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Migration and Income Diversification

Evidence from Burkina Faso

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Abstract

This paper uses limited-dependent variable methods and new data from Burkina Faso to test the impact of inter-continental and continental migration on activity choice and incomes in rural households. Econometric evidence supports our theoretical expectation that the impact of emigration varies both by migrant destination and production activity. We find no evidence of either positive or negative effects of continental migration on agricultural or livestock activities, and only a small negative impact on non-farm activities. However, inter-continental migration, which tends to be long term and generates significantly larger remittances, stimulates livestock production while being negatively associated with both staple and non-farm activities.

Keywords: West Africa, Burkina Faso, rural livelihoods, migration, income diversification

1. INTRODUCTION

The diversification of incomes into non-crop production has been identified as a critical livelihood strategy for rural households, particularly in Africa (Barrett, Reardon, & Webb, 2001). Recent research suggests that household members who migrate can facilitate investments in new activities by providing rural households with liquidity, in the form of remittances, as well as income security, in the form of a promise to remit in the event of an adverse income shock. That is, migration enables rural households to overcome imperfect credit and insurance markets. If this hypothesis is correct, then other things being equal, the presence of migrants in rural households should be positively correlated with the diversification of production into non-staple activities.

However, migration itself represents a diversification strategy with characteristics that may resemble those of other investments. Usually it entails costs (transportation, maintenance of the migrant until s/he becomes established at the migrant destination, diversion of the migrant's time away from household production activities, and in the case of international migration, the costs of border crossings). It also entails risks (that the migrant may fail to find work and/or send remittances to the household). Costs and risks are likely to be greater for international migration, which often entails travel over long distances and long periods of separation between migrant and household, and which always entails legal or illegal border crossings. Because of this, the relationship between migration and diversification into non-staple activities is theoretically ambiguous; it must be determined empirically.

This paper uses econometric methods and new data from Burkina Faso to explore the relationship between migration and rural income diversification. The analysis is based upon unique new data collected by one of the authors (Wouterse) in a 2003 survey of 223 households in four villages situated on the Central Plateau of Burkina Faso. Rural households in these villages send out migrants within the African continent but also inter-continentally, primarily to Europe. Many also derive income from cash crops and diversify their household production into livestock and non-farm activities. In the West African context, cash crop and non-farm production activities tend to be both risky and labor intensive. In contrast, livestock production tends to be relatively labor-extensive, with high

output per worker-day, but it is costly in terms of capital inputs (purchase of livestock) and entails risks, as well (e.g., loss of animals to disease or drought). We test separately the effects of African and inter-continental migration on participation in cash crop, livestock and non-farm activities and on income from these activities. Our findings offer tentative evidence in support of the NELM view. Results show that intercontinental migration enables households to shift into riskier but higher-return activities. A loss of labor to continental and intercontinental migration, however, negatively affects labor-intensive activities, a finding consistent with missing labor markets.

We begin by presenting, in Part 2, a discussion of diversification and migration theory, including the role of migration in a context of missing or incomplete rural markets, as posited by the new economics of labor migration (NELM). Part 3 describes the study area and data. Part 4 presents the agricultural household model used to explore the role of continental and inter-continental migration in determining household activity choice and activity incomes. It provides the conceptual basis for the empirical analysis. Part 5 reports our econometric results, followed by a discussion of econometric issues related to the use of cross-section data. We conclude in Part 6 by discussing some of the implications of our findings for understanding the influences of migration on rural income diversification and welfare.

2. DIVERSIFICATION, MIGRATION, AND INCOMPLETE MARKETS

"Push" and "Pull" Motives for Diversification

Rural households in developing countries typically derive their income from a number of sources (Reardon, 1997). Motives for income diversification can be categorized as "push" and "pull." Push factors prompting diversification often are linked with risk reduction (Barrett, Reardon, & Webb, 2001). Frequently, rural households have to cope with both poverty and a high degree of income variability. In the face of incomplete insurance markets, income diversification is viewed as a household strategy to minimize income variability and ensure a minimum level of income (Reardon, Delgado, & Matlon, 1992). Pull factors refer to an effort by rural households to exploit strategic

complementarities between activities, such as crop-livestock integration (Barrett, Reardon, & Webb, 2001). Despite the advantages of having a diversified "income portfolio," rural households without access to credit frequently find themselves in the conundrum of lacking the liquidity to invest in non-staple activities.

Migration Determinants and Impacts

Many explanations for why people migrate have been advanced, and each has its own implications for predicting migration's impacts on sending households, including on income diversification.[1] In neo-classical migration models (e.g., Todaro (1976)) a rational individual bases the decision to migrate on the expected wage at the destination and the costs involved in migrating. Migration in such models affects the migrant sending area only through a loss of labor, the opportunity cost of which depends on local labor supply, as well as through a loss of human or financial capital. However, when migrants and households maintain ties with each other after migration, it is more appropriate to analyze migration in a household model (Stark, 1991). According to the New Economics of Labor Migration (NELM) theory, migration may represent an effort by households to overcome market failures constraining local production. An implicit contractual arrangement exists, wherein the household foregoes the migrant's labor and may even finance migration in order to receive remittances at a later stage. Household members who migrate can facilitate investments in new activities by providing liquidity, in the form of remittances, as well as income security, in the form of a promise to remit to the household in the event of an adverse income shock. That is, migration can enable rural households to overcome credit and insurance market imperfections.

