

**Local diversification of income sources versus migration: Complements or
Substitutes?
Evidence from rural families of the Senegalese Groundnut Basin**

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Abstract

Much has been written to show the importance of diversification for rural African households because of the considerable share of non-farm revenues in total income (Reardon, 1997; Reardon et al., 1998). The literature points out push and pull factors explaining that risk and adverse shocks which characterize farm activities urge rural population to diversify into more profitable non-farm activities. But less attention has been paid to the distinction between two diversification patterns, namely local diversification and migration, and their relationship. Drawing on the theoretical and empirical literature, we identify the advantages and drawbacks of local diversification versus migration decision in terms of expected pay-offs for the family and the individual.

Based on original data from a sample of rural families in two villages of the Senegal Groundnut Basin, the present paper examines whether local diversification and migration are complements or substitutes, by investigating the choice of the number of migrants in the family. We consider the family as a basis of reciprocal relations and point out that its role of insurance may differ when the member migrates.

Our analysis indicates that when agricultural endowments are low and variable in the whole, migration is found to be functioning rather as an alternative activity to local diversification, than as a complement. Such a finding implies that with relative low returns expected from local economy, migration provides rural households with a form of insurance against adverse shocks.

JEL Codes: O15, O55, D70, Q12

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

Introduction

In many developing countries, and particularly in Africa, agricultural income represents an essential component of rural households' subsistence. However, this type of income exhibits a high seasonality and leads to uncertain outcomes, 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. (2005), diversification refers to the allocation of assets and time to both on- and off-farm activities. Empirical studies in rural Africa have revealed that non-farm income sources may account for as much as 40-45% of the average household income and seem to be growing in importance (Reardon, 1997; Bryceson and Jamal, 1997; Little et al, 2001; and Barrett et al., 2001). Therefore, 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 totally engaged in agricultural production. They refer thereby to a portfolio theory: more precisely, they identify "pull and push factors". The former are those generated by opportunities outside agriculture; the latter refer to the decline of expected agricultural income, and the income uncertainty generated by prices instability (Reardon et al., 2006). As for diversification in general, it can lead to migration for some family members: migrants' remittances represent thus a large proportion of total family income.

Despite the huge literature on diversification, to our knowledge, few studies distinguish the various types of diversification methods. In particular, diversification can take place at the local level when a household member is engaged in a non-farm activity but still remains 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. Thus, the present paper proposes to investigate first the decision of families whether to diversify their activities or not, and second, their choice of diversification method. In particular, we will investigate if local diversification and migration are complementary strategies or substitutable ones.

We used original data from a survey conducted in the Senegalese Groundnut Basin to study this question. This assessment remains important in many rural areas in Senegal where agricultural conditions are unfavourable. The contribution of migration and diversification to household incomes was brought forward in numerous empirical studies for different countries, among which Senegal. From a survey conducted in 88-89, Kelly et al. (1993) emphasized the extent of diversification and the differences due to local conditions. They estimated the share of non-farm income in the average total income at 60% for households located in the North and 24% for those living in the centre. Regarding migration, Diatta and Mbow (1999) found that remittances were a substantial revenue source for families with migrant members, and that the transfers were also used to promote development in migrants' home communities. Moreover, migrants' remittances seem to be growing in importance because from 25 millions USD in 1997, they reached 270 millions USD in 2002 (Sander and Barro, 2003).

The remainder of the paper is organized as follows: section 1 underlines the pertinence of the research question by articulating it with previous studies dealing with diversification and migration. Section 2 presents the setting in which this research has been carried out, describes data collected and defines an empirical strategy. Section 3 explains the estimation method and variables choice. Section 4 presents the results and offers several interpretations of the findings.

