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Household migration decisions as survival strategy: the case of Burkina Faso

ZEF Discussion Papers on Development Policy, No. 105

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Suggested Citation: Konseiga, Adama (2006) : Household migration decisions as survival strategy: the case of Burkina Faso, ZEF Discussion Papers on Development Policy, No. 105, University of Bonn, Center for Development Research (ZEF), Bonn

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Adama Konseiga

Household Migration Decisions as Survival Strategy: The Case of Burkina Faso

Number
105

ZEF – Discussion Papers on Development Policy
Bonn, April 2006

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Adama Konseiga: Household Migration Decisions as Survival Strategy: The Case of Burkina Faso, ZEF – Discussion Papers On Development Policy No. 105, Center for Development Research, Bonn, April 2006, pp. 36.

ISSN: 1436-9931

Published by:
Zentrum für Entwicklungsforschung (ZEF)
Center for Development Research
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Abstract

The paper examines the basic determinants behind the process of migration from Burkina Faso to Cote d'Ivoire. It uses a detailed household survey dataset on migration, natural resource management, risk management and solidarity collected in 2000 and 2002 in Northeastern Burkina Faso. In addition, two other village and institutional level surveys were conducted. The methodology emphasizes the link between economic theories and empirical evidence, using econometric tools that are robust to the selection bias. This enables to investigate the specificities of the seasonal migration and to estimate migration incomes.

The structural model of migration decision revealed the importance of migration as a mere survival strategy in the study regions. Results showed that even under the pessimistic scenario where the direct benefits of the regional integration program would go exclusively to the leading economy, households in the Sahel may benefit from an increased economic attractiveness of this destination. Owing to the fact that the migration 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 agro pastoral activities. Additionally, the role of the unsecured livestock activity acts as an 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.

Kurzfassung

In diesem Papier werden die Hauptgründe für die Migration von Burkina Faso in die Elfenbeinküste untersucht. Dabei wird ein detaillierter Haushaltsdatensatz verwendet, der Daten zu Migration, natürlichem Ressourcenmanagement, Risikomanagement und Solidarität enthält, die in den Jahren 2000 und 2002 im nordöstlichen Teil von Burkina Faso erhoben wurden. Zudem sind zwei andere Erhebungen auf der Dorfebene und der institutionellen Ebene durchgeführt worden. Die Methodologie betont den Zusammenhang zwischen ökonomischen Theorien und empirischen Belegen, indem ökonometrische Instrumente verwendet wurden, die robust sind gegen die Selektivität der Stichprobe. Dies ermöglicht die Untersuchung der Ausprägungen der saisonalen Migration und die Abschätzung der zu erwartenden Migrationszuflüsse.

Das strukturelle Modell zur Migrationsentscheidung verdeutlicht die Bedeutung von Migration als reiner Überlebensstrategie in den untersuchten Regionen, die durch schwerwiegende Knappheit von natürlichen Ressourcen gekennzeichnet sind. Die Ergebnisse zeigen, dass selbst bei einem pessimistischen Szenario, bei dem die direkten Vorteile des regionalen Integrationsprogramms ausschließlich der stärksten Ökonomie in dieser Region zugute kämen, Haushalte in der Sahelzone immer noch von einer erhöhten ökonomischen Attraktivität dieses Bestimmungsortes profitieren könnten. Aufgrund der Tatsache, dass die Migration saisonbedingt ist, trägt die gesteigerte Migration zu einer Verbesserung der Liquidität bei, welche es den Haushalten ermöglicht, das Marktversagen in den Bereichen Kredit und Versicherung zu überwinden und in ihre wichtigsten ökonomischen Aktivitäten zu investieren. Zudem stellt die Rolle der ungesicherten Viehwirtschaft ein Hindernis für die Migration von ländlichen Gruppen dar. Die Ergebnisse der Studie legen die Entwicklung von Maßnahmen nahe, die durch die Etablierung gut funktionierender ländlicher Arbeitsmärkte und durchsetzbarer Rechte der Schäfer Einkommenssicherheit schaffen. Zudem ist es wichtig, regionale Gesetze hinsichtlich der freien Bewegung von Arbeit durchzusetzen.

