# How migrants choose their destination in Burkina Faso?

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A place-utility approach

## *INTRODUCTION*

Characteristics of places of residence are known to play a major role in the migration decision-making process (Gardner 1981; Hugo 1985; Findley 1987; Lucas 1997). Although a large amount of research has been conducted on the factors influencing the decision to leave a region, very few studies have tackled the factors determining the destination of migration (Bilsborrow 1984; Oberai and Bilsborrow 1984). One of the most famous theories developed to explain migration and including characteristics of places of residence is the push and pull model developed by Lee (1966). In this model, migration is a response to repulsive forces at the origin (such as high population density or pressure on land resources), and attractive forces at the destination (such as employment opportunities). In the cost-benefit model developed by Sjaastad (1962), migration decisions depend on the stream of benefits anticipated in alternative locations compared with those obtainable in the current location and the various costs involved in movement. Compared to the push and pull model, this model is attractive because it recognizes the effect of the individual characteristics of potential migrants (Rhoda 1983). Actually, individual characteristics are "filters" through which information about potential movers' present location and potential destinations passes (Hugo 1981). Perceptions of the same factors can vary considerably from individual to individual according to their levels of education, aspirations, awareness of urban opportunities and general level of modernization. In addition, a person's decision to migrate is influenced both by his own characteristics and attitudes and how these have been conditioned by household and community factors. The existence of family members and friends (in the current area of residence and in the alternative destinations considered) may be more significant in stimulating or restricting migration, and in directing migration (INSTRAW 1994).

Recently, Junming (1997) wrote that "with microeconomic models, it is impossible to predict the strength and direction of the relationship between the likelihood of migration and individual variables in the absence of information on the social, economic and historical conditions of places of origin and destination". However, with the growing interest in the context in demography, the use of statistical tools such as multilevel models becomes easier and questions on communities were included in the surveys, such as the precursory survey in Ecuador

(Bilsborrow, McDevitt et al. 1987), the survey conducted in Nepal (Axinn, Barber et al. 1997) and more recently the Demographic and Health Surveys.

However, the place-utility approach focuses upon the perceived utility of alternative places of residence but that is very difficult to determine in surveys - even in specialized migration surveys - because of its subjectivity (INSTRAW 1994). A more feasible alternative is to use information on the measured or objective characteristics of places to investigate the effects of characteristics of the community of origin and of communities of destination in migration decisions (INSTRAW 1994).

Empirical applications have showed recently that contextual factors at the origin influence migration decisions but very few studies concerned factors at the destination. This kind of study needs a good set of fine-resolution data. For this reason, applications almost exclusively concerned the developed countries such as the migration choice made by retirees in the USA (Duncombe, Robbins et al. 1999) or the American youths' locational choices after leaving the parental home (Garasky 2002). In developing countries, applications about the choice of destination are often at a very coarse resolution (provinces, regions). Funkhouser and Ramos introduced economic and non-economic factors to explain the choice of migration destination of Dominican and Cuban immigrants to the mainland United States and Puerto Rico (Funkhouser and Ramos 1993). In Kenya, wages and employment at the destination seem to be more important than conditions at the origin to explain migration (Barber and Milne 1988). Intervening opportunities, measured as the value of the variable in all regions other than the origin and the destination, are also significant. The conclusions of Shen (1999) in China are similar: the pushing mechanism is not operating effectively in the interregional migration. By studying the factors influencing village settlement in Thailand, Entwisle et al. (2004) highlighted clues for the destination choice: the availability of suitable land for cultivation, proximity to water, markets and prices, road access, and proximity to other villages.

## *OBJECTIVE AND HYPOTHESES*

Faced with the lack of empirical application in developing countries, the objective of this study is to understand how contextual factors at the destination influence migration decisions in a West African country (Burkina Faso). Put simply, this paper explores the extent to which geographic, economic and environmental characteristics determine the destination choice of migrants.

Intuitively, assumptions about pull factors (factors attracting migrants to a destination) can be inferred from what is already known about push factors (factors encouraging migrants to leave a region). These assumptions can broadly be divided into two types: first, those related to the ecological context; second, those related to the local economic context.

### FIRST HYPOTHESIS: THE FAVOURABLE NATURAL ENVIRONMENT IS A PULL FACTOR OF MAJOR IMPORTANCE FOR MIGRANTS.

This is a highly plausible hypothesis in the Burkinabè context, where rain-fed agriculture is the main source of livelihood, and natural resources are insufficient in a large part of the country. Land availability, soil quality and rainfall conditions (quantity and inter-annual variability) are expected to play a significant role in the migrants' choice of destination. In Burkina Faso, rainfall deficit, shortage of land and unfavourable ecological features (such as poor, overexploited land and substantially reduced natural resources) at the place of origin have already been shown to be push factors (Mathieu 1998; Henry, Boyle et al. 2003; Henry, Piché et al. 2004; Henry, Schoumaker et al. 2004). This study aims to assess whether the opposite conditions act as pull factors, attracting migrants to more prosperous regions.

### SECOND HYPOTHESIS: THE ECONOMIC DIVERSIFICATION OF PLACES IS AN ATTRACTIVE FACTOR FOR MIGRANTS.

The local economic context is known to be a major factor influencing the decision to migrate (Amin 1974). In Burkina Faso, 90 % of the population is engaged in agriculture (INSD 2000) but the agricultural economy is very vulnerable to several factors such as a drought or a change in international trade. So, diversification is a crucial mechanism whereby households cope with high levels of income and production uncertainty. However, whether the diversification of economic activities and modernization of agriculture encourage or deter migration is a controversial question. Some scholars contend that the availability of local work outside the agricultural sector (in services, construction, mining, commerce or manufacturing) retains migrants in rural areas (Haggblade, Hazell et al. 1989; Junming 1997; Katz 2000). In contrast, others have found that the presence of such alternative activities stimulates migration by providing individuals and families with the financial means to move (Rhoda 1983; ILO 1998). Results concerning migration to cities in Burkina Faso appear to support this second viewpoint (Beauchemin, Schoumaker et al. 2003).

## *DATA*

One of the reasons that this study has not been done before is the lack of accurate fine resolution data. This is all the more true in an African setting. To accurately understand how migrants choose their destination by focusing on the characteristics of places, a multi-level approach is needed with data at individual and community levels. In addition, because migration could be a response to changing conditions (individual or contextual), a longitudinal approach has been chosen. This paper benefits from exceptional reliable multi-source longitudinal data, presented below.

1. **Individual data** are provided by a nationally-representative retrospective survey on migration, conducted in 2000 by the UERD at the University of Ouagadougou, the Demography Department of the University of Montreal and the CERPOD (Poirier, Piché et al. 2001). 3,570 households were sampled in eight strata chosen according to geographic, climatic and ethnic criteria and respecting provincial divisions. In addition, 9,612 life histories were collected. The detailed biographical questionnaire covered family origins, migration histories (date and place of settling, status of residence, land access, purpose of migration, etc.), and also employment, matrimonial and fertility histories.

2. **Community-level data** come from one of the first national-scale retrospective community surveys conducted on 600 settlements in early 2002 (Figure 1) (Beauchemin, Schoumaker et al. 2003). The survey was designed to be linked with the individual migration survey. It comprises one third of all the villages cited in the individual survey, i.e. all the villages in which people lived at the time of the survey and a large sample of villages in which they lived in the past. The questionnaire covered a broad range of topics, including land availability, transportation, agriculture, infrastructure, and employment opportunities. Efforts were made to obtain retrospective information dating back to 1960 from groups of community informants (administrative representatives, village chiefs and other knowledgeable informants). The surveyed settlements cover all the country but it is not a random sample: 6% of small villages of Burkina Faso (<5,000) were sampled, 60% of villages (5,000 – 10,000), and 86% of towns (>10,000).

3. In addition, **rainfall data** covering the 1960-1998 period were obtained from the global monthly precipitation data set produced by the Climatic Research Unit at the University of East Anglia (New, Hulme et al. 2000). These data have been interpolated from a network of stations at a spatial resolution of 0.5 degree latitude and longitude, and are linked to the survey community data.