Migration and Diversification

The impacts of migration and remittances on diversification depend on the motivations for diversification, the constraints on diversification, and migration's effect on both. Migration, if it results in remittances for the household, can be viewed as a livelihood diversification strategy, as remittances are a source of income that is likely to be uncorrelated with household income from agriculture. That is, it could reduce the "push" to diversify for risk reasons. On the other hand, if new activities are perceived as risky, and

if a lack of liquidity constrains investment, the presence of migrants in rural households could stimulate diversification into non-staple activities. As a substitute for formal insurance, i.e., by remitting in the event of an adverse income shock, migrants may facilitate the adoption of new technologies as well as entry into new activities with higher expected returns but also higher risk than traditional ones. As a substitute for formal or informal credit, migrant remittances may enable households to overcome liquidity constraints on investing in new technologies and activities. These are basic predictions of NELM theory. Migration also may compete with other household activities for scarce family resources, including time. By reducing the supply of household labor, migration could negatively affect both the "push" and "pull" to invest in labor-intensive activities.

In general, NELM predicts that the effects of migration on activity choice and production in an incomplete market environment may be important. This stands in contrast to separable agricultural household models (e.g., Singh, Squire and Strauss, 1986), in which migration, by assumption, simply increases household use of hired labor and remittance transfers affect only consumption, leaving production and investment decisions unchanged. A significant effect of migration on production would be evidence against the separable household-farm model and in favor of a NELM approach.

Tests of the NELM theory have appeared in the literature. Rozelle, Taylor and de Brauw (1999) find evidence that migration and remittances affect crop production in China, and Taylor, Rozelle and de Brauw (2003) extend the test of the NELM theory for China to include non-farm self-employment. Their findings that remittances partially compensate for a negative lost-labor effect and stimulate crop and possibly self-employment production provide evidence in favor of the NELM theory. Taylor (1992), using longitudinal data, finds evidence suggesting that migrant remittances affect income in households of rural Mexico differently in the short and long run, and remittances affect incomes indirectly through asset accumulation. In Africa, Lucas (1987) investigates the consequences of emigration to South Africa's mines for agricultural activities in Botswana, Lesotho, Malawi, Mozambique and the South African homelands. He finds that emigration reduces crop production in the subsistence sector in the short run, but remittances enhance both crop productivity and cattle accumulation in the longer run in all but one of the five countries studied. These studies include a single variable for migration and do not consider

that the impacts of migration and remittances may be different for different migrant destinations.

Following Adams on Pakistan (1998), De la Briere, Sadoulet, de Janvry and Lambert (2002) on the Dominican Republic, and Mora and Taylor (2005) on Mexico, we propose that a distinction needs to be made between migration types—in the Burkina Faso context, between continental and inter-continental migration. These two forms of migration may affect household risk, liquidity and labor constraints differently. Inter-continental migration to distant labor markets usually entails a relatively long-term loss of labor and costs and risks associated with border crossing, often attempted without documents. However, average remittances are considerably larger from inter-continental than continental migrants.

3. DATA AND STUDY AREA

Data to test the impact of continental and intercontinental migration on activity choice and incomes are from a household survey conducted in four villages of Burkina Faso in February and March 2003. The four villages are situated on the Central Plateau, Niaogho and Béguédo in the south and Boussouma and Korsimoro in the north. The Central Plateau constitutes the central region of Burkina Faso, where the intensity of soil use is high compared with other regions. High population density is said to have led to a saturation of space in this region, and lands on the Central Plateau are generally overexploited and degraded (Brasselle, Gaspart, & Platteau, 2002; Breusers, 2001; Reyna, 1987).

The four villages were purposively selected according to several criteria. A first consideration was their difference in accessibility. Boussouma and Korsimoro are situated on the main road from the capital of Burkina Faso (Ouagadougou) to the north. Niaogho and Béguédo are isolated and can only be reached by a three-hour journey on a dirt road. A second selection criterion for Niaogho and Béguédo was the prominence of intercontinental migration (primarily to Italy) by people from these villages. Cross-section data on socio-demographic characteristics and production and consumption activities were gathered from

a random sample of about 60 households in each of the four villages.[2]

Households were selected as randomly as possible in the absence of any pre-existing census maps. After mapping a village, each enumerator was sent out in a different direction to select households at an equal distance from one another, ensuring that all peripheral areas were covered. Although an attempt was made to interview several household members, in practice the head of the household answered most questions.

Farm households in the four villages can generally be described as extended, as, in a polygamous setting, they often not only comprise the household head and his wives, but also their grown sons along with their wives and children. Family members were included in the extended household definition on the basis of living in the same compound and normally eating meals together.

