged between 15 and 64 also can be defined as the ratio of the non-working population to the working population was also calculated. Using this definition, a dependency ratio of 0.8 would imply that there are 8 dependents for every 10 working-age persons. This statistic provides an indication of the level of responsibility of economically active persons in providing for dependants. The average the dependency ratio for the study area is about one (unity) implying that the number of economically active people is the same as that of economically inactive people per household. This is also not very different from the national dependency ratio. The national dependency ratio as reported by the National Statistical office is 0.906 – which means that every 10 working persons are supporting just over 9 dependents. There is no significant difference in the dependency ratio between households in the upland and those along the railway. With regard to occupation, agriculture is most frequently reported occupation (82%) in the study area followed by fishing (37.4%). Other frequently reported forms of occupation include casual labor employment (*ganyu*), weaving, and carpentry.

A differentiation of selected household demographic characteristics by gender in Table 2 reveals that male-headed households have more potential income earners than female-headed households and this is clearly reflected in the differences in the dependency ratios. Female-headed households have significantly ($p = 0.1$) higher dependency ratios than male-headed households.

The average land holding size for the study area is about 1 ha and is consistent with the land holding size for Machinga district of 1.1 reported by Chinsinga (2008). There are no differences in the size of land owned, between male-headed and female-headed households. However, the landholding capacity for the Chilwa plain area is increasingly getting smaller due to the increase in population and poor soils for agricultural production especially in the northern Lake Chilwa area (Njaya, 2001). Consistent with this notion, Peters (2004) reports that there also is an increasing pressure on land due to influx of migrants attracted to Lake Chilwa for fishing and fish-trading, which appear to have increased steadily over the past fifty years, albeit fluctuating according to the level of

the lake, which periodically dries up. This attraction is not just for those already living in the vicinity but also for people from as far away as the Lower Shire and Central Regions of Malawi.

Figure 3 depicts occupational differences between male-headed and female-headed households. More female headed households (91.8%), than male headed households (78.9%) reported agriculture as the main occupation. Fish trading was reported as a major occupation among male-headed households (51%), while only 5% of the female-headed households reported fishing trading as their major activity..

LIVELIHOOD STRATEGIES AND ACTIVITIES

Household income and strategies

This study focuses on the activity dimension of livelihoods. Income portfolios are constructed for household and the proportions summarized as means for each location and displayed as table and pie charts. Figure 4 depicts information on income portfolios for the study area. The figure provides a very concise picture of livelihood strategies in Nayuchi. Non-farm income appears to play an important role in their livelihoods as it accounts for 59% of the total household income. Fish trading is the single major non-farm income source for the area accounting for 33.7% of the total household income. This is no surprise considering that Nayuchi is surrounded by two lakes (Lake Chilwa and lake Chiuta) where most residents spend their time trading in fish or fishing. Crop income remains an important component in the livelihoods of people in the area accounting for about 38% of the household income. Maize (20.6%) and rice (16.4%) are the key crops in the area. Other key livelihood sources include *ganyu* (whose income account for 15.1%), grocery/shop (income accounting for 3.4%) and beer sales (income accounting for 2%).

When disaggregated by gender, results in Figure 5 reveal that maize is a major source of income among female-headed households (26%) compared to male-headed households (17%). A higher proportion of income among male-headed households (40%) than female headed households (21%) is from fish selling. Due to data limitations this study did not distinguish between fish traders and fishermen, although the two can be very different considering the initial capital requirements to invest in the activities.

However, the low contribution of fishing income among female-headed households can be attributed to the prohibitively high capital investments that are required for participation in fishing as well as fish trading. Fishermen require investments in boats and nets that are quite expensive, while fish traders equally require financial capital to be able to finance their fish purchases and to

