

# SEASONAL MIGRATION AS SURVIVAL STRATEGY

**Adama Konseiga**, Junior Research Fellow, Center for Development Research (ZEF), University of Bonn (Germany).  
[akonseig@uni-bonn.de](mailto:akonseig@uni-bonn.de)  
www.zef.de

## Acknowledgements

---

The views and conclusions expressed in this paper are those of the author. They are neither the views of the Center for Development Research (ZEF), nor those of its collaborating partner the Center for International Development Studies and Research (CERDI). The author is grateful for comments and suggestions provided by Jean-Louis Combes, Elisabeth Sadoulet, Susanna Wolf, Nong Zhu, Aurelien Beko and the Macroeconomic and Trade Research Group at ZEF. He also acknowledges the technical cooperation during the field research from Boureima Drabo and Bonayi Dabiré. Finally, his special thanks go to Céline Dutilly-Diane who supported this project all the way from the farmers' households during the fieldwork to the handling of the data. However, the usual disclaimer applies.

## Abstract

---

This paper examines the motivations behind the important migration from Burkina Faso to Côte d'Ivoire, the economic pole in the West African Economic and Monetary Union. The paper, unlike most of the previous works, uses a detailed survey dataset collected in 2002 in Northeastern Burkina Faso and applies a methodology robust to the selection bias. It enables to study the specificities of the seasonal migration and estimate consistent migration incomes. The structural model of migration decision revealed the importance of migration as a mere survival strategy in the study regions confronted with congestion costs and severe scarcity of natural resources.

Results supported that even under the pessimistic scenario where the direct benefits of the regional integration program would go exclusively to the polar country, households in the West African Semi-Arid Tropics (in particular the Sahel) may still benefit from an increased economic attractiveness of this destination. First, because it is seasonal, the increased migration will translate into higher liquidity that enables

households to overcome credit and insurance market failures and invest in their main agropastoral activities. Second, an interesting finding is also the role of the unsecured livestock activity as impediment to migration of the pastoralist groups. The study recommended the development of policies that address security issues through well-functioning rural labor market institutions and enforceable rules regarding shepherd contracts. It is also important to enforce regional laws regarding the free movement of labor.

## **1. Introduction**

Restriction of the movement of persons is increasingly gaining recognition as a severe impediment to trade, particularly in services. Removal of these restrictions could result in important benefits to the world as a whole and in particular to the suppliers of this labor. Hamilton and Whalley (1984) suggested that the liberalization of world labor markets could double world income and imply proportionately even larger gains for the developing countries. Thus allowing labor to move between countries would seem to be an important tool for growth and development. The migrant workers produce, earn wages, pay taxes and consume in the host country, as well as send remittances back to their home countries. Even though these benefits are dampened with the brain-drain phenomenon, Barro and Sala-i-Martin (1995) view the latter as an extreme case that is likely to offset the benefits only in conditions of crumbling empires.

Migration activities play a central role in the decision of Burkina Faso to participate profitably in the process of creating a common market in the West African Economic and Monetary Union (WAEMU). The current paper aims to shed light on the motivations for sahelian seasonal migration and to allow a better understanding of its welfare implications. Burkina Faso is indeed the largest supplier of migration labor to Côte d'Ivoire and it is worth assessing the welfare and policy implications of the theories of migration concerning its participation to the Union. There is a long history of migration between Burkina Faso and Côte d'Ivoire that started before the constitution of the two countries, during French colonization (Zanou, 2001). First, considered as a labor pool for the economic development of the neighboring countries, the erstwhile forced migration became the outcome of the free decision of the Burkinabè households after

independence. Therefore this labor mobility responded to demographic and economic differences between the two countries and has been also reinforced by the constitution of regional and common currency blocks (Decaluwé, Dumont, Mesplé-Somps, and Robichaud 2000). The differences in their natural resources endowments and the capacity of Côte d'Ivoire to attract foreign direct investment brought several decades of rapid growth and consolidated large income gap between the two neighboring countries. The sole factor of income gap gives enough incentives to the farmers to leave their dry lands in Burkina Faso for the available and favorable lands for cocoa and coffee farming and the forests in Côte d'Ivoire.

The purpose of the current study is twofold. First I develop a model that deals with the question of the benefits of further regional liberalization of the movement of labor through the constitution of a common market. Second I re-examine the uncertain economic impact of the Union for landlocked countries (Decaluwé, Dumont, Mesplé-Somps, and Robichaud 2000). The migration model introduced by Todaro (1969) and Harris and Todaro (1970) has been for long time the dominant formal theory of migration in developing countries. In this early literature, income gap (or expected income) constitutes the principal aspect of migration motivation. The larger is this gap, the stronger is the propensity of migration. However, with the New Economics of Migration (NEM), migration is no more solely an individual decision but rather a decision made at household level. Beyond income gap<sup>1</sup>, factors such as individual and family characteristics, risk coping strategies and labor and capital market imperfections in the destination and home countries influence the migration decisions, too (Stark 2003). Using the survey data collected in northeastern Burkina Faso in summer 2002, I test the prediction of the Todaro model. The latter cannot fully cover the specific context of the Sahel and is complemented with the NEM.

The empirical part first analyzes the determinants of migrants' income at home and in the host country. In a second step, I study the impact of income gap on migration decision. The dataset allows studying the most important type of Sahelian migration to

---

<sup>1</sup> Migration is fundamentally dissimilar to the flow of water, which will always be observed in the presence of height differentials.

Côte d'Ivoire that is the seasonal migration.<sup>2</sup> In her sociological study of the Fulani ethnic group in the same survey region, Hampshire (2002) recognized the importance of seasonal economic migration (SEM) in the local livelihoods and evaluated the median length of time spent away to be five months following the harvest. This compares to the average length of stay in my dataset, which is 7 months when it is the head of household who migrates.

The rest of the paper is organized as follows. In section 2, a brief review of the principal theory, the Todaro model, and its recent developments is undertaken. Section 3 presents the econometric model used. Then, the data and the estimation methods are described and the related methodological problems highlighted in section 4. The econometric results follow in the fifth section. I close the study by drawing the main conclusions and subsequent research perspectives.

## **2. Understanding the migration phenomenon**

In the theories and policies of economic growth and development, migration of labor is regarded as a key instrument to promote economic welfare. Similarly, most trade theories emphasize factor mobility as an important policy instrument to achieve a high level of economic development. As mentioned by Ghatak, Levine and Price (1996), recent evidence seems to underline the case for adopting economic policies which would:

- (a) Re-allocate labor from low productivity to high productivity areas. Migration is socially desirable as long as it transfers labor from low to high productivity areas; and
- (b) Promote factor mobility and improve efficiency of the tradable sector so that trade could be regarded as an engine of economic growth.

Since Todaro (1969) and Harris and Todaro (1970) the motivation of migration, which refers to why certain people migrate, is a very important research question. However in their survey, Lalonde and Topel (1997) could not find empirical works that directly estimate the determinants of international migrations even though a broad literature exists at domestic level. Since then the situation did not improve in the case of West Africa and it is therefore a key-issue that the current chapter analyzes the

---

<sup>2</sup> The main characteristics that appear from national censuses and migration surveys allow describing West African migration as a temporary or circular labor migration (Cordell, Gregory and Piché 1996).

determinants of migrants' and nonmigrants' income and the effect of subsequent income gap in the structural model of the decision to migrate. The literature on migration admits that the income gap is the most important determinant of migration decision. However, households' level factors (educational attainment, experience, qualifications and job status) and other risk related factors became also important determinants in the recent developments of the theory. Therefore I use a general form of the Harris and Todaro (HT) model and extend the migration decision at family level. Mutual interdependence inside the household unit, uncertainty and relative deprivation, and imperfect and incomplete markets and financial institutions are the fundamental premises that enable to include the risk-averse behavior, key aspect of the New Economics of labor Migration (Stark 1991).