Agriculture (staple cropping, cash cropping and livestock) is the primary activity of the households that we surveyed. Cropping is characterized by a single short cropping season per year. Labor productivity tends to be low. There is a general lack of irrigation, rainfall is low, and soils are generally poor (Kessler & Geerling, 1994). A consequence of engaging in rainfed agriculture in a drought-prone environment is that households face substantial income risk. Formal crop insurance is not available to mitigate this risk in the West-African Semi-Arid Tropics (WASAT). The lack of such insurance is thought to be due to the high spatial covariance of rainfall shocks and to moral hazard problems associated with crop insurance in general (Reardon, Delgado, & Matlon, 1992).

Uncertainty combined with missing markets for risk creates incentives to diversify income generating activities. Diversification of activities enables households to reduce the risk they face by generating income from sources not correlated with cropping income. Households in the study area diversify their income by engaging in migration, livestock production and non-farm activities.

In all four villages household members were found to engage in migration; around 64 per cent of the households that were interviewed had one or more migrant during 2002. Household members were classified as migrants if they had been absent from the household for a period of more than a month during the year. Migrants were included as household members if they were counted by the head of the household in the household inventory.[3] Household members who migrate almost always stay away for more than one

year. Information on migrants who were away at the time of the survey was supplied by the head of the household. It included duration of absence, destination, reasons for migrating, and remittances sent back to the household.

Population movements in Burkina Faso date back several centuries, but large-scale migration finds its origin in colonial times. During this period large numbers of rural Burkinabé migrated to work on plantations and in mines in Ghana, Nigeria, Côte d'Ivoire and other countries as a means to pay taxes imposed by the colonial government (Adepoju, 1977; Arthur, 1991; Cordell, Gregory, & Piché, 1996). Intercontinental migration, in particular to Western Europe, has become more important for Africans in recent decades (Adepoju, 1977; Arthur, 1991; Findley, 1997; Yusuf, 2003). Within Burkina Faso, rural out-migration has contributed to the urbanisation process (Cordell, Gregory, & Piché, 1996). From the Central Plateau of Burkina Faso, migration primarily by the Mossi ethnicity to unexploited lands in the south and west has taken place since the 1960's. This migration accelerated after the droughts of 1968-1973 and 1983-1984 (Laurent, Mathieu, & Totté, 1994).

The village surveys revealed two principal types of migrant destination: continental and intercontinental.[4] Households from all four villages engage in continental migration. Households in Niaogho and Béguédo also participate in intercontinental migration. Continental migrants are generally young men who attempt to find work elsewhere on the African continent. The primary destination of continental migrants from the surveyed villages until recently was Côte d'Ivoire. However, the migrant flow to Côte d'Ivoire has all but vanished, due to the unstable political situation, ethnic tensions and anti-foreigner sentiment there. Many Burkinabé now migrate to the capital of their country, Ouagadougou. Intercontinental migration from Niaogho and Béguédo in nearly all cases is comprised of young (Bissa) males who go to Italy, initially to engage in horticulture around Naples. Intercontinental migration is highly lucrative in terms of remittances sent back to the household; however, it involves high entry costs, particularly for transportation. Continental migration is less costly but generates comparatively few remittances.[5]

In addition to cropping activities and migration, many households keep livestock. Livestock in Burkina Faso tends to be raised for multiple purposes. In the surveyed villages, sales of so-called recurrent production, including milk and wool, are extremely

rare. Households derive income from livestock mainly through embodied production: an increase in weight or herd size. Other functions of livestock, cattle in particular, include transportation and traction. Livestock manure is an input in agricultural production. Most importantly, livestock represents a capital asset, enabling the farm household to meet unexpected expenditures, for example, when income is low due to a shock (Udo & Cornelissen, 1998). The self-insurance value of livestock is more limited in the case of correlated shocks, e.g., drought, which affect livestock as well as crop production (Dercon, 2002). Livestock also functions as a portfolio investment option in the absence of other ways of storing wealth (Moll, 2005). Livestock production is a relatively high-return activity in Burkina Faso; however, it is also capital-intensive, requiring liquidity for the purchase of animals.

Many households also derive income from non-farm activities. These tend to be self-employment activities and not wage labor, as a labor market does not exist in the surveyed villages. Important activities of women include food preparation and sales, whereas men engage in a number of artisan activities. Most non-farm activities are intensive in labor but not capital, although a small number of households were found to engage in high-return commercial activities.

Table 1 shows that all households surveyed engage in staple cropping. [TABLE 1 HERE]. Many also cultivate cash crops, including onions, rice, cotton and maize on irrigated or waterside plots. Cash cropping can be considered a high-return activity for which an entry constraint may exist, particularly large requirements for purchased inputs. Studies often distinguish between cash and staple crops as separate activities, viewing households engaged in cash cropping as more diversified than those engaged only in staple production. However, cash crops and staples tend to have highly correlated returns, limiting the potential for diversification into cash crops as an income insurance strategy (Reardon, Delgado, & Matlon, 1992).