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. However, what makes poor countries economic situation worse is that whatever quantities of human capital are formed; a certain proportion is lost through the migration leakage. Even though it is generally recognized that migration benefits are dampened with the above brain-drain phenomenon, Barro and Sala-i-Martin (1995) view the brain loss as an extreme case that is likely to offset the benefits only in conditions of crumbling empires.

In recognition of the importance of labor migration, the West African Economic and Monetary Union (UEMOA)[1] revised in 2003 its treaty to reinforce the existing clauses favoring the free movement of labor. The new treaty abolished all kind of discrimination against members in the Union labor market, exception made for civil servant positions. It recognized the right of residence and right of establishment and free entrepreneurship of any citizen in all member-States. Yet, one year later in February 2004, obstacles to the implementation of these regulations appeared with the Ivorian law for national preference concerning access to employment in the private sector. Not only that the latter provisions discriminate against all foreigners including member states, it also urges enterprises to achieve in a very short run (two years maximum) a complete nationalization of employment. The new law will add to the administrative obstacles and restrictive migration policies that migrants already faced. In general, the worsening sociopolitical crisis in Côte d'Ivoire remains a critical threat to the integration process. Recent changes in the regional migration pattern are observed, especially an important (economic-driven and forced) return migration to Burkina Faso.

Even under the perspective of a long run increased factors' mobility in UEMOA, Decaluwé, Dumont, Mesplé-Somps, and Robichaud (2000) concluded that Burkina Faso could be the main loser in the regional integration because its labor and capital are moving into Côte d'Ivoire. In Burkina Faso where agriculture and livestock farming involve 87 percent of the active population, the exodus of farmers could result in important loss of agricultural production.

1 Member countries are Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo.

Obviously, the latter conclusion does not take into account the mitigating economic effects of migration that occur through human capital formation, technology diffusion, remittances, creation of business and trade networks, and return migration.

Considering household units, the New Economics of Labor Migration (NELM) shows that the easing of the surplus and risk constraints is a crucial condition for the small farmer to carry out desired technological change. 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. The resulting benefits are expected to be stronger in the case of seasonal migration as opposed to geographically distant and permanent migration. First, 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 prevent the household from moving toward the local high-return activity. The adverse effect of lost labor[2] may be higher when migration is permanent and migrants tend to be younger and better educated than an average rural laborer. Second, 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 (Hampshire 2002). 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). In their case study of 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 cocoa farms in Côte d'Ivoire but still cultivate cotton and grain during the short sahelian rainy season. The main economic activities in North-East Burkina Faso (Seno-Oudalan) and in the Sahel in general are extensive pastoralism and rain fed agriculture, which is only possible in the short rainy season July-September (Claude, Grouzis and Millville 1991).

The current paper aims to shed light on the motivations for sahelian seasonal migration and to allow a better understanding of its welfare implications. Migration activities play a central role in the decision of Burkina Faso to participate profitably in a regional common market. Burkina Faso is the largest supplier of migration labor to Côte d'Ivoire. 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 since the 1960s, the labor mobility responded to strong demographic and economic differences

between the two countries and has been reinforced by the constitution of regional and common currency blocks. Farmers 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 strategy in the current study is twofold. First, I develop a simple 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 NELM, migration is no more solely an individual decision but rather a decision made at household level. Beyond income gap[3], 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).

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. 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 NELM. 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 same section. I close the study by drawing the main conclusions and subsequent research perspectives.

[2] 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.
[3] Migration is fundamentally dissimilar to the flow of water, which will always be observed in the presence of height differentials.

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 especially in the case of West Africa and it is therefore a key-issue that the current paper analyzes the determinants of migrants' and nonmigrants' income and the effect of subsequent income gap in the structural model of the decision to migrate. Following the seminal work of Todaro, it is admitted that 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:

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

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 employment abroad and C, the approximation for the economic and psychological cost of the migration.

Migration will take place only if $\boldsymbol{V}$ 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 $L_f + MN_h$.. N_h is the home country active population and M the rate of migration. L_f and N_h are exogenous values so that:

$$p = \frac{\overline{L}_f}{\overline{L}_f + M\overline{N}_h}.$$

The underlying assumption is that of full employment in the attractive destination before migration occurs. 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 (Own survey CAPRi[4] 2002).