1. Local diversification of activities versus Migration: complements or substitutes?

Numerous studies put forward the importance of diversification and migration as livelihood strategies developed by the rural population of 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 then propose a common framework to link both 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. Whilst 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, viewing diversification as both subsistence farming and commercial agriculture. In other studies, they take into account the possibility to engage in non-farm activities in addition to farming. In our study, we consider this second definition where diversification is a mix of farm and non-farm activities integrating the relative risk of both activities. We understand thus diversification as an insurance mechanism aiming at minimizing 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 importance of non-farm diversification. In addition, Alderman and Paxson (1992) interpreted diversification in terms of portfolio strategy: farmers mitigate risks and smooth thereby their consumption over time.

In fact, in developing countries, the problem of income variability remains unsolved because of the lack or imperfection of some markets like those of credit and insurance. As a consequence, households devote substantial resources to stabilizing the stream of income in order to protect themselves from the dire consequences of high income fluctuations and subsequent liquidity constraints (Bardhan and Udry, 1999). Several empirical studies confirm the existence of such strategies for different countries in Sub-Saharan Africa (Reardon et al., 1992; Kelly et al. 1996; Abdulai and CroleRees 2001).

As noted above, the choice to migrate is partly motivated by the same reasons, but we will show that others should be added to these, which influence the incentives to diversify in this way. We identified 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 been long 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. A large set of models were developed on this basis to assess this question - see Stark (1997) for a literature review - but most of them consider migration as an individual decision.

However, it is often argued that migration cannot be an individual decision, but that other household members are involved in it (Connell et al., 1976). Thus, besides migrants' characteristics, those of the household should be integrated in the models. Then migration is an outcome of maximising the household utility rather than individual one (Rempel, 1981;

Stark and Levhari, 1982; Low, 1986). In a study conducted in Kenya, Hoddinott (1994) modelled migration as the outcome of joint utility maximisation by the prospective migrant and other household members. Closer to our empirical field, Azam and Gubert (2002) used two surveys conducted in the Senegal River Valley - Senegal and Mali – and showed that the decision to migrate is not individual but collective. In addition, by investigating migration in Côte d'Ivoire, Lambert (1994) followed up the literature in which migration corresponds to the outcome of a family strategy rather than individual one. Moreover, the decision to migrate was described by Stark and Taylor (1991) as the result of a complex negotiation within the household. Furthermore, factors others than the expected revenue 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 a diversification response in the presence of risk. Risks of crop failure, price fluctuations, insecurity of land tenancy, livestock diseases, and inadequate availability of agricultural wage work, may each render the rural context quite precarious (Stark and Levhari, 1982). This wage should be pooled at the family level when the right incentives are set (Lucas, 1997): moreover, migrants' transfers intervene especially when the family local revenues are hit by a random shock, and enable the family to smooth its consumption (Azam and Gubert, 2002). 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 analyzed as an intra-family strategy to diversify risk (Lambert, 1994) and alleviate liquidity constraints, through remittances.

However, the revenue of the future 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 on migration, 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; Taylor, 1986, 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*¹, 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): 'continental and intercontinental migrations do indeed constitute two different diversification strategies. Intercontinental migration is a strategy for accumulation only accessible for households that have a certain level of wealth at their disposal, such as land or access to irrigated land. Continental migration can be viewed as a survival strategy stemming from a lack of wealth but positively related to household size'. In addition, other studies underline international migration as an accumulation strategy, and show that remittances have enhanced crop productivity in the long run (Lucas, 1987).

When putting forward the necessity to understand migration as a family and not only individual strategy, we also underline the fact that reciprocal behaviours may be at stake. However, the representation of families and that of their internal exchanges, vary widely

¹ *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.

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 self-interested exchange, like in Chiappori's initial work. We propose to follow the line of Arrondel and Masson that reconcile both views, and propose to understand the existence of families with regard to the reciprocal relationships that gather the group. With respect to the types of social relations and motivations, Kolm (1984) distinguished between four modes of transfer: "taking by force; gift-giving; exchange and reciprocity". Contrary to exchange which is by pair of transfers globally chosen by participants, in the case of reciprocity, each transfer is free by itself: the receiver is free to hand out a return gift or not. The latter agent may feel an internal obligation to return the favour; the cost of non-giving may be increased by social pressure but remains free, otherwise it would not be gift-giving but forced. Kolm relates this type of transfer to the individuals' motivation: when belonging to the same group and therefore being engaged in a symmetrical relationship with other group members, reciprocity can emerge. Furthermore, proximate relationships are necessary to promote sympathy. In fact, reciprocity was invoked as a reason for migration.

