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## **Local diversification of income sources versus migration: Complements or Substitutes? A case study from rural Senegal**

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## **Abstract**

*Much has been written on the importance of diversification of activities in rural Africa. However, less attention has been paid to distinguish two diversification patterns, namely local diversification and migration, and their relationship. This paper examines whether they are complements or substitutes, by using original data from two Senegalese rural areas. We adopted a multivariate Tobit model to investigate the relationship between local diversification and migration, and a probit model to analyse the probability of being in National or International migration. Nontrivial finding suggests that local diversification and migration are substitutes, implying that migration is a form of insurance.*

JEL Codes: O15, O55, D70, Q12

Keywords: *migration, diversification, mutual insurance, Groundnut basin, Senegal*

## **1. Introduction**

In many developing countries, and in African countries, agricultural income is an essential component of rural households' subsistence. However, this type of income exhibits a high seasonality and outcomes are thus uncertain, because of market prices volatility and environmental hazards. Consequently, household members partly allocate their working time to activities which provide a more stable income so as to cope with adverse shocks. According to Barrett et al. [2001], diversification refers to the allocation of assets and time to both on- and off-farm activities. Empirical studies in rural Africa have revealed that nonfarm income sources may account for as much as 40-45 per cent of the average household income and seem to be growing in importance [Reardon, 1997; Bryceson and Jamal, 1997; Little et al, 2001; and Reardon et al., 2006]. The image of Africa as "a continent of subsistence farmers is thus misleading"[Bryceson and Jamal, 1997]. Theoretical analysis presents the rationale of diversification as a way to mitigate the risks incurred by small producers.

Drawing on the portfolio theory “pull and push factors” are identified. The former are those generated by opportunities outside agriculture; the latter refer to the decline of expected agricultural income [Reardon *et al.*, 2006]. These incentives can lead some family members to migrate: migrants’ remittances represent then a non negligible proportion of total family income.

Despite the large strand of literature on diversification, to our knowledge, only few studies distinguish between the various types of diversification methods. In particular, diversification can take place at the local level when a household member is engaged in nonfarm activities but still lives in the village; but it can also lead some family members to leave the village. The latter form of diversification is considered as an essential component of the observed strategies of migration and then monetary transfer. In particular, we will investigate if local diversification and migration are complementary strategies or substitutable ones, with regards to their relative risks and expected incomes.

We use original qualitative and quantitative data from a survey which we conducted in 2006 and 2007 in the Senegalese Groundnut Basin. Even though the study area is small, this assessment remains important in many rural areas in Senegal where agricultural conditions are unfavourable. In fact, the contribution of migration and diversification in the household income is found to be essential in numerous empirical studies for different countries, among which Senegal. [Kelly *et al.*, 1993; Diatta and Mbow, 1999; Sander and Barro, 2003 for instance].

The remainder of the paper is organized as follows: section 2 underlines the pertinence of the research question by articulating it with previous studies dealing with diversification and migration. Section 3 presents the setting in which this research has been carried out and describes the data. Section 4 defines an empirical strategy and presents the results and their interpretation. Finally, we conclude in section 5.

## **2. Local diversification of activities versus Migration: complements or substitutes?**

Numerous studies put forward the importance of diversification and migration as livelihood strategies for rural population in developing countries. In fact, few farming households rely solely on the income derived from agricultural production to guarantee their subsistence and well-being [Reardon, 1997]. The literature addresses several issues among which the motivations of diversification and migration and their consequences. We present the theoretical and empirical foundations developed by the literature on diversification on the one hand, and on migration on the other. We put forward the characteristics of migration that differ from local diversification and should influence the family strategies.

Diversification motives can be summarized into two categories, push factors that are linked to risk reduction and pull factors that rely on strategic complementarities between activities. Then, according to the first set of motives, households diversify their activities as to manage risk or cope with adverse shocks. In the second set, the driving force of diversification corresponds to an accumulation objective. [See Barrett et al., 2001; Reardon et al., 2006 for further details]

Besides this very general statement, diversification can be defined in various ways. Some studies focus on farm activities, and define diversification as joint activities in subsistence farming and commercial agriculture. Other studies take into account the possibility to engage in nonfarm activities in addition to farming. In our study, we consider this second definition where diversification is a mix of farm and nonfarm activities that integrates the relative risk of both activities. Thus, we understand diversification as an insurance mechanism aiming at compensating agricultural income variability. Evidence in this way is given in the case of Burkina Faso by Reardon et al. [1992] who showed that the capacity of households to cope with shocks following a drought depends heavily on the level of nonfarm diversification. Alderman and Paxson [1992], for instance, interpreted diversification as a portfolio strategy:

farmers mitigate risks through a diversified portfolio of occupations and smooth thereby their consumption over time.

As noted above, the choice to migrate is partly motivated by the same reasons, but we will show that other factors –specific to migration- should be added to these. We identify three major subsets of incentives that drive the migration decision: high expected revenues; collective insurance and investment.