The potential migrants consider the various opportunities on the labor markets of the two countries and then choose either to migrate toward the host country or to remain home to maximize their expected utility. Therefore, the decision to migrate depends basically on an evaluation made by the migrant of the expected incomes. Expected incomes depend on the current wages in the destination country and a subjective evaluation of the probability to get a job that depends on the unemployment rate. The higher the anticipated income gain; the higher will be the propensity of migrating. In a formal way, the present value of expected net income of a migrant is given by:

$$V = \int_0^{\infty} [p w_f - w_h] e^{-rt} dt - C = \frac{1}{r} [p w_f - w_h] - C \quad (1)$$

where  $w_f$  and  $w_h$  represent respectively the average income of the foreign country and that of the home country;  $r$ , the discount rate reflecting the preference of the migrant for the present time;  $p$ , the probability to find an employment abroad and  $C$ , the approximation for the economic and psychological cost of the migration.

Migration will take place only if  $V$  is positive, that is if:

$$p w_f - w_h > rC \quad (2)$$

The equilibrium condition is thus:

$$p w_f - w_h = rC \quad (3)$$

The probability to obtain a job abroad  $p$  is given by the total number of employments in the host country  $L_f$  divided by its working population once migration has taken place  $L_f +$

$MN_h$ .<sup>3</sup>  $N_h$  is the home country active population and  $M$  the rate of migration.  $L_f$  and  $N_h$  are exogenous values so that:

$$p = \frac{\bar{L}_f}{\bar{L}_f + MN_h}.$$

Equation (3) can now be re-written to get the migration rate at equilibrium:

$$M = \left[ \frac{w_f - w_h - rC}{rC - (w_f - w_h)} \right] \frac{\bar{L}_f}{N_h} \quad (4)$$

with the subsequent results (Ghatak, Levine and Price 1996):

$$\frac{\delta M}{\delta w_f} > 0; \quad \frac{\delta M}{\delta w_h} < 0; \quad \frac{\delta M}{\delta \bar{L}_f} > 0; \quad \frac{\delta M}{\delta C} < 0 \quad (5)$$

This simple explanation of the migration decision by Todaro's model has several political implications among which a marginal increase in wages in the host country (consequence of a successful regional policy marked by rising levels of foreign direct investment, international trade, technological advances and research and development) or seemingly a marginal decrease in domestic wages provokes more migration.<sup>4</sup> Borjas and Freeman (1992) also argued that the magnitude and composition of immigrant flows are determined by the labor market opportunities (including real wages, costs of migrating and uncertainty) in the host country relatively to those in the home country. It should be noticed that any impact on flows of migration is transmitted to the home economy through the main channel of remittances so that modeling flows of migrants is partly akin to modeling the remittances flows as well.

An alternative to the view that migration decision is a response to a foreign-domestic wage differential has been brought by the New Economics of Migration. In their survey Ghatak, Levine and Price (1996) argued that evidence on international migration showed that migration does not flow automatically in response to wage differentials. Characteristics of migrants and the process of self-selection are found to be

<sup>3</sup> Under the assumption of full employment in the attractive destination before migration. Zanou (2001) argued that at the beginning of the migration process, there was an important shortage of labor in Côte d'Ivoire. Current observations reveal also a negligible unemployment occurrence among migrants community (CAPRI 2002).

<sup>4</sup> This result could be damped only at the end of a long process of convergence that would reduce the income gap between the two countries. But observed facts show a persistence of migration in most cases (inter-states migration in USA for instance).

important determinants of the rate of migration. Based on these findings that factors other than earnings differences influence migration decisions, the theory can be broadened to explain why migration sometimes fails to occur even when substantial earnings differences exist, or why migration will continue even without such differentials (see several illustrations in Stark 2003). For example, income uncertainty in the receiving country may deter risk-averse persons from migrating, even if expected earning gains are positive. Even more important, family ties and cultural differences between source and receiving countries raise the cost of immigration. Therefore, ethnic enclaves in the receiving country encourage new migrants (see Gubert 2000 on the rationale behind migrants' choice of destinations). Family can play another important role in the migration decisions. If the current generation altruistically values the utility of their offspring, then utility maximizing migration decisions will be dynamic. It may pay the current generation to migrate even if the change in their own wealth is small or negative, because their descendants will be better off in the receiving country.

Stark (1991) supports the above arguments that migration is not only a consequence of income gap but responds as well to other individual or familial incentives. Individuals are migration actors who search to maximize the expected income of the household and by the same time to minimize risks (strategy of risks pooling). The individual migrants participate to their households' strategy against different markets failures problems. Many migratory phenomena would not have occurred if the set of markets and financial institutions were perfect and complete, free of asymmetries. Migration operates as a risk management strategy and/or as a way to ease the liquidity constraint of the household in the absence of insurance and credit market.<sup>5</sup> Bardhan and Udry (1999) showed that migration is one of the strategies that households use to ensure that their incomes do not fluctuate too severely. Households might spread their members across space through migration in order to reduce the variance of the aggregate household

---

<sup>5</sup> A second strand of motivation considers migration as a response to the relative deprivation that depends on the relative income position of the migrant in his community as well as on the income distribution in both destinations. Migration is then a means to achieve a better social status. A person utility then does not depend only on his absolute well-being, but also on his relative standing in the community. Therefore he may migrate so as to improve his social standing or simply change his reference community. It can be predicted under such conditions that a community with low but uniform incomes will produce less migrants than a community with somewhat higher yet heterogeneous incomes.

income. According to the new portfolio investment theory, families indeed spread their labor assets over geographically dispersed and structurally different markets to reduce risks and some evidence suggests that after migration, members of the family combine and share their incomes. Such pooling is regarded as a form of insurance against uncertain income flows from specific markets and helps smoothing the family consumption path. Thus, if future earnings are uncertain and imperfectly but positively related in a geographically specific area, the migration policy of a member of the income-pooling family diversifies risk (Stark, 1991).

Thus, migration and remittances could increase production output of the migrant household if they release the constraints that are limiting the expansion of their activity. However, in the case of missing or imperfect labor market, the household must rely on the family labor and thus sending a household member may also stop the household from moving toward the local high-return activity. The adverse effect of lost labor<sup>6</sup> may be higher when migration is permanent and migrants tend to be younger and better educated than an average rural laborer. The household migration strategy raises also the question of asymmetric information. Any risk-pooling mechanism must overcome the information and enforcement problems associated with insurance contracts. The insurer might be subject to either moral hazard or adverse selection or both as discussed in Azam and Gubert (2002) and de la Briere, Sadoulet, de Janvry, and Lambert (2002). The preceding shortcomings of the migration strategy are less likely to hold in the specific context of Sahelian migration that is largely seasonal (Chapters 3 and 4; Hampshire 2002). In the rural semi-arid Sahelian village of Zaradougou in Mali, de Haan, Brock and Coulibaly (2002) found that for decades migration to Côte d'Ivoire has been a central part of household strategies integrating the village into an economy that spread across political borders. Most households employed a large proportion of their active labor force to work on their second farms in Côte d'Ivoire but still cultivate cotton and grain during the short sahelian rainy season. If labor shortage<sup>7</sup> and information asymmetry seem not be a severe

---

<sup>6</sup> If a migrant household's marginal product on the farm is positive, farm production will fall when the household sends out-migrants, due to the reduction in available labor.