First, altruism was proved to explain migration, and then migrants are concerned with the welfare of other household members. In most cases, empirical analysis show that mixed motivations of moderate altruism or enlightened egoism can be considered as an important reason to remit (Lucas and Stark, 1985 for Botswana). 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. But selfish motivations to the choice of remittances level are also observed, particularly linked to inheritance (Lucas and Stark, 1985). Second, some studies consider migration as an investment made by the family, and remittances as a repayment of cost education supported by parents. In fact, a positive relationship between remittances and migrants' education is often observed (Johnson and Whitelaw, 1974; Rempel and Lodbell, 1978, Lucas and Stark, 1985). This relationship is interpreted as a repayment of the principal invested by the family. In the same perspective, de la Brière et al. (2002) presented remittances as a way to reimburse the family for past expenditures, such as education and cost directly related to migration (Stark and Lucas, 1988; Poirine, 1997), or to invest for the future either out of a concern for inheritance, or as a way of maintaining status and returning home with social capital (Lucas and Stark, 1985; Hoddinott, 1992, 1994; De La Cruz, 1995; Poirine, 1997). In the Kenyan case, Hoddinott (1997) showed that the guarantee that the migrant will have access to land while coming back is correlated to the level of remittances he sends. The latter observation show that rules and norms within the family may play a great role in the decision to migrate and send remittances.

In a New Institutional Economic framework, Guilmoto (1998) underlines that migration becomes an institution because it can be considered as an intra-family contract, which involves a set of mutual obligations between the migrants and their families.

Although there have been numerous studies on 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, whether they must be considered as complements or substitutes. Thus, this paper seeks to remedy this gap by drawing empirical evidence from the Senegalese Groundnut Basin.

Therefore, we propose to analyze migration as a collective insurance arrangement between the migrant and his family. The result of such an arrangement is that both can rely on each other, even if it is implicit and informal. Then the family expects to receive a part of future migrants' earnings, but in return it accepts to offer a safety net to migrants in case of problems.

2. Data and empirical strategy

Data were collected in two villages, Kanene and Ouanar, respectively located in the North and South of the Senegalese Groundnut Basin. These two *Wolof*² 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, we can underline that more often than not empirical and theoretical studies consider the household as the relevant unit. However, considering the social context of the Groundnut Basin, we choose the family rather than the household as our unit of analysis. In the two villages 89 families³ comprising 229 households were surveyed. These families comprise several households linked by kinship, living in the same compound and having meals together. Then, we bet that the family chief – more precisely *Borom njël* – was better able to give useful information than the heads of single households.

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, leaving date, destination country or city, remittances sent at home and the assistance they can benefit, if they return home, were recorded for every migrant.

Concerning off-farm activities, information collected includes the type of activity, the location and the amount of income generated. For farm activities, we recorded information on labour (family and hired labour), land, equipment use, crop (type, production, prices) and livestock. We also asked for consumption practices, with the quantity purchased and produced, and also family members' contribution in buying non produced goods.

The villages were selected for two main reasons: The first one is related to their contrasted agro ecological situation, illustrated by less favourable agricultural conditions in the North whilst these conditions are relatively favourable in the South. The second one concerns the economic differences as to their accessibility and conditions regarding infrastructure (see Table 1)

Table 1 Differences in village characteristics

	Ouanar	Kanene
Soils	- Good soil quality - Shortage of arable land	- Poor soil quality - Availability of arable land
Annual rainfall	550 to 600 mm/an	250 to 300mm/an
Crops	- Groundnut and Cotton - Millet and Maize	- Groundnut and “Niebe” - Millet
Accessibility, Infrastructure	- Isolated area with less infrastructure for health and education	- Accessible area with more infrastructure for health and education

² *Wolof* corresponds to one of the main ethnic group in the Groundnut Basin of Senegal

³ 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*

These agro ecological differentiated situations reflect in the demographic and socio-economic observations in the villages.