## *METHODOLOGY*

In the studies exploring the contextual factors of migration, migration is often analysed in term of flows between regions, destination choice data at the provincial level being widely available. Yet migrants rarely consider entire provinces as their potential destinations, their interest focusing on smaller spatial entities within a province, such as villages or towns (Kanaroglou and Ferguson 1998). In this paper, the risk of migration by an individual is modeled as a function of characteristics - at every point in time - of the place at the origin and of the place at the destination. Individuals are assumed to migrate to improve their situation, or level of utility, based on perceptions which are shaped by a mix of personal attributes and destination characteristics.

### THE RANDOM UTILITY MODEL

The introduction of the characteristics of destination places is made by using random utility models. The assumption of this kind of model is that an individual is able to evaluate the utility associated with each potential destination and to choose the place that maximizes his utility (Gordon and Vickerman 1982; Davies, Greenwood et al. 2001; Knapp, White et al. 2001). In fact, the destination chosen may not have the maximum utility – other destinations may yield a higher one but are not evaluated (Pellegrini and Fotheringham 2002).

Accurately, an individual at place i faces j choices, including moving to a different area or staying at the current location (Davies, Greenwood et al. 2001). Suppose that the utility level of choosing place j for this individual is

$$U_{ij}=\beta' X_{ij} + \varepsilon_{ij} \quad (1)$$

where $X_{ij}$ is a vector of choice-specific attributes. If the individual chooses destination j, then the utility $U_{ij}$ is the highest among all J choices (i.e., $U_{ij}>U_{ik}$ for all $k\neq j$). Thus, when choice j is made, the statistical model for the probability of moving from area i to area j can be represented as

$$P(y_i=j) = P(U_{ij}>U_{ik}) \text{ for all } k\neq j \quad (2)$$

### THE SET OF ALTERNATIVES CHOICE

In theory, all potential destinations are taken into account and not only those chosen by the migrants, although, researchers typically do not have the possibility to collect information on all

potential alternatives (Davies et al., 2001). In addition, as the set of possible alternatives is typically large, it can hardly be argued that the individual is able to evaluate it all (Thill 1992). More realistically, the individual considers only a portion of the universal set. Therefore, the *a priori* likelihood that the true set of options from which selection is made is mis-specified by the analyst is larger than with a smaller universal choice set.

In this study, the list of considered destinations is compounded by all alternatives chosen by migrants and by a random sample of nine non-chosen alternatives in the true choice set. Actually, it has been proven that, under specific conditions, the approximation of the true choice set by a subset of it does not jeopardize the consistency property of a choice model's estimates (Baydar, White et al. 1990; McFadden's, 1978 cited by Thill 1992).

Contrary to the case of choice-set mis-specification that has just been discussed, it is expected that the consistency of the parameter estimates is always adversely affected when the choice set defined by the analyst includes options that are actually never evaluated by the decision maker (William and Ortuzar, 1982, cited by Thill, 1992). How to obtain this? Probably the best way is to make a survey on all residences visited by a sample of migrants, over a long period of time. We have the chance to have it, as the sample of the community survey used in this study is not random, but composed of a set of destinations already chosen by at least three migrants from 1960 to 2000. We assume that this set is likely closer to the portion of the universal set considered by migrants. This assumption is not true for pioneers however.

#### DEFINITION OF MIGRATION

In this study, we focus on the last male migration before the survey, over the last 10 year period (1990-2000). The analysis is restricted to male migration because females are frequently passive in the migration decision in Burkina Faso (Le Jeune 2003). The focus on the last migration is explained by the concern of limiting the inaccuracy related to the memory of the interviewees in retrospective surveys. The analysis sample is restricted to people of 15 and over. The age of 15 was retained as the age at which participation in decision making is considered to commence.

Migration is defined here as a change of residence involving a departure for a duration of at least three months[3]. The migratory matrix (Table 1) reveals that abroad is the most frequent

[3] A 3-month migration definition was used to include temporary migrations in the dry season and migration related to short-term activities in urban areas (Poirier et al., 2001).

origin, among the last migration movements occurred from 1990 to 2000 (56,1 %), followed by the rural areas (27,0 %). The flows are directed largely to a rural area (70,8 %). Migration to cities concerns only 16,0 % of the last movements from 1990 to 2000. Note that migrations to abroad are not covered by the survey, as people are interviewed in their place of destination, in Burkina Faso only. Because of a lack of community data relating to them, the two main cities and abroad were excluded from the analysis. Anyway, factors explaining migration to cities are assumed to be very different than for migration to the small localities.

So, we focus on migration from a village or medium-sized town to a village or a medium-sized town. A village is defined as a settlement with less than 10,000 h. Medium-sized towns include all settlements with more than 10,000 h., except Bobo-Dioulasso and Ouagadougou, the two main cities of the country. In this restricted analysis sample, the most frequent movement comes from a village and is directed to another village (Table 2). 19.9% of migration comes from a village to a medium-sized town. 15% of movements have a medium-sized town as origin. Return migration, defined as a move to the village occupied at the age of 6[4], concerns 33.2 % of moves. They are included in the analysis because the likelihood to return to the village of 6 is expected to be higher if this village is better-off than if conditions of livelihood are difficult in it.

The driving factors of migration decision are expected to differ in cases of short- and long-distance movement. In short-distance moves, migrants are likely to have a better knowledge of the characteristics of destination places than in long-distance moves. In addition, migrants are likely to more easily and frequently keep contact with their family/community. Although not a perfect measure, an indicator of proximity, measured by a dummy variable indicating if migration crosses the province boundaries, has been used to distinguish two types of movements. Inter-province migrations are slightly more important (58.1%) than intra-province moves (41.9 %) (Table 2).

Each individual of at least 15 is thus "followed" from his next to last residence in a village/town until his last migration to a village/town or until the time of census taking (survey in 2000). If the individual didn't leave his village/town between 1990 and 2000, he is included in the sample as non-migrant (Figure 2). The data are organised as a person-period data file in which each line represents a three-month period, and the dependant variable indicates if a migration occurs during each three-month interval. The biography of each male is copied 9 times to include

[4] In the EMIUB survey, only the birth department was collected, not the village.

the 9 random non-chosen alternatives of destination in addition to the chosen destination. Overall, the sample consists of 1 801 men and a total of approximately 600 800 person-periods.

### ESTIMATION OF MODELS USING AN EVENT-HISTORY APPROACH

Binary and multinomial logistic regression methods are used to estimate discrete-time event history models (Allison, 1995). Models that do not distinguish among the event types are fitted with binary logistic regression. The statistical model is specified as follows:

$$\log\left(\frac{p_{ti}}{1-p_{ti}}\right) = \alpha_t + \beta'.\mathbf{X}_{\mathbf{ti}} \tag{3}$$

where $p_{ti}$ is the conditional probability that individual $i$ experiences the event (last migration) at age $t$, given that the event has not already occurred. $\alpha_t$ represents the baseline hazard function, and $\boldsymbol{X_{ti}}$ is a vector of individual and contextual covariates. Both time-constant and time-varying covariates are included in the models.

Multinomial logistic regression is used for competing risk analyses that distinguish among the types of migration (intra- or inter-province move). The discrete-time competing risk model assumes that the log-odds of experiencing an event of type $r$ rather than an event of type $s$ (the reference category) at time t are given by:

$$\log\left(\frac{p_{rti}}{p_{sti}}\right) = \alpha_{rt} + \beta_r'.\mathbf{X}_{\mathbf{rti}} \tag{4}$$

where $p_{rti}$ is the conditional probability of an event of type r occurring at time t for individual $i$, given that no event has occurred prior to time t. $\alpha_{rt}$ represents the baseline hazard function for an event of type r, and $\boldsymbol{X_{rti}}$ is a vector of covariates. Censored cases (no migration) are treated as the reference category, and the types of migration (intra- or inter-province move) are distinguished as separate events. All of the models take into account the fact that the data are clustered, and the standard errors of the regression coefficients are adjusted accordingly using Huber-White standard errors (Hox 2002).