In the surveyed villages the share of non-cropping income tends to increase across income quintiles, a finding similar to that of Abdulai and CroleRees for rural Mali (Abdulai & CroleRees, 2001). If, as widely believed, risk aversion is decreasing in income and wealth, then the poor will display a greater demand for diversification, other things being equal (Barrett, Reardon, & Webb, 2001). However, poor households are less able to

overcome the entry barriers to high-return diversification options. Investment options are constrained by an incomplete credit market; formal credit institutions were not found to exist in the four villages. Limited collateral and collateral substitutes severely limit rural households' access to formal credit, in West Africa as elsewhere (Binswanger, McIntire, & Udry, 1989; Binswanger & Rosenzweig, 1986; Fafchamps, Udry, & Czukas, 1998; Reardon, Delgado, & Matlon, 1992).

The lack of collateral is compounded by a missing land market. In rural Africa land markets often barely function and are generally quite thin (Lanjouw, Quizon, & Sparrow, 2001). In Burkina Faso commercial land market transactions were found to be extremely rare (Ouedraogo, Sawadogo, Stamm, & Thiombiano, 1996). In the Central Plateau, high population density has led to land scarcity, and cultivation on the basis of hereditary possession is most common (Kessler & Geerling, 1994). The lack of commercial land market transactions implies that land cannot function as collateral for credit.

Labor market imperfections also may discourage diversification. The use of hired labor in agriculture is rare in the four surveyed villages, representing approximately one percent of total labor use (measured in worker days). A missing market for labor is characteristic of rural areas lacking a large landless class and with homogeneous factor endowments (De Janvry, Fafchamps, & Sadoulet, 1991). There appears to be a cultural barrier to offering one's own labor for a wage, as it is thought to be a sign of inability to sustain production on one's own fields (Mazzucato & Niemeijer, 2000). Exchange labor in the form of work parties is slightly more common, but it is limited to a few crops with particular patterns of seasonality, such as onions. Local wage labor options thus are not available, forcing household members to migrate in search of jobs.

Migration, by providing households with a source of income that is uncorrelated with agriculture, can facilitate investments in other activities. Table 1 shows that household participation in continental migration is prominent in the middle-income groups, whereas intercontinental migration is most important for households in the upper income quintile. The latter households also participate more in livestock production.

An overview of the endogenous income and participation variables by household migration status (non-migrant, continental and inter-continental) is given in Table 2. Consistent with agricultural household theory (e.g., Singh, Squire and Strauss), net income

from each household production activity was calculated as total revenue minus the costs of purchased inputs. For crop production this includes the value of subsistence output, using the average local price received by sellers of the crop. The livestock income calculation takes into account the net change in value of herds as well as the sale of animal products. [TABLE 2 HERE]

The three household groups display differences in both per-capita income and activity mixes. Remittance income of households with intercontinental migrants is about six times that of continental-migrant households. Almost all households with intercontinental migration own livestock, but participation in livestock production is much lower for households without migrants and those with continental migrants. Participation rates in non-farm activities are lower for households with intercontinental migrants than the other two groups.

Two hypotheses emerge from this summary analysis of the survey data. First, inter-continental migration facilitates livestock investment, as reflected in a higher rate of participation in livestock activities, whereas continental migration does not. Second, intercontinental migration discourages participation in non-crop activities that are labor intensive. Households with continental migrants, lacking the capital and insurance to enter into high-return but capital-intensive activities, remain engaged in low-return, labor intensive ones.

4. EMPIRICAL ANALYSIS OF MIGRATION AND DIVERSIFICATION

A simple farm household modeling framework is used as the basis for our empirical work. (A summary of the model derivation appears in the Appendix.) Consider a farm household with preferences represented by a utility function of the form given in (1):

$$U = Eu(C, X_l; Z_U) \quad (1)$$

where C is a vector of consumption goods, X_l is leisure, and Z_U is a vector of household characteristics influencing utility. Household utility is a positive function of net income both in-kind and in-cash from all sectors (Nakajima, 1986; Reardon, Delgado, & Matlon, 1992). Households maximize (expected) utility subject to a cash income constraint of the following form:

$$C = \sum_i y_i + R_C(M_C) + R_I(M_I) \tag{2}$$

Where y_i denotes net income from activity i for i = s(staple production), cc(cash crop production), lv (livestock production), and nf (non-farm production); and R_C and R_I are remittances from continental and inter-continental migrants, which are functions of family time allocated to these two migration activities (M_C and M_I, respectively). Net income from staple production is given by a net income production function:

$$y_s = p_s g_s(L_s; A) + \eta_s \tag{3}$$

L_s is household labor input in staple cropping, A a vector of assets including land available to the household for cropping activities, p_s is the output price of staples, and $\eta_s \sim N(0, \sigma_s^2)$ represents the stochastic or uncertainty component of staple production, due to weather and other shocks.