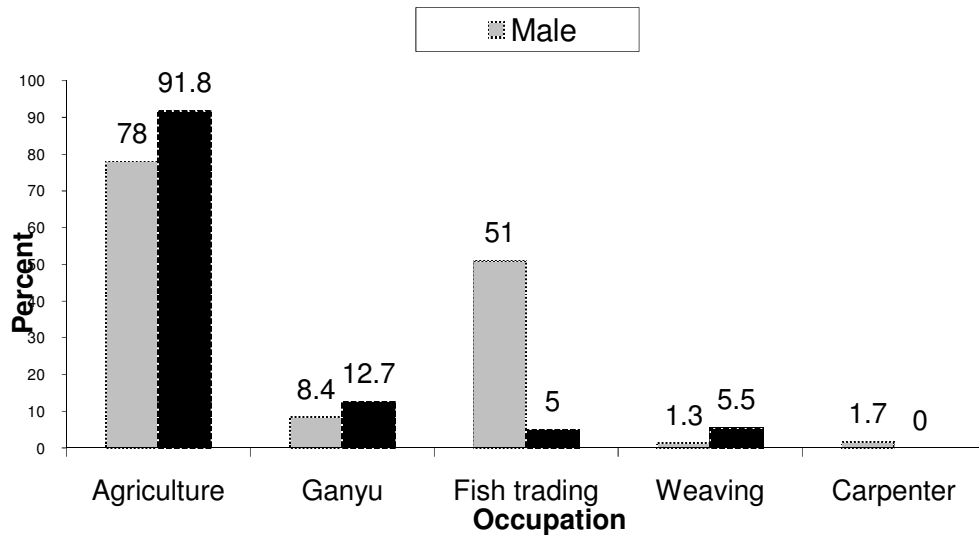


Figure 3. Main occupation by gender of household head.

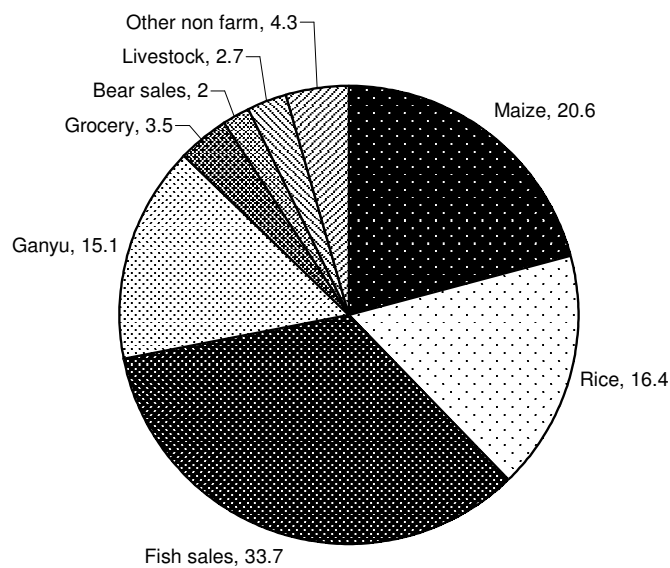


Figure 4. Mean household income portfolio for Nayuchi.

transport the fish to lucrative markets which are far from the area. In most cases women would have to purchase fish from fishermen for re-sell, however, fish markets are far from the area. Furthermore, fishing areas are far from the homesteads such that households seeking to participate in fish trade and fishing require temporary migrations from households for the period that they want to engage into the activity and this limits single female-headed households from participating in the activity.

Income portfolio by income group

A comparison of livelihood strategies across income groups is presented in Table 3. Farm income is less important among high income groups. It accounts for about 48% of the total income in the low income group while it declines to 35% in the high income group.

Non-farm income appears to be more important for the high income group, implying that rich households are diversifying away from agriculture. However, a counter argument to such a hypothesis is that diversifying away from agriculture leads to higher incomes. The implication is that in the absence of a counterfactual, these results have to be understood with caution since we can not establish causality.

