Senegalese rural households multiple livelihoods strategy: a potential solution for rural employment issues

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October 2015

Abstract

This paper analyzes survey data from three distinct agro-ecological zones in Senegal to shed light on the varied patterns, drivers, and consequences of rural pluriactivity, defined as households' use of multiple livelihoods strategies and diversification of income sources across the agricultural and non-farm sectors. In policy circles, such diversification of income sources is increasingly being touted as a way to overcome rural underemployment and poverty, yet little is actually known about pluriactivity among rural households in Africa, including in Senegal.

Using qualitative data and primary quantitative data on 1,500 rural households collected in 2013, this paper seeks to fill a knowledge gap by analyzing the determinants of pluriactivity and investigating its contributions to, and effects on, the income levels and income disparities of Senegalese rural households. It finds that certain household characteristics, the mode of land acquisition, crop types and the level of farm income are associated with rural households' choice of pluriactivity as a livelihoods strategy, and documents that while pluriactivity is widespread across rural Senegal, the drivers behind households' choice of pluriactivity as a livelihoods strategy vary greatly between different agro-ecological zones.

Interestingly, in the survey areas, pluriactivity's net effect is to lower disparities in income distribution among rural households. Another key finding is that some poor households may be prevented from adopting pluriactivity as a strategy due to high entry barriers for nonfarm activities.

This study concludes that while pluriactivity plays a major role in household survival in rural Senegal, it typically serves to reinforce farm activities, rather than constituting a viable farm exit strategy.

Keywords: Multiple livelihoods strategy – pluriactivity– diversification – underemployment –unemployment – rural development – rural households– agriculture– rural nonfarm sector– Senegal.

1. Introduction

For a long time, the idea of developing viable farms large enough to provide adequate farm income to rural households had been a central question in classical approaches of agricultural and rural development. However, persistent poverty of rural populations, unemployment and/or underemployment, and internal migration persist. These rural populations try to reduce their vulnerability by migrating to urban areas or by adopting strategies of diversification at the local level.

Increasing engagement in diversifying income sources via multiple livelihoods strategies is among the emerging features of the rural world. For a few decades, restructuration of rural development models, ongoing in developing countries in Africa and beyond, has been manifested by a diversification of populations' activities into nonfarm sectors. Bryceson (1999) asserts that nonfarm activities are ever-increasing in a continuous process of "depeasantization" which involves reorientating the rural economy away from agriculture.

This paradigm shift has been reinforced by results of several studies documenting higher nonfarm incomes for rural households. The contribution of the rural nonfarm sector - in employment generation and in rural income growth at the early stages of development - is well documented in the development literature (Hossain, 2004). Over time, the nonfarm-based rural economy has experienced a rapid development, significantly contributing to both rural employment and income generation (Haggblade and al, 2009). In fact, nonfarm activities have become a relatively stable mean for smoothing income . Diversification is an essential part of agricultural and rural policies (Tocco and al, 2013).

Household pluriactivity[1] is conditional on the context and environment in which it evolves (Silva and al, n.d.). Smaller farms can survive only if they use income from other sectors (Kimhi and Nachlieli, 2001). According to Haggblade (2005), landless households depend on nonfarm incomes to complete farm wages. Sumner (1991) suggests considering family heritage as a key factor in building pluriactive households. Fluctuations in weather conditions require producers to adopt readjustment (or regulation) strategies to cope with climate risks (Escobal, 2001). Furthermore, diversification is expected in normal years (without drought) in order to accumulate resources and overcome negative shocks (Reardon, 2001).

The importance of shifting to diversification has led to consider income improvement via multiple livelihoods as a solution to poverty. For Escobal (2001), households are drawn into nonfarm activities because their income is higher than that of agriculture. Households can benefit from nonfarm incomes, even low, when they practice seasonal agriculture or when they face long-term unemployment. Pluriactivity not only reduces income variation (Stark 1991; Lanjouw 2001; Losch and al, 2013) but also improves households' incomes and their status (Fuller, 1990; Evans and Ilbery, 1993; De Vries, 1993; Ellis 2000). In some Asian countries, rural nonfarm activities

[1] In this paper we use the term "pluriactivity" to denote multiple livelihoods strategies and diversification of income sources at the household level.

undermine class differentiation by providing alternative livelihoods to the poor with limited access to land in rural areas (Saith, 1992). Zhu (2002) shows that participating in nonfarm activities in rural China reduces both inequalities and poverty. According to Butault and al (1999), pluriactive households have higher global incomes. De Janvry and Sadoulet (2001) stated that in Mexico, nonfarm activities generate on average more than half of incomes of farm households. Participating to those activities helps reduce poverty and contributes to balancing income distribution.

Beside these positive effects of multiple livelihoods strategies, the literature has sometimes shown that pluriactive households do not always have the best socioeconomic situation. Beyond income, authors focused on quality of life of pluriactive households. Silva and al, (n.d.) compared and contrasted pluriactive households to see how they behave and analyzed their socioeconomic situation in accordance with income-generating activities. McCoy and Filson (1996) assessed the effects of off-farm labor on the life quality perception of West Ontario rural populations Low satisfaction levels and lack of leisure time were the most frequent issues for the latter. While pluriactivity of farm households allows them to keep up with the expensive agricultural life style for some time, the burden can be heavy especially for women, particularly when they have children.