Following Abdulai and Crole Rees (2001), households' income derived from non staple-cropping activities, including cash-cropping, livestock and non-farm activities, is conditional upon their ability to overcome entry constraints, $K_{ns}, ns = cc, lv, nf$; that is,

$$y_{ns} = \left[p_{ns} g_{ns}(L_{ns}; A) + v_{ns}(L_{ns}; A)\eta_{ns}\right] | K_{ns} \tag{4}$$

where p_{ns} is the output price of non-staple products; L_{ns} is household labor input into non-staple activities; K_{ns} represents entry constraints, such as investment capital required to

initiate production of good *ns*; η_{ns} is a stochastic term reflecting impacts of weather and other shocks on non-staple production ($\eta_{ns} \sim N(0, \sigma_{ns}^2)$); and $v_{ns}(L_{ns})$ represents the effect of the intensity of labor investments on production risk (Just & Pope, 1979) (For simplicity, we assume that $K_i = 0$ for staple production.) The entry constraint may be modeled as a function of household assets including the stock of continental and inter-continental migrants, M_C and M_I. The liquidity available to the household for investment is a function of household wealth, where the maximum wealth, W^{max}, available to the household is a function of its assets, which include having earlier continental or inter-continental migrants as well as non-migration assets, Z_K:

$$\sum_{ns} K_i \leq W^{\max}, W^{\max} = g_W(M_C, M_I, Z_K) \tag{5}$$

If perfect labor markets exist, the wage is exogenous, hired workers can substitute for labor lost to migration, and labor availability will not be a constraint on household production activities. However, if perfect labor markets do not exist, labor availability for production and migration is constrained by the household labor supply; i.e.,

$$\sum_{i} L_i \leq T - M_C - M_I - X_l \tag{6}$$

In this case, the opportunity cost of labor in production is represented by a household-specific "shadow wage" that increases with household labor allocated to migration, other things being equal (Jacoby, 1993; Skoufias, 1994; Strauss, 1986). This potentially creates a trade-off between household production and migration.

Migration may influence activity choice as well as activity incomes, through its impact on labor supply, credit and liquidity constraints. Analogous to Taylor and Yunez-Naude (2000), our empirical analysis of the impact of migration on household income takes into account the influence that migration may have on activity choice. Ignoring the endogeneity of activity choice can lead to biased estimates of coefficients in the activity income regressions.

An approach similar to that proposed by Abdulai and CroleRees (2001) can be used to model the household decision-making process. Households engage in a particular activity if their expected utility from doing so exceeds that from not investing in the activity, subject to capital constraints. As mentioned previously, capital constraints linked to missing markets may constrain engagement in cash-cropping, livestock and non-farm activities. In the absence of a capital market, only households that are able to overcome the entry constraint, if binding (i.e., those that can afford K_{ns}), will allocate labor to non-staple activities. If participation is optimal and feasible (i.e., the capital constraint on participation is not binding), households will allocate a marginal unit of labor to non-staple activities if:

$$E\left[u_C \frac{dC}{dL_{ns}}\right] \middle\| \frac{W^{\max}}{K_{ns}} \geq E\left[u_C \frac{dC}{dL_s}\right] \tag{7}$$

(Capital constraints may limit both participation in an activity and investment in the activity given participation.) Given participation, the income of household n from staple and non-staple activities can be represented in reduced form as:

$$\begin{aligned} y_s^n &= \gamma_{0s} + \gamma_{1s} M_C^n + \gamma_{2s} M_I^n + \gamma_{3s} X^n + \varepsilon_s^n \\ y_{ns}^n &= \gamma_{0ns} + \gamma_{1ns} M_C^n + \gamma_{2ns} M_I^n + \gamma_{3ns} X^n + \varepsilon_{ns}^n \end{aligned} \tag{8}$$

for *ns = cc, lv,* and *nf*. In equation system (8), $\gamma_{1,i}$ denotes the effect of a marginal increase in continental migration on net income when the household participates in activity *i*; γ_{2i} denotes the effect of inter-continental migration; X^n denotes a vector of other variables (i.e., household assets) influencing activity incomes; and γ_{3i} is a vector of marginal impacts of these variables.[6] The parameters in (8) reflect potentially complex influences of explanatory variables on production, liquidity constraints, and risk. The objective of this study is not to isolate these effects, but rather to test for the influence of migration on activity incomes. This migration effect on non-migration incomes would be nil in a perfect-markets or "separable" agricultural household model, i.e. $\gamma_{1i} = \gamma_{2i} = 0$. A finding

that continental or intercontinental migration significantly affects activity choices and/or incomes in migrant-sending households would support the NELM. However, if migration influences liquidity constraints, labor availability or income risk, the effect of migration may be either positive or negative, depending upon which effects dominate. The sign of an activity-specific migration effect thus is indeterminate *a priori*.