Table 2 Descriptive statistics on family characteristics

Frequency (% in family)	Ouanar	Kanene
Family size	16, 95	18, 18
Number of migrants	1, 20 (7%)	2, 38 (13%)
Number of males	8, 46 (49, 9%)	9, 2 (50, 2%)
Mean age of family head	49	57

As families are larger in Kanene (North)⁴, we expect to find on average more migrants in the Kanene families. Furthermore, even though the proportion of males in the family is around the same across villages, the proportion of migrants is higher in Kanene. We derive from this observation that the number of migrants is not only determined by demographic characteristics. We investigate then the economic determinants of migrations.

Table 3 Income composition by village

	Ouanar		Kanene	
	Fcfa *	%	Fcfa	%
Staple cropping	538 194	33, 45	24 670	3, 23
Cash cropping	717 591	44, 59	254 161	33, 32
Livestock	27 308	1, 70	16 910	2, 22
Farm income	1 283 093	79, 74	295 741	38, 77
Nonfarm income	207 532	12, 90	29 020	3, 80
Remittances	118 513	7, 36	437 895	57, 43
Total income	1 609 138		762 656	

* 1 € = 655, 957 Fcfa

Table 3 provides information on income sources, and it shows that agricultural income (cash and staple crops) remains the main income source - more than 75% - for rural households located in the South of the Groundnut Basin. On the contrary, for those leaving in the North, remittances constitute the principal income source. And these statistical results are consistent with agricultural endowments differences in the two villages.

We propose to turn to econometrical analysis to disentangle, first the numerous determinants of the collective insurance arrangement to send a family member outside the village. We define a migrant according to the following conditions:

- i°) a family member who is recorded by the family head as a non resident member;
 - ii°) a family member who left home and work outside the village for more than six months.
- We consider thereby national and international migrations without any distinction.

Regarding the decision to migrate, it is essential to underline that it can come from either the family member who want to migrate or the family head. However, in both cases, migration often involves the family head's acceptance, and migrants who don't respect his opinion run the risk of losing the support of their family. Then, we consider this acceptance as essential when analyzing migration as a collective insurance arrangement between the migrant and his family.

⁴ This observation is correlated with the average age of the family head, whereby the latter are older in Kanene

3. Estimation method and variables

The descriptive analysis in the previous section shows the importance of non-farm activities, such as migration and local non agricultural activities in rural families' total income. Thus, to investigate if local diversification and migration are complements or substitutes, we propose to examine the determinants of the number of migrants in the family.

We used the two-step procedure developed by Heckman:

i°) Firstly, we adopted a probit model to explain the family choice to have a migrant. This choice took value 1 if the family has at least one migrant and 0 otherwise.

ii°) Secondly, for families having at least one migrant, we regressed the number of migrants on some explicative variables, such as the characteristics of the family and migrant.

This Heckman procedure was useful in our study because families without migrants were not automatically dropped to the estimation.

The selected variables are the following (see appendix 1 and 2 for description of variables and summary of statistics):

Regarding demographic variable, we expected the number of migrants (*nbmig*) to be growing with family's composition and some individual characteristics.

As for family's composition, we took into account the number of children (*nbchild*) in the family. We expected it to have a positive effect on the probability to send at least one migrant and on the number of migrants. As concerns individual characteristics of the family head, we expected his age (*age_head*) to increase the number of migrants because this variable was consistent with family size. In addition, more often than not, migrants tend to possess certain demographic and socio-economic characteristics in terms of age, sex and education. Then, we included the migrant's individual characteristics, namely his level of French education (*schoolevel*) and his age (*age_mig*). We expected a positive influence of the level of French education on the number of migrants and a negative influence of the variable age. As for gender, we chose to drop it from explicative variables because of social customs, women were not allowed to migrate and work outside the village. So only, male migration is considered in this paper.