Household multiple livelihoods strategies have been identified as a survival strategy and also as strategy of capital accumulation. Some studies have shown that nonfarm gains are crucial strategies to continue farm activities and hence are means of survival (Glauben and al, 2003). Kodithuwaku (1997) asserts that survival cannot be the only reason for being pluriactive and households are attracted by new opportunities. Multiple livelihoods strategies are used to link opportunities to resources, which eventually results in wealth creation and accumulation. However, Kimhi and Nachlieli (2001) have shown that the natural process of structural change is often inhibited, as farmers choose to compensate low incomes with nonfarm incomes rather than leaving agriculture. Kimhi (1998) found that the natural speed of structural changes has decreased due to the orientation towards part-time farming. He has shown that when farm incomes fall below the viability threshold, farmers support their declining activities with nonfarm incomes instead of exiting the agricultural sector.

Part-time farmers or pluriactive households are often perceived as groups that can potentially leave agriculture (Bryden and al, 1993; Tocco and al, 2010). This idea can be true insofar as they belong to families in which nonfarm gains become important as income sources. Weiss (1997) noted that being employed off-farm as well as the number of off-farm work hours have statistically significant effects on the probability of leaving the agricultural sector. Roe (1995) came to the same conclusions for the United States. In fact, he found that working off-farm increases the probability of a farm stopping its operations. Pfeffer (1989) realized that part time farmers in Germany have very little hope to keep on farming in the future. Unlike suggestions that pluriactiviy can make modern farms more viable, the degree of dissatisfaction pertaining to farm labor - particularly their feeling that farms are not profitable - reinforces the conclusions of McCoy and Filson (1996). The latter noted that most

farmers are in transition out of agriculture, though many of them have not accepted that yet. According to Kimhi (2000), part time agriculture is like a channel through which rural labor force finds its way out of agriculture. Part-time farmers, compared to their counterparts, have a lower probability of continuing farm activities (Weiss, 1999). In contrast, some authors such as Kimhi and Bollman (1997) have shown that the farm exit probability is inversely proportional to off-farm labor in Canada and Israel.

Household multiple livelihoods strategies - their determinants and their role - have been widely studied in developed countries. They have been studied also in Asian countries and in Latin America. Some studies have shown that they can prevent the natural process of structural change in the agricultural sector by allowing small and non-profitable farms to survive with income generated from other sectors (Donellan and al, 2013). What about African rural economies? In the African context, it is important to understand the behavior of pluriactivity that is increasingly frequent in rural households. Many households seem to run into an invisible wall in the transition process, as they have difficulties earning enough income through diversification. They seem to be trapped in poverty. Are these adaptive processes new? Did they reconfigure rural areas? Are they similar to historic trajectories of structural change? Do they mostly contribute to rural livelihoods (Losch and al, 2013)? For Brycesson (2002), the African case of income diversification suggests a more ambiguous image. This diversification can reinforce class hierarchy as those who get higher incomes redirect part of their agricultural capital to more gainful farm activities.

In Senegal, despite the growing importance of income diversification in rural areas, little is actually known about its determinants and its role in income generation for rural households. For Elloumi (1993), the analysis at a national level helps figure out, on one hand the importance of pluriactivity and its impacts on the evolution of agricultural structures; and on the other hand, the relation between conjonctural conditions and the level of pluriactivity. The analysis at a micro zone level should provide a better understanding of how incomes and off-farm activities intervene in the functioning and evolution processes of farms. We use such a micro zone approach in this paper. Three Senegalese rural areas will be studied. The groundnut Bassin is characterized by rainfed agriculture and is prone to underemployment, with high population density causing an increased pressure on natural and land resources. The Senegal River Delta and the Niayes have better farming conditions because of their water endowment and public investments in hydraulic infrastructure and equipment. They also display more nonfarm employment opportunities for their populations. These differences offer a good opportunity to apply the household multiple livelihoods model. Reardon and al, (1998b) have shown that rural diversification strongly varies between regions given that it is related to resources and endowments of rural households. Bryden and Fuller (1988) believe that no matter how strong incentives are, households' reaction only depends on their capacity to act.

Thus, different issues related to multiple livelihoods strategies in Senegal are addressed through the following questions:

- What are the determinants of multiple livelihoods choices of households?
- What is the magnitude and the signal sent by the pluriactivity behavior of Senegalese rural households in accordance with the agro ecological zone? In other words, it consists in examining the role of that pluriactivity and stating whether it is a viable survival strategy or a step in the way out of agriculture. What is the role of agriculture in that income diversification strategy and how is it affected in return? i.e. whether multiple livelihoods strategy develops in areas with favorable opportunities or in areas where bad conditions tend to limit agricultural development.
- Finally, what are the effects of pluriactivity on households, particularly on their incomes? Are incomes in pluriactive households necessarily higher, more stable, or well distributed?

Understanding the functioning of rural labor markets is a major priority for solving problems of rural unemployment and underemployment. It is essential to have an insight into the functioning of these markets by looking at the determinants of the allocation of rural employment and its adjustments (Tocco and al, 2012) The behavior of pluriactivity, being one of these adjustments, is therefore a key component in the process of understanding rural labor markets. Understanding the meaning and the signal of multiple livelihoods strategies - their causes and their effects on rural households in three different agro-ecological zones of Senegal - will provide relevant implications and policy recommendations to be promoted, if necessary, according to the characteristics of these areas. The negative connotations often associated with part-time farming, is one of the reason for which pluriactive households are not often well understood either in the macroeconomic perspective of policies or in the individual perspective of household behavior. Research is hence needed to help bridge the gap at this level (Bryden and Fuller, 1988).

This article is organized as follows: Section 2 provides the theoretical framework and the empirical design and data and methods of the study. Section 3 uses the EJMAO[2] data set to study the determinants of pluriactivity, show its importance and its role according to agro-ecological zones and assess its impacts on the income distribution of rural households. Finally, Section 4 concludes with policy implications and recommendations.