The observation of activity incomes is conditional upon participation. To correct for censorship and investigate the determinants of participation, the equations in (8) were estimated jointly controlling for activity choice, utilizing Lee's (1978) generalization of Amemiya's (1974) two-stage estimator. This procedure consists of first estimating a probit regression for participation in each non-staple activity with the complete set of explanatory variables in (8). The probit indicator function thus estimated is of the following form:

$$I_{ns}^{n} = \gamma_{0ns} - \gamma_{0s} + (\gamma_{1ns} - \gamma_{1s})M_{C}^{n} + (\gamma_{2ns} - \gamma_{2s})M_{I}^{n} + (\gamma_{3ns} - \gamma_{3s})X^{n} \tag{9}$$

The estimated coefficients from the probit regressions for each activity choice are then used to calculate the inverse Mills ratios:

$$IMR_{ns}^{n} = -\phi(\hat{I}_{ns}^{n}) / \theta(\hat{I}_{ns}^{n}) \tag{10}$$

where $\phi(\cdot)$ denotes the normal density function and $\theta(\cdot)$, the cumulative normal distribution function. In the second stage, the inverse Mills ratios are included as explanatory variables in their respective activity-income regressions; i.e.,

$$y_{ns}^{n} = \gamma_{0ns} + M_{C}^{n}\gamma_{1ns} + M_{I}^{n}\gamma_{2ns} + X^{n}\gamma_{3ns} - \sigma_{ns}IMR_{ns}^{n} + u_{ns}^{n} \tag{11}$$

One advantage of this two-step approach is that one obtains estimates of the effect of each explanatory variable on the probability of participating in each income activity, as well as the effect on activity incomes given participation.

The censorship-corrected activity-income equations were estimated jointly for all households using iterated least squares to exploit the information contained in the cross-equation error correlations.

The vector of explanatory variables X^n includes household size and number of dependants; physical capital variables (land and irrigated land, the number of cattle, and the value of farm equipment at the start of the survey year, the quantities of which are pre-determined); and household characteristics (human capital variables, including age of the household head, number of adults with primary and secondary education, and the number of past absentees, i.e., household members who migrated in the past but returned). Prices are assumed to be region-specific and are captured by location dummy variables.

Variables for continental and inter-continental migration also need to be specified. Migration represents an endogenous activity choice. However, most migrants in the surveyed households left in the past, typically several years prior to the survey. It is therefore possible to consider the number of past migrants as a predetermined "migration capital stock" variable (Taylor & Yunez-Naude, 2000). The migration capital stocks, or number of household members at each migrant destination, prior to the survey year were used to measure continental and inter-continental migration in the econometric model.

An overview of the explanatory variables included in the econometric model is given in Table 3. [TABLE 3 HERE] Households with migrants of either type are larger and have an older household head than non-migrant households. Households with intercontinental migrants also have more dependents (members who where economically inactive). Household size is related to labor availability and thus, in a context of imperfect hired labor markets, may explain activity choices and incomes. Past absentees are household members who have been absent from the household in the past but have returned. Households with continental migrants have a larger number of past absentees, which might be a proxy for migration experience. Migrant households have more adults with primary education than non-migrant households, and households with continental migrants have the most adult members with secondary schooling. Households with intercontinental migrants have higher initial assets (land, cattle and farm equipment, measured in the year prior to the survey) than households without migrants and those with only continental migrants. As mentioned previously, a land market does not exist; thus,

migration cannot facilitate land acquisition in this study area. The higher value of productive assets (livestock, plough and cart) among intercontinental migrant households reflects past investments.

5. FINDINGS

The results of the probit estimation for activity choices are given in Table 4. The table reports the estimated percentage point change in the probability of participating in a particular activity that is associated with a one-unit change in the corresponding explanatory variable. [TABLE 4 HERE].

The probability of participating in livestock production increases with inter-continental migration but is not significantly related to continental migration, other things being equal. Inasmuch as remittances from inter-continental migration are considerably larger than those from continental migration (Table 2), this finding is consistent with the hypothesis that inter-continental (but not continental) migration enables households to overcome liquidity and/or risk constraints on livestock investments.

In contrast to livestock production, inter-continental migration has a significant negative effect on participation in non-farm activities, which tend to be labor intensive and thus are expected to compete with long-term inter-continental migration for household labor. A positive and significant coefficient on the location dummy, which is set equal to one for the easy access villages of Boussouma and Korsimoro, suggests that market access stimulates non-farm activities (a large market is held regularly in Korsimoro). The number of adults with secondary education has a positive and significant influence on the probability that a household engages in non-farm activities. Abdulai and CroleRees uncover a similar relationship between education and diversification into non-farm activities for rural Mali (2001).

No significant relationship is apparent between migration and participation in cash cropping. On one hand, cash crop production requires capital that may be supplied by inter-continental migration, and it may entail risks. On the other, it is labor intensive and thus competes with long-term inter-continental migration for household labor. Non-migration

assets, in particular access to irrigated land, are key variables determining households' engagement in cash cropping.

The results of the estimation of activity incomes given participation, which corresponds to the second stage of the model, appear in Table 5. The table reports the estimated absolute effects of one-unit changes in the corresponding explanatory variables on income from each activity. [TABLE 5 HERE]

Overall, the findings in Table 5 reinforce those of Table 4 with respect to the effects of migration on staple and non-staple incomes. Other things being equal, an additional inter-continental migrant reduces net income from staple production by 27,700 FCFA, a finding consistent with the existence of an imperfect labor market that prevents households from hiring substitutes for family labor lost to long-distance migration.[7] The negative effect of intercontinental migration on staple income is also consistent with a risk model: Households with inter-continental migration may reduce the effort they invest in staple cropping as an income-insurance strategy, knowing that they can rely on remittances should shortfalls occur. There is weak evidence of labor substitution through equipment use (the positive coefficients on the lagged farm equipment variable in Table 5).