## *EXPLICATIVE VARIABLES*

Table 3 shows proportions of the individual explicative variables included in the analysis for the sample as a whole[5] and for migrants[6]. This comparison highlights the selectivity of the migration process. After this presentation, the independent contextual variables are described by hypothesis and Table 4 compares proportions of the contextual variables for village/town at the origin and at the destination with proportions of these variables for all localities in Burkina Faso. Note that because characteristics of localities at the origin and at the destination are taken into account at the time of the migration, one locality chosen by two migrants is counted two times in the sample because the two migrations may occurred at two different time period. This is the reason that the number of medium-sized towns in the destination sample is higher (71) than in the Burkinabè reference sample (55). Characteristics at the origin are given for information. For the sake of parsimony, only the most significant results about destinations are presented in this section. Finally, although household-level factors may also be important determinants of migration, few time-varying household-level variables were collected in the survey, and none was retained in this study.

### AT THE INDIVIDUAL LEVEL (TABLE 3)

In developing countries, age is strongly linked to the risk of migration. The propensity of migrating is high between 15 and 40 but decreases sharply after the age of 40. In the multivariate analysis, the non-linear relationships between age and the risk of migration are modelled by a function of age and its logarithm. These two measures form the baseline hazard of migration.

As shown in numerous migration studies, education is positively related to migration, especially for migrations to urban areas (Lututala 1995; Todaro 1997). This assertion is confirmed in the analysis sample: 20.7% of migrants have a primary level compared to 15.5% in the population at risk. Education is measured by a time-constant variable indicating the level attained by the individual at the age of 15[7].

The majority ethnic group in Burkina Faso, the Mossi, is distinguished from other ethnic groups in terms of propensity to migrate. They live mainly on the densely populated Central Plateau (the Mossi Plateau), but are also known for their migrations to south-western regions

[5] At the arrival in the next to last residence, when people began to be at risk.

[6] At the time of the last migration.

[7] The educational level does not vary very much after the age of 15.

(Marchal, 1975; Mathieu, 1994). They constitute 44% of the analysis sample but 48% of migrants. The Fulani are also a highly mobile population (12 % of the sample but 16% of migrants). They live essentially in the northern and eastern parts of the country where they are specialised in cattle-raising (Hampshire and Randall 1999). The third category, including 10 ethnic groups (e.g. the Senoufo, the Gourmantche and the Gourounsi), constitutes 44% of the analysis sample but only 36% of migrants.

Finally, the principal activity performed by the individual at each point in time is included in the models. People engaged in other activities than agriculture and cattle-raising (such as students or people making crafts and small-scale food trading) are assumed to be more mobile. They constitute 11% of the analysis sample and 34% of migrants. On the other hand, farmers and cattle-raisers are expected to have a low propensity to migrate because of their attachment to the land. They make up respectively 80% and 8% of the sample and only 59% and 6% of migrants.

### H1: RAINFALL CONDITIONS (TABLE 4)

To test the first hypothesis, the mean annual rainfall over the 1960-98 period (Figure 3) and an indicator of drought measured as the percent of normal precipitation over the three preceding years were tested. These two variables measured at the department level have been used in a previous study to capture two dimensions of the potential impacts of rainfall on out-migration. The two indicators have been selected on an empirical basis, being significant predictors of the poor harvests (for more information, see Henry et al., 2004b).

The first variable (mean annual precipitation) is considered a good indicator of agricultural productivity and of vulnerability to drought. Four categories corresponding to areas where crops with similar yield responses to water are cultivated (Doorenbos and Kassam 1987) are compared: less than 500 mm per year, 500 to 699 mm per year, 700 to 899 mm per year, and more than 900 mm per year. The previous study reveals that people living in drier regions are more likely to leave their villages for another village than those living in wetter regions (Henry, Schoumaker et al. 2004). People are expected to move to areas with favourable rainfall conditions.

The second variable is a time-varying variable indicating the extent to which rainfall in the department over the three preceding years differed from the long-term rainfall conditions in the department. The measure is the ratio of the mean rainfall over the three preceding years[8] to the

[8] People may be able to cope with one poor harvest without resorting to migration (for more details, see Henry et al., 2004b).

mean rainfall over the 1960-1998 period, and three categories are compared in the models (less than 85 %, 85 to 94 %, and more than 95 %). Short-term unfavourable rainfall conditions tend to push men to leave for other rural areas but delay moves to urban areas (Henry et al., 2004b). Migrants are thus expected to choose to settle in rural areas if rainfall conditions over the three preceding years were favourable.

No major differences were found concerning the rainfall characteristics of the villages but medium-sized towns at the destination seems to have more favourable rainfall conditions. 93% of medium-sized towns chosen as destination are located in the 700-899mm agro-climatic region, compared to 60% in Burkina Faso. In terms of rainfall deficit, 87% of medium-sized towns chosen as destination have experienced normal rainfall conditions during the year of migration (more than 95% of the 1960-98 rainfall mean), compared to 66% in Burkina Faso.

### H2: ECONOMIC DIVERSIFICATION (TABLE 4)

The economic diversification of villages/towns is expected to be an attractive factor for migrants. Currently, people supplement family earnings through small-scale income-generating activities in order to ensure food sufficiency (Ward, Ballif-Spanvill et al. 2004).

The first variable to be tested is the use of gardening within the community. In Mali, market gardening has decreased the level of rural exodus, particularly among young men in search of gainful employment (Marceau Rochette 1989). In Burkina Faso, 34% of villages and 96% of medium-sized towns used gardening (green beans, tomatoes, onions, etc.). Migrants are expected to choose a destination where gardening is available. Villages at the destination are distinguished from reference villages by a higher proportion of gardening (45.5%).

Cotton cultivation is known as a factor influencing internal migration flows by attracting migrants. A previous study confirmed that cotton yields were indeed high in provinces at the destination and low in provinces at the origin (Henry, Boyle et al. 2003). Currently, the literature is abundant on the role of cotton because migration flows driven by cotton cultivation cause a lot of upheaval locally (in the destination villages). In addition, a large part of the country's revenue (60%) comes from cotton (Ouédraogo 2003). The second variable is the presence of a cash crop (cotton or rice) in the village/town. 18% of villages and 10% of towns had reported a cash crop among their most important crops. Villages at the destination have a higher proportion of cash crops (26.4%) and the differences are accentuated for medium-sized towns: 76% of towns have cash crops compared to 10% in Burkina Faso.

The possibility to obtain another professional activity (mostly off-farm employment in services, construction, mining, commerce or manufacturing) in the village is one of factors attracting migrants. With the advent of a major drought, men leave their villages in search of income-producing labour (Glantz 1987). The third and fourth variables are the availability of paid farm employment and paid non-farm employment in the village/town. The presence of paid agricultural employment seems to be a driver of migration to medium-sized town (83% of destination sample compared to 74% of reference sample).

As agriculture is the main activity in Burkina Faso, the need for money implies the need for increasing yields. The modernization of agriculture is likely to be influential in the destination decision. Four variables were introduced in the models: the use of plough, the use of tractor, the presence of irrigation, and the use of water-conservation techniques. Measured at the community-level, it is assumed to equally affect all community members. In Mali, the families living in villages which had irrigated perimeters were more likely to have larger numbers of migrants (Findley 1992). The use of contour stone walls not only reduces erosion but also improves the availability of water for cultivation by encouraging infiltration (Bandre and Batta 1998). Very simple to implement and relatively cheap, this soil and water conservation technique has been shown to significantly improve cereal yields in Burkina Faso (Marceau Rochette 1989; Bandre and Batta 1998). The use of tractors and ploughs are higher in the destination places than the reference, such as the presence of irrigation in destination town.

All variables included for the test of the second hypothesis are time-varying.

#### ADDITIONAL CONTROL VARIABLES

Three additional control variables were included in the models. The first one indicates the size of the settlement. Two categories were compared: a village with less than 10,000 inhabitants and a medium-sized town with more than 10,000 inhabitants, except Ouagadougou and Bobo-Dioulasso, the only two major cities in the country. The attraction of the more populated settlements is assumed.