With reference to the literature which underlines that migration acts as an insurance mechanism, we included family characteristics regarding agricultural production. Thus, we took into account the total amount of land cultivated by the family head (*STC_BNJ*) and his agricultural equipment through the dummy variable (*equipagr_nul*). This latter took value 1 if the family hasn't any agricultural equipment and 0 otherwise. We expected that a low level of land endowment pushes some family members into migration as to supplement a low farm income. As a consequence, we think that the land variable will decrease the probability to have at least one migrant and the number of migrants. We expected the same effect for physical asset variable because poor families, without agricultural equipment, should not be able to support financial costs of migration.

Furthermore, drawing on the importance of networks on migration, we included a dummy variable (*djm*) indicating the existence of a migrant in the past, for example, the present family head. This variable (*djm*) took value 1 if the family experienced migration before and 0 otherwise. Moreover, we used a proxy to capture potential reciprocal behaviour in the family through the dummy variable (*strongties*). It took the value 1 if the migrant changed from status – namely, marital status or position in the family - during the migration period. Besides,

we included another variable (*first*), defined as the length between the year of the first migration in the family and the survey year. We expected these three variables (*djm*, *strongties*, *first*) to have a positive effect on the number of migrants in the family.

Regarding our main question on ‘complementarity’ or ‘substitutability’ of migration and local diversification, we proposed to capture it through the variable (*diversification*). This variable accounts for the number of males that are engaged in local diversification (note: we tested also the total number of family members engaged in it, including females. And we also weighted this number with respect to part-time or full-time work. The following results didn’t change).

As for income variables, we took into account agricultural and non agricultural incomes that stand for the total local revenues received in the previous survey’ year. Agricultural income (*agrelev_inc*) corresponds to the total amount of income earned from farming and livestock. We expected this variable (*agrelev_inc*) to have a negative influence on the number of migrants. Non agricultural income (*nonagr_inc*) was measured through the total income obtained from local non agricultural activities. We expected this variable (*nonagr_inc*) to decrease the number of migrants.

Last, we included a village effect ($\nu\nu = 1$ for Kanène) and we denoted the interaction between the variables described above and this effect by $_{\nu\nu}$. Because of the neighbourhood effect within a village, we expected a positive influence of the variable village on the probability, for a given family, to have at least one migrant.

4. Empirical results and discussion

We present in Table 4 the results of the above described Heckman model, explaining the determinants of the number of migrants in the families of the two villages. In the first column, we summarize the results concerning the determinants of the number of migrant in the family. While, in the second column we have the probability, for a given family, to count at least one migrant.

Table 4: Estimation results

	nbmig	at least one
nbchild	0.171 (0.046) ***	0.313 (0.099) ***
ageb1	0.115 (0.273)	0.266 (0.472)
ageb3	0.611 (0.285) **	0.221 (0.661)
schoolevel	-0.032 (0.255)	-0.412 (0.448)
agemig2	-0.384 (0.240)	
agemig3	-0.438 (0.415)	
STC_BNJ	-0.014 (0.023)	0.024 (0.041)
equipagr_nul	0.055 (0.609)	-2.029 (1.100) *
first	0.057 (0.026) **	
strongties	0.296 (0.156) *	
vv	0.013 (0.539)	1.615 (0.758) **
djm		0.578 (0.686)
djm_vv		-1.147 (0.926)
diversification	0.477 (0.282) *	0.491 (0.378)
diversification_vv	-0.680 (0.354) **	
agrelev_inc	-0.404 (0.223) *	
agrelevinc_vv	0.304 (0.460)	
nonagr_inc	-0.085 (0.656)	-0.015 (0.879)
nonagrinc_vv	-6.765 (3.716) *	-6.702 (6.235)
_cons	0.260 (0.897)	-2.849 (0.837)
lambda	0.098 (0.493)	