<sup>7</sup> The main economic activities in Seno-Oudalan are extensive pastoralism and rainfed agriculture, which is only possible in the short rainy season July-September (Claude, Grouzis and Millville 1991).

impediment to the migratory strategy; non local migratory income sources may however involve a lower degree of control as a result of political decisions or political crisis.

Ghatak, Levine and Price (1996) formalized some of the premises of the NEM by generalizing the above HT model. The idea that migration results from a family's optimizing decisions implies a choice concerning which<sup>8</sup> family member(s) migrate to maximize remittances to the home family. As long as the family can induce income transfers among its members,<sup>9</sup> it will send family members abroad to maximize the family's net wealth.

Let the utility of a representative family be  $U(Y)$  where  $Y$  is income and  $U$  is a concave utility function with  $U' > 0$ ,  $U'' < 0$ .<sup>10</sup> Let the family or household chooses a proportion  $M$  of the family to migrate. As before let  $N_h$  be the home labor force so that

$M \cdot \bar{N}_h$  is the total migration. The family chooses the proportion  $M$  of its members to migrate at a cost  $rC$  per period. Migrants obtain employment with probability  $p$  at a foreign wage  $W_f$ . The proportion that remains,  $1-M$ , receives a domestic wage  $W_h$ .

Let  $\tilde{w}_f = w_f - rC$  be the net foreign wage after paying for migration costs. Then the family maximizes his expected per period utility:<sup>11</sup>

$$E(U(Y)) = pU(M\tilde{w}_f + (1-M)w_h) + (1-p)U((1-M)w_h) \quad (6)$$

Now let consider the simple case of a logarithmic functional form for the utility function  $U(Y) = \log Y$ , then the equilibrium conditions of the probability of migration give the following outcome:

<sup>8</sup> A family that seeks to increase the likelihood of its migrant to find a job may invest in the migrant's skills.

<sup>9</sup> This relates to a cooperative game framework where the stayers and the migrant member take a joint decision that secures a mutually advantageous coordination. Similar results appear when the decision to remit by a particular migrant is a contribution to investment in household assets later to be inherited. The parent who holds the bequest can allocate it according to the children relative attentions (strategic bequest motives).

<sup>10</sup> A concave utility function embodies an assumption of risk-averse households.

<sup>11</sup> It is then assumed that with probability  $(1-p)$ , the unemployed migrants receive no income and therefore the nonmigrants members of the family should provide them with the subsistence income. Note that including an option for enjoying leisure time change the whole model results (Stark 1991). Indeed unemployment rates among the migrants are found to be low in many studies, which stylized fact, is confirmed in our 2002 survey.

$$M = \left[ \frac{p(\tilde{w}_f - w_h) - (1-p)(w_h)}{(w_h)(\tilde{w}_f - w_h)} \right] w_h \quad (7),$$

provided that the right hand side of (7) lies in the bounded interval  $[0,1]$ . Under the condition that  $\tilde{w}_f > w_h$ , migration takes place (i.e.,  $M \geq 0$ ) if and only if  $p(\tilde{w}_f - w_h) \geq (1-p)w_h$  meaning that  $w_h \leq p\tilde{w}_f$  is also the condition for any migration at the household unit level. Finally the substitution of the probability of obtaining employment  $p = \frac{\bar{L}_f}{\bar{L}_f + M\bar{N}_h}$  into (7) gives the equilibrium household migration rate.

The current study constitutes an important step to the evaluation of the economy-wide effect of changes in factors mobility flows inside UEMOA under the assumption that good and factors flows are complements. According to Markusen (1983), the widely held notion, that trade in goods and factors are substitutes, is in fact a rather specific result that only occurs in the factor proportions models.<sup>12</sup> The alternative bases for trade (returns to scale, imperfect competition, production and factors taxes, and differences in production technologies) share the common characteristic that factor mobility leads to an increase in the volume of world trade. Grether, De Melo, and Müler (1999) argued similarly that trade in goods and trade in factors of production are two different ways to exchange factors services.<sup>13</sup> There is actually little integration of Burkina Faso into UEMOA in terms of trade so that regional integration is not appealing in terms of usual integration indices like intra-trade indices. Although Burkina Faso is the most important importer in UEMOA with 18 percent of the total imports, on average during the period 1989-1995, its exports to the rest of sub-Saharan Africa represented only 0.9 percent of intra-trade. On the other hands, Côte d'Ivoire<sup>14</sup> supplied 25 percent of all sub-Saharan African regional exports (Yeats 1998). A more meaningful integration index should

<sup>12</sup> Even within this model, Razin and Sadka (1997) show that, when both commodity trade and factor mobility are simultaneously possible, the outcome can be a complete indeterminacy between the two modes of international flows that are commodity trade and factor mobility.

<sup>13</sup> See also Harris and Schmitt (2003) for a review of recent theoretical developments on trade as a complement to international mobility of labor.

<sup>14</sup> According to Decaluwe, Dumont, Mesplé-Somps, and Robichaud (2000), Côte d'Ivoire's share in 1995 UEMOA regional exports was 10% whereas its imports from the other Union members represented only 0.8% of the total imports.

actually include migration that is export of labor services. Such a comprehensive index reflects the integration of goods but also factor markets inside UEMOA, considering Burkina Faso as an implicit shareholder that can enjoy the success of Côte d'Ivoire and the common market at large.

### **3. Econometric methodology**

Unlike the international exchange of labor, rural-to-urban migration is a well-documented phenomenon in West Africa. While most of the earlier work concentrated on long-term or permanent migration the importance of short-term and seasonal migration is becoming increasingly recognized (Hampshire 2002). The latter is the focus of the empirical work in this section.

The permanent migration to Côte d'Ivoire concerns households who generally establish in the cocoa farming zones whereas the seasonal migration concerns households who temporarily work<sup>15</sup> in Ivorian cities for the duration of the long slack season when rain-fed agriculture is not possible in the Sahel (October to June). Once migrated in Côte d'Ivoire, the permanent migrants are specialized in agriculture that contributes for 86 percent in the total income, probably because there is less need for diversification in cocoa farming in the host country. The Fulani in the Seno-Oudalan region rarely practice permanent migration; meanwhile in 1996, 73 percent of all individuals sampled were involved in some form of temporary migration lasting at least two weeks (Hampshire 2002). Typically temporary or seasonal migrants are men who leave following the harvest, are away for much of the dry season and return in time for the rains in order to cultivate.