Income strategies by income portfolio and by gender

As reported by Kabeer (1997) there are a number of key issues concerning livelihood relationships between rural women and men in the context of poverty and its incidence in the rural economy. One assumption is that rural women are poorer than rural men. In other words, female-headed households are poorer than

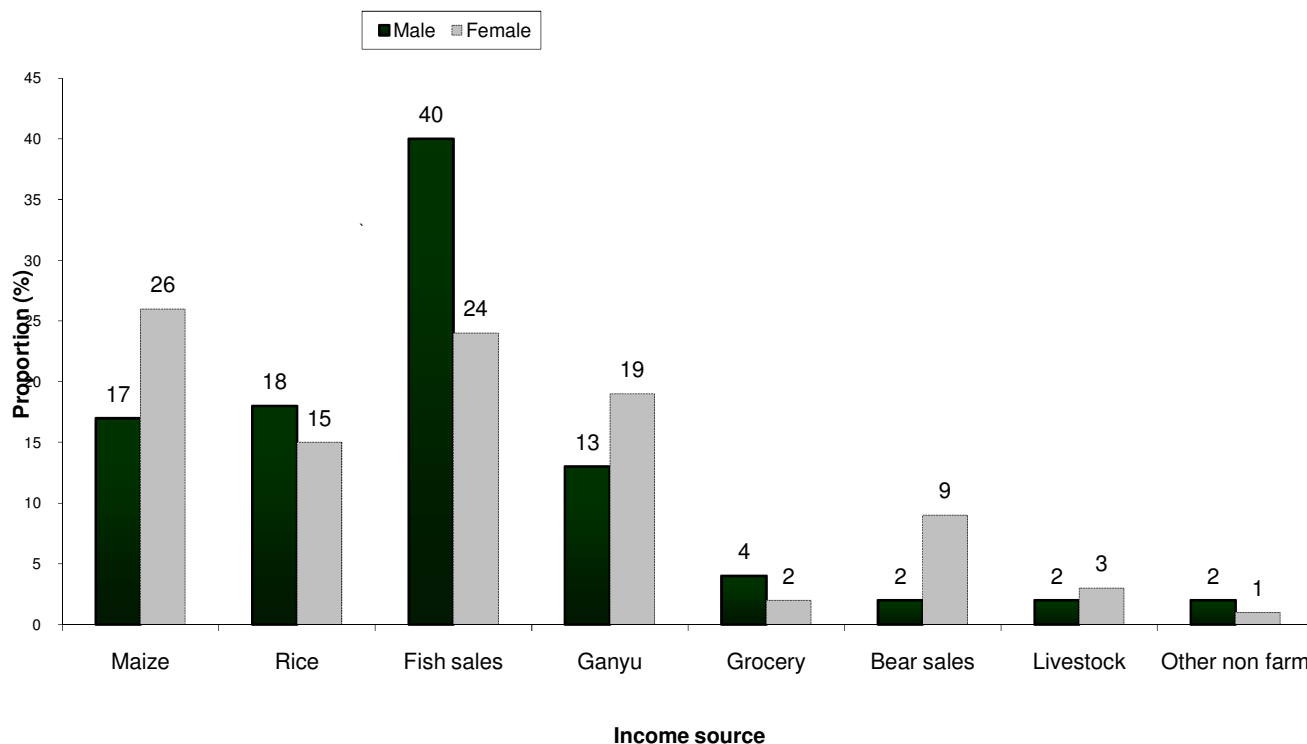


Figure 5. Mean household income portfolio by gender.

Table 3. Mean household income portfolios, by income group.

Characteristic	Income quartile				All
	I	II	III	IV	
Farm income in (MK)	936	2936	4814	17463	6505
Share of total income (%)	47.7	46.0	34.25	34.80	41
Non-farm income (MK)	977	3593	8977	29168	10628
Share of total income (%)	52.3	54	65.75	65.20	59
Total income (MK)	1913.67	6529.44	13791.87	46631.74	17134.57

Source: Nayuchi livelihood assessment (2008).

Table 4. Mean Income portfolio by gender.

Characteristic	Male headed (n=301)	Female headed (n=111)	Overall (n=412)
Average household income	20844.31	8236.52	17439.29
Percapita income	4748.69	1985.46	3998.77
1 st quartile per capita income (%)	17.8	43.2	24.7
2 nd quartile per capita income (%)	23.2	29.7	24.9
3 rd quartile per capita income (%)	28.5	17.1	25.4
4 th quartile per capita income (%)	30.5	9.9	24.9

Source: Nayuchi livelihood assessment, 2008.

male-headed households. In this study we compare incomes between male-headed households and female-headed households. As presented in Table 4, female-headed households are found to be poorer than male-headed households. The average household

income for male-headed households (K20844.31) is significantly higher (at $p=0.01$) than income for female-headed households (K8236.52). This finding suggests that any programs aimed at assisting female-headed households to raise their standards of

Table 5. Land management technology adoption by gender.