2. Methodological framework

2.1. The Agricultural Household Model as theoretical model

In order to study the pluriactivity of rural households, the agricultural household model is considered the most appropriate theoretical framework. This model

[2] ***EJMAO***:(*Emploi des Jeunes et Migration en Afrique de l'Ouest*) is a two year Research Program (2012-2014) on Youth Employment and Migration in West Africa led by three think tanks *CEDRES (Centre d'Etudes, de Documentation et de Recherche Economiques et Sociales)* in Burkina Faso, *Miseli (l'anthropologie dans le développement)* in Mali and *IPAR(Initiative Prospective Agricole et Rurale)* in Senegal with the support of IDRC (International Development Research Centre) and FDA (French Agency for Development).

developed by Singh, Squire and Strauss (1986) has been frequently used to study the allocation of rural labor force by authors such as Huffman, (1980); Janvry and Sadoulet (1996); Kimhi (1994; 2000); Lanjouw and Lanjouw (2001), Adelman and al, (2002).

Farm household models are very useful in analyzing the behavior of farmers. The model allows researcher to understand the behavior of rural labor force by integrating production decisions (agricultural supply and demand factors of production) and household decisions in terms of consumption and labor supply. According to Kimhy (2000), the version of the farm household model, for the typical case of part-time farming or pluriactivity, involves firstly a decreasing marginal productivity of labor in the farm and on the other hand, off-farm jobs and hired labor being available at fixed salary. As a result, excepting corner solutions, farmers divide their time between leisure, farm work and nonfarm work. For Huffman (1980), the participation rate in a nonfarm activity can be interpreted as the number of farmers seeking a solution to difficult times, whereas the days of off-farm work indicate the intensity of nonfarm labor supply. In addition, modeling the behavior of farm households may serve as a theoretical framework for analyzing the effects of pluriactivity on the composition of household income. The model in which the agricultural household is both producer and consumer can be used to support an analysis of pluriactivity effects on inequalities in agricultural and total income of farm households (Butault and al, 1999).

The agricultural household model is based on the assumption that households need to maximize their utility, which is a function of consumption and leisure and is subject to the constraints of time and budget. Becker (1965) assumed that households maximize their utility function defined in relation to food consumption, and time allowed between work and leisure. Indeed, the basic model is always one where the individual or the household maximizes utility by identifying variables of leisure, consumption and preferences. From this optimization, it is possible to derive a labor supply function (Bigsten and al, 1997).

$$Max\ U = U\ (C_f, C_m, C_l, a_i) \quad (1)$$

Under time constraints of household members: T_f

$$T_f = C_l + l_f + l_o \quad (2)$$

Total worktime endowment of household members T_f is finite and allocated between leisure (C_l), farm labor (l_f) and nonfarm labor (l_o). It is generally assumed that time allocated to leisure and farm labor is positive but for certain individuals, time allocated to nonfarm labor can be void. So, $l_o \geq 0$.

Total work time available for labor is given in the next equation

$$T = H + C_l + l_f \quad (3)$$

H being the net quantity of sold labor force if H >0 or the net quantity of bought labor force if H <0

Global quantity of labor in farm production (L) is composed of household labor l_f and hired labor l_h :

$$L = l_f + l_h \quad (4)$$

The constraint of nonfarm labor is the following:

$$l_o = {l_o}^{max} = T_f - l_f = f(w_o, p_f, l_f, a_i, R, H, Z) \quad (5)$$

${l_o}^{max}$ is the maximum available work hours for nonfarm labor in household labor force. ${l_o}^{max}$ is function of nonfarm wage w_o , farm profit – i.e. production minus costs $p_f Q(L, d_j, \bar{K}) - \sum w_j d_j$ -, of household exogenous income R, human capital (competence) of the farm operator H and conditions of local labor market Z. The level of nonfarm wage w_o, which the farm operator is confronted to, is also subject to human capital of the farm operator H and conditions of local labor market Z.

$$C_l, l_f, l_o, l_h \geq 0 \quad (6)$$

Budget constraint is assessed as follows:

$$p_m C_m + p_f C_f = w_o l_o + (p_f Q(L, d_j, \bar{K}) - \sum w_j d_j) + R \quad (8)$$

Where $p_f Q(L, d_j, \bar{K})$ is the value of farm production, $p_f$is the price of agricultural production in the farm, $\bar{K}$ is land surface allocated to crops, d_j represents fix factors and other features of farm families (livestock, land, skills and experiences) ;

2.2. Methodology and empirical design

To analyze determinants of household multiple livelihoods, we use a logit model to explain the choice of pluriactivity from explanatory variables.

The decision of household to have a multiple livelihoods strategy is studied with the econometric model of participation. This decision is consider as binary. Once the probability of pluriactivity is established, all variables supposed to have an influence on this decision can be tested.

The households rationally are supposed to participate in the nonfarm labour market when the nonfarm wage offered is higher than the reservation wage. This can be formalized as :

$$\mathrm{E[I/X]} = \mathrm{p}(O_i = 1) = \mathrm{P}(w_r < w_0) = \beta'\mathrm{X} \quad (1)$$

w_r= réservation wage

w_r= non farm wage

where $p(O_i = 1)$, is the probability to participate in both agricultural and non-agricultural labour markets which happens when $w_r < w_0$. It means that the wage rate is lower than the nonfarm wage offered

The probability of a household being pluriactive is estimated using a vector of exogenous variables X that are supposed to influence the hidden reservation wage and the nonfarm wage and consequently the households' decision whether to adopt a multiple livelihoods strategy.

The dependent variable is the choice of household multiple livelihoods strategies which is a binary variable. Thus, the dependent variable is equal to 1 if the household is considered as pluriactive and 0 otherwise. The regression is made by considering a set of independent variables – as given in table 1 below - that are supposed to have an influence on the pluriactivity behavior of rural households.