Observations:

89

64

* Represents 10% level of significance

** Represents 5% level of significance

*** Represents 1% level of significance

For demographic variables, as expected, the number of children has a significantly positive effect on the probability to have at least one migrant as it has on the total number of migrants. Indeed, children who represent 55% of family size in average are less productive outside the village, and they represent an important share of family labour. Moreover, migrants are often married, and their children remain in the village under the responsibility of the family head. As concerns individual characteristics of the family head, we include his age and collapse it into three categories: as a reference, we choose individuals between 50 and 60.

As expected, we draw from the data that family head's age increases the number of migrants in the family, because the coefficient of age more than 60 has a positive and statistically significant effect. On the contrary for migrants' individual characteristics, the level of French education has no impact on the number of migrants: we tested for this relationship as we wondered if the education level influences the choice of family members who are prone to migration. We should underline that, at the destination area, migrants are engaged in activities – such as commerce - which doesn't require general knowledge. Then, regardless to their engagement in the informal sector, the level of French education has no impact on the number of migrants in the family.

For farm characteristics variables, we introduced in the econometric specification asset and land endowments as proxies for family wealth. Surprisingly, we find that the total amount of land cultivated by the family head has no impact on the probability to have a migrant and on the number of migrants. However, we obtained the expected sign for agricultural equipment on the probability to have at least one migrant. In other words, poor families without agricultural equipment are less likely to have a migrant, because their asset endowment doesn't produce enough resources to support the financial costs of migration. Then, the number of migrants is higher for families who are well endowed in physical assets, like agricultural equipment, than those who are lacking in.

For variables standing for the importance of networks, we obtain the expected positive effect on the number of migrants in the family. As concerns the variable (*first*), that stands for the distance in time between the first migration experience and the survey year, results show that it increases the number of migrants. These finding may reflect the development of family networks which can allow future migrants to settle more easily in the destination areas. Therefore, we point out the fact that migration is an old phenomenon in this region and the existence of networks should play a major role to get a job and housing, and financially support the recent migrant. Moreover, the variable village (*vv*) corroborates the importance of these networks, through neighbourhood, because families living in the Northern village are more likely to have at least one migrant. Furthermore, the change of status and position of the migrant during the migration period (*strongties*) is positively correlated to the number of migrants. We interpret this result by underlining that, in spite of the distance separating migrants and their families, the ties between them remain strong because of the importance of social capital. In addition, migrants are compensated for their efforts during the migration period, by getting a higher position in the group, and this stands for a reciprocity explanation of the migration decision. Thus, a typical profile of a family member designed to migrate - through a consensus between the family head and the future migrant - corresponds to an about 22 years old single male adult without formal education.

To investigate whether local diversification and migration are complements or substitutes, we include the variable (*diversification*) in the econometric specification. This variable, that summarizes the number of part-time and full-time family members engaged in local non agricultural activities, is positive and significant on the number of migrants. However, by

including the village effect, results show that for rural families in Kanène the engagement in local non agricultural activities decreases the number of migrants. As a consequence, we can conclude that in this village where agricultural conditions are unfavourable, local diversification and migration seem to be substitutes for rural families. This finding is corroborated by income variables because in this village, revenues earned from non agricultural activities decreases the number of migrants. In other words, when families have opportunities in local diversification, the number of migrants will be less important because these families can benefit both from agricultural and non agricultural incomes at home. Moreover, with agricultural income effect, we can also point out the weight of local opportunities on migration decision. Indeed, results suggest that a low agricultural income is a driving force for families to push some of their members into migration, because such income has a negative influence on the number of migrants. In other words, agricultural income variation and its influence on migration partly reflect the trade-off between on-farm production and the engagement in migration activities. Furthermore, we can refer to the insurance motivation to explain the agricultural income effect on migration. Owing to the need to manage income risk, we can argue that a low level of farm income enhances the number of migrants, because families seek to diversify labor supply outside the village.