In contrast to staples, livestock production is significantly higher for households with inter-continental (but not continental) migrants. These findings are consistent with liquidity or risk constraints on livestock investments that are binding in households without inter-continental migrants but loosened by remittances sent home from abroad.

Both continental and inter-continental migration have negative associations with income from non-farm activities, but the effect of inter-continental migration is more than four times greater. This result is not unexpected given the labor intensity of most non-farm activities. A loss of household labor to long-term migration, without access to hired labor markets, appears to reduce investment in non-farm activities, leading to a reduction in net income.

Household size is positively related to income from staple production, in which household labor is an important input, reinforcing the argument that imperfect labor markets prevent households from substituting hired for family labor. Household physical capital has a significant positive effect on income from all activities. Abdulai and CroleReese (2001), using data from rural Mali, also found that household wealth (measured

by landholdings and value of equipment) positively influences income from cash cropping (cotton), non-farm activities and livestock.

Human capital is important in explaining income generation in all activities except staple and cash cropping. The coefficient on the secondary education variable is positive and significant for livestock and non-farm activities. These results illustrate the importance of schooling in shaping rural household incomes, similar to Taylor and Yuñez-Naude's (2000) findings from rural Mexico.

(a)

Migration-Asset Interactions

Missing or incomplete markets, particularly for credit and insurance, create the possibility of asymmetric impacts of migration and remittances on household incomes across the asset distribution. Taylor and Wyatt (1996) found that, in rural Mexico, remittances significantly increased farm income in households with liquid (but not illiquid) assets. (The illiquid assets considered were non-marketable ejido lands).

We tested for differences in migration effects across the asset distribution by adding migration interactions with both relatively liquid (initial cattle and farm equipment) and illiquid assets (land and irrigated land) to the model. The estimated effects of these interactions, together with the new estimated direct migration effects when these interactions are included, are reported in Table 6.

The interaction effect of land and inter-continental migration (Panel I) is positive in the livestock equation (0.94), and the direct migration effect becomes insignificant. That is, inter-continental migration positively affects livestock production only when households have access to the complementary land input. This interaction effect is even stronger for irrigated land (Panel II), and it is also significant for initial livestock holdings (Panel IV), underlining the importance of initial asset holdings in shaping the influence of inter-continental migration on livestock production.

For cash cropping, the inter-continental migration interaction effect is positive and significant for irrigated (Panel II) but not total land (Panel I). This positive interaction effect counteracts the negative migration effect reported here, as in Table 5. The direct

effect of irrigated land remains positive and significant, illustrating the importance of irrigation for cash-crop cultivation. In contrast with inter-continental migration, continental migration interacted with irrigated land significantly reduces cash-crop income, apparently magnifying the opportunity cost of migration in terms of lost cash-crop output. This combination of results is what one would expect when migration competes for family labour but only inter-continental migration generates sufficient remittances to finance labour substitutes in cash-crop activities.

For staples, the migration interactions are significant only when they involve farm equipment (for continental migration) and livestock (for international migration). For non-farm activities, a positive land interaction effect of inter-continental migration partially mitigates the direct effect found here as well as in Table 5.

The findings from our model with asset-migration interactions suggest some potentially troubling distributional implications. Asset-rich households with intercontinental migrants are likely to further increase their income by investing in risky but high-return activities, whereas continental migration in a context of a missing market for labor may even lead households to diversify less.

(a) Econometric issues

The findings presented above could suffer from econometric problems inherent in the use of cross-section data, and these should be kept in mind while interpreting our results. The most important potential problems are endogeneity of right-hand variables and non-random selection of households into the two migration regimes, both of which may be complicated by the presence of unobserved variables.

As mentioned previously, the absence of land markets in the study area prevents migration from significantly driving the accumulation of land. Other potentially endogenous explanatory variables include asset holdings and schooling. All are predetermined, i.e., they are measured prior to the year in which incomes are observed. In most cases, household heads' schooling was completed many years prior to the survey. (Recall that the average age of heads in the sample ranges from 49 to 59 years). If

household schooling were correlated with unobserved variables that, in turn, were correlated with incomes measured in 2003, this could introduce a bias into our estimates; however, it is not clear what the sign of this bias might be.