Descriptive statistics and results of qualitative surveys will describe different models of multiple livelihoods strategy by agro-ecological zone. Finally, the Gini index decomposition allows us to identify the sources of the disparities and to analyze the source of income variability so as to measure the impact of pluriactivity on rural household income distribution. The variation coefficient of income is also used to measure and decompose income inequality according to the source. Decomposable by source of income, this indicator allows us to measure the contribution of different categories of income received by the household to total income inequality.

2.3. Study areas

Three agro ecological areas have been chosen, with reference to their agro climatic and socio-economic characteristics.

The Groundnut Basin, the main peanut production area in Senegal is characterized by rainfed agriculture. In addition to peanuts, there is a widespread millet production during rainy season. One of the specificities of the Groundnut Basin is its high population density, causing hence a strong pressure on land and other natural resources. In this rural area of Senegal, there are enormous constraints related to soil degradation and dependency of agriculture on erratic rainfall. This situation causes migration, especially by young people and women, to urban areas such as Dakar, the capital, and to rural areas like the Niayes and the Delta of the Senegal river where there are more economic opportunities, facilitated by irrigation systems. A total of 700 households in nineteen villages have been surveyed in the Groundnut Basin.

The second agro-ecological zone of this study is the Niayes Region, which is a rural farming area characterized by inter-dune slacks with a shallow groundwater table that favors horticultural products. This region is home to farm migrants generally coming from Senegalese rainfed areas and from neighboring countries. Twelve villages were surveyed in the Niayes, with a total of 400 households.

Third, the Delta of Senegal River – the western part of the valley that has benefited from important public investments in water control and in development of irrigated agriculture – is a rural area for irrigated farming rice, tomato and sweet potato with irrigation schemes. This zone is also home to farm migrants from rainfed areas of Senegal and neighboring countries. Thirteen villages were surveyed in the Senegal River Delta for a total of 400 households.

2.4. Data

The data used in this study came from the research program Youth Employment and Migration in West Africa. That program covered Burkina Faso, Mali and Senegal.

The data were collected in 2013 through household surveys, semi-structured interviews and focus groups. The surveys collected information on 1,500 households of the Groundnut Basin, the Delta of Senegal River and The Niayes. The sampling process began with the selection of research sites. Then, in the three agro-climatic zones discussed above, there has been a rational choice of the villages based on economic and sociological criteria of differentiation. Afterwards, for each village, the households were drawn randomly.

In the context of the present study, we use information contained in the household survey questionnaire with modules on individual employment, farm production units, and nonfarm production units. These modules have provided information on individual characteristics of each household's members, various sources of incomes and expenditures for the previous year (2012). Data on farm and nonfarm production units have been used for more details on agricultural and non-agricultural income of household labor force.

Furthermore, qualitative data were used, mainly to examine the role of multiple livehoods strategies and see whether they are a sustainable solution or a way out of farming. Empirically, it is difficult to distinguish between part-time farmers and those who abandon subsistence farming if they do not leave the farm (Kimhy,2000).

In this article, we are interested in pluriactivity at the household level. Ellis (2000) defined a pluriactive household as a household with more than one income-generating activity. We consider a farm household has a multiple livelihoods strategy from the moment that one of its members has a primary or secondary occupation outside agriculture in the broad sense. In other words, a household is pluriactive if its occupied labor force members undertake an activity other than agriculture for a wage, be it on the farm (independent nonfarm activities) or off-farm as employees in a nonfarm company (nonfarm wage labor).

Crop diversification made by producing different crops alternately on the farm or producing multiple crops is not considered to be multiple livelihoods strategy in our study. A household in which members practice at the same time agriculture, livestock, fishing, hunting or gathering is considered as agricultural and non-pluriactive.

Therefore, rural households are classified according to the three categories below:

1) Households are considered as exclusively agricultural if all its labor force, without exception, practices agriculture (crop production, livestock, fishing, hunting and gathering, agricultural wage-work).

2) Households are considered as exclusively in the non-agricultural sector if they have all household members who work in the agricultural sector. In other words, all of the workforce of the household, without exception, are either in independent or non-farm wage work activities.

3) Households are considered as pluriactive households in the two following cases: internal diversification and off-farm diversification.

- Internal diversification or inside pluriactivity: The household labor force diversifies its sources of income inside the farm by combining several activities. We consider the following activities: handicraft, trade, transportation, small-scale processing, carpentry, or other non-agricultural activities on the farm. This form of diversification refers to the concept of companies within the holding, which includes practicing an activity associated with the agricultural farm, but which does not use the land (Donnellan et al, 2013).
- External diversification or off-farm pluriactivity: These are households with active members having - in addition to the activities on the family farm - other non-agricultural activities. Essentially, this will be households in which some members are in nonfarm wage-labor.

3. Results and discussions

3.1. Descriptive analysis

Table 1 shows the descriptive statistics and labels of the variables. We assume that these variables influence households' multiple livelihoods strategies and incomes of rural households:

Household incomes:
Incomes are classified according to the different categories of households. Thus we have:

• farm income: this is income from agricultural production, income from hunting, forestry and fishing and also agricultural wage labor.

• Non-farm income is the income from non-agricultural activities (including any income from handicrafts, construction, transportation, trade, etc) and income from non-agricultural wage labor.

Household characteristics: We consider household size, number of dependents (i.e. children less than 10 years old) in the household; the number of young people in the household (aged between 10 and 34 years); the number of occupied workers in the

household represents members who have more than 10 who have a primary or secondary activity at the time of the survey.

Farm holding characteristics: we consider households' available land, the nature of this land, the acquisition modes (inheritance, purchase, loan, etc.), the types of property (individual, family, etc.), and cultivated crops which are thought to be important in the behavior of households pluriactivity.