The permanent migration strategy that concerns only 19 households in the 2002 CAPRI survey is assumed independent of the seasonal migration. For the current study I constituted a sample of Seasonal Economic Migration (SEM) composed of 135 nonmigrant and 69 migrant households. About 34 percent of the sample of the seasonal migration study is migrant households, whose migration project appears beneficial to them according to the theory. Analyzing the behavior of migrant households from a

---

<sup>15</sup> Economic activities at the destination range from the very lucrative trade in livestock, to temporary wage labor, informal self-employment, to begging.

population leads to incidental truncation problem because migrants are a restricted nonrandom part of an entire population. Individual migrants are not randomly and uniformly distributed in the population so that there is a selectivity phenomenon of migration. The same applies at the level of the households that supply migrants' labor; therefore these households may possess unobserved characteristics that are generally positively related to the income resulting in a sample selection bias. With such a distortion, results from a standard Ordinary Least Squares (OLS) are simply biased. The regression model that includes the above selection issue is the migration model à la Nakosteen and Zimmer (1980). The simultaneous system writes:

Net benefit of moving:

$$V_i^* = \alpha' Z_i + \gamma' X_i + \varepsilon_i \quad (8)$$

Income of migrant households:

$$\log w_{fi} = \beta_f' X_{fi} + \mu_{fi} \quad (9)$$

and income of nonmigrant households:

$$\log w_{hi} = \beta_h' X_{hi} + \mu_{hi} \quad (10)$$

To estimate the simultaneous migration decision and income equations, it is assumed that  $V_i^*$  and  $\log w_i$  have a bivariate normal distribution with correlation  $\rho$ .

A preliminary analysis of the last two equations is necessary in order to study the semi-structural model of migration decision based on the net benefit of moving. However, an analysis of income in either sub-sample must account first for the structural differences of both markets and for the incidental truncation of the mover's (stayer's) income on the sign of the net benefit. To face estimation problems of a model with sample selection, a Heckman two-step procedure is used for each of the two sub-samples of movers and stayers. The Heckman regression model can be written for the selected sample as:

Selection model:

$$P_i^* = \alpha' Z_i + \gamma' X_i + \varepsilon_i' \quad (8)'$$

where  $P^*$  is the probability of the variable indicator of the sign of the selection criteria, that is the net benefit from migration.

$Z_i$  and  $X_i$  represent the independent variables of the selection equation identification and those of the income equation respectively.

Income model:

$$\log w_i = \beta' X_i + \beta_\lambda \lambda_i + \nu_i \quad (9-10)'$$

where the following relationship exists between the coefficient of the inverse Mills ratio  $\lambda$  and the model statistics:  $\beta_\lambda = \rho \sigma_\mu$ . The inverse Mills ratio (IMR) itself evaluates as the ratio of the probability and cumulative density functions from the selection equation. Heckman (1979) argues that this function is a monotone decreasing function of the probability that an observation is selected into the analyzed sample.

The Heckman's two-step estimation procedure applies to each of the selected group (movers and stayers) taking into account the fact that migrants and nonmigrants face distinct labor market structure respectively in Côte d'Ivoire and in Burkina Faso. For observations in each group, the probit equation (8)' is estimated to obtain estimates of  $\alpha$  and  $\gamma$  and compute the inverse Mills ratio. At a second step, the inverse Mills ratio is added to the earnings equation to produce the estimated coefficients of  $\beta$  and  $\beta_\lambda$ .

Finally the semi-structural model of migration of first interest can be studied to test the prediction of the Todaro model and those of the New Economics of Migration using the expected income gap for each household and the risk-related covariates.

$$P^* = \alpha' Z_i + \eta (\log \hat{w}_{fi} - \log \hat{w}_{hi}) + \varepsilon_i' \quad (11)$$

However the coefficients estimated measure how the log-odds in favor of migrating change as the independent variables change by a unit. For interpretation, marginal effects should then be computed and several other approaches for interpreting nonlinear outcomes for meaningful profiles of the independent variables can be used (Long and Freese 2001).

#### **4. Estimation**

There is a considerable body of empirical work on internal migration using cross-sectional survey data and based on a discrete choice model. Lucas (1988) and Zhu (2002) are some applications on Botswana and China, respectively. However, the specificity of the current paper remains the regional focus and the detailed information collected. The rich household, village and institutions level surveys data collected in 2002 at the origin country (Burkina Faso) allow the first detailed empirical analysis of migration in West Africa.

At the core of the estimation model is an earning equation expressing households' income as a function of individual and external characteristics (Ghatak, Levine and Price, 1996). First, I estimate the income equations for the migrants and nonmigrants in Burkina Faso. Second, I study the impact of the income gap between these two groups on the seasonal migration decision. The method is a structural probit model using the two-step procedure developed by Heckman (1979) and applied in previous studies such as Nakosteen and Zimmer (1980); Perloff (1991); Agesa and Agesa (1999).

##### *4.1 Data source*

The data come from the surveys conducted in summer 2002 in Burkina Faso, which concerned 48 villages in the two Northeastern provinces of Oudalan and Seno. The head of household of the randomly constituted sample had to answer the household questionnaire whereas the village leaders were chosen to answer two additional questionnaires: the village questionnaire and the institutional questionnaire.

The total sample includes 250 households among which 69 seasonal migrants. The seasonal economic migrant is defined as a household whose member migrant stays less than a year in the destination country. This definition is confirmed by a direct question about migrants' return plan and ensures that migration is not incompatible with continuing involvement with agropastoral production. Hampshire (2002) finds that the Fulani, main ethnic group of Seno-Oudalan<sup>16</sup>, has a median length of time spent away of

---

<sup>16</sup> Constituted of Fulbe and Rimaibe, the Fulani constitute a quarter of the population in the study area (Institut National de Statistique et Démographie 1994).

five months and she defined a notion of short-term, non-local economic migration called “exode” that is a movement for duration of between one month and two years.

#### 4.2 *Estimation samples*

The analysis of seasonal economic migration in the Sahel of North-Eastern Burkina Faso considers the nonmigrant households living in the Sahel as the reference group for the migrant households who sent a member in Côte d'Ivoire. As previously explained and summarized in table 1, the survey completed in Burkina Faso concerned 102 migrant households to Côte d'Ivoire, 135 nonmigrant households and 13 households that do not send a member in Côte d'Ivoire but elsewhere.<sup>17</sup> Among the 102 migrant households to Côte d'Ivoire, while 14 cases have contact with a relative who is external to the household composition in Côte d'Ivoire, 69 are defined as seasonal migrants because the migrant returned yearly home for the household agricultural activities of the rainy season that last on average 3 months of labor-intensive work. The remaining 19 migrant households are permanent migrants who established durably in Côte d'Ivoire (RCI). The latter group of migrants deserves a specific survey that will trace them in their residence place in Côte d'Ivoire where necessary information on their incomes, their migratory history and other characteristics will be collected for an analysis of the phenomenon. From the interviews I realized in 2002 in Côte d'Ivoire, it appears that the permanent migrants own cocoa farms that constitute a very important source of income whereas the seasonal migrants are obliged to temporary positions in towns where they work in non-qualified positions (guards or butchers) for less than 12 months every year. The second group generally can just get positions that do not interest native Ivorian whereas the first group asserted that they earn a much better living than the local community. This explains probably part of the frustrations and clashes between the two communities.

---

<sup>17</sup> They represent only 5 percent of the sample who mainly migrate to Burkinabè cities.

**Table 1: Sample structure**

<b>Flow direction</b>	<b>Seasonal Migrants</b>	<b>Permanent Migrants</b>	<b>Other migrants</b>
Burkina Faso to Côte d'Ivoire	69	19	14*
Burkina Faso to other direction			13
Nonmigrants (Reference group)	135		
Sample for seasonal migration analysis	204		

\*Non-membership to the household.

In total the potential estimation sample for the seasonal migration study is composed of 204 households, movers to Côte d'Ivoire and stayers. However, not all information was available in the case of one household and the latter is lost in the estimation procedure as a result of casewise deletion of observations with missing information. There exist econometric techniques to deal with missing values but they should be used with caution.