High expected income as a reason to move has long been emphasized by the economic literature [*Stark, 1997*]. Sjaastad, as earlier as 1962, formalized this idea by hypothesizing that the individual migrates if the net income flows expected from this migration is higher than the costs of moving, should it be financial or psychological. Then, models developed by Todaro [*1969*] and Harris and Todaro [*1970*] consider that the final migrant's decision results from a comparison between the expected utility of migrating and that of remaining in the village. A large set of models were developed on this basis to assess this question<sup>1</sup>, but most of them consider migration as an individual decision.

However, it is often argued that migration is not an individual decision, but that of the whole family [*Connell et al., 1976*]. In fact, according to the New Economics of Labour Migration, the focus of migration theory has been shifted from independent individuals to larger units, namely families or households [*Stark, 1991; Stark and Bloom, 1985*]. Therefore, in face of market failures, migration operates as a households' risk management strategy, which is a way to alleviate the household liquidity constraint in the absence of credit and insurance markets. Then migration is the outcome of the family utility maximisation rather than the result of an individual decision [*Rempel, 1981; Stark and Levhari, 1982; Low, 1986; Stark, 1991*]. As a consequence, besides migrants' characteristics, those of the family should be taken into account. For instance, in a study conducted in Kenya, Hoddinott [*1994*] modelled

migration as the outcome of joint utility maximisation by the prospective migrant and other family members. Closer to our empirical field, Azam and Gubert [2006] used two surveys conducted in the Senegal River Valley -Senegal and Mali- and showed that the decision to migrate is not individual but collective. Moreover, the decision to migrate was described by Stark and Taylor [1991] as the result of a complex negotiation within the household. Thus, families or households rather than individuals, must be chosen as critical decision-making entities in which migration patterns are determined. However, factors others than the expected revenues are then taken into account, in particular, income uncertainty at the level of the family.

In fact, from the family point of view, the remittances the migrant sends home may be seen as an insurance when facing the individual risk of agricultural production in the absence of an agricultural labour market that would secure wages [Stark and Levhari, 1982]. Moreover, migrants' transfers intervene especially when the family local revenues are hit by a random shock, and enable the family to smooth its consumption [Stark, 1991 quoted by Azam and Gubert, 2005]. This monetary incentive is confirmed by the fact that migrants are more educated on average, and thus send higher transfers to the family [Hoddinott, 1994]. Then, migration can be analysed as an intra-family strategy to diversify risk [Lambert, 1994] and alleviate liquidity constraints, through remittances.

However, the revenue of a potential migrant is uncertain, insofar as the distance associated with migration, in particular international migration, increases the difficulty to get access to housing or employment in the destination country. Some studies show that networks, kinship and information play a major role when considering the decision to migrate and the choice of the destination area [Lucas, 1997]. Thus, the presence of relatives or potential ethnic contacts, the language similarity and the stock of persons in the destination area, have significant impact on migration. Empirical evidences are numerous [Caces and al., 1985, for instance].



In the case of Senegal, the importance of migration networks is confirmed by the role of neighbourhood or the belonging to the same ethnic group [*Ndione and Lalou, 2005*], the same area [*Guilmoto, 1998* in the case of the Senegal River Valley], or the same religious brotherhood [particularly for *Murids*<sup>2</sup>, as shown by *Sander and Barro, 2003*].

Furthermore, migration is a diversification strategy which doesn't have the same effect depending on whether it is continental or intercontinental migration. Wouterse [2006] analyses intercontinental migration as an accumulation strategy for wealthier households and continental migration as a survival strategy due to a lack of wealth but positively related to household size.

By considering migration as a family strategy, the literature puts forward that reciprocal behaviours may be at stake. However, the representation of families and that of their internal exchanges, vary widely across economists: Becker [1976] sees indeed the family as dominated by an altruistic and omnipotent pater familias; yet, theoretical models were also developed, where the family is considered as a piece of self-interested exchanges, like in Chiappori's initial work. We propose to follow the line of Arrondel and Masson [2006] that reconcile both views, and propose to understand the existence of families with regard to the reciprocal relationships that gather the group. Reciprocity was invoked as a reason for migration and the subsequent remittances.

In fact, the altruistic approach explains migration from the main idea that migrant cares about the welfare of family members left behind. In such a case, altruism spurs the migrant to remit a part of his income to his family. Therefore, remittances are shown to increase with the severity of droughts [*Lucas and Stark, 1985*], the size of the non-migrating group [*Hoddinott, 1994*] and the number of remitting migrants [*Agarwal et al, 2002*]. These observations can be considered as signalling altruism. Furthermore, even the self-interest approach explains why migrants remit and thus guarantee revenues to their families; inheritance is shown as a major

reason for explaining remittances. Empirical evidence from Botswana supports the idea of mixed motivations with moderate altruism or enlightened egoism as an important reason to remit [*Lucas and Stark, 1985*].