Table 1 : **Descriptive statistics**

Variables	Variable labels	Expected sign	Mean
	1. Household total income		
inc_totalhh	Of all households **(1492**)	?	2 135 558
inc_agrhh	Of Farm households **(507)**	-	1 085 616
inc__nonagrhh	Of Nonfarm households **(97)**		2217473
inc_plurihh	Of Pluriactive households **(888)**		2503187
Plurihh	Pluriactive households **(888)**		2503187
inc_Agr	Income from agriculture	+	1218507
inc_liv	Income from husbandry	?	56056
inc_fish	Income from fisheries	?	85120
inc_NonAgr	Income from non-farm activities	?	917051
inc_agr_wage	Income from wage agriculture	?	23327
inc_nonagr_wage	Income from non-agricultural wage	?	656140
	2. Household characteristics		
farm_size	Household size	+	10.83
youth_ Numb	Number of young people (10-34 years) in household	+	3.27
hh_withmigr	Household with migrant (yes/no)	+	
oc_worker_Numb	Number of employed persons in household	-	5.29
numb_Less10years	Number of dependent persons (under 10 years)	+	7.2
noeduc_Numb	Number of persons without education	+	3.63
inf_edu_ Numb	Number of persons with informal education	+	0.561
	3. Agroecological zones		
zone1	Groundnut Bassin	?	
zone2	Niayes Region	?	
zone3	Senegal River Delta	?	
	4. Household lands		
hh_withland	household with land (yes/no)	+	
land_hh	Area of lands available per household in Ha	+	3,45
nat_land	Irrigated surface (yes/no)	?	
mod_acqui	Household with inherited lands (yes/no)	?	
Rainfed_crop	Household growing rainy season crops (yes/no)	+	
Peanut_prod	Peanuts production in household(yes/no)	+	
Cereal_Prod_	Cereals production in household (yes/no)	+	
Fruit_Prod	Fruit production in household (yes/no)	+	

Table 2 below shows that multiple livelihoods are a very common strategy in the three agro-ecological zones. Pluriactive households account for 60% % of total rural households.

In the Rainfed Groundnut Basin area, about 62,% of households are pluriactive, 34% are farm households and only 4,% are nonfarm households. This area offers relatively few nonfarm rural employment opportunities for households.

In the irrigated area of The Niayes, multiple livelihoods strategies are more important than in other areas; 76% of households are pluriactive. A low presence of exclusively agricultural households is noted in this area (10%), and non-agricultural households are more important in this area (14%) than the other two agro-ecological zones.

The irrigated area of the Senegal River Delta is dominated by exclusively agricultural households (58% of farm households). This area has a higher proportion of this category of households than the other two areas. Also it has a high proportion of pluriactive households (39%) of nonfarm households and only 6%.

Table 2 : **Categories of households by Agroecological zones**

	Farm households		**Non-farm households**		**Pluriactive households**		**Total**
Agroecological zones							
Groundnut Bassin	239	34,29%	26	3,73%	432	61,98%	697
Niayes	39	9,77%	57	14,29%	303	75,94%	399
Senegal River Delta	229	57,83%	14	3,54%	153	38,64%	396
Total	507	33,98%	97	6,50%	888	59,52%	1492

3.2. Econometric estimation: Determinants of pluriactivity in Senegalese rural households

The Logistic model results are presented in Table 3.

Regarding household characteristics, we found that household size is an important determinant of multiple livelihoods strategies. Household size is significantly positive in explaining the decision by households to combine agricultural and non-agricultural activities. Interaction between household size and pluriactivity can be explained by the importance of scale for larger households to engage in diversification. In fact, Donnellan and al. (2013), have shown that companies' workload can be divided between the different members for large households.

The number of young people in the household also has a significant positive influence on household pluriactivity. Households with more young people are more likely to diversify their sources of income by non-agricultural activities. The age and the sex of the household head do not have any influence on the adoption of multiple livelihoods strategies by Senegalese rural households. The number of active people in a household has a negative significant influence on this strategy. Indeed, our estimates show that a large number of household members with employment decrease the probability of the household to diversify. The same goes for the number of children under 10 years old. This is normal because the more children in charge, the more the household is motivated to have non-agricultural activities to supplement its resources. The results show no link between pluriactivity and formal education level of household members but show a negative impact of informal education level on household multiple livelihoods strategies.

Furthermore, our results show that the diversification strategy of rural households depends on agro-ecological zones. In the Niayes Region, an area where farming is possible throughout all the year, rural people still find it necessary to engage in non-farm rural activities. Moreover, statistics show that pluriactivity is more important in this rural area compared to the others in our study. This could be explained by the diversity of non-farm employment opportunities essentially favored by the development of agriculture. Barrett and al (2001) showed that the rural non-farm sector is growing rapidly in areas where agriculture is dynamic and agricultural production available for processing and distribution. Among such non-agricultural jobs, trade is highly developed in the Niayes area, especially for women.

The land situation of households is an important factor in the behavior of rural households. According to Zhu (2002), the amount of land - being the most important heritage - can represent to some extent the initial household wealth. Although participation in non-agricultural activity is costly or initially risky, households that are more endowed in land are in a better position. Consequently, they will have a greater ability to overcome entry barriers. Availability of inherited land gives an idea of the original wealth of the farm household. Our results support this position since the mode of acquisition of land has a positive influence on multiple livelihoods strategies of Senegalese rural households. Indeed, households whose lands were inherited are more likely to be pluriactive. To this end, Jervell (1999) suggested that the legacy of family farmland is often an important factor. One of the family farms' characteristics is that they are inherited from a generation to another. But the rigidities of land and agricultural markets can also induce adjustments during the family life cycle to enable the provision of income to a family that is expanding. Diversification of income sources may be more common in small farms (those which are less endowed in land). Inherited land being not sufficient, members of these households need to explore non-agricultural activities. However, our simulations show that household land allocation does not have a significant effect on the pluriactivity of Senegalese rural households. The same applies to households the nature of the land.