The two major cities of Burkina Faso may influence the migratory process between the other places of the country however. Migrants are assumed to be attracted by places located near the two largest markets of the country. In addition, some migrants are likely to include large cities in their set of destination alternatives. To palliate the absence of the two cities in the models, the distance of the settlement to Ouagadougou or Bobo-Dioulasso was constructed by

using a Geographical Information System. Three categories were compared: less than 100, 100-199, and more than 200 kilometres of Ouagadougou or Bobo-Dioulasso[9].

Finally, the last variable indicates if the settlement is connected by a road. A good transportation network is assumed to increase the attraction of the destination by directing migrants to the well-connected places. In Burkina Faso, 57% of villages are not connected by a road. All medium-sized towns are connected by a road (tarred or non-tarred).

## *MULTIVARIATE RESULTS (TABLE 5)*

With the concerns of explaining the choice of the last migration in Burkina Faso, different models are developed to test the two hypotheses. In table 5, the individual-level variables were introduced as control variables in addition to the community-level variables. In model 1, all moves are included. As mentioned above, the driving factors of migration decision are expected to differ in cases of short- and long-distance movement. Intra- and inter-province migrations are distinguished with competing risk models. The results are presented in two separate columns (models 2a and 2b), each column pertaining to the contrast between a single type of movement and no migration (reference).

In order to test the push and pull effects, variables at the origin and at the destination were introduced in the models.

### INDIVIDUAL FACTORS:

The odds ratios of the individual-level variables vary slightly in the models presented here (Table 4). For the sake of parsimony, this section will briefly sum up the main results.

As expected, results reveal the high propensities to migrate for people working in another activity than agriculture and cattle-raising. People engaged in activities such as crafts making, small-scale food trading or students seem to be freer to make a long-distance move than farmers or cattle-raisers. Fulani are the most mobile ethnic group category, followed by the Mossi. Fulani people seem to prefer to stay within their province. Surprisingly, the effect of education on the propensity to migrate is not significant. This unexpected result could be explained by the definition of the migration used in this study, as migrations to the main cities and abroad were

[9] The size of the sample does not allow the use of finer categories.

excluded from this analysis. The positive relation between education and migration has been shown especially for migrations to urban areas.

### H1: RAINFALL VARIABLES

With all movements combined (Model 1), the risk of leaving places with favourable rainfall conditions is higher than localities with unfavourable rainfall conditions. This result is unexpected in comparison to previous results concerning the risk of the first departure from the village after the age of 15 (Henry, Schoumaker et al. 2004). The analysis by types of movements indicates that this is mostly the effect of the inter-provincial movements, however. Rainfall conditions in the three preceding years are not significantly related to the propensity for leaving the community. Again, this result is unexpected compared to previous results (Henry et al., 2004b). The first migration after the age of 15 seems more sensitive to rainfall conditions than the last one before the survey. One tentative of explanation could be a higher homogeneity of the first migration than the last one, in terms of age at the migration and motives for example. It could lead to the conclusion that the difference in propensities to move from a drier region compared to a move from a wetter region is higher for young migrants than for their elders. These young migrants seem also to be more sensitive to rainfall deficit.

Rainfall conditions of the destination places seem to be influential in the migration decision, mostly in case of short-distance moves. Unexpectedly, people seem to be attracted by places from the less favourable agro-climatic zones (measured by the mean annual rainfall). This unexpected result could be explained by the high importance of return migration in the driest region. As expected, places with a rainfall deficit over the three preceding years at the destination (less than 85% of long-term average) are repulsive for migrants. This result underlines the importance of the temporal variability of the environment on migration (by the effect of drought). People seem to include rainfall conditions in their choice of destination only in case of short-distance movement, probably because these migrants have a better knowledge of rainfall conditions of their closed environment.

### H2: ECONOMIC DIVERSIFICATION

In a context of high vulnerability, diversification is a crucial mechanism whereby households cope with high levels of income and production uncertainty. The second hypothesis is that the economic diversification of villages/towns is an attractive factor for migrants. This hypothesis was tested in two parts. First, the effect of the presence of income-generating

activities in the settlement is introduced to explain the propensity to choose a destination by migrants. The second part aims to test the attractive power of the presence of factors of modernization of agriculture at the destination.

#### H2A : INCOME-GENERATING ACTIVITIES

For these variables, results differ slightly by type of moves. As a tool to complete their revenues, gardening retains migrants at the origin, mostly to engage themselves in long-distance moves. The presence of cash crop at the origin has a similar aim, but this result is slightly significant. The possibility to have paid employment (agricultural or non agricultural) will encourage migration (results are no or slightly significant however). This result could be explained by the cost of migration but also by the selectivity of the migration process. Migrants with paid employment are likely to be less attached to the place of their activities than farmers.

At the destination, results found for the origin are inversed. Localities with gardening attract people but for inter-provincial moves only. As expected, the presence of cash crops at the destination is a driver of migration. Cotton growing, and its expected revenues, is known to attract migrants to the west and the south-western parts of the country. Finally, the presence of paid employment (agricultural and non- agricultural) reduced the propensity to choose the locality as destination, unexpectedly. No explanation was found.

#### H2B: MODERNIZATION OF AGRICULTURE

The presence of tractors at the origin retains short-distance migrants, as the use of ploughs in the settlement encourages migrants to leave, mostly for a locality located in another province. Irrigation seems to have the same effect. Results found for the use of a water-conservation technique are similar than those found in the previous study (Henry et al, 2004b), but non-significant here however. This technique, by improving yields, may decrease the need for migration.

At the destination, the presence of tractors attracts migrants, the tractor is probably seen as a symbol of high technology and its presence may give migrants the assurance of producing high yields. Irrigation at the destination reduced the propensity to choose the locality for inter-provincial moves such as the presence of a water-conservation technique for short-distance moves. This last result could be explained by the fact that these techniques are used where needed mainly in over-crowded areas (such as the Mossi plateau). So, it is not surprising that these regions are not attractive.

### ADDITIONAL CONTROL VARIABLES

Migration leaves mostly a village to go to a medium-sized town. This result is mostly true for short-distance moves. People don't have reason to leave a medium-sized town for another town or a village (with respect of the migration definition used in this study), mostly in the provincial level. The attractivity of a town is 14 times higher than a village in case of short-distance moves and 3 times higher in case of long-distance moves. As not expected, the distance of the locality to Ouagadougou and Bobo-Dioulasso seems not to influence migration. This result could be explained by the large differences in the processes underlying rural-urban and rural-rural migration (medium-sized towns in Burkina Faso are largely rural). As expected, the presence of roads at the origin encourages migration but do not seem to direct migrants to the destination places. Finally, the proximity variable highlights the importance of intra-province moves in the model including all moves.

## *DISCUSSION AND CONCLUSIONS*

Very few studies have tackled the factors determining the destination of migration in the context of developing countries. Yet, understanding the decision-making process of migrants is essential to predict migration movements and to improve conditions at the destination (particularly in regions of massive in-migration). This study aims at better understanding how migrants select their destination in Burkina Faso, by exploring the extent to which geographic, economic and environmental characteristics determine the destination choice of migrants. More precisely, two hypotheses were tested: first, the favourable natural environment is a pull factor of major importance for migrants; and second, the economic diversification of places is an attractive factor for migrants.

The significant results of this study are summarized in table 6. By introducing characteristics at the origin and at the destination in the same model, this study may compare the push and the pull effects. The choice of destination places are modeled first for all moves and then separately by types of migration: short-distance versus long-distance moves.

The push effect of migration in rural Burkina Faso consists of favourable mean rainfall conditions, the presence of ploughs, irrigation and a road in the settlement. Medium-sized towns and the presence of gardening and tractor in the settlement retain migrants.

The pull effect of migration consists of unfavourable mean rainfall conditions, unfavourable rainfall conditions over the three preceding years for short-distance moves, the

presence of gardening and tractors, and medium-sized towns. The presence of paid agricultural employment, irrigation and water-conservation techniques seem to be repulsive factors for migrants.