#### 4.3 *Variables*

The following sections analyze the impact of income gap on migration behavior of the seasonal migrants from Burkina Faso to Côte d'Ivoire. The income regression equation and the selection equation are both estimated before the structural migration economy can then be studied. The migration income (households with observed remittances flows) regression model is estimated using the Heckman procedure to take into account the fact that the assumption of random-participation-in-the-migration is unlikely to be true and thus, standard regression techniques would yield biased results. The dichotomous dependent variable of the selection equation is constructed considering that households who would have negative benefit of migrating may be unlikely to choose to migrate (Ghatak, Levine and Price 1996), their personal reservation income (including the local off-farm income) being greater than the income offered by moving from home. The selection binary variable, named seasonal and nonmigrant household indicator, therefore identifies the households for which the migration income is observed (34 percent of

seasonal migration) or not observed. Table 2 lists the variables together with their theoretical expected sign wherever it is non-ambiguous.

#### 4.4 *Empirical results*

This section implements the econometric analysis and interprets successively the income model and the structural model of the migration participation. The latter evaluates the impact of the income gap corrected for selection bias.

##### *The income model*

Unlike the case of permanent migrants who live in Côte d'Ivoire, the seasonal migrants and the nonmigrants have similar monetary income sources because they cope with the same agroclimatic risks related to the semi-arid tropics (Reardon, Matlon, and Delgado 1988). Considering the total sample in rural Sahel, 57.6 percent of the survey households have farm activities<sup>18</sup> as the main source of their earnings whereas the off-farm and migration activities represent 42.4 percent. Remittances alone represent the main source of income in nearly a quarter of cases whereas other local off-farm activities stand for 20 percent (see table 3). The latter non-agricultural local income sources concerns primarily the nonmigrant households and is composed of non-livestock petty trade, gold panning, craft activities (making mats, baskets, and weaving), construction, sale of firewood, prepared food sale, transport, motorcycle and vehicle repair.

The truncated migration income distribution follows a nonlinear function (Greene, 2000) and incomes in the population are supposed lognormally distributed. The latter assumption is supported by the kernel density test of skewness and kurtosis and justifies the semi-logarithmic functional form with the natural logarithm of household annual income as the dependent variable. The latter includes income from crops, income from livestock, income from truck farming and all other off-farm incomes. It accounts for input costs and is constructed using observed (grain and livestock) prices in the villages both in 2002 and 2000, which allows controlling for the important differences in prices between the two rounds of the survey. The following econometric results are however

---

<sup>18</sup> This includes rain-fed agriculture, livestock husbandry and truck farming.

similar for both current income and income at constant prices, therefore I proceed with the former (see table 4).

**Table 2: Variables considered in the model for seasonal migration**

Labels of variables	Expected sign in migration decision
<b>Household level</b>	
Average age of household	(-)
Available labor force 2002	(+)
Dummy public school or literacy+	(+)
Level of mistrust+	(-)
Monogamist household+	(+)
Agriculturalist ethnic+	(+)
Household risk coping strategy is gold panning +	(-)
Income gap between seasonal and nonmigration choices	(+)
<b>Village level</b>	
Average area allocated to millet in the village	(+)
Low rainfall, dry oudalans+*	(+)
Medium rainfall, north seno+*	(+)
Density of households at village level	(+)
Income variance in 2000	(+)

Source: Own Survey.

+ indicates a dummy variable

\* The reference group is high rainfall

**Table 3: Sources of incomes**

Main source of income	Percentage of Sample households (CAPRI2)
Rainfall agriculture	0.40
Livestock farming	56.40
Migration activities	21.60
Craft industry	2.40
Truck farming	0.80
Retail trade	3.20
Paid activities including gold panning	11.20
Other	4.00

The independent variables simultaneously used for the SEM income and the migration decision equations (see table 2) are:

- Average area allocated to millet in the village that calculates the average per village of the mean area effectively allocated by households to millet production.

- Average age of household that is the average age of the adults above 12 years old.
- Available labor force 2002 that is the workforce the household can allocate to agropastoral activities.
- Low rainfall, dry Oudalan indicates a yearly rainfall level of 400 mm and corresponds to the driest region of Oudalan in the North of the survey zone.
- Medium rainfall, north Seno corresponds to a level of 450 mm per year.
- Dummy public school or literacy indicates whether any household member over 12 years old has been educated in a public school or has received training in local language literacy.
- Level of mistrust stands for the indicator of social or safety capital that takes the value 1 if the household never confides his livestock holdings to another person in the village as a result of mistrust. The level of trust adds to the social cohesion in a population and builds its social capital. Social capital refers to the various networks of relationships among economic and social actors and the values and attitudes associated with them. In short, it represents the “glue” that holds groups societies together (Putnam 1993). Halfinadi is an activity that consists in confiding one’s herd to another pastoralist household during the period of absence. Even though the shepherd is often remunerated in in-kind goods, a side effect is to foster trust between citizens, promote solidarity and reciprocity.

For identification of the selection equation, I used the density of households in the village that captures the expected positive effects of population density, and the marital status of the head of household as a monogam, which may influence the decision to move or not while the household size controls income for the available labor force. These identifying variables are all believed to strongly affect the chances for migration (the cost of migrating, the reservation income and therefore the net benefit) in the model but they may not influence the offer earnings. Although it is well known that for instrumental variables estimation, one requires a variable that is correlated with the endogenous variable, uncorrelated with the error term, and does not affect the outcome of interest conditional on the included regressors, identification in sample selection issues is often not as well grounded. Because the Inverse Mills Ratio (IMR) is a nonlinear function of the variables included in the first-stage probit model, then the second-stage earnings

equation is considered identified because of this non-nonlinearity even if there is no excluded variable.

The results in table 4 support that the earnings of seasonal migrant households are a positive function of the land area cultivated in the village for the main crop (millet), the labor force and the level of safety. Lower rainfall areas have also better income, indicating probably that other factors account for crop yields. However, income is negatively affected by the average age of household members. The likelihood of migrating is significantly dependent on income factors as well as village population density. The selection equation partially explains the unexpected effect of rainfall on income because lower rainfall is at the same time a regional dummy, which corresponds to the poorest lands in the Oudalan and the northern Seno. In the context of the dry and drought-affected zones of the Sahel, people prefer to diversify in non-local activities and then earn more of their income through migration (positive sign of lower rainfall). An alternative explanation is due to the technological innovation. Dutilly, Sadoulet and de Janvry (2003) found that stone bunds technology, used in the survey area for rainwater harvesting and soil erosion control, has the highest productivity impact in low rainfall areas. When rainfall is abundant, stone bunds retain too much water, depressing yields. This important finding motivates a special attention to the adoption of technology in designing sahelian development policy.

Another important finding is that the positive and significant effect of education passes through the channel of migration. The level of mistrust plays a negative role in migration indicating that pastoralist groups (mainly Fulbe, Gaobe and Bella ethnic groups) are less likely to move because they earn better income through livestock husbandry, especially when they are in a context where the delegation of the herd (during the slack season) to another villager is not safe.<sup>19</sup> The level of dead or stolen bovines found in the survey in case of delegation partly explains this result. Finally, the identifying variable (population density) plays a strong positive role on the chances of the household to migrate.

---

<sup>19</sup> The survey asked if the head of household can delegate his main activity of livestock farming to tierce persons in the village.