Although there have been numerous studies on the diversification of activities, there are few studies investigating both local diversification of activities and migration. In other words, there is a gap as concerns the relationship between migration and local diversification, and whether they must be considered as complements or substitutes. Actually, one can argue that they are complements because remittances received by resident members may spur them to invest and participate in local diversification of activities. Yet, it remains that, because of their regular frequency and their level, these remittances can discourage recipients to participate in local diversification of activities. Thus, the purpose of our study is to remedy this gap by drawing empirical evidence from a Senegalese rural area, particularly the Groundnut Basin. Therefore, we propose to analyse migration as a collective insurance arrangement at the family level.

### 3. Data and descriptive statistics

Data were collected in two villages, Kanene and Ouanar, respectively located in the North and South of the Senegalese Groundnut Basin. These two *Wolof*<sup>3</sup> villages were chosen because of their contrasting agro-ecological features and economic differences which undoubtedly influence the extent and nature of diversification patterns. Surveys were conducted in two steps, a first one from May to June 2006 in the North, and a second one from November 2006 to January 2007 in the South.

Regarding the unit of analysis, most of the empirical and theoretical studies are conducted at the household level, which is considered as the most convenient unit. In fact, the household analytical framework allows for a joint analysis of production and consumption decisions and a focus on intra-household interdependencies [*Haddad et al., 1997; Fafchamps, 1998, Lawrence et al., 1999*]. However, given the social context in Senegalese rural areas, the choice of the household -corresponding to a nuclear family- as the relevant unit can lead to biased results because the operation of rural populations is more complex. In fact, individuals belonging to the same lineage were grouped around production-consumption groups (*njël* in Wolof language) under the responsibility of a chief (*Borom njël*). In other words, such a group can be considered as an extended family comprising several households linked by kinship, living in the same compound and having meals together. Thus, agricultural production is organized around the *njël* in which different members, according to their status and position, have the social obligation to contribute to agricultural work for collective production. And, in return, the *Borom njël* must allocate land to these members as individual fields and ensure that the family food needs are met. In these families, members who want to migrate have to get the chief's consent before leaving and send remittances after having settled down and found a job in the destination area.

Therefore, we consider a family as a set of individuals participating in collective production, through labour force for residents and transfers for non-residents –that is migrants’ members. Thus, in the two villages 89 families<sup>4</sup> comprising 229 households (nuclear families) were surveyed by the authors. For each family, the *Borom njël* was interviewed on a face-to-face basis.

We found that the choice to migrate is up to the family member that wants to migrate or to the family head. However, in both cases, migration involves the family head’s acceptance, and migrants who bypass this decision run the risk of loosing the support of their family. Thus, we define a migrant according to the following conditions:

i°) a migrant is a family member who is living outside the village for more than six months a year.

ii°) but a family member who is still reported by the family head as a member of the *njël* or extended family;

The survey data includes detailed information on the demographic characteristics with an inventory of family members, ages, genders, positions in the family and activities. In this part of the survey, the family head was interviewed whereby information about migrants was asked for, including status before and after migration, the date of leaving, destination country or city, remittances sent at home and their rights and obligations, if they return home, were recorded for every migrant. Nonfarm activities include the type of activity, the location and the amount of income generated. For farm activities, we recorded information on family and hired labour, land size, equipment use, crop (type, production, prices) and livestock. We also asked for consumption practices and the individual members’ contribution in the purchase of non produced goods.

From the statistical point of view, 72% of the families report at least one migrant member and 90% of these migrants are sending remittances to their families. Moreover, we distinguish between international migration and national migration: families experience those types of migration at respectively 26% and 74% (see table 1 for migrants' characteristics according to the destination country).

Descriptive statistics show that family members who migrate to national cities are younger than those abroad. In fact, national migration costs are lower than those related to international migration. Moreover, national migration is usually the first migration experience, particularly in the capital Dakar. And this is a first step that allows accumulating financial and social capital to bear the cost of international migration.

Finally, regarding their marital status, many of the migrants are singles before leaving the villages while an important share of them get married and reach a higher social position in the family during migration.

**Table 1:** Migrants' characteristics according to migration types (total number 449 men for the two villages)

<b>Migration types</b>	<b>National</b>	<b>International</b>
Number of migrants	122 (74%)	43 (26%)
Age of migrants (when leaving for the first time)	21.4	25.2
Age of migrants (survey year)	27.0	35.1
Marital status, single (reference married)		
- before migration	93.4%	76.7%
- now (survey' year)	54.9%	37.2%

The family characteristics are given in table 2. We draw from the data that families with international migrants are larger compared to those with national ones and that their family head is older. However, they farm the lowest amount of land, even when controlling for

family size. The average level of remittances differs widely according to migration types, with 774 160 Fcfa for international migration and 178 532 Fcfa for national. On average, families with international migrants have the lowest level of farm and local non farm incomes.