Taking into account the high quality of data for an African setting (fine temporal and spatial resolutions), the small number of significant results is disappointing, as surprising is the absence of the attractive power of the paid employment on migrants.

The results of this paper should not be considered as definitive, as several improvements may be introduced. In their study of the destination choice made by immigrants from Ontario, Kanaroglou and Ferguson (1998) suggest analysing the behaviour of migrants by categories. As individual characteristics are filters through which information about potential destinations passes, this study could be pursued by making a typology of migrants according to their characteristics (main activity, ethnic group, age). The sample size of the survey is highly restrictive to obtain significant results by categories, however.

The choice of destination may also differ according to the motives of migrants. The survey used in this study collected information about the motives of migration but there is no certitude that motives declared by respondents correspond to the underlying reasons for migration.

Another suggestion is given by Svart (1976), "not one of these studies clearly addresses the problem of separating the actual characteristics of places from the stated reasons for place evaluation" (Svart, 1976, p.317). The analysis of the differences between objective and subjective characteristics of places needs a specific survey about perceptions, concerning the field of sociology or psychology more, however.

Finally, these contextual determinants of migrants' choice of destination do not act independently of one another. Rudolph (1992) views economic and ecological factors "not as causal, but as delimiting factors which act as parameters within which there still remains a large area of play for other variables" (Rudolph, 1992, p.133 cited by Poirier and Piché 1999). Thus, in addition to economic and natural factors, other variables need to be taken account, especially those related to the social context. African research has shown clearly that the migration decision process involves community groups and not only individuals (Guilmoto 1998; De Bruijn and Van Dijk 2003). It is possible that social networks, for instance, are even more essential than the economic and geographic factors in determining migrant's choice of destination. All these social, economic and ecological factors operate and interact at different levels (individual, household and

community). In order to gain a better understanding of migration decisions, these questions have to be included in the migration surveys.

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## REFERENCES

Amin, S. (1974). Modern migrations in Western Africa. London, Published for the International African Institute by Oxford University Press.

Axinn, W., J. Barber, et al. (1997). "The Neighborhood History Calendar: A Data Collection Method Designed for Dynamic Multilevel Modelling." Sociological Methodology **27**: 355-392.

Bandre, P. and F. Batta (1998). Soil and Water Conservation in Burkina Faso. London, Overseas Development Institute.

Barber, G. M. and W. J. Milne (1988). "Modelling internal migration in Kenya: an econometric analysis with limited data." Environment and Planning A **20**: 1185-1196.

Baydar, N., M. J. White, et al. (1990). "Effects of Agricultural Development Policies on Migration in Peninsular Malaysia." Demography **27**(1): 97-109.

Beauchemin, C., B. Schoumaker, et al. (2003). Migration and Urbanization in Burkina Faso. The Impact of Rural Development Policies. European Population Conference, Varsovie.

Bilsborrow, R. (1984). Guide pour des enquêtes sur les migrations internes dans les pays en voie de développement : des variables communautaires. Genève, Bureau International du Travail.

Bilsborrow, R. E., T. M. McDevitt, et al. (1987). "The impact of origin community characteristics on rural-urban out-migration in a developing country." Demography **24**(2): 191-210.

Davies, P. S., M. J. Greenwood, et al. (2001). "A conditional logit approach to US state-to-state migration." Journal of Regional Science **41**(2): 337-360.

De Bruijn, M. and H. Van Dijk (2003). "Changing population mobility in West Africa: Fulbe pastoralists in Central and South Mali." African Affairs **102**: 285-307.

Doorenbos, J. and A. H. Kassam (1987). Réponse des rendements à l'eau. Rome, FAO.

Duncombe, W., M. Robbins, et al. (1999). "Retire to where? A discrete choice model of residential location."

Entwisle, B., J. Edmeades, et al. (2004). Village settlement, Deforestation, and the Expansion of Agriculture in a Fontier Region: Nang Rong, Thailand**:** 43.

Findley, S. E. (1987). "An Interactive Contextual Model of Migration in Ilocos Norte, the Philippines." Demography **24**(2): 163-190.

Findley, S. E. (1992). Circulation as a Drought-coping Strategy in Mali. Migration, Population Structure and Redistribution Policies. C. Goldscheider. Boulder, Westview Press, Brown University**:** 61-91.

Funkhouser, E. and F. A. Ramos (1993). "The choice of migration destination: Dominican and Cuban immigrants to the mainland United States and Puerto Rico." International Migration Review **27**(3): 537-556.

Garasky, S. (2002). "Where are they going? A comparison of urban and rural youths'locational choices after leaving the parental home." Social Science Research **31**: 409-431.

Gardner, R. W. (1981). Macrolevel Influences on the Migration Decision Process. Migration Decision Making: Multidisciplinary Approaches to Microlevel Studies in Developed and Developing Countries. G. De Jong and G. Gardner. New York, Pergamon Press.**:** 59-87.

Glantz, M. H. (1987). Drought and economic development in sub-Saharan Africa. Drought and hunger in Africa. M. H. Glantz. Cambridge, Cambridge University Press**:** 37-58.

Gordon, I. and R. Vickerman (1982). "Opportunity, preference and constraint: an approach to the analysis of metropolitan migration." Urban Studies **19**: 247-261.

Guilmoto, C. Z. (1998). "Institutions and migrations. Short-term versus long-term moves in rural West Africa." Population Studies **52**(1): 85-103.

Haggblade, S., p. Hazell, et al. (1989). "Farm-Nonfarm linkages in rural sub-saharan Africa." World Development **17**(8): 1173-1201.

Hampshire, K. and S. Randall (1999). "Seasonal Labour Migration Strategies in the Sahel: Coping with Poverty or Optimising Security?" International Journal of Population Geography **5**(5): 367-385.

Henry, S., P. Boyle, et al. (2003). "Modeling inter-provincial migration in Burkina Faso, West Africa: The role of socio-demographic and environmental factors." Applied Geography **23**: 115-136.

Henry, S., V. Piché, et al. (2004). "Descriptive analysis of the individual migratory pathways according to environmental typologies." Population and Environment **25**(5): 397-422.

Henry, S., B. Schoumaker, et al. (2004). "The impact of rainfall on the first out-migration: a multi-level event-history analysis in Burkina Faso." Population and Environment **25**(5): 423-460.

Hox, J. (2002). Multilevel Analysis: Techniques and Applications. Mahwah, Lawrence Erlbaum Associates.

Hugo, G. (1981). Village-community ties, village norms, and ethnic and social networks: a review of evidence from Thrild World. Migration decision making: multidisciplinary approaches to microlevel studies in developped and developping countries. G. F. De Jong and R. W. Gardner. New York, Pergamon Press**:** 186-224.

Hugo, G. (1985). Investigating Community-Level Effects on Population Movement. The Collection and Analysis of Community Data. J. Casterline. Voorburg, International Statistical Institute**:** 157-175.

ILO (1998). Migration and population distribution in developping countries: problems and policies. Population distribution and migration. Proceedings of the United Nations Expert Group Meeting on Population Distribution and Migration, Santa Cruz, Bolivia, 18-22 January, 1993. United Nations. New-York, United Nations.

INSD (2000). Analyse des résultats du recensement général de la population et de l'habitation de 1996. Ouagadougou, Ministère de l'Economie, des Finances et du Plan.

INSTRAW (1994). The migration of women: methodological issues in the measurement and analysis of internal and international migration. Santo Domingo, Dominican Republic, INSTRAW.

Junming, Z. (1997). Multilevel analysis of rural outmigration in Guandong, China.**:** 30.

Kanaroglou, P. S. and M. R. Ferguson (1998). "The aggregated spatial choice model vs. the multinomial logit: an empirical comparison using migration microdata." The Canadian Geographer **42**(3): 218-231.

Katz, E. (2000). Individual, household and community-level determinants of migration in Ecuador: are there gender differences ? Paper presented at the Annual Meeting of the Population Association of America, Los Angeles.

Knapp, T. A., N. E. White, et al. (2001). "A nested logit approach to household mobility." Journal of Regional Science **41**(1): 1-22.