**Table 4: Heckman selection for seasonal migration**

	(1) <b>Logarithmic household total income in 2002 (2002 prices)</b>	(2) <b>Seasonal and nonmigrant household indicator</b>
Average area allocated to millet in the village	0.334 (2.64)***	0.236 (1.34)
Average age of household	-0.025 (-1.74)*	-0.051 (-2.98)***
Available labor force 2002	0.060 (3.42)***	0.075 (2.24)**
Low rainfall, dry Oudalan	0.825 (3.09)***	1.410 (5.12)***
Medium rainfall, north Seno	0.620 (2.26)**	0.712 (2.31)**
Dummy public school or literacy	0.225 (1.35)	0.797 (2.66)***
Level of mistrust	0.411 (2.01)**	-0.505 (-1.80)*
Density household		11.277 (3.44)***
Monogamist household		0.471 (1.29)
Constant	12.914 (25.66)***	-1.232 (-1.48)
Observations	203	203

z statistics in parentheses

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

Wald chi2(14) = 81.19

Prob > chi2 = 0.0000

Uncensored obs = 69

The parameters estimated under the earnings regression are the marginal effects of the regressors for the entire population. It should therefore be noted that the coefficients  $\beta$  can be used for inference only when analyzing the whole population. The marginal effects in the income regression for the subgroup of migrants are different from the estimated coefficients and can be obtained from equation (9)':

$$E\left[\log \frac{w_i}{V} > 0\right] = E[\log w_{fi}] = \beta_f X_{fi} + \rho \sigma_w \lambda_{fi} \quad (12)$$

It follows that the marginal change in income as one continuous independent variable changes, holding all other variables constant is:

$$\frac{\delta E(\log w_{fi})}{\delta x_i} = \beta - \gamma(\beta_\lambda) \delta_i^{20} \text{ where}$$

$$\delta_i = \lambda_i^2 - \psi \lambda_i, \quad \psi = -(\alpha' Z_i + \gamma' X_i)$$

It is necessary while studying migration to evaluate these quantities because it is quite possible that the magnitude, sign, and statistical significance of the real marginal effects might all be different from those of the Heckman estimate of  $\beta$  (Greene, 2000). The outcome depends on the level of all variables in the model and is evaluated by computing the marginal effect for each observation in the sample and then averaging across all values. Table 5 shows the sample average of the effects of partial or discrete changes in the explanatory variables. Contrary to standard arguments, average marginal effects (AME) are not asymptotically equivalent with marginal effects usually computed at sample means, the latter called marginal effects at the mean (MEM)<sup>21</sup> are not always good estimates of the first. The difference between AME and MEM increases actually with the variance of the linear prediction of the outcome variable.

The previous interpretations of the Heckman outcomes are confirmed in the case of a seasonal migrant household (see table 5) and now human capital effectively has the significant positive effect on income that were captured by the selection equation in table 4.

---

<sup>20</sup>  $\delta_i$  is strictly comprised between 0 and 1, playing then an attenuation role.

<sup>21</sup> There are situations where the sample means used during the calculations of MEM simply refer to either nonexistent or inherently nonsensical observations.

**Table 5: Marginal effects on seasonal migration income**

Average area allocated to millet in the village	0.400 (3.13) ***
Average age of household	-0.031 (-2.11) **
Available labor force 2002	0.066 (3.68) ***
Low rainfall, dry oudalans-	0.994 (3.70) ***
Medium rainfall, north seno-	0.708 (2.56) **
Dummy public school or literacy	0.313 (1.84) *
Level of mistrust	0.350 (1.69) *
Density household	1.405 (3.70) ***
Monogamist household	0.057 (1.25)
Observations	203

Notes: Marginal effects on E(income|mover==1) after heckman

z statistics in parentheses \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

- The marginal effects on these two variables are corrected for the fact that rainfall includes more than 2 categories: low, medium and the reference group (high rainfall).

It is now interesting to contrast these effects with the case of nonmigrant group. Tables A1 and A2 (see Appendix) show the income model for nonmigration and its marginal effects respectively, under the opposite assumption of households choosing not to participate into migration. The following table 6 summarizes the related marginal effects for both groups. It clearly appears that the seasonal migration strategy in addition to help diversifying against agroclimatic risks leads to better income results. Migrant households benefit more from the village endowment in millet lands because they can invest on their agricultural plots to enhance productivity. This finding supports the argument that income diversification through migration is not a barrier to agriculture so long as migrants' labor force is available during cultivation season and innovation is made accessible through easing liquidity constraints and inducing higher risk-taking. They suffer also more from age structure because older households can't profitably affect labor to migration. The nonmigrant has a comparative advantage in the impact of labor force on income. But households with migration strategy from the driest zones of the Sahel will have higher incomes. This outcome should be related to the unstable climatic conditions in the Sahel, which makes migration an important risk coping tool (Stark

1991). Given the condition of lower rainfall, households from the province Oudalan and northern Seno will have relatively higher propensity to migrate and those who are selected for migration have the highest impact on their income because they are able to better diversify their income sources. Another important result is that while population density favors income for migrant groups because it increases the likelihood of migrating through the related scarcity of local resources and social network effects, the effect will actually be negative for nonmigrant through congestion costs. This makes migration in the region a survival strategy.

Human capital seems not efficiently used in the local context while it has strong significant effect when households move to a more developed destination where the return to human capital is likely to be high, at least at household level. As explained above, the impact of level of mistrust is important only for migration project where migrant households who do not delegate their pastoral activities may have a better income.

**Table 6: comparison of marginal effects on income**

	Migrants	Nonmigrants	Relative advantage of migration strategy
Average area allocated to millet in the village	0.400***	0.228*	+0.172
Average age of household	-0.031**	-0.009~	-0.022
Available labor force 2002	0.066***	0.120***	-0.054
Low rainfall, dry oudalans-	0.994***	0.360~	+0.634
Medium rainfall, north seno-	0.708**	0.286~	+0.422
Dummy public school or literacy	0.313*	0.190	
Level of mistrust	0.350*	-0.066	
Density household	1.405***	-2.408***	+3.813
Monogamist household	0.057	-0.095	

~ indicates that the output is significant in the base model (Table A2-5)

statistics in parentheses\* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Now with the regression outputs of Heckman selection models for both selected and non-selected groups, one can estimate the income gap for each household conditional to his participation or not to migration. These results are now used to examine and compare the Todaro theory and the New Economics of Migration.

*The structural migration decision model*

Unlike the selection equation in the Heckman procedure that corresponds to a reduced form equation of migration participation, it is now important to evaluate the effect of the predicted income gap. Therefore, the logarithmic income differential between seasonal and nonmigration choices is used to study the structural model of migration where additional control variables are agriculturalist ethnic group, level of mistrust, available labor force in 2002, income variance in 2000, average age of household and its squared value, gold panning as an alternative risk coping strategy. Table 7 summarizes the expected incomes with and without migration project and a comparison test indicates there is a strong and significant difference between the two groups.