Table 2: Families' characteristics (89 families)

<b>Migration types</b>	<b>National</b>	<b>International</b>
Age of family head	52.4	60.2
Family size	16.6	23.9
Number of residents	14.6	20.4
Total land	12.27 ha	11.74 ha
Total land per adult equivalent	0.9 ha	0.67 ha
Farm income	867 988 Fcfa (74%) **	595 450 Fcfa (42%)
Non farm income	130 481 Fcfa (11%)	38 080 Fcfa (3%)
Remittances	178 532 Fcfa (15%)	774 160 Fcfa (55%)
Total income	1 177 001 Fcfa	1 407 690 Fcfa

\* 1 € = 655, 957 Fcfa

\*\* In brackets: share in total income

#### **4. Estimation method and empirical results**

The previous statistical analysis puts forward the importance of nonfarm activities in the families' total income. We stress thereby two types of diversification: migration and local diversification of activities. We investigate whether they are positively or negatively correlated. In a first section, we consider the total number of migrants. And in a second section, we differentiate migration types according to the destination country, and distinguish domestic or national migration on the one hand, and international migration, on the other.

##### **4.1. Migration and local diversification: complements or substitutes?**

###### **4.1.1 Migration and local diversification: Empirical strategy**

We adopt a simultaneous equation approach that allows for the joint decision of the levels of the two diversification types. As endogenous variables, we consider on the one hand, the ratio of the total number of migrants, relatively to the total number of male family members (*totalmigration\_ratio*), because only male residents are allowed to migrate. On the other hand, we select the number of adults in the family who are engaged in non agricultural activities, relatively to the total number of family members (*diversification\_ratiotous*), including women. Given that all of them have the possibility to work outside the farm at the local level. We estimate the following equation system. We take into account the truncation in the distribution of the endogenous variable by choosing a bivariate Tobit model. Exogenous variables differ across the equations as some of them are supposed to influence the migration rate only. Last, we allow for the heteroskedasticity of residuals within the villages by clustering the regressions at the village level.

(1) Migration equation

$$\begin{aligned} \text{totalmigration\_ratio} = & \beta_0 + \beta_1(\text{female\_number}) + \beta_2(\text{age\_inf50}) + \beta_3(\text{age\_5060}) \\ & + \beta_4(\text{s\_french}) + \beta_5(\text{total\_land}) + \beta_6(\text{agr\_equipment}) \\ & + \beta_7(\text{agricultural\_income}) + \beta_8(\text{agriculturalincome\_vv}) \\ & + \beta_9(\text{nonagricultural\_income}) + \beta_{10}(\text{headpast\_migration}) \\ & + \beta_{11}(\text{newfirst\_510}) + \beta_{12}(\text{newfirst\_sup10}) + u \end{aligned}$$

(2) Diversification equation

$$\begin{aligned} \text{diversification\_ratiotous} = & \alpha_0 + \alpha_1(\text{age\_inf50}) + \alpha_2(\text{age\_5060}) + \alpha_3(\text{total\_land}) \\ & + \alpha_4(\text{agr\_equipment}) + \alpha_5(\text{agricultural\_income}) \\ & + \alpha_6(\text{agriculturalincome\_vv}) + \alpha_7(\text{nationalmigration\_ratio}) \\ & + \alpha_8(\text{internationalmigration\_ratio}) + u' \end{aligned}$$

We select three sets of exogenous variables: first, we include the demographic and productive characteristics of the family. And we introduce -only in the migration equation- variables standing for the family networks in the destination cities. Therefore, variables referring to the migration experience the family accumulate to take into account the cumulative shape of migration decision.

### *Demographic characteristics*

The set of demographic characteristics includes the number of women, the age of the family head and the level of French education in the family. We expect a positive effect of the number of women (*female\_number*) on the migration ratio. In fact, in our study area, all family members contribute to farm activities during the rainy season, such as agricultural work in the common field. Therefore, we think that a higher number of female members implies a higher potential labour force, thus male can free themselves from farm activities and then engage in migration. Moreover, for the age of the family head, we distinguish three categories: age lower than 50 years (*age\_inf50*); age between 50 and 60 years (*age\_5060*) and age above 60 years (*age\_sup60*). As a reference, we chose the last category and we believe that both diversification and migration are increasing with the age. In fact, the family head is generally the oldest family member, and we are more likely to observe a high proportion of adults, and subsequently migrants, when he gets older. Last, to analyse the effect of human



capital, we include the number of family members who attend French school through the dummy variable (*s\_french*). Therefore it takes 1 if there is a family member who reaches at least primary school in French education and 0 if all members have a Koranic education. Given that some empirical studies (*Reardon et al., 2006; Abdulai and Delgado, 1999; Barrett et al., 2001*; for instance) find a positive relationship between education level and engagement into nonfarm activities, we expect a positive influence of the level of French education on the migration ratio. Moreover, we think that a schooling in French increases the probability to migrate, which is not the case, for instance, for people who only received Koran schooling and have no other skilled position than teaching Koran.