Le Jeune, G. (2003). Les migrations féminines du milieu rural vers le milieu urbain au Burkina Faso: faits, causes et implications. Département de démographie. Montréal, Université de Montréal**:** 128.

Lee, E. (1966). "A theory of migration." Demography **3**: 1.

Lucas, R. E. B. (1997). Internal migration in developing countries. Handbook of population and family economics. M. R. Rosenzwieg and O. Stark, Elsevier. **1B:** 721-798.

Lututala, M. (1995). Les migrations africaines dans le contexte socio-économique actuel: une revue critique des modèles explicatifs. La sociologie des populations. H. Gérard and V. Piché. Montréal, Les presses de l'Université de Montréal - AUPELF-UREF (Universités francophones)**:** 391-416.

Marceau Rochette, R. (1989). Le Shael en lutte contre la désertification: leçons d'expériences. Weikersheim, Margraf.

Mathieu, P. (1998). "Population, pauvreté et dégradation de l'environnement en Afrique : fatale attraction ou liaisons hasardeuses ?" Nature, Sciences, Sociétés **6**(3): 27-34.

New, M. G., M. Hulme, et al. (2000). "Representing 20th century space-time climate variability. II: Development of 1901-1996 monthly terrestrial climate fields." Journal of Climate **13**: 2217-2238.

Oberai, A. and R. E. Bilsborrow (1984). Theoretical Perspectives on Migration. Migration Surveys in Low Income Countries: Guidelines for Survey and Questionnaire Design. R. Bilsborrow, A. Oberai and G. Standing. London & Sidney, Croom Helm**:** 14-30.

Ouédraogo, F. G. (2003). Forums SOFITEX, les producteurs ont pris bonne note. L'hebdomadaire du Burkina. **213**.

Pellegrini, P. A. and A. S. Fotheringham (2002). "Modelling spatial choice: a review and synthesis in a migration context." Progress in Human Geography **26**(4): 487-510.

Poirier, J. and V. Piché (1999). Trente ans de recherche explicative en démographie. Réflexions autour des dangers du cloisonnement. Théories, paradigmes et courants explicatifs en démographie. Chaire Quetelet 1997. D. Tabutin, C. Gourbin, G. Masuy-Stroobant and B. Schoumaker, Academia-Bruylant/L'Harmattan**:** 41-64.

Poirier, J., V. Piché, et al. (2001). "Projet d'étude des stratégies de reproduction des populations sahéliennes à partir de l'enquête *Dynamique migratoire, insertion urbaine et environnement au Burkina Faso*." Cahiers québécois de démographie **30**(2): 289-309.

Rhoda, R. (1983). "Rural Development and Urban Migration: Can We Keep Them down on the Farm?" International Migration Review **17**(1): 34-64.

Rudolph, R. L. (1992). "The European family and economy: central themes and issues." Journal of Family History **17**(2): 119-138.

Shen, J. (1999). "Modelling regional migration in China : estimation and decomposition." Environment and Planning A **31**: 1223-1238.

Sjaastad, L. A. (1962). "The costs and returns of human migration." Journal of Political Economy **70**: 880-893.

Svart, L. M. (1976). "Environmental Preference Migration: A Review." Geographical Review **66**(3): 314-330.

Thill, J.-C. (1992). "Choice set formation for destination choice modelling." Progress in Human Geography **16**(3): 361-382.

Todaro, M. (1997). Urbanization, unemployment and migration in Africa: theory and policy. New York, Population Council.

Ward, C., B. Ballif-Spanvill, et al. (2004). "Weeding out failed practices: a case study of community gardens in rural Mali." Human Ecology **32**(4): 509-521.

**Figure 1. The 600 settlements in the community survey in Burkina Faso.**

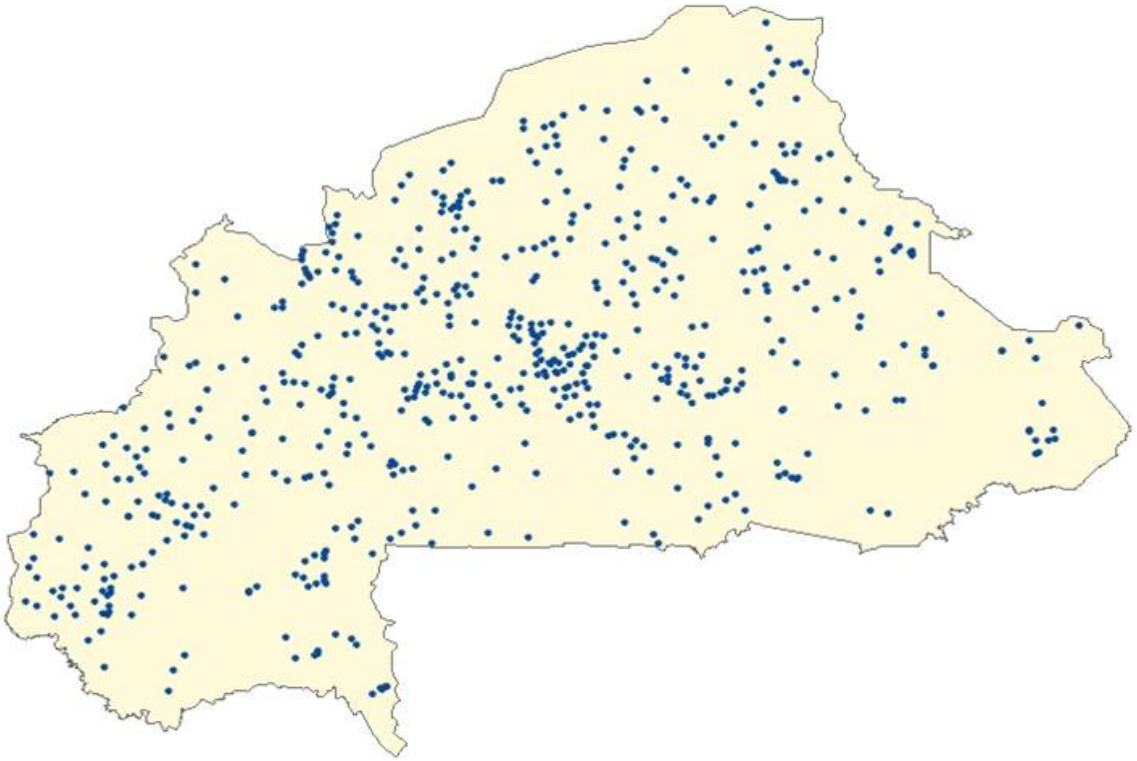

**Figure 2. Composition of the database (in grey)**

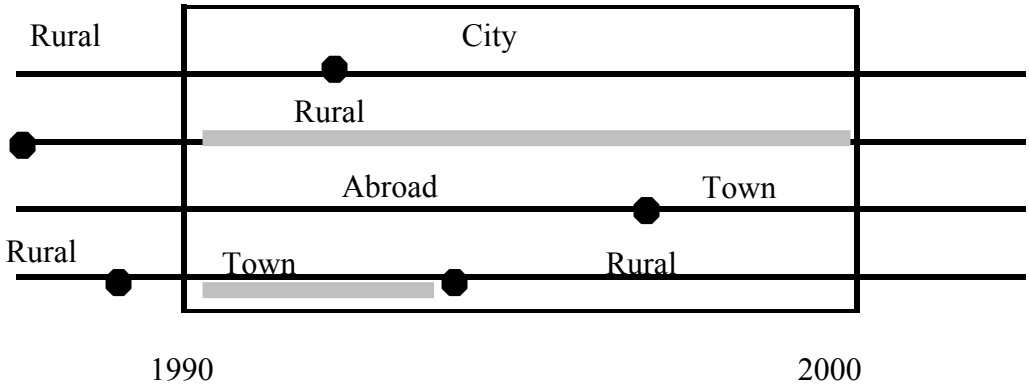


Figure to be improved!!!