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.

We used a Heckman two step procedure to estimate first, the probability of a family to have a migrant, and then for families having at least one migrant, we estimate the number of migrants by taking family and migrant characteristics as explicative variables.

Our empirical illustration from rural Senegalese families indicates that local diversification and migration seem to be substitutes when agricultural endowments are not favourable and incomes from farming are low and variable in the whole. We interpret this result by assuming that in low-potential agricultural areas, families seek new ways to ensure their own daily life, and migration is a key survival strategy in such a context in order to cope with crop income shocks and to smooth consumption. Thus, given that income sources from migration are uncorrelated with agricultural and local non agricultural incomes, we consider migration as a collective insurance arrangement. And the rationale of such a collective arrangement is that some of the family members devote themselves to migration as to diversify the family portfolio income and spread risks spatially. This is consistent with a large part of the literature showing that the low level of asset endowments and the increasing risk oblige some families to diversify spatially by sending some of their family members to migration.

Identifying whether local diversification and migration are complements or substitutes can allow us to better understand why the number of migrants is higher in some areas and lower in others. And at a macro level, this distinction could become a good indicator for policymakers to elaborate their programmes by taking into account the characteristics of these two types of diversification, widely developed in rural areas of Senegal.

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Appendix 1 : Description of variables

Name of variable	Description of variable
nbmig	Number of migrants in the family
nbchild	Number of children in the family, i.e. those who are less than 15 years old
age_head	Age of the family head
ageb1	Age of the family head less than or equal to 50
ageb2	Age of the family head greater than 50 and less than or equal to 60
ageb3	Age of the family head greater than 60
age_mig	Average age of migrants
agemig1	Average age of migrants less than or equal to 20
agemig2	Average age of migrants greater than 20 and less than or equal to 35
agemig3	Average age of migrants greater than 35
schoolevel	French education level of migrants. It Takes 1 for those learning French and 0 otherwise
STC_BNJ	The total amount of land cultivated by the Family head
equipagr_nul	Takes 1 if the family has no agricultural equipment and 0 otherwise
first	Number of years since the departure of the first migrant
strongties	Takes 1 if the present migrant was single before leaving his village and get married during migration
vv	Equals 1 if Kanene (in the North of the Groundnut Basin)
djm	The previous migration experience of the family head, (1 if he was a migrant in the past and 0 otherwise)
diversification	Number of family members engaged in local off-farm activities
agrelev_inc	Net value of food and cash crops production including livestock (evaluated at their shadow prices)
nonagrinc	Income of local non-farm activities

Appendix 2: Summary of statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
nbmig	64	2.594	1.761	1	9
nbchild	89	9.562	5.168	2	28
ageb1	89	0.427	0.497	0	1
ageb2	89	0.281	0.452	0	1
ageb3	89	0.292	0.457	0	1
agemig1	85	0.270	0.447	0	1
agemig2	85	0.400	0.493	0	1
agemig3	85	0.082	0.277	0	1
schoolevel	89	0.461	0.501	0	1
STC_BNJ	89	10.757	7.537	0	49
equipagr_nul	89	0.045	0.208	0	1
first	64	9.141	6.271	1	22
strongties	89	0.921	1.263	0	7
vv	89	0.562	0.499	0	1
djm	89	0.461	0.501	0	1
djm_vv	89	0.371	0.486	0	1
diversification	89	0.843	0.752	0	5
diversification_vv	89	0.483	0.740	0	5
agrelev_inc (10 ⁶ FCFA)	89	0.728	0.927	0	5.020
agrelevinc_vv (10 ⁶ FCFA)	89	0.166	0.320	0	2.464
nonagr_inc (10 ⁶ FCFA)	89	0.107	0.254	0	1.8
nonagrinc_vv (10 ⁶ FCFA)	89	0.016	0.036	0	0.17