#### *Productive characteristics*

We expect that the family asset endowment increases both migration and local diversification ratios. In fact, the engagement in nonfarm activities requires an investment, and in a context of credit market failure, we think that families which are well-endowed with physical capital are more likely to overcome entry barriers and diversify their activities. Therefore, we include in the estimations the amount of land cultivated by the family head (*total\_land*) in hectares and his physical asset through agricultural equipment (*agr\_equipment*). This latter takes 1 if the family has at least one agricultural material, like hoe or sower, and 0 if not. Furthermore, we must underline that the land size is, in our case, perfectly exogenous because land is inherited and there is no land market. However, it is less obvious for agricultural equipment, because families can obtain it thanks to income earned from local nonfarm activities or migration. Therefore, we propose to test the endogenous character of family agricultural equipment further. As concerns family local revenues, we introduce in the econometric specification the agricultural and non-agricultural incomes that represent the total local revenues received in the previous year of the survey. Agricultural income

*(agricultural\_income)* is earned from farming and livestock, a shadow income that is the imputed value of crop production at the market price. Moreover, we allow for the interaction between agricultural income and the village dummy –with the Northern village as a reference (*agriculturalincome\_vv*). We expect a negative correlation with the ratio of migration and that of local diversification, because we think that the amount of remittances will discourage resident members to farm. Furthermore, non agricultural income (*nonagricultural\_income*) is measured through the total income obtained from local non agricultural activities.

### *Migration experience*

The third category of explanatory variables is included only in the migration equation. In fact, drawing on the importance of networks on the migration decisions, we include a dummy variable (*headpast\_migration*) which is 1 if the family head experience migration and 0 if he never migrated. We choose the family head because according to his social position in the family, he is likely to facilitate the departure of migrants by establishing contacts in the destination area. Besides, we consider (*newfirst*) the span between the year of the first migration in the family and the survey year. We distinguish three categories: (*newfirst\_inf5*) when this span is lower than 5 years, (*newfirst\_510*) when it is between 5 and 10 years; and (*newfirst\_sup10*) for span upper than 10 years. We choose as a reference those whose span is below 5 years (the lower span). Many people prefer to move to places where they have family members, because they can rely on them to provide shelter and information which help to integrate their new environment. Besides, in reference to the 70's drought, migration is an old phenomenon for the two villages, particularly in the North where many of the current family head emigrated before getting married. Therefore, we expect a positive effect of this variable on the migration ratio.

### 4.1.2 Migration and local diversification: Results

Table 3 summarises the results of the joint decision of migration and diversification at the family level.

**Table 3:** Bivariate Tobit model

Endogenous variables	totalmigration_ratio	diversification_ratiotous
female_number	0.019 (0.000)***	
age_inf50	-0.053 (0.018)***	0.011 (0.057)
age_5060	-0.084 (0.009)***	-0.021 (0.017)
s_french	-0.019 (0.038)	
total_land	0.013 (0.005)***	0.005 (0.003)*
agr_equipment	0.297 (0.127)**	0.066 (0.084)
agricultural_income	-0.104 (0.017)***	-0.037 (0.006)***
agriculturalincome_vv	-0.074 (0.039)*	0.050 (0.006)***
nonagricultural_income	0.005 (0.136)	
headpast_migration	-0.074 (0.008)***	
newfirst_510	0.270 (0.121)**	
newfirst_sup10	0.268 (0.119)**	
nationalmigration_ratio		-0.661 (0.225)***
internationalmigration_ratio		-0.424 (0.197)**
Constant	-0.211 (0.275)	0.175 (0.215)

Observations 89

Log pseudolikelihood = 4.183

Robust standard errors in parentheses

- \* significant at 10%;
- \*\* significant at 5%;
- \*\*\* significant at 1%

### Migration of family members

Concerning the migration decision of the family, namely the proportion of migrants in the male population, the results are as follows. The demographic structure of the family affects the proportion of migrants. In fact, we find that the migration ratio is increasing with the number of women. This finding suggests that women can stand for male in family labour force concerning agricultural work, therefore allowing male members to leave the farming activities and engage in migration. Moreover, when the age of the family head is lower than 60 years, the ratio of the total number of migrants relatively to the total number of male family members is less important. This result is consistent with the size of the family, because families with an old head tend to have more adult members who can carry out farm activities while others devote themselves to migration. Furthermore, the existence of a family member who received a French schooling –at least primary school level- doesn't influence the migration ratio. This is contradictory to Wouterse's (2006) results applied to another Sahelian region, namely Burkina Faso, where she found that the level of education is positively related to migration, with a distinction between primary and secondary school level. In fact, activities carried out by migrants' native to the two surveyed villages of our study are, more often than not, in the informal sector, so they don't require general knowledge.

We find that the productive characteristics of the family have an impact on the proportion of migrants in the family. Thus, families who are well endowed with land and physical assets have a higher migration ratio. This provides evidence for the role of asset endowment: this can be a proxy for the family wealth and then its ability to support financial costs related to migration. This result supports the hypothesis according to which wealthier families are driven by an accumulation objective and can be pulled by new opportunities.

The level of income earned from agricultural production impacts negatively on the migration ratio. We obtain the same results when allowing for the interaction between this variable and the Northern village characterized by uncertainty and variability of agricultural incomes. We conclude that families that meet their needs through farming are less likely to have a high level of migration ratio. However, we find that non-agricultural income –a proxy of local diversification- doesn't have any effect on the proportion of migrants in the family. However, we propose to investigate in the diversification equation such a relationship by considering the ratio of national migrants and that of international one as exogenous variables.