**Table 7: Joint test of difference between migrants (N=69) and nonmigrants (135)**

Variable	Mean_migration	Mean_nonmigration	t	P_value
expected benefit of migration	0.36	0.11	-4.35***	0.00
Conditional expected value of income (logarithm CFA francs)	13.68	12.96		

Source: Own calculations

Column 2 in Table 8 presents the average marginal effects on migration. Representing the average of partial and discrete changes over the observations, the computed marginal effects evaluate changes in the probability of migration. However, the computation of marginal effects on migration of an increase in age cannot hold all other variables constant, because its squared value is obviously not kept constant. The latter complication is accounted for and the total effect of age on the probability of migration includes both direct and indirect effects. The important difference in earnings found in Table 7 is confirmed in the semi-structural migration regression. Confirming the Todaro predictions, income gap appears to have the strongest impact on migration decision. A gain of 79158 CFA francs in income gap, which represents 10 percent of the sample mean income and would result from the benefits of UEMOA that accrue to the winner Côte d'Ivoire, would induce an increase of 6.3 percentage points in migration participation. This represents some 18.6 percent increase in seasonal migration, from a sample level of 33.82 percent to 40.12 percent of the households. In a similar way, the

results support the New Economics of Migration, through the strong significant impact of income risk. If a village experienced important income instability in 2000, this enhances the current practice of seasonal migration, as a coping strategy. A very important result however is that, an increase in the level of mistrust among households of only 10 percentage points (insecurity in livestock activities) would decrease the probability of migration by 3.2 percentage points. Traditionally Fulbe, Gaobe and bella ethnic groups are known as pastoralists and very reluctant to migration abroad, therefore if delegation of livestock is not safe, it is obvious that this will increase the incentives to stay home for these groups. Hampshire (2002) documented the centrality of cattle and herding to Fulbe identity. On the other hand, the cultivators groups (Rimaibe, Mallebe and Mossi) as confirmed by the positive effect of the variable “Agriculturalist ethnic group” are more accustomed to coping with cropping risks through migration strategy. Labor force as already discussed also increases the participation to migration.

To summarize, the most appealing results are the role of microeconomic theories of migration and the social capital factor in explaining seasonal migration in the Sahel. The confirmation of Todaro’s prediction means that the income gain in Côte d’Ivoire relative to the counterfactual of staying home has a strong positive effect on households’ decision to migrate. There are two channels that attested the NEM. First, under low and uncertain rainfall conditions, the reduced form equation shows that households diversify incomes toward non-local migration. A second way of attesting the risk management strategy is that income variance enhances the propensity to migrate. However, a whole group of households, the pastoralists do not have access to this important income diversification and risk coping strategy because they can’t safely leave their livestock behind. Livestock is a self-insurance mechanism that is also depleted in the face of agroclimatic shock and drought-induced cropping short-falls. It is therefore important to develop local labor market that allows households to hire shepherd services under secured conditions.

**Table 8: Structural model of decision to migrate**

	(1)	(2)
	Seasonal and nonmigrant household indicator	Marginal effects on Prob(migration) after probit
Income gap	2.265 (5.50)***	0.559 (7.16)***
Agriculturalist ethnic group	0.517 (2.31)**	0.129 (2.36)**
Level of mistrust	-1.504 (-4.83)***	-0.324 (-6.60)***
Available labor force 2002	0.177 (4.33)***	0.044 (4.97)***
Income variance in 2000	1.09e-12 (1.70)*	1.13e-18 (24.79)***
Average age of household	0.013 (0.09)	0.003 (0.09)
Squared Average age of household	-0.00013 (-0.07)	
Household risk coping strategy is gold panning	-0.281 (-0.76)	-0.067 (-0.78)
Constant	-2.441 (-0.91)	
Observations	203	203

z statistics in parentheses

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

Scalar measures of fit:

Prob &gt; chi2 = 0.0000

Pseudo R2 = 0.3188

Count R2<sup>22</sup>: 0.833

Adj Count R2: 0.507

McKelvey and Zavoina's R2: 0.514

## 5. Conclusion

This paper constitutes the first empirical work on migration decision inside UEMOA. The results confirmed the prediction of the Todaro model as well as gave support to risk pooling factors as recently emphasized by the NEM.

Results supported that even under the pessimistic scenario where the direct benefits of the regional integration program would go exclusively to the polar countries such as Côte d'Ivoire, households in the West African Semi-Arid Tropics (in particular

---

22 Constructed using observed and predicted values of the model. As suggested by Long and Freese (2001) this is corrected for the largest row marginal.

the Sahel) may still benefit from an increased economic attractiveness of this destination. Therefore, it can be inferred that under the conditions that polar countries in the UEMOA allow for free movement of rural labor, an increased income gap of a magnitude of 10 percent of the Sahelian average income would induce an increase of 6.3 percentage points in migration participation. Because it is seasonal, the increased migration will translate into higher liquidity that enables households to overcome credit and insurance market failures and invest in their main agropastoral activities. At the same time, households are able to smooth their consumption, which in the local context is subject to high uncertainty. The latter is shown in the results in two different ways. On the one hand, important income instability in the preceding period enhances the practice of seasonal migration. On the other hand, under low rainfall conditions, households preferably diversify incomes toward non-local migration. Migration is an important survival mechanism in the regions confronted with congestion costs and scarcity of natural resources because of the high population densities.

An interesting finding is the role of security in livestock activity. An increase in the level of mistrust among households of only 10 percentage points (insecurity in livestock activities) would decrease the probability of migration by 3.2 percentage points. Because livestock is a widespread self-insurance mechanism in the region, it is important to develop policies that address security issues and policy makers can achieve this through institutions that develop rural labor market and enforceable rules regarding shepherd contracts called Halfinadi in the Sahel. These are contracts under which households confide their herd to another household who guards the cattle against money or in-kind remuneration. The differentiated effects on ethnic groups and places of origin suggest a research question about the selection patterns of the different migration types (seasonal and permanent migrations). This implies a comparative analysis of different regions of origin in Burkina Faso.

Other factors explain seasonal migration decision positively through the affiliation to the (short-growing-season) agriculturalist ethnic group, the availability of extra-labor force, education, population density and negatively through age.

Under the assumption that a household adopts migration strategy, its income is also negatively affected by age. Other variables that affect the total income of migrant

households are the availability of crop lands, the household's labor force, lower rainfall, education, social capital and population density. The rainfall and land availability positive effects are explained by the agricultural investments made possible through the channel of remittances. This finding suggested the important relationship between migration and technological innovation.

Finally the paper showed the remarkable importance of migration to the survival of landlocked Sahelian countries in UEMOA. An extension of the current study is to consider a counterfactual comparing the income prospects of migrant households with and without remittances, the latter considered as substitute for home earnings (Barham et Boucher 1998). The approach allows mitigating the optimistic assumption about migration benefits and considers the impact of the recent Ivorian crisis on the return migration prospects.

## REFERENCES

- Agesa, J., and R.U. Agesa. 1999. Gender Differences in the Incidence of Rural to Urban Migration: Evidence from Kenya. *The Journal of Development Studies* 35(6): 36-58.
- Bardhan, P., and C. Udry. 1999. *Development Microeconomics*. Oxford: Oxford University Press, 236p.
- Barham, B., and S. Boucher. 1998. Migration, remittances, and inequality: Estimating the net effects of migration on income distribution. *Journal of Development Economics* 55: 307–31.
- Barro, R.J., and X. Sala-i-Martin. 1995. *Economic growth*. Cambridge, Massachusetts, London, England: The MIT Press. 544p.
- Borjas, G.J., and R.B. Freeman. 1992. *Immigration and the Workforce: economic consequences for the United States and source Areas*. A NBER Project Report, University of Chicago Press: Chicago and London.
- Claude J., M. Grouzis, and P. Millville. 1991. Un espace Sahélien : La mare d'Oursi, Burkina Faso. Paris : ORSTOM.