**Figure 3. Map of Burkina Faso Showing Mean Annual Rainfall at the Department Level, 1960-98**

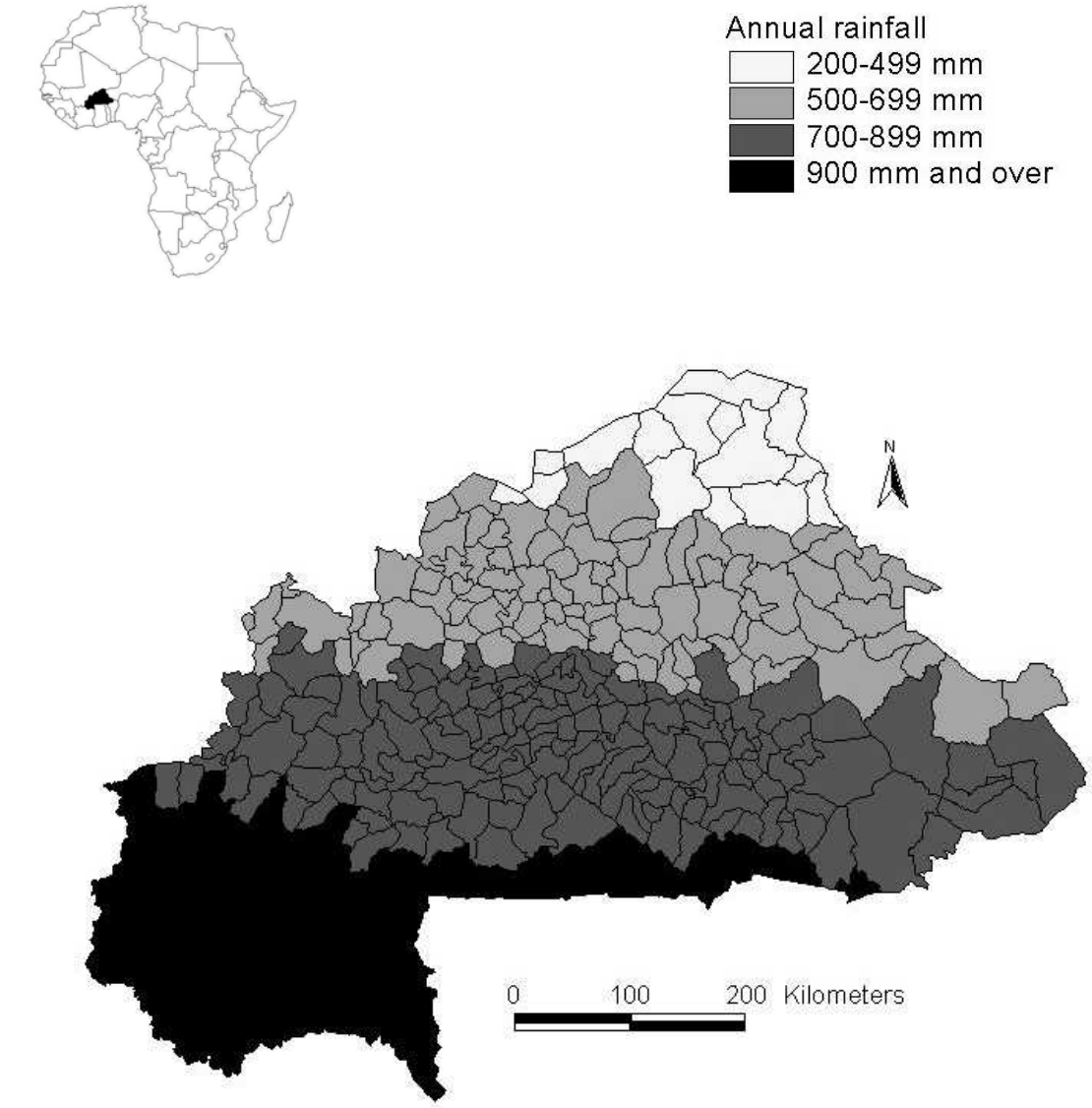

***Table 1. Migratory matrix of the last migration occurred from 1990 to 2000, expressed in percentage***

| | Village | Medium-sized town | Ouagadougou/ Bobo-Dioulasso | Total |
|---|---|---|---|---|
| Village | 16.6 | 4.9 | 5.5 | 27.0 |
| Medium-sized town | 2.4 | 1.2 | 3.3 | 6.9 |
| Ouagadougou/Bobo-Dioulasso | 5.1 | 2.6 | 2.3 | 10.0 |
| Abroad | 46.7 | 4.5 | 4.9 | 56.1 |
| Total | 70.8 | 13.2 | 16.0 | 100%<br>*(n=1272)* |

***Table 2. Characteristics of the Last Male Migration***

| | % of sample |
|---|---|
| *Origin and destination of migration* | |
| Rural to rural | 65.58 |
| Rural to medium-sized towns | 19.85 |
| Medium-sized towns to rural | 9.87 |
| Medium-sized towns to medium-sized towns | 4.69 |
| *Proximity* | |
| Intra-provincial move | 41.92 |
| Inter-provincial move | 58.08 |
| *Return migration* | |
| Return migration | 33.18 |
| No-return migration | 66.82 |
| Sample size | 217 |

***Table3: Descriptive Statistics of the Sample***

| | Sample (1) | Migrants (2) |
|---|---|---|
| *Age at migration* | | |
| 15-19 | | 14.6 |
| 20-24 | | 14.8 |
| 25-29 | | 14.3 |
| 30-34 | | 17.4 |
| 35-39 | | 17.5 |
| 40-44 | | 5.0 |
| 45-49 | | 3.2 |
| 50 and over | | 13.2 |
| *Education* | | |
| No education | 84.5 | 79.3 |
| Primary and over | 15.5 | 20.7 |
| *Ethnic group* | | |
| Mossi | 43.6 | 47.9 |
| Fulani | 12.1 | 16.4 |
| Other | 44.3 | 35.7 |
| *Activity (TV)* | | |
| Agriculture | 80.6 | 59.5 |
| Cattle-raising | 8.1 | 5.9 |
| Other | 11.3 | 34.6 |
| Sample size | 1801 | 217 |

1. Descriptive statistics of the sample at the arrival in the next to last residence, when people began to be at risk.

2. Descriptive statistics of the sample at the time of the last migration (migrants).

TV means time-varying variable

***Table 4. Characteristics of the Localities at the Origin and at the Destination (at the time of migration), Compared to all Localities in Burkina Faso (1990-2000), by Size of the Locality***

| | Origin | | Destination | | Reference | |
|---|---|---|---|---|---|---|
| | Villages[2] | Medium-sized towns[3] | Villages[2] | Medium-sized towns[3] | Villages[2] | Medium-sized towns[3] |
| **H1: Rainfall variable** | | | | | | |
| *Mean annual rainfall* | | | | | | |
| 200-499 mm | **3.5** | 3.7 | **7.1** | 0.0 | **4.3** | 0.3 |
| 500-699 mm | **14.4** | 23.7 | **23.7** | 0.0 | **25.9** | 8.9 |
| 700-899 mm | **64.4** | 53.5 | **43.8** | 92.7 | **43.9** | 60.6 |
| 900 mm and over | **17.8** | 19.1 | **25.5** | 7.3 | **25.9** | 30.2 |
| | ***100.0*** | *100.0* | ***100.0*** | *100.0* | ***100.0*** | *100.0* |
| *Inter-annual rainfall variability(TV)* | | | | | | |
| <85% | **0.7** | 0.0 | **1.0** | 1.7 | **0.9** | 2.4 |
| 85-94% | **25.0** | 48.8 | **36.4** | 11.5 | **32.4** | 31.3 |
| 95% and over | **74.4** | 51.2 | **62.6** | 86.9 | **66.8** | 66.3 |
| | ***100.0*** | *100.0* | ***100.0*** | *100.0* | ***100.0*** | *100.0* |
| **H2: Economic diversification** | | | | | | |
| ***Income-generating variables*** | | | | | | |
| *Gardening[1](TV)* | **39.0** | 88.1 | **45.5** | 100.0 | **34.5** | 96.4 |
| *Cash crop[1](TV)* | **35.3** | 17.1 | **26.4** | 76.1 | **17.6** | 10.3 |
| *Paid agricultural employment[1](TV)* | **57.1** | 74.0 | **34.7** | 83.3 | **54.4** | 74.0 |
| *Paid non-agricultural employment[1](TV)* | **23.2** | 92.3 | **15.0** | 25.8 | **17.6** | 45.0 |
| ***Modernization of agriculture*** | | | | | | |
| *Tractor[1](TV)* | **26.2** | 72.8 | **20.9** | 93.8 | **12.0** | 43.7 |
| *Plow[1] (TV)* | **93.6** | 98.3 | **84.2** | 100.0 | **74.4** | 99.7 |
| *Irrigation[1](TV)* | **21.9** | 66.8 | **0.0** | 85.9 | **6.8** | 21.8 |
| *Water cons. Techniques[1] (TV)* | **29.3** | 43.7 | **34.6** | 19.6 | **41.0** | 28.3 |
| Sample | **179** | 38 | **146** | 71[4] | **540** | 55 |