Regarding the relationship variables which stand for the importance of networks in the potential destination country or city, we obtain the expected positive effect of the absence span of the first migrant among family migrants. Results show that the proportion of migrants increases with this absence span. This positive impact, which is consistent with findings from other studies [*Lucas, 1997, Ndione and Lalou, 2005* for instance], may reflect the development of family networks allowing future migrants to settle more easily in the destination area. However and surprisingly, we draw from the results that the past migration experience of the family head has a negative effect on this proportion. Hence, we can argue that the family head didn't maintain any ties in the place of his past emigration, since his homecoming. As a consequence, this absence of ties doesn't lead to the existence of a network facilitating a recent migration of family members.

### Diversification of family activities

Turning now to determinants of the proportion of adults who are engaged in non agricultural activities relatively to the total number of family members, we can summarize the results as follows.

We find that the individual characteristics of the family head –namely his age- doesn't have any impact on diversification ratio. This finding leads us to believe that diversification and migration result from two different strategies and decisions, the first one being more individual while the second one involves a family decision.

The total cultivated area increases the diversification ratio while agricultural equipment doesn't have any impact on it. Such a finding suggests that families which are well endowed with land are more likely to have members engaged in local nonfarm activities. In fact, adult family members have their individual plots where they grew cash crop, like groundnut. Then, incomes earn from groundnut sale can serve as an investment to begin nonfarm activities. This positive effect of land on nonfarm activities is in accordance with the results of Abdulai and Crole-Ress [1999] and Reardon et al. [2006].

Agricultural income has a negative and significant influence on the diversification ratio, suggesting that families which can earn enough income from farming are less likely to engage in nonfarm activities. However, the interaction of this variable with the village dummy turns out to be positive and significant. This may be linked to the fact that the uncertainty and the variability of agricultural income in the Northern village are higher than in the South, so that rural families in this area will prefer to protect their livelihoods through the engagement in local diversification, even if agricultural income is high.

Finally, in order to investigate whether local diversification and migration are complements or substitutes, we include national and international migration ratios in the econometric specification (*nationalmigration\_ratio* and *internationalmigration\_ratio*, respectively the

proportion of national and international migrants in the male population at the family level). They both have a negative effect on the ratio of local diversification. This finding may reflect the trade-off between local diversification and migration because they compete in terms of labour, but only for men. In other words, when there are more members engaged in activities at the local level, the family will be less prone to have members who can devote themselves to migration, either at the national or international level. Furthermore, we can point out the higher returns generated by migration in terms of remittances compared to local non farm earnings. As a consequence, we can conclude that local diversification and migration – national or international- are substitutes for rural families in our study area with a higher influence of national one.

We should note that, even if we study ratios that are in a way logically linked, this “substitutability” is not trivial, as only men are likely to migrate, whereas women as well as men participate in nonfarm activities. In addition, women represent a stock of labour that can be allocated to off-farm activities or not. Finally, the correlation in error terms between the two equations is significant. This strengthens the choice of estimation model analysing jointly migration and diversification equations, through the bivariate Tobit.

## **4.2. National or International migration?**

### **4.2.1. National or International migration? Empirical strategy**

In order to distinguish between national and international migration, we adopt probit models. Tobit models leading to inconsistent results, because only few families experienced international migrations- we investigate the probability for a family to have at least one member engaged in one of these two migration types.

We consider:

### National migration equation

$$\begin{aligned} \text{nationalmigration\_ratio}^* = & \beta_0 + \beta_1(\text{female\_number}) + \beta_2(\text{age\_inf50}) + \beta_3(\text{age\_5060}) \\ & + \beta_4(\text{s\_french}) + \beta_5(\text{total\_land}) + \beta_6(\text{agr\_equipment}) \\ & + \beta_7(\text{agricultural\_income}) + \beta_8(\text{agriculturalincome\_vv}) \\ & + \beta_9(\text{nonagricultural\_income}) + \beta_{10}(\text{headpast\_migration}) \\ & + \beta_{11}(\text{newfirst\_510}) + \beta_{12}(\text{newfirst\_sup10}) + \beta_{13}(\text{s1\_strong}) + u \end{aligned} \quad (1)$$

Where

$$\text{nationalmigration\_ratio} = \begin{cases} 1 & \text{if } \text{nationalmigration\_ratio}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

### International migration equation

$$\begin{aligned} \text{internationalmigration\_ratio}^* = & \alpha_0 + \alpha_1(\text{female\_number}) + \alpha_2(\text{age\_inf50}) + \alpha_3(\text{age\_5060}) \\ & + \alpha_4(\text{s\_french}) + \alpha_5(\text{total\_land}) + \alpha_6(\text{agr\_equipment}) \\ & + \alpha_7(\text{agricultural\_income}) + \alpha_8(\text{agriculturalincome\_vv}) \\ & + \alpha_9(\text{nonagricultural\_income}) + \alpha_{10}(\text{headpast\_migration}) \\ & + \alpha_{11}(\text{newfirst\_510}) + \alpha_{12}(\text{newfirst\_sup10}) + \alpha_{13}(\text{s1\_strong}) + u' \end{aligned} \quad (1)'$$