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

$$M = \left[\frac{w_f - w_h - rC}{rC - w_h} \right] \frac{L_f}{\overline{N}_h} \quad (4)$$

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

[4] Collective Action and Property Rights (CAPRi) is a System-Wide Program and one of several intercenter initiatives of the Consultative Group on International Agricultural Research (CGIAR). The first round of the survey was conducted in 2000 and concerned a larger sample of 401 households.

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

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. This result could be dampened 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). Borjas and Freeman (1992) 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.

An alternative to the view that migration decision is simply a response to a foreign-domestic wage differential has been brought by the NELM. 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 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 dynastic. 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. A recent development of the literature on motivations 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 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.

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 at the same time to minimize risks (strategy of risks pooling). The individual migrants participate in the households' strategy against different markets failures problems. Many migratory events 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. 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 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).

Ghatak, Levine and Price (1996) formalized some of the premises of the NELM by generalizing the above HT model. The idea that migration results from a family's optimizing decisions implies a choice concerning which[5] family member(s) migrate to maximize remittances to the home family. As long as the family can induce income transfers among its members, it will send family members abroad to maximize the family's net wealth. 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).

Let the utility of a representative family be *U(Y)* where *Y* is income and *U* is a concave utility function with $U' > 0,\ U'' < 0$.[6] 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 $\boldsymbol{M}.\overline{\boldsymbol{N}}_{\boldsymbol{h}}$ 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.

[5] A family that seeks to increase the likelihood of its migrant to find a job may invest in the migrant's skills.
[6] A concave utility function embodies an assumption of risk-averse households.

Let $\widetilde{w}_f = w_f - rC$ be the net foreign wage after paying for migration costs. Then the family maximizes his expected per period utility:[7]

$$E\left(U\left(Y\right)\right) = pU\left(M\widetilde{w}_f + \left(1-M\right)w_h\right) + \left(1-p\right)U\left(\left(1-M\right)w_h\right) \tag{6}$$

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

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

provided that the right hand side of (7) lies in the bounded interval $[0,1]$. Under the condition that $\widetilde{w}_f > w_h$, migration takes place (i.e., $M \geq 0$) if and only if $p(\widetilde{w}_f - w_h) \geq (1-p)w_h$ meaning that $w_h \leq p\widetilde{w}_f$ is also the condition for any migration at the household unit level. Finally, the substitution of the probability of obtaining employment $p = \frac{\overline{L}_f}{\overline{\overline{L}_f + M\overline{N}_h}}$ 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. Even within the latter framework, 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. 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 Müller (1999) argued similarly that trade in goods and trade in factors of production are two different ways to exchange factors services.[8] There is actually little integration of Burkina Faso into UEMOA in terms of trade so that regional integration is not appealing in

[7] It is then assumed that with probability (1-p), the unemployed migrants receive no income and therefore the nonmigrant 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 the 2002 survey.

[8] See also Harris and Schmitt (2003) for a review of recent theoretical developments on trade as a complement to international mobility of labor.

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 hand, Côte d'Ivoire supplied 25 percent of all sub-Saharan African regional exports (Yeats 1998). According to Decaluwé, Dumont, Mesplé-Somps, and Robichaud (2000), in 1995 Cote d'Ivoire's share in UEMOA regional exports was 10% whereas its imports from the other Union members represented only 0.8% of the total imports. A more meaningful integration index for the region should 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

International migration of labor is not well documented 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. The latter is the focus of the empirical work in this section. Typically, seasonal migrants are men who leave following the harvest, are away for much of the dry season and move back to rural areas to work in agricultural production in the peak rainy season. 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[9] 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 to 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).

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

[9] Economic activities at the destination range from the very lucrative trade in livestock to temporary wage labor, informal self-employment and to begging.

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 ρ. 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 in equations (8)' and (9-10)' below.

Selection model:

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

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

$\boldsymbol{Z}_i$ and $\boldsymbol{X}_i$ represent the independent variables of the selection equation identification and those of the income equation respectively.

Income model:

$$\log w_i = \beta' X_i + \beta_\lambda \lambda_i + \nu_i \qquad (9\text{-}10)'$$

where the following relationship exists between the coefficient of the inverse Mills' ratio λ 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 (f(Ag)/F(Ag)) from the selection equation model. Similarly in modeling nonselection model, the natural choice for the nonselection hazard or the inverse of Mills' is the standard form for the hazard f(Ag)/(1-F(Ag)) from the nonmigration model. This is equivalent in writing f(Ag)/F(Ag). It is a different computation that arrives at the same value because the Gaussian is symmetric. Ag are obtained from the probit estimation on whether the net benefit of moving is observed. Heckman (1979) argues that the IMR 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 α and γ and compute the inverse Mills' ratio. At a second step of the Heckman procedure, the inverse Mills' ratio is added to the earnings equation to produce the consistent estimates of β and β_λ. 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 NELM respectively using the expected income gap for each household and the risk-related covariates.