Technology	Male headed (n=301)	Female headed (n=111)	Overall (n=412)
Fertilizer	64.1	61.3	63.3
Compost manure	37.2	31.5	35.7
Contour ridges/bunds	17.9	8.1	15.3
Irrigation	12.3	11.7	12.1
Agro forestry	5.0	7.2	5.6
Vertivar	0.7	0.0	0.5

Source: Nayuchi livelihood assessment, 2008.

Table 6. Farm productivity portfolio by gender.

	Yield quartile				
	I	II	III	IV	All
Male maize yield (kg/ha)	109	282	552	1630	759
Percentage (%)	14	28	27	32	100
Female maize yield (kg/ha)	115	304	540	1689	537
Percentage (%)	32	24	28	16	100
Male rice yield (kg/ha)	91	276	566	2141	858
Percentage (%)	22	21	28	29	100
Female rice yield (kg/ha)	83	261	525	1825	484
Percentage (%)	24	33	31	12	100

Source: Nayuchi livelihood assessment, 2008.

living in the study area, will have the dual beneficial effect of both reducing the gender inequality in incomes and of reducing poverty overall. The overall household income for the ADP is K17439.39 which translates into a per capita income of K3998.77. This level of per capita income is significantly lower than the national average of US dollars 160 per annum. Looking at the income portfolios, it is found that there are more female-headed households (43.2%) in the lower income quartile than male-headed household (17.8%) an indication that income inequalities exist between men and women in the area.

The answer to the puzzle of income inequalities between male-headed and female-headed households partly lies in the differences in household composition. As reported earlier, male-headed households have more potential income earners than female-headed households and this partly explains the difference in incomes between the two groups. The lack of capital to invest in fishing and fish trading (which appears to be more lucrative than agriculture) may also explain income differences between the two categories. This finding is consistent

FARM PRODUCTIVITY AND DIVERSIFICATION

Maize and rice are the dominant crops for they are grown by 100% and 61% of the households, respectively. Other less widely grown crops are cassava (16%) sweet potatoes (8%), sorghum 4%, millet (4%) and soybeans (1%). While there are no striking differences in crops grown between male and female-headed households, there are some differences in the way crops are managed. Farmers in the study area are exposed to a number of agricultural land management technologies. These include the use of fertilizer, compost manure, contour ridge making, irrigation agro-forestry and the use of vertivar grass. As indicated in Table 5, fertilizer-use is the most frequently (63.3%) reported land management technology followed

by use of compost manure (35.7%). Although World Vision project reports indicated that extensive capacity building initiatives in irrigation and agro-forestry had been undertaken in the area only 12 and 5.6% of the households, respectively, reported using these technologies.

There are some differences in technology-use tendencies between male and female-headed households, however, this does not tell whether there are any differences in the intensity of use of the technologies. In general more male-headed households use fertilizer, compost manure and construct contour ridge bunds than female-headed households. The significantly higher proportion of male-headed households using compost manure and constructing contour ridges is consistent with prior expectation considering that both of the technologies are labor intensive and may require extra labor which female-headed household can not provide.

Farm productivity and gender

Farm performance was measured by looking at land productivity. Yields for both maize and rice are significantly higher among male-headed households as compared to female-headed households. As indicated in Table 6, the average yield for maize is higher among male-headed households (759 kg/ha) than the yield (537 kg/ha) for female-headed households. The yield for rice is 858 kg/ha among male-headed households compared to 484 kg/ha among female-headed households.

With regards to the distribution of households across the quartiles, there are more female-headed households in the lower yield quartiles than male headed households for maize (Table 6). About 14% of the male headed households belonged to the lower quartile of maize yields compared to 32% of the female headed households. While this could be fairly speculative, the yield differences could be attributed to a number of factors including

Table 7. Farm intensification by gender.