Where

$$\text{internationalmigration\_ratio} = \begin{cases} 1 & \text{if } \text{internationalmigration\_ratio}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)'$$

The explanatory variables selected for these probit models are the same as those in the bivariate Tobit estimation. In addition, we include another dummy variable (*s1\_strong*) that is a proxy to capture potential reciprocal behaviour in the family. It takes 1 if there is a least one migrant who changed from status (namely, marital status or position in the family) during the migration period. We expect this variable to increase the probability to observe national or international migration. In fact, most of the males who migrate for the first time are single, and thanks to the income generated by migration activities, they get married during the migration period and acquire a higher social and economic position in the family. Thus, this evolution encourages those who remain in the village to migrate and improve their social well-being.



## 4.2.2 National or International migration? Results

Table 4 summarises the results of the probit estimation models for national and international migration

Table 4: Probit estimation results for migration type

	National	International
female_number	0.004 (0.028)	0.022 (0.025)
age_inf50	0.083 (0.167)	-0.237 (0.120)**
age_5060	-0.038 (0.172)	-0.099 (0.127)
s_french	0.054 (0.130)	0.010 (0.130)
total_land	0.034 (0.016)**	0.015 (0.013)
agr_equipment	0.669 (0.238)***	(.)
agricultural_income	-0.080 (0.121)	-0.207 (0.113)*
agriculturalincome_vv	-0.577 (0.201)***	-0.016 (0.244)
diversification_ratiotous	0.145 (0.553)	0.986 (0.707)
headpast_migration	-0.120 (0.136)	-0.303 (0.139)**
newfirst_510	0.282 (0.094)***	0.447 (0.217)**
newfirst_sup10	0.172 (0.134)	0.766 (0.134)***
s1_strong	0.536 (0.116)***	0.041 (0.141)
Observations	89	85
Pseudo R2	40.82%	45.40%
Robust standard errors in parentheses		
<ul style="list-style-type: none"> <li>• * significant at 10%;</li> <li>• ** significant at 5%;</li> <li>• *** significant at 1%</li> </ul>		

Regarding national migration, we draw from the results that productive characteristics of the family are positively correlated to the probability to have at least one migrant at the national level. This finding suggests that families which are well-endowed in assets are more likely to support financial costs related to national migration. Moreover, the impact of family agricultural equipment on national migration is higher because it increases the probability of having a national migrant by 66.9 per cent; while that of total land is only 3.4 per cent.

Furthermore, when agricultural income interacts with the dummy village, we find a negative correlation with the probability to have at least a national migrant. In fact, uncertain agricultural conditions in the Northern village and remittances level received by families in this area don't encourage them to invest and allocate more labour and time in farming activities. We put forward the role of remittances which are more stable than local incomes. Therefore, we conclude that when the environment is risky, national migration acts as a substitute to local diversification.

As for relationship variables, we find that only the absence span between 5 and 10 years has a significant and positive effect on national migration, because this latter is an intermediary stage between the period people left their village and the final stage when they reach international migration. Moreover, we find that the general change of status and position (*sl\_strong*) of at least one family migrant increases the probability for the family to have a member in national migration. In spite of the distance separating migrants and their families, the ties between them remain strong because of the importance of social capital. The latter result is not trivial, as migration sometimes turns out to decrease the ties with the family. In addition, the change of status encourages adult male residents to migrate in order to improve their social well-being. We should notice that in our study area, for the Southern village particularly, only 6% of migrants get married before migration, while they are 36% at the

survey year. And in the Northern village, married migrants were 12% before migration and they represent 55% at the survey year.

Turning to the study of the determinants of international migration, we find that the age of the family head has a positive and significant impact. We point out that this age is consistent with family size and structure, and then an allocation of family labour allowing adult residents to remain in farming and local nonfarm activities, and other members, particularly adult males, to migrate. Surprisingly, productive assets, such as land and agricultural equipment, have no impact on the probability to have at least one international migrant.

As for local revenues, we find a negative and significant impact of agricultural income on the probit estimation of international migration, suggesting that, while families can rely on incomes from their own agricultural production, they prefer to allocate labour to farming to the detriment of international migration.

Furthermore, for relationship variables (*newfirst\_510* and *newfirst\_sup10*) we find that the interval between the year in which the first migrant left the village and the year of survey is positively correlated with the probability to have a member engaged in international migration. Even if the two variables have a positive effect, we note a higher coefficient when this interval is above 10 years. Such a finding suggests that the interval between the first migration experienced at the family level and the survey year is decisive and that networks are important. However, the family head's past migration (*headpast\_migration*) decreases the probability to have at least one international migrant. We put forward that the family head doesn't keep strong ties with his local network.