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

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 at destination and sending zones. 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. 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. Burkina Faso is a Sahelian agricultural country where agriculture and livestock farming are the main contributors to the gross domestic product and play a fundamental role in the development strategy of the economy. However, for several decades now, drought and rainfall instability degraded the natural resources in the region, rendering farming uncertain. To respond to the increasing poverty in the region, policy-makers engaged in programs for land resources conservation since late 1980s. The principal objective of the CAPRi 2000 survey was to evaluate their impact. The study was conducted in one of the most drought-affected area, the northeastern region of the provinces of Seno and Oudalan. This region is characterized by a Soudano-Sahelian climate with an average annual rainfall estimated at 350-600 mm and is therefore devoted mainly to livestock farming. The study objective was to measure the impact of the various PSB/GTZ projects and programs on natural resource management and household livelihood strategies (McCarthy, Dutilly-Diane, and Drabo 2002). Thus, communities were stratified into four categories on the basis of the length of participation in various PSB/GTZ programs, as follows: villages treated by GTZ before 1996 (13), villages that entered the program between 1996 and 1999 (12), new GTZ's villages (9) and a group of control villages which have never worked with GTZ (14). Data were collected in all the 48 villages of four administrative regions (Gordadji, Dori, Gorom and Bani) at the community, institutional, household and market levels. Because livestock is the primary cash income generating activity in this region and because the first round survey was interested particularly in the use and management of common pastures and herd mobility, household is

defined as comprised by all individuals whose livestock income depends on the same herd. The main sections of the household survey questionnaire were: household demographic characteristics (composition, age, education), crop and animal production, annual income by source (agriculture, off-farm local, migrant remittances), and household members' participation in community-based organizations and natural resource management activities. Then, a total of 401 households were interviewed in 2000. The communities comprised 91 households on average, with 9 individuals per households, including 3.5 children under 12 years holds. The main ethnics groups are Rimaibe, Fulbe and Bella with a large proportion of transhumant.

The results of the first round survey revealed important migrations in the region, especially toward Côte d'Ivoire: 39 percent of households were concerned and remittances represented more than one quarter of households cash income. For a sustainable livelihood strategy, households actually rely primarily on the important role of an optimal mix between agriculture and livestock, the income diversification and the improvement of productivity. While the first round focused on collective action in natural resource management, the importance of migration induced the second round survey to consider two strata in 2002: migrant households and a control group of nonmigrants, using the 2000 sampling frame. The survey sample has then been constituted randomly to make sure that CAPRi 2002 respects the heterogeneity of characteristics and selects both migrant households and those who did not sent migrant internationally. A migrant household is defined by the following characteristics: at least one person above 12 years old who was previously a member of the household or simply a relative (in this case should have kept contact with the household) has left to live or work temporarily elsewhere. It is expected that the family who has a member abroad may change their economic behavior. Households that sent migrants abroad might invest and consume more on average. The stratified random sampling improves the precision of the estimates and reduces bias that could come from non-response of the migration questions.

In 2002, 9 enumerators participated in the survey, grouped together in three teams with a leader. The latter is responsible of administering the village and institutions levels survey and holds a role of coordinator in the conduct of the survey. Before interviews, 250 households were sampled using the sampling frame of the first round.[10] After first data cleaning and editing, corrections were made for the outliers. The total final 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. It ensures that migration is not incompatible with continuing involvement with agro pastoral production. Crosschecking of the seasonal status was made through a direct question about migrants' return plan. Hampshire (2002) finds that the Fulani, main ethnic group of Seno-Oudalan[11], has a median length of time spent away of five months and she defined a notion of short-term, non-local economic migration

[10] 401 households were randomly selected in 2000 from the population census conducted by the PSB/GTZ project extension workers.