Characteristic	Male	Female	All
Proportion of land cultivated	92.1	90.7	91.7
Maize purchase inputs (MK/ha)	3921.56	2444.61	3586.11
Rice purchase inputs (MK/ha)	1966.29	1411.00	1828.69

Source: Nayuchi livelihood assessment, 2008.

Table 8. Income portfolios by agricultural productivity.

Characteristic	Income quartile				
	I	II	III	IV	All
Total income	1913.67	6529.44	13791.87	46631.74	17134.57
Farm income	936	2936	4814	17463	6505
Share of total income	47.7	46.0	34.25	34.80	40.59
Non-farm income	977	3593	8977	29168	10628
Share of total income	52.3	54	65.75	65.20	59.41
Land cultivated (hectares)	2.12	2.27	2.30	2.08	2.20
Maize yield(kg/ha)	359.9	566.7	622.87	1119.9	686.87
Rice yield (kg/ha)	212.16	391.73	619.57	1281.64	757.22

Source: Nayuchi livelihood assessment (2008).

differences in the intensity of inputs used as well as the technologies used which this study did not explore. Furthermore, productivity differences may also arise from differences in the efficiency of input use (technical efficiency) between farmers, again, an aspect that has not been explored. Of relevance to this study is the fact that female-headed household are not gaining as much as male-headed households from agriculture which might be a push factor for them to diversify away from agriculture to compensate for their low agricultural production.

Agricultural intensification and gender

For purposes of this study we adopt the definition of agricultural intensification offered by Tiffen et al. (1994). They define agricultural intensification as the increased average input use of labour or capital on a smallholding, either on cultivated land alone and grazing land for the purpose of increasing the value of output per hectare. In this study we use purchase inputs such as fertilizer and seed and the land management variable such as the proportion of land cultivated as indicators of intensification.

The proportion of land cultivated is a good measure of agriculture intensification in an area is indicated in Table 7, using the proportion of land cultivated and a measure of farm intensification, no significant differences are observed between male and female-headed households. However, it is interesting to note that with respect to the intensity of input use, male-headed households are investing more in purchase inputs per hectare than female-headed households in both crops. This partly explains the productivity differences that were observed earlier. The finding suggests that any improvements in agricultural productivity among women must start with improving their access to purchase inputs.

Livelihood diversification and farm output

In this section, we discuss the relationship between agriculture and household level diversification. There is a strong linkage between

agriculture and non-farm activities in the sense that they both require the principal resource of labour. The impact of household level diversification on farm productivity and output depends on numerous factors relating to the allocation of farm family labour, the strategic perspectives of household members concerning the future livelihoods role of the farm, inheritance effects on the viability of holdings due to farm size changes and the process of socio-economic change in the larger economy (Ellis, 2000). Taking land as an example of a resource necessary for agriculture production, there are number of relationships with livelihood diversification. Land subdivisions and fragmentations that occur during inheritance, for example, can be a major cause of fragmentation in some communities. Ellis (2000) also reports that land fragmentation in densely populated areas leads to the creation of farm holdings that are insufficient to provide their owners with a means of subsistence which results into a push reason for household diversification. This may also result into a decline in land productivity and sometime technical inefficiencies due to suboptimal plot sizes and land fragmentation (Simtowe, 2001). As illustrated in Table 8, the average household income for both locations was MK17134.57 which translates into a per capita income of MK3998.77. Non-farm income constituted a larger share (59.41%) of total household income. However it was noted that the share of farm income was much higher (47.7%) for the households in the lower income quartile than those in the higher income quartile (34.8%). This may seem to suggest that richer households tend to diversify away from agriculture into non-farm economic activities, however, in the absence of well established causality, it is difficult to substantiate this fact as the finding may also be interpreted as "diversification leads to high incomes" which is different from the assertion that "high income leads to diversification".

Livelihoods diversification by gender using diversity indices

Utilizing income portfolio in order to understand the livelihood strategies for the poor rural households is insufficient for two reasons. First, the high variability of income implies that there is

Table 9. Mean diversity indices by gender and income group.

Income category	Male	Female	Total
Low income	1.66	1.7	1.67
Middle income	1.75	1.8	1.76
High income	2.1	1.79	2.04
Total	1.85	1.76	1.83

Source: Nayuchi livelihood assessment (2008).