As far as types of crops are concerned, it is clear that cereals and fruit production has a significant negative influence on household pluriactivity. Households producing these crops have a lower tendency to be pluriactive. However, groundnut production has no significant effect on household diversification.

Our results do not establish a link between pluriactivity and farm income of households. It was expected that when farm incomes are low, households develop multiple livelihoods strategies. Kimhi (1998) showed that when agricultural incomes fall below sustainable levels, farmers adapt through generating revenues from other areas instead of leaving the agricultural sector. In other words, multiple livelihoods strategies can be used to facilitate the sustainability of unviable farms. To the contrary, Rosegrant and Hazell (2001), based on data from Asian countries, have shown a positive relationship between the level of farm income and the proportion of non-farm rural employment and income derived from non-agricultural activities.

Table 3 : Logistic model results

Pluri_hh	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
household_size	.2570646	.0361482	7.11*	0.000	.1862154	.3279138
age_CM_	.0061136	.0050193	1.22	0.223	-.003724	.0159512
sex_CM_	-.0914318	.211295	-0.43	0.665	-.5055624	.3226989
Youth_Number	.1716002	.0488181	3.52*	0.000	.0759184	.267282
hh_with_migrant	-.0057288	.1408099	-0.04	0.968	-.2817111	.2702535
Oc_worker_Numb	-.2856854	.0390052	-7.32*	0.000	-.3621343	-.2092366
numb_Less10years	-.281235	.046749	-6.02*	0.000	-.3728613	-.1896086
noeduc_Numb	-.0525284	.0275058	-1.91	0.056	-.1064388	.001382
inf_edu_ Numb	-.210573	.0619841	-3.40*	0.001	-.3320596	-.0890865
zone1	-.3956775	.2693297	-1.47	0.142	-.9235541	.1321991
zone2	.5924564	.2690914	2.20*	0.028	.065047	1.119866
hh_withland	.3930798	.2668074	1.47	0.141	-.1298531	.9160127
availand_hh	-.0146094	.0144714	-1.01	0.313	-.0429729	.0137541
acqui_mod	.3246267	.1447774	2.24*	0.025	.0408683	.6083852
nat_ter	.3765013	.2101473	1.79	0.073	-.0353799	.7883826
rainfed_crop	.1062336	.1901364	0.56	0.576	-.2664269	.4788941
peanut_prod	-.0478626	.1841652	-0.26	0.795	-.4088197	.3130945
cereal_prod	-1.038737	.2353198	-4.41*	0.000	-1.499955	-.5775185
fruit_prod	-.4886495	.2424281	-2.02*	0.044	-.9637998	-.0134992
inc_agr_hh	-2.64e-08	3.42e-08	-0.77	0.442	-9.35e-08	4.08e-08
_cons	-.1152662	.4007216	-0.29	0.774	-.9006662	.6701338

Key * stand for significant at 5%

Beyond the determinants of Senegalese rural households' multiple livelihoods, it is important to see how different categories of rural households located in different agro-ecological zones are doing when they are pluriactive. Another important issue pertaining to the pluriactivity is whether this is a temporary phenomenon - in other words, is it a gradual withdrawal from agriculture or is it a permanent survival strategy of rural households? The following sections discuss these issues.

3.3. Role of multiple livelihoods strategy in Senegalese rural households: different models of pluriactivity by agro-ecological zones

According to the descriptive statistics given in Table 2 above, it is clear that in Senegal multiple livelihoods strategy is important for rural households both in rainfed areas and irrigated ones. This shows that even in areas with relatively developed agriculture, households feel the need to engage in non-agricultural activities. However, it should be noted that in Senegalese rural areas, pluriactivity models differ across agro-ecological zones.

3.3.1. In the rain-fed area: agricultural constraints push traditionally agricultural households to multiple livelihoods strategy

In the area of the Groundnut Basin, household pluriactivity is due partly to the low productivity and farm incomes on the one hand, and on the other hand to persistence of underemployment caused by

rain-fed agriculture. Indeed, in this area, households combine agricultural and non-agricultural activities mainly because agriculture is very seasonal and therefore part time. By combining farm income with non-agricultural income, these households can stabilize their income throughout the year, given that revenues are complementary. According to Losch and al, (2013), non-agricultural wage employment may be a reliable option for the poor to supplement their agricultural income between cropping seasons. So the pluriactive households face more risks than other households.

In the Senegalese rain-fed zone, climate events have led farming households to embrace pluriactivity. Following a drought period, some households try out non-agricultural activities. This conjectural context may lead to a stable situation of pluriactivity. Because farm incomes are not sufficient, households diversify their sources of income as soon as the opportunity arises. Bryceson (1999) suggests that diversification is used as a coping strategy and also in response to the superficial market, especially the lack of a rural credit market. Although farming families are engaged in agriculture first, they may have interest in diversify into the non-agricultural sector, rather than increasing production or undertaking new agricultural activities. Investing all family resources in agriculture can be a risky strategy.

For households in the Senegalese rain-fed zone, nonfarm activities help invest and improve conditions for agriculture. Lack of resources to develop agriculture is one of main reasons of pluriactivity in the area of the Groundnut Basin. Bryceson (2002) argues that farmers are increasingly facing agricultural difficulties due to high costs of agricultural inputs. They are struggling to provide for their own agriculture. Lack of land, constraints related to the availability of agricultural inputs (seeds, fertilizers, pesticides), price variations, storage and flow of production problems, and plant diseases cause farmers to diversify. Also, farm households that are doing well at harvest time prefer to go into non-agricultural activities instead of extending their farming activities. This is because access to land is quite complicated.