[11] Comprised of Fulbe and Rimaibe, the Fulani represent a quarter of the population in the study area (Institut National de Statistique et Démographie 1994).

called "exode" that is a movement for duration of between one month and two years. This compares to the average length of stay in the CAPRi dataset, which is 7 months when it is the head of household who migrates.

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 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. The latter group represents only 5 percent of the sample who mainly migrate to Burkinabè cities. Among the 102 migrant households to Côte d'Ivoire, while 14 cases have contact with a relative who is external to the household composition, 69 are defined as seasonal migrants because the migrant returned yearly home for the 3 months of labor-intensive agricultural activities. The remaining 19 migrant households are permanent migrants who established durably in Côte d'Ivoire. 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 latter group generally can just get positions that do not interest native Ivorian whereas the former asserted that they earn a much better living than the local community does. This explains probably part of the frustrations and clashes between the two communities.

Table 1: Sample Structure

Flow direction	Seasonal Migrants	Permanent Migrants	Other migrants
Burkina Faso to Côte d'Ivoire	69	19	14*
Burkina Faso to other direction			13
Nonmigrants (Reference group)		135	
Total Sample	204	154	

*Non-membership to the household.

In total, the potential estimation sample for the current 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 case wise 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, 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. Table A1 in appendix shows the summary statistics of independent variables for the entire sample and for the seasonal, permanent and nonmigrant households.

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 agro climatic 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[12] 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 log normally 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

[12] This includes rain-fed agriculture, livestock husbandry and truck farming.

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 in 2000, which allows controlling for the important differences in prices between the two rounds of the survey. The following econometric results are however 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**
Household level	
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	(+)
Village level	
Average area allocated to millet in the village	(+)
Low rainfall, dry oudalan+*	(+)
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)**
Household level	
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 agro pastoral 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 because 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 (monogamic), 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-Diane, 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.[13] 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.

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

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

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

$$\frac{\delta E(\log w_{fi})}{\delta x_i} = \beta - \gamma(\beta_\lambda)\delta_i$$ [14] where

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

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 β (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)[15] 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 was captured by the selection equation in Table 4.

[14] δ_i is strictly comprised between 0 and 1, playing then an attenuation role.

[15] 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 oudalan-	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 A2 and A3 (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 agro climatic 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 cannot 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 individual 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 oudalan-	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 A3)
Statistics in parentheses* Significant at 10%; ** significant at 5%; *** significant at 1%

Now with the regression outputs of Heckman 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	13.68	12.96		

Source: Own calculations. 0.36 indicates the average predicted income surplus for a migrant household. All values are in logarithm CFA francs.

Column 3 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. Two channels attested the NELM. 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 cannot safely leave their livestock behind. Livestock is a self-insurance mechanism that is also depleted in the face of agro climatic shock and drought-induced cropping shortfalls. 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) Seasonal and nonmigrant household indicator	(2) Marginal effects on Prob(migration) after probit
Income gap	2.265	0.559
	(5.50)***	(7.16)***
Agriculturalist ethnic group	0.517	0.129
	(2.31)**	(2.36)**
Level of mistrust	-1.504	-0.324
	(-4.83)***	(-6.60)***
Available labor force 2002	0.177	0.044
	(4.33)***	(4.97)***
Income variance in 2000	1.09e-12	1.13e-18
	(1.70)*	(24.79)***
Average age of household	0.013	0.003
	(0.09)	(0.09)
Squared Average age of household	-0.00013	
	(-0.07)	
Household risk coping strategy is gold panning	-0.281	-0.067
	(-0.76)	(-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 > chi2 = 0.0000
Pseudo R2 = 0.3188
Count R2[16]: 0.833
Adj Count R2: 0.507
McKelvey and Zavoina's R2: 0.514

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

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 NELM.

Results supported that even under the pessimistic scenario where the direct benefits of the regional integration program would go exclusively to the economically leading countries such as Côte d'Ivoire, households in the West African Semi-Arid Tropics (in particular the Sahel) may still benefit from an increased economic attractiveness of this destination. Therefore, it can be inferred that under the conditions that economically leading 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 agro pastoral 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 specific research concerning 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 croplands, 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. The latter finding suggests an 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 considering the impact of the recent Ivorian crisis on the return migration prospects.