Table 10. Table livelihood strategies for the households.

Livelihood strategy	Proportion of households involved (%)			Total income
	Female	Male	All	
Only farming	42	34	37	14629
Only non-farm business	1	1	1	-
Only <i>ganyu</i>	1	1	1	-
Only fish selling	0	1	1	-
Farming and non-farm business	9	9	9	17117
Farming and <i>ganyu</i>	23	13	16	7440
Farming and fish selling	13	28	24	22745
Farming, <i>ganyu</i> and fish selling	11	14	13	22915

Source: Nayuchi livelihood assessment (2008).

high heterogeneity in the livelihood strategies. Second it is not possible to capture the relative level of participation of each household in each of the livelihood strategies. Thus one may not capture, for example the proportion of female headed households that earn their living from maize production. Ellis (2000) notes that one possible way of getting round these problems is to find the summary statistic that captures both income shares and participation shares in a single figure that can be compared across sample groups. An index of diversity widely used in biodiversity studies and in portfolio analysis in financial economics can be used to explain both the income shares and participation shares. A measure proposed by Chang (1997) cited in Ellis (2000) has been widely used to describe diversity best in terms of both the number of activities and the distribution of total income between them.

The diversity index can be calculated as follows:

Sum of squares of the proportional contributions to total income

Using the entire range of major household income sources, we calculated a livelihood diversity index for all households. Table 9 shows the mean diversity indices categorized by gender of the household head.

Clearly, from the results it can be concluded that high income households are more diversified than low income households. However, there are no significant differences in the degree of diversity between male and female headed households. Thus diversity indices which combine the information on both the number of income sources and the distribution of total income between them, have been helpful in explaining differences in income levels between poor and rich households. As discussed in the next section (Table 10), high income households are mainly those that combine farming with fish trading.

A classification of households based on the diversification path discussed in the conceptual framework, show that households fall under five major livelihood strategies. As illustrated in Table 10. The

results show a significant rate of livelihood diversity across households and gender. Approximately 60% of the households have more than one activity in almost all cases in combination with agriculture. The remaining 40% of the households are active in mainly agriculture only as livelihood strategies. Very few relied on only non-farm business, only *ganyu* and only fish selling as a livelihood strategy. The findings suggest that agriculture is the dominant unilateral activity and that when household diversify away from agriculture, they mainly do not abandon agriculture. Instead they combine both agriculture and other non-agricultural activities. A comparison across the gender of household-head shows that a larger proportion of female-headed households (42%) rely on agriculture as a unilateral activity than male-headed households (34%) suggesting that males have more diversified livelihoods than females. It is also interesting to observe that when female-headed households diversify away from agriculture, tend to combine agriculture with *ganyu*. About 23% of female-headed households combine agriculture with *ganyu* compared to only 13% of male-headed households. When male-headed households diversify away from agriculture, they mainly do so by combining agriculture with fish selling. About 28% of the male-headed households derive their livelihoods from agriculture in combination with fish selling as opposed to only of the households derive their livelihood from 13% for female-headed households. It is further interesting to see that about 13% of the sample household simultaneously derives their livelihood from three simultaneous activities- farming in combination with *ganyu* and fish selling. In general these findings reveal interesting difference in livelihood strategies between men and women.

Determinants of livelihood diversification

The dependent variable in the empirical estimation for this study is the choice of a livelihood strategy from the set of livelihood strategies listed in Table 10. The econometric estimation of the determinants of livelihood diversification is conducted using the

Table 11. Determinants of livelihood diversification- Multinomial logit model.