In Senegalese groundnut basin, several factors may help explain the role of pluriactivity. Given that the amount of available farm land is insufficient to allow the extension of agricultural activity, households prefer to turn to non-agricultural activities instead of investing in agriculture when their incomes rise. Also, all households who can seize the opportunity become pluriactive because inherited land is not enough. Thus, with trade, craft or processing, they can buy more land and thus increase their productive capacity.

3.3.2. In the irrigated areas: agro climatic and economic conditions create a favorable environment for multiple livelihoods strategy

The importance of pluriactivity in the Niayes and in the Senegal River Delta area is due to the development of agriculture in these areas. Indeed, a well-developed agricultural sector stimulates the development of rural non-farm activities through many links. Growth in agricultural labor productivity increases food supply per capita and allows a part of the family labor to undertake non-agricultural activities. In areas where agriculture is strongly growing, the rural nonfarm sector is also developing well. A large literature on growth linkages suggests that each additional dollar of value added in agriculture generates additional 0.60 to 0.80 dollars in the rural non-farm economy in Asia, and 0.30 to 0.50 dollars in Africa and Latin America (Haggblade and al, 2009). Households from irrigated areas in rural Senegal or where irrigated agriculture is less risky can participate in nonfarm activities to increase and diversify their incomes and to alleviate credit constraints. According to Reardon (2001), the rural nonfarm sector is rapidly growing in areas where agriculture is dynamic, agricultural output is available

for processing and distribution, inputs are available, sale and repair of agricultural equipment are developed, and where agricultural incomes are spent on local goods and services.

One can also argue that household pluriactivity in rural areas with irrigated agriculture is favored by existing opportunities. These opportunities also explain the passage of households from exclusively nonfarm or exclusively agricultural activities to pluriactivity. Some households were not originally agricultural. However, they subsequently embraced agriculture once non-farm incomes allowed them to access agricultural land. Indeed non-farm households decide to diversify and to engage in agriculture when they have very profitable non-agricultural activities. Usually, it is originally landless households that are involved in the nonagricultural sector (transport, trade etc.); and after saving enough money, they use their nonfarm income to buy agricultural land.

In the Niayes area in particular, the context supports pluriactivity. Households combine their agriculture with trade and processing throughout the year. This combination of activities is encouraged by the possibility of sharecropping in this rural area, compared to other areas of our study. The heads of households employ external labor and control agricultural activities. They then proceed to a division of labor within the household. Usually the head of the household controls all collective activities within the household.

There is also the case of fishmongers in fishing areas. Access to land is not the main constraint for these women. They may have land, but they prefer to use external workers in the fields. Women in this area prefer non-agricultural activities because agriculture requires rather difficult working conditions. The youth work in the fields, sometimes accompanied by external workers.

It is important to note that in Senegalese rural areas, be it in rain-fed areas or in irrigated areas, rural populations do not intend to abandon agriculture, and therefore do not see pluriactivity as a stepping stone out of agriculture. Households just seek income stability and improvement in the family's wellbeing. Agriculture remains the basis for other activities because most of the rural households start with agriculture. Even originally landless households that were not agricultural in the beginning hope to continue farming. The different income sources of the households are not separated; each activity in turn can be used to finance other household activities. Agriculture is supported by non-agricultural activities, and the latter use agricultural resources. This is a loop: when households improve their agricultural incomes through non-agricultural activities, they take advantage to improve farm income by investing in the purchase of agricultural equipment and vice versa.

Agriculture is a tradition for the vast majority of rural households in Senegal. But it is definitely not a way out to go exclusively to non-agricultural activities. Pluriactivity not only allows to families to increase agricultural production capacity, to overcome agricultural risks, to supplement income from agriculture, but also to exploit lands that remain untapped because of lack of resources. This especially applies to households with sufficient land that do not have the financial resources to exploit it. It is therefore important to see whether pluriactive households are better off. The following section discusses the effect of pluriactivity on household income.

3.4. The impact of pluriactivity on household income

In this section, we try to estimate the effect of pluriactivity on household income. With pluriactivity, the prospects for income improvement and stability as well as social development are theoretically very high. In this section, we estimate the effect of pluriactivity on household income. In other words, we

study the distribution of household income, i.e. the contribution of each source of income in the global income of pluriactive households.

3.4.1. Share of different sources of income on the total income of pluriactive households

The question is whether nonfarm revenues are used to compensate low farm incomes. So we measure income inequality according to different sources. Inequalities source being more important than that of global income (Butault et al, 1999), we use the Gini decomposition and the coefficient of variation to see the effects of pluriactivity on household income.

Table 4 shows inequality in pluriactive households' incomes. Farm income is the main source (56%) of income for these households. The share of non-farm income is also high (44%). Many studies have shown that rural households in developing countries typically earn more from agriculture than from any other income source (Reardon and al,1998; Lanjouw and Lanjouw , 2001; Reardon,1997).

The Gini decomposition shows that global income distribution (into farm income and nonfarm income) causes a Gini coefficient of 0.522. Farm income alone gives a Gini coefficient of 0.609. This means that the distribution of income in the absence of non-farm income is more unequal. Nonfarm income decreases income inequality among households. Farm income and non-farm income households pluriactive are substitutes, as the highest Gini coefficient of non-farm income corresponds to the lowest global income. The Gini correlation between farm income and total income is higher than the correlation between nonfarm income and total income. Farm income has a much larger share in global income and its correlation with the latter is very important.