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Appendix

A1 Sample statistics

Table A1: Descriptive Statistics (Seasonal, Permanent and Nonmigrant)

Variable	Migration strategy	N	Percent missing	Mean	Standard Deviation
Average area allocated to millet in the village	Nonmigrants	135	0.00	1.48	0.76
	Seasonal	69	0.00	1.52	0.54
	permanent	19	0.00	1.39	0.50
	Entire sample	250	0.00	1.47	0.68
Average age of household	Nonmigrants	135	0.00	37.14	7.75
	Seasonal	69	0.00	33.11	5.66
	permanent	19	0.00	34.08	6.21
	Entire sample	250	0.00	35.57	7.14
Available labor force 2002	Nonmigrants	135	0.00	5.71	2.77
	Seasonal	69	0.00	7.30	4.16
	permanent	19	0.00	8.26	3.19
	Entire sample	250	0.00	6.43	3.40
Low rainfall, dry oudalan +	Nonmigrants	134	0.74	29.10	
	Seasonal	69	0.00	62.32	
	permanent	18	5.26	50.00	
	Entire sample	248	0.80	40.73	
Medium rainfall, North Seno+	Nonmigrants	134	0.74	22.39	
	Seasonal	69	0.00	24.64	
	permanent	18	5.26	22.22	
	Entire sample	248	0.80	24.60	
Dummy public school or literacy+	Nonmigrants	135	0.00	9.63	
	Seasonal	69	0.00	27.54	
	permanent	19	0.00	21.05	
	Entire sample	250	0.00	17.60	
Density household	Nonmigrants	134	0.74	0.04	0.03
	Seasonal	69	0.00	0.05	0.05
	permanent	18	5.26	0.06	0.06
	Entire sample	248	0.80	0.04	0.04
Monogamist household +	Nonmigrants	134	0.74	87.31	
	Seasonal	69	0.00	89.86	
	permanent	18	5.26	77.78	
	Entire sample	248	0.80	87.50	

Table A1: Descriptive Statistics (continued)

Boys under 12	Nonmigrants	135	0.00	1.62	1.66
	Seasonal	69	0.00	2.01	2.15
	permanent	19	0.00	2.26	1.24
	Entire sample	250	0.00	1.81	1.77
Number of quarters	Nonmigrants	135	0.00	5.10	3.18
	Seasonal	69	0.00	4.83	2.73
	permanent	19	0.00	5.16	2.83
	Entire sample	250	0.00	5.05	2.99
Heterogeneity in community livestock	Nonmigrants	134	0.74	7116.35	29194.95
	Seasonal	69	0.00	1543.34	4085.20
	permanent	18	5.26	2268.61	4815.12
	Entire sample	248	0.80	4624.14	21773.92
Agriculturalist ethnic group+	Nonmigrants	134	0.74	46.27	
	Seasonal	69	0.00	56.52	
	permanent	18	5.26	38.89	
	Entire sample	248	0.80	49.19	
Income variance in 2000	Nonmigrants	135	0.00	1.23e+11	1.50e+11
	Seasonal	69	0.00	2.21e+11	2.21e+11
	permanent	19	0.00	2.09e+11	2.33e+11
	Entire sample	250	0.00	1.63e+11	1.86e+11
Household internal strategy is gold panning+	Nonmigrants	135	0.00	14.07	
	Seasonal	69	0.00	5.80	
	permanent	19	0.00	0.00	
	Entire sample	250	0.00	10.40	

NB: results are presented as a percent for dummy variables (those affected with sign +).

A2 Model of nonmigration

Table A2: Heckman Nonselection Model (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	-0.236
	(2.81)***	(-1.34)
Average age of household	-0.020	0.051
	(-1.63)*	(2.98)***
Available labor force 2002	0.137	-0.075
	(4.62)***	(-2.24)**
Low rainfall, dry oudalan	0.670	-1.410
	(2.44)**	(-5.12)***
Medium rainfall, north seno	0.426	-0.712
	(1.94)*	(-2.31)**
Dummy public school or literacy	0.388	-0.797
	(1.39)	(-2.66)***
Level of mistrust	-0.170	0.505
	(-0.92)	(1.80)*
Density household		-11.277
		(-3.44)***
Monogamist household		-0.471
		(-1.29)
Constant	12.359	1.232
	(23.71)***	(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 A3: 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(income|stayer==1) after Heckman
z statistics in parentheses
* Significant at 10%; ** significant at 5%; *** significant at 1%

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