Dependent variable: Livelihood strategy vs. only agriculture				
	Farming and non-farm business	Farming and <i>ganyu</i>	Farming and fish selling	Farming plus <i>ganyu</i> and fish selling
Sex head of household (1=male, 0= female)	-0.25 (0.42)	-0.77** (0.35)	-0.04 (0.05)	-0.28 (0.39)
Age (yrs)	-0.01 (0.01)	0.00 (0.01)	-0.01 (0.01)	0.00 (0.01)
Years of schooling	-0.23 (0.34)	-0.16 (0.29)	0.00 (0.24)	-0.45 (0.36)
Household size	-0.06 (0.09)	0.01 (0.07)	-0.01 (0.06)	0.02 (0.07)
Land size (acres)	-0.08 (0.11)	0.02 (0.09)	0.03 (0.07)	-0.18 (0.13)
Distance to market (km)	-0.02 (0.05)	-0.06 (0.04)	-0.01 (0.03)	-0.03 (0.04)
Received credit (1=yes, 0=otherwise)	-33.30*** (0.38)	-1.65** (0.80)	-1.20** (0.59)	-1.52* (0.83)
Upland	0.57 (0.41)	0.42 (0.37)	0.26 (0.31)	0.67** (0.35)

Source: Nayuchi livelihood assessment (2008).

multinomial logit regression and the results presented in Table 11. For the purposes of this study, the pure agriculture strategy (only farming) is used as the base category and as a measure of no diversification. An attempt is made to choose explanatory variables based on theory but our choice is also limited by data availability. The explanatory variables considered include household resource endowment, access to markets including credit markets as well as other socioeconomic attributes.

In the analysis the "only agriculture" livelihood strategy is used as a base category. The results in column 2 are for households factors that influence households to choose the combination of farming and non-farm business. Results indicate that households with access to credit are more likely to derive their livelihood from purely agriculture strategy. The findings suggest that access to credit enables households to increase their productivity and probably produce enough for the households such that they do not any further diversification. The gender of the head of household is only significant the choice of the combination of farming and *ganyu*. *Ganyu* is generally associated with poor households who lack land and other inputs to invest in agriculture. Consequently, such household complement low agricultural incomes with work as casual laborers. The finding that female-headed households are more likely to participate in such a strategy is therefore consistent with prior expectation. The gender of household head is however insignificant for the other three livelihood strategies.

The location of the household (that is whether upland or along the railway, is only significant in determining the last strategy- (Farming + *ganyu* + fish selling). Results show that households along the shore have a higher probability of choosing the strategy than households in the upland. In all the fact that about 60% of the

households combine agriculture with other activities indicates that agricultural production is unable to meet the needs of people in the study area. This is however, not surprising considering the low yield realized by farmers in the study area.

Conclusion

The main objective of the study is to create a better understanding of the current underlying factors that define the livelihood systems of the households in the study are with focus on the gender of the head of household. Results show that selling fish is the single major non-farm income source by crop production. Results further reveal higher proportion of income among male-headed households (40%) than female headed households (21%) come from fishing. The low contribution of fishing income among female headed households can be attributed to the prohibitively high capital investments that are required for households to participate in fish trading. Female-headed households are found to be poorer than male-headed households. More than 60% of the households combine a number livelihood strategies including agriculture while only 37% of them rely purely on agriculture.

A multinomial discrete choice model was used to analyze the determinants of livelihood diversification. The results indicate that female-headed households are more likely to combine agriculture and *ganyu* or diversify away from agriculture than male-headed households. Furthermore, households with access to credit are found to be more likely to rely purely on agriculture than to diversify away from the purely agriculture strategy.

The results of the empirical analyses confirmed the role of improved access to credit in enhancing agricultural productivity and self-sufficiency, which crucially affects diversification decision making and planning. Policies aimed at promoting farm-level productivity and self sufficiency need to emphasize the critical role improving farmer access to credit services. It is interesting to observe that the intensity of input use is higher among male-headed household who spend more money per hectare than female-headed households. This partly explains the productivity differences that are observed. The fact that female-headed households have lower productivity and that are more likely to diversify in *ganyu* confirms the wide belief that despite their high involvement in agriculture, they are neglected by extension agents and credit service providers. Consequently they will tend to diversify into less capital intensive activities such as participation in *ganyu*. Furthermore, the fact those high income households tend to diversify into lucrative enterprises such as fish trading and suggest the need to implement policies that support the development of the non-farm sector as a means of increasing rural farm incomes. Although insignificant, large farm sizes were found to discourage diversification away from pure agriculture. This is more pronounced for the diversification into non-farm self employment. This suggests that availability of land is a potentially a factors that may push some households into non-farm diversification.

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