Table 4 : **Gini Decomposition by Income Source**

Source	Sk	Gk	Rk	Share	% Change
inc_agr	0.4769	0.6052	0.7901	0.4369	-0.0400
inc_liv	0.0172	0.9722	0.5007	0.0160	-0.0012
inc_pech	0.0507	0.9742	0.8367	0.0791	0.0285
inc_agr_wage	0.0125	0.9852	0.4960	0.0117	-0.0008
inc_AGR	0.5572	0.6091	0.8361	0.5437	-0.0134
inc_nonagr	0.1102	0.8659	0.5937	0.1085	-0.0017
inc_nonagr_wage	0.3327	0.7303	0.7471	0.3478	0.0151
inc_NONAGR	0.4428	0.6734	0.7986	0.4563	0.0134
Total income		0.5219			

3.4.2. Comparing global income and farm income in pluriactive households

When measuring income inequality in pluriactive households with the square of the coefficient of variation, we see that all revenues positively contribute to the dispersion of global income (see Table 5 below). The dispersion of global income is lower, and is more important than that of non-agricultural incomes.

The contribution of a given income source to revenue inequality is the ratio of the covariance and variance. This is interpreted as the decline of inequality in total income that would happen if the income source was considered void or equally distributed in all households. Farm income contributes to 52% of global income inequality but this contribution is less than its share in global income (i.e. 56%). As for

nonfarm income, it makes a lower contribution to income inequality (48%). Thus, there would be a decrease in income inequality by 48% if nonfarm income were zero or equally distributed. We can conclude that pluriactivity can reduce income variation of rural households. Pluriactive households have a higher global income.

Walker and Ryan (1990) have come to this conclusion in the Indian semi-arid tropics: nonfarm income from self-employment has not only become an important source of income, but also a way to diminish income variability. The income from nonfarm work can be used to reduce income inequality. Zhu (2002) has shown that participation in nonfarm activities in rural China reduces both inequality and poverty.

Table 5 : **Income inequality Composition and sources**

	Mean	**Variation coefficient**	**Squarred variation coefficient**	**Share in global income (%)**	**Contribution to global income inequality**
Global income	2513139	1.46	2.13	100%	100%
Farm income	1400256	1.74	3.03	56%	52%
Non farm income	1112884	2.1	4.4	44%	48%

4. Conclusion and policy implications

Our results suggest that household characteristics have a large influence on pluriactivity. Household size, the number of young people in the household and the number of dependents remain important determinants of pluriactivity in Senegalese rural households. Large households with high proportion of young people commonly find it necessary to diversify their income sources outside agriculture. This shows that agricultural productivity is lower with a large number of active persons.

The land situation of households also influences their decision to pursue pluriactivity; the salient factor is not farm size but the mode of land acquisition. For instance, households with inherited land are more likely to be pluriactive. Unlike farm size, household size has a significant effect on pluriactivity. However, we can still argue that through household size, farm size has an effect on pluriactivity.

Moreover, when considering pluriactivity effects on rural households - notably in income and its distribution - we conclude that pluriactivity leads to a more equal distribution of household income. Nonfarm incomes are used to decrease income inequality between households. Thus, pluriactivity is essential for the survival of the Senegalese rural households.

We must recognize that rural households across all agro-ecological zones will have to become pluriactive in the future. Resources from agriculture are insufficient in all areas. However, convergence models of pluriactivity vary from one agro-ecological zone to another. So pluriactivity does not only

develop in areas with disadvantaged agriculture. In rural areas of rainfed agriculture, we find a survival pluriactivity, whereas in areas with irrigated agriculture we find a pluriactivity of opportunities. To increase rural household income, the choice is often focused on non-agricultural activities and not on increasing production capacities for various reasons (lack of land, the moral hazard problem with external labor, access to funding ...).

However, not all households that wish to do so can become pluriactive. The initial investment required for non-agricultural activities is often the main constraint. There are barriers to entry for many non-agricultural activities. Often, households do not have the resources to start commercial activities, handicrafts or other non-agricultural activities. Especially in rain-fed areas, pluriactivity is limited by a lack of resources and low household income. Because pluriactivity is costly (barriers to entry) and initially risky, the richest households are in a favorable position as they can finance themselves and use their wealth as a buffer to adverse shocks. It must be recognized that practicing non-agricultural activities requires costs that often represent barriers to entry for poor households or individuals who want to embrace such activities (Leavy and White, 2003; Bagamba and al, 2009; Brycesson, 2002). Thus, poor households that face problems in their agricultural work and wish to diversify their income sources may not be profitable. Furthermore, to enable pro-poor growth, it is important to remove social and economic barriers that prevent the poor from access nonfarm employment.

This study clearly shows that nonfarm rural activities are important to Senegalese rural households. Despite positive general trends, the level of development of rural non-farm economies remains low. At present, the non-farm sector in Senegal is characterized by a high level of self-employment, the supply of small services, and precariousness of employment.

Adapted microfinance strategies should be targeted at low income farming families that wish to diversify, to enable them to overcome entry barriers. Also projections about the likely speed of land/farm consolidation should be revised downwards? Rural non-farm employment programs must take regional differences in the drivers of pluriactivity into account.

In a country where a large majority of the population is rural and agricultural productivity is low, policy makers should consider the nonfarm sector as a potential alternative to agriculture in order to achieve rural development and solve employment issues. The nonfarm rural economy so often emphasized in the literature could be an adequate response to the recurrent poverty in rural Senegal. Rural development policies should focus on the development of nonfarm rural activities, while trying to improve the situation of the Senegalese agriculture. The agricultural sector on its own cannot provide jobs and adequate income to rural populations.

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