Concerning the productive family assets, we note that candidates to international migration already experienced national or domestic migration in Dakar, the capital of Senegal. During

this first experience, the majority of them practiced trade activities that allow them to save a part of their earnings, and organise their departure for international migration by getting information through networks of parents or friends who are abroad. This basic itinerary of migrants shows the importance of family productive characteristics for the first migration –i.e. national one- and the role of networks and personal savings for international migration.

## **5. Conclusion**

In this paper, we started by emphasizing the importance of the diversification of activities in many developing countries regarding the level of income it generates. However, the underlying idea of our study is to point out the difference between local diversification and migration, and to investigate if these two diversification patterns are complements or substitutes.

First, we investigate the relationship between local diversification and migration by integrating family and migrant characteristics as explicative variables. Second, we distinguished national and international migration and investigate the probability for a family to experience one of these two migration types.

Our empirical illustration from rural Senegalese families indicates that migration, national or international, and local diversification are substitutes. This result is consistent with the insurance. Thus, given that income sources from migration are uncorrelated with agricultural and local non agricultural incomes, we consider migration as a collective insurance arrangement. This is consistent with a large part of the literature showing that the low level of asset endowments and the increasing risk lead families to diversify spatially by sending some of their family members to migration. Furthermore, our econometric specification reveals, on the one hand, the importance of family productive characteristics for national migration, and,

on the other hand, the role of networks for international migration which is a long-term decision.

Identifying the relationship between local diversification and migration could be useful as a good indicator for policymakers to elaborate their programs, when they take into account the characteristics of these two types of diversification, widely developed in rural areas of Senegal.

### Notes

1. see Stark [1997] for a literature review
2. *Murids* are members of one of the most important religious brotherhoods in Senegal. They are characterized by their strong networks and their ability to help each other, particularly when they migrate in Italy, Spain, USA, etc.
3. *Wolof* corresponds to one of the main ethnic group in the Groundnut Basin of Senegal
4. In *Wolof*, the accurate concept when surveying rural families corresponds to the term *njël* and the main person who can give us useful information is named *Borom njël*
5. We test for the causality between agricultural equipment and total migration ratio on the one hand, and agricultural income and total migration ratio on the other. We find their coefficients to be not significant, suggesting that they are not endogenous variables.

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## Appendix 1: Variables' description

Name of variables	Description of variables
national_migration	Number of national family migrants recorded by the family head
international_migration	Number of international family migrants recorded by the family head
totalmigration_ratio	The total number of migrants, relatively to the total number of male family members
nationalmigration_ratio	The total number of national migrants, relatively to the total number of male family members
internationalmigration_ratio	The total number of international migrants, relatively to the total number of male family members
diversification_ratiotous	The number of family adults engaged in non agricultural activities, relatively to the total number of family members
female_number	Number of female in the family
Age	Age (years) of the family head with three levels:
age_inf50	Family head whose age is inferior or equal to 50
age_5060	Family head whose age is strictly superior to 50 and inferior or equal to 60
age_sup60	Family head whose age is strictly superior to 60
s_french	It takes 1 if there is a family member who reaches at least primary school in French education and 0 if all members get a Koranic education
total_land	The total area (ha) cultivated for all crops
agr_equipment	The agricultural equipment held by the family head which takes 1 if he has at least one agricultural material
agricultural_income	Agricultural income ( $10^6$ Fcfa) corresponds to the imputed net value of food crop and cash crop production and livestock
agriculturalincome_vv	Agricultural income ( $10^6$ Fcfa) by including a village' difference
nonagricultural_income	Non agricultural income ( $10^6$ Fcfa) corresponds to the income of nonfarm activities
headpast_migration	The previous migration experience of the family head, if he was a migrant or not in the past
newfirst	The interval between the year in which the first migrant leave the village and the year of survey (2006)
newfirst_inf5	When this interval is lower than 5 years
newfirst_510	When this interval is between 5 and 10 years
newfirst_sup10	When this interval is upper than 10 years
s1_strong	Change in the migrant marital status and position during the migration period

## Appendix 2: Summary statistics

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
national_migration	89	0,640	0,483	0	1
international_migration	89	0,281	0,452	0	1
totalmigration_ratio	89	0,310	0,236	0	0,833
nationalmigration_ratio	89	0,234	0,214	0	0,750
internationalmigration_ratio	89	0,076	0,143	0	0,583
diversification_ratiotous	89	0,107	0,106	0	0,500
female_number	89	5,067	3,194	1	17
age_inf50	89	0,427	0,497	0	1
age_5060	89	0,281	0,452	0	1
s_french	89	0,640	0,483	0	1
total_land	89	10,914	7,627	0	49
agr_equipment	89	0,955	0,208	0	1
agricultural_income	89	0,728	0,927	0	5,020
agriculturalincome_vv	89	0,166	0,320	0	2,464
nonagricultural_income	89	0,107	0,254	0	1.8
headpast_migration	89	0,461	0,501	0	1
newfirst_510	89	0,225	0,420	0	1
newfirst_sup10	89	0,258	0,440	0	1
s1_strong	89	0,449	0,500	0	1