- Cordell, D. D., J.W. Gregory, and V. Piché. 1996. *Hoe and Wage. A social history of a circular migration system in West Africa*. Boulder, CO: Westview Press.
- Decaluwé, B., J-C. Dumont, S. Mesplé-Somps, V. Robichaud. 2000. *Union économique et mobilité des facteurs: le cas de l'UEMOA*.
- <http://www.crefa.ecn.ulaval.ca/cahier/liste00.html>
- De la Brière, B., E. Sadoulet, A. De Janvry, and S. Lambert. 2002. The role of destination, gender, and family composition in explaining remittances: An analysis for the Dominican Sierra. *Journal of Development Economics* 68 (2): 309–28.
- Dutilly-Diane, C., E. Sadoulet, and A. de Janvry. 2003. How improved natural resource management in agriculture promotes the livestock economy in the Sahel. *Journal of African Economies* 12:343–70.
- Ghatak, S., P. Levine., and S.W. Price. 1996. Migration Theories and Evidence: An assessment. *Journal of Economic Surveys*, 10(2): 159-197.
- Greene, W.H. 2000. *Econometric Analysis*, New Jersey, Prentice-Hall International, Inc.
- Grether, J-M., J. De Melo., and T. Müler. 1999. Réflexions sur la non-équivalence entre politiques migratoires et politiques commerciales. In A. Bouët et J. Le Cacheux (éds.), *Globalisation et politiques économiques: les marges de manœuvre*, Paris, Economica : 427-448
- Gubert, F. 2000. *Migration et gestion collective des risques. L'exemple de la région de Kayes (Mali)*. Université d'Auvergne Clermont Ferrand I. CERDI.
- Hamilton, B. and J. Whalley. 1984. Efficiency and Distributional Implications of Global Restrictions on Labour Mobility: Calculations and Policy Implications. *Journal of Development Economics*, 14: 61-75.
- Hampshire, K. 2002. Fulani on the Move: Seasonal Economic Migration in the Sahel as a Social Process. *The Journal of Development Studies* 38 (5): 15-36.
- de Haan, A., K. Brock, N. Coulibaly. 2002. Migration, Livelihoods and Institutions: Contrasting Patterns of Migration in Mali. *The Journal of Development Studies*. 38(5): 37-58
- Harris, J., and M.P. Todaro. 1970. Migration, Unemployment and Development: a Two-Sectors Analysis. *American Economic Review* 60: 126-142.

- Harris, R. and N. Schmitt. 2003. The consequences of increased labor mobility within an integrating North America. In *North American linkages: Opportunities and challenges for Canada*. Edited by R. Harris, pp. 313-352.
- Heckman, J. 1979. Sample selection bias as a specification error. *Econometrica* 47: 153-161.
- Lalonde, R.J. and R.H. Topel. 1997. Economic impact of international migration and the economic performance of migrants. In: *Handbook of population and family economics*, eds : Rosenzweig M.R. and Stark O.: 799-847.
- Long, J.S., and J. Freese. 2001. *Regression models for categorical dependent variables using Stata*. College Station, Texas: Stata Press.
- Lucas, R.E.B. 1988. *Migration from Botswana*. Economic Journal. 95:358-82.
- Markusen, J. R. 1983. *Factor Movements and Commodity Trade as Complements*. Journal of International Economics 14: 341-356.
- Nakosteen, R.A., and M.A. Zimmer. 1980. Migration and Income : The Question of Self-Selection. *Southern Economic Journal* 46: 840-851.
- Perloff, J. M. 1991. The Impact of Wage Differentials on Choosing to Work in Agriculture. *American Journal of Agricultural Economics* 73(3): 671-80.
- Perz, S. G. 2000. Household Demographic Factors as Life Cycle Determinants of Land Use in the Amazon. 2000 Meetings of the Latin American Studies Association, Hyatt Regency Miami, March 16-18. <http://136.142.158.105/Lasa2000/Perz.PDF>
- Putnam, R. 1993. *Making democracy work. Civic traditions in modern Italy*. Princeton: Princeton University Press. Quoted in Ziemek, S. M. 2003. *The Economics of volunteer labor supply. An application to countries of a different development level*. Development Economics and Policy series edited by Heidhues, F. and J. von Braun. Frankfurt am Main: Peter Lang.
- Razin, A., and E. Sadka. 1997. International migration and international trade. In: *Handbook of population and family economics*, eds: Rosenzweig M.R. and Stark O.: 851-887.

- Reardon T., P. Matlon, and C. Delgado. 1988. Coping with Household-level Food Insecurity in Drought-Affected Areas of Burkina Faso. *World Development*, 6 (9): 1065-1074.
- Stark, O. 1991. *The Migration of Labor*, Oxford: Basil Blackwell Inc., 406 p.
- Stark O. 2003. Tales of migration without wage differentials: Individual, family, and community contexts. ZEF-Discussion Papers on Development Policy No. 73, Center for Development Research (ZEF), <http://www.zef.de/publications.htm>, 13 p.
- Todaro, M. P. 1969. A Model of Labour Migration and Urban Unemployment in Less Developed Countries. *American Economic Review* 59 (1): 138-148.
- Yeats, A.J. 1998. What can be expected from African Regional Trade Arrangements? Some empirical evidence. *World Bank*,  
<http://www.worldbank.org/html/dec/Publications/WorkPapers/wps2000series/wps2004/wps2004-abstract.html>
- Zanou, B. 2001. Migrations. Rapport d'Analyse du RGPH-98. Institut National de la Statistique (INS) Côte d'Ivoire.
- Zhu, N. 2002. The impacts of income gap on migration decisions in China. *China Economic Review* 113: 1-18.

## APPENDICES

### Model of nonmigration

**Table A1: Heckman nonselection model for nonmigrant households**

	(1) Logarithmic household total income in 2002 (2002 prices)	(2) Choice of not to migrate
Average area allocated to millet in the village	0.312 (2.81)***	-0.236 (-1.34)
Average age of household	-0.020 (-1.63)*	0.051 (2.98)***
Available labor force 2002	0.137 (4.62)***	-0.075 (-2.24)**
Low rainfall, dry oudalan	0.670 (2.44)**	-1.410 (-5.12)***
Medium rainfall, north seno	0.426 (1.94)*	-0.712 (-2.31)**
Dummy public school or literacy	0.388 (1.39)	-0.797 (-2.66)***
Level of mistrust	-0.170 (-0.92)	0.505 (1.80)*
Density household		-11.277 (-3.44)***
Monogamist household		-0.471 (-1.29)
Constant	12.359 (23.71)***	1.232 (1.48)
Observations	203	203

z statistics in parentheses

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

Wald chi2(14) = 91.90

Prob > chi2 = 0.0000

Uncensored obs = 134

**Table A2: marginal effects on nonmigration income**

Average area allocated to millet in the village	0.228 (1.94)*
Average age of household	-0.009 (-0.70)
Available labor force 2002	0.120 (3.93)***
Low rainfall, dry oudalan	0.360 (1.27)
Medium rainfall, north seno	0.286 (1.25)
Dummy public school or literacy	0.190 (0.65)
Level of mistrust	-0.066 (-0.34)
Density household	-2.408 (-3.39)***
Monogamist household	-0.095 (-1.43)
Observations	203

Notes:

Marginal effects on  $E(\text{income}|\text{stayer==1})$  after heckman

$z$  statistics in parentheses

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