*[1] The figure indicates the proportion (expressed in percentage) of places with the presence of the activity or the tool.*

*[2] Villages are defined as a locality with less than 10,000h.*

*[3] Medium-sized towns include all settlements with more than 10,000h, except Ouagadougou and Bobo-Dioulasso.*

*[4] See text for further explanations.*

*(TV) means time-varying variable.*

***Table 5: Event History Models of Individual and Rainfall and Economic Contextual Effects on the Risk of Migrating (results are expressed in odds-ratio)***

| Explanatory variables | Model 1<br>All moves | Model 2a<br>Intra-prov. moves | Model 2b<br>Inter-prov. moves |
|---|---|---|---|
| *Baseline hazard* | | | |
| Age | 0.86* | 0.84 | 0.88* |
| Log age | 150.65* | 334.79 | 66.43** |
| *Education* | | | |
| No education (R) | 1.00 | 1.00 | 1.00 |
| Primary and over | 0.91 | 1.52 | 0.70 |
| *Ethnic group* | | | |
| Mossi (R) | 1.00 | 1.00 | 1.00 |
| Fulani | 2.35* | 3.66* | 1.76+ |
| Other | 0.68 | 0.76 | 0.63 |
| *Activity* | | | |
| Agriculture (R) | 1.00 | 1.00 | 1.00 |
| Cattle-raising | 0.51 | 0.17 | 1.17 |
| Other | 6.69*** | 4.74*** | 8.75*** |
| **H1: Rainfall variables** | | | |
| *Mean annual rainfall at the origin* | | | |
| 200-499 mm | 0.12** | 1.11 | 0.06*** |
| 500-699 mm | 0.20** | 1.09 | 0.14*** |
| 700-899 mm | 0.39+ | 3.17+ | 0.17*** |
| 900 mm and over (R) | 1.00 | 1.00 | 1.00 |
| *Inter-annual rainfall variability at the origin* | | | |
| < 85 % | 0.01 | 7.72 | 0.01 |
| 85 – 94 % | 0.05 | 10.93 | 0.05 |
| 95 and over (R) | 1.00 | 1.00 | 1.00 |
| *Mean annual rainfall at the destination* | | | |
| 200-499 mm | 2.73* | 5.49** | 1.37 |
| 500-699 mm | 1.76 | 2.43+ | 1.15 |
| 700-899 mm | 1.39 | 2.93** | 0.94 |
| 900 mm and over (R) | 1.00 | 1.00 | 1.00 |
| *Inter-annual rainfall variability at the destination* | | | |
| < 85 % | 20.98 | 0.06** | 36.70 |
| 85 – 94 % | 16.04 | 0.05 | 18.12 |
| 95 and over (R) | 1.00 | 1.00 | 1.00 |

| Explanatory variables | Model 1<br>All moves | Model 2a<br>Intra-prov. moves | Model 2b<br>Inter-prov. moves |
|---|---|---|---|
| **H2a: Income-generating activities**[1] | | | |
| *Gardening at the origin* | 0.24*** | 0.63 | 0.15*** |
| *Cash crops at the origin* | 0.60+ | 0.85 | 0.72 |
| *Paid agricultural employment at the origin* | 1.82 | 1.57 | 1.41 |
| *Paid non-agricultural employment at the origin* | 2.35+ | 1.51 | 1.77 |
| *Gardening at the destination* | 2.19* | 0.95 | 2.21** |
| *Cash crops at the destination* | 1.72+ | 1.66+ | 1.53 |
| *Paid agricultural employment at the destination* | 0.39** | 0.61 | 0.33** |
| *Paid non-agricultural employment at the destination* | 0.37+ | 0.19* | 0.59 |
| **H2b: Modernization of agriculture**[1] | | | |
| *Tractor at the origin* | 0.65 | 0.18* | 1.28 |
| *Plow at the origin* | 4.60*** | 2.67** | 8.08*** |
| *Irrigation at the origin* | 5.99** | 9.02*** | 5.35+ |
| *Water-conservation technique at the origin* | 0.96 | 0.98 | 0.70 |
| *Tractor at the destination* | 2.42*** | 1.56 | 2.53** |
| *Plow at the destination* | 1.00 | 1.03 | 1.29 |
| *Irrigation at the destination* | 0.35** | 1.47 | 0.21*** |
| *Water-conservation technique at the destination* | 0.66* | 0.40** | 0.89 |
| **Additional control variables** | | | |
| *Size of the settlement at the origin* | | | |
| < 10,000 h (R) | 1.00 | 1.00 | 1.00 |
| >= 10,000 h | 0.17* | 0.05*** | 0.66 |
| *Distance to Ouagadougou or Bobo-Dioulasso at the origin* | | | |
| <100 Kms | 0.04 | 0.05 | 0.05 |
| 100-199 Kms | 0.14 | 0.70 | 0.13 |
| > 200 Kms (R) | 1.00 | 1.00 | 1.00 |
| *Presence of road at the origin* | 4.57*** | 4.15** | 3.65*** |
| *Size of the settlement at the destination* | | | |
| < 10,000 h (R) | 1.00 | 1.00 | 1.00 |
| >= 10,000 h | 6.12* | 14.45*** | 3.00** |
| *Distance to Ouagadougou or Bobo-Dioulasso at the destination* | | | |
| <100 Kms | 11.58 | 18.69 | 5.25 |
| 100-199 Kms | 7.38 | 1.35 | 7.03 |
| > 200 Kms (R) | 1.00 | 1.00 | 1.00 |
| *Presence of road at the destination* | 0.55 | 0.72 | 0.63 |

*** : p<0.01; ** : p<0.05 ; * : p<0.10; + : p<0.20 (two-tailed tests)

[1] Reference category= absence of the activity or the tool in the settlement

**Table 6. Summary of the Significant Results of Models Presented in Table 5.**

| | | At the origin | | | At the destination | | |
|---|---|---|---|---|---|---|---|
| | | All moves | Intra-prov. move | Inter-prov. Move | All moves | Intra-prov. move | Inter-prov. move |
| H1 | Mean annual rainfall | + | . | + | - | - | . |
| | % of normal rainfall during the year (inter-annual variability) (TV) | . | . | . | . | + | . |
| H2a | Gardening (TV) | - | . | - | + | . | + |
| | Cash crop (TV) | . | . | . | . | . | . |
| | Paid agricultural employment (TV) | . | . | . | - | . | - |
| | Paid non-agricultural employment (TV) | . | . | . | . | - | . |
| H2b | Tractor (TV) | . | - | . | + | . | + |
| | Plough (TV) | + | + | + | . | . | . |
| | Irrigation (TV) | + | + | . | - | . | - |
| | Water-conservation techn. (TV) | . | . | . | - | - | . |
| Add. Var. | Size of settlement (TV) | - | - | . | + | + | + |
| | Distance to Ouagadougou/Bobo-Dioulasso | . | . | . | . | . | . |
| | Road (TV) | + | + | + | . | . | . |

(TV) means time-varying variable.

+ means that the risk of migrating increases with a high value of the variable, - means a decrease and . in the case of non-significant results ($p<0.1$).