The two migration variables in our analysis also are predetermined. Nevertheless, unobserved variables could be correlated with both past migration status and current incomes. If so, then the estimated impacts of migration status on incomes could reflect influences of these unobserved variables. To take an example, suppose that more entrepreneurial households both have a high proclivity to invest in livestock and are more likely to participate in inter-continental migration. It would then be difficult to determine whether migration induces livestock investment or the reverse. We address this concern by including a measure of lagged livestock holdings, together with migration and (in Table 6) migration-asset interactions, as explanatory variables in the livestock income regression. If, however, both the predetermined livestock and migration variables were correlated with the unobservable "entrepreneurial" variable, our estimated effect of inter-continental migration on livestock investments could still be biased upward, unless the effects of the unobserved variable were captured by other exogenous explanatory variables in the model. If the positive effect of inter-continental migration on livestock investments were due to unobserved entrepreneurial ability, however, it is not clear why one would find a *negative* association between inter-continental migration and income from other activities. It is not possible to address this concern by controlling for household fixed effects in a cross-section analysis.[8]

6. CONCLUSIONS

In a context of missing or incomplete markets, migration activities that absorb household labor while contributing liquidity through remittances may influence both activity choice and activity incomes. The NELM theory points to the important role that migration may play in enabling households to overcome credit and risk constraints and facilitating investments in relatively high return activities. Our analysis controls for activity choice while testing for the effects of migration on activity incomes. It does this for two types of migration: continental and relatively long-term but high-return inter-continental.

Taking the stock of continental and inter-continental migrants at the beginning of the survey year as given and using a two-stage selection model, inter-continental migration is found to play an important role in household income diversification into livestock production and non-farm activities, positively affecting the first but negatively affecting the second. The positive effect of inter-continental migration on livestock production suggests that inter-continental migration enables households to overcome entry barriers resulting from missing and imperfect credit markets. The negative effect on staples and non-farm activities is consistent with a missing or imperfect labor market and household labor constraints that create a trade-off between long-term, inter-continental migration and engagement in relatively labor intensive activities at home. Households with inter-continental migrants abandon or choose not to engage in activities that compete for household time while producing returns inferior to those from inter-continental migration. Inter-continental migration is complementary with livestock production but not with other production activities in the households we studied. Our econometric tests of interaction effects between migration and asset holdings reveal the importance of some assets in compensating for the loss of labor to migration, as well as a complementarity between intercontinental migration and assets that facilitates households' engagement in risky but high-return activities.

In combination, these findings offer tentative support for new economics of labor migration theory in rural Burkina Faso and highlight the importance of inter-continental migration in enabling households to overcome entry barriers to high-return but low labor-intensity activities. However, negative influences of migration on non-farm and staple activities suggest that migration may lead households to diversify less when production activities are labor-intensive.

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Table 1. Income Composition across Per-Capita Income Quintiles (2002)

Quintile	***Income per capita*** (FCFA)[b]	***Staple cropping***	***Cash cropping***	***Live-stock***	***Non-farm***	***Remittances*** continental	***Remittances*** intercontinental
Lowest	15487	70 (100)[c]	11 (58)	0 (35)	12 (40)	3 (44)	4 (5)
Second	28180	61 (100)	13 (70)	3 (55)	15 (55)	4 (55)	4 (9)
Third	40568	57 (100)	10 (66)	5 (64)	18 (73)	7 (59)	3 (13)
Fourth	55695	50 (100)	8 (66)	6 (50)	26 (75)	5 (52)	4 (11)
Highest	106043	46 (100)	9 (77)	9 (75)	19 (73)	6 (41)	11 (30)

Source: Author's survey
Notes: [a] migrants are not included as household members
[b] 168 FCFA=1$(PPP 2002) (World Bank, 2005)
[c] figures in parenthesis are percentage of households in income quintile that participated in respective activity

Table 2. Income Per Capita[a] from Different Activities by Household Migration Status (2002)

	Mean net income (FCFA)		
	Non-migrant (N=79)	***Continental (N=112)***	***Inter-continental (N=32)***
Total income (FCFA)[b]	42621	47060	67803
Staple cropping	24420 (100)[c]	26219 (100)	22168 (100)
Cash cropping	4940 (66)	4604 (64)	6031 (88)
Livestock	2710 (37)	2327 (57)	4313 (97)
Non-farm activities	10551 (61)	9024 (72)	7779 (41)
Remittances	~	4886	27512

Source: Author's survey
Notes: [a] migrants are not included as household members
[b] 168 FCFA=1$(PPP 2002) (World Bank, 2005)
[c] figures in parentheses are percentage of households in income quintile that participated in respective activity

Table 3. Descriptive Statistics by Household Migration Status.

Variable mean	***Non-migrant (N=79)***	***Continental migrant (N=112)***	***t-test means[b]***	***Intercontinental migrant (N=32)***	***t-test means[c]***
Household composition					
Household	9.57 (5.52)[a]	13.34 (6.17)	-4.34	18.56 (9.11)	-6.37
Dependants (number)	4.11 (3.10)	4.76 (3.33)	-1.36	7.38 (6.41)	-3.61
Age household head	49.14 (12.40)	54.62 (15.15)	-2.65	58.59 (10.63)	-3.78
Stock of continental migrants, lagged	~	1.10 (1.14)	~	~	
Stock of inter-continental migrants, lagged	~	~	~	1.56 (1.13)	
Human capital					
Past absentees (number of return migrants)	0.27 (0.45)	0.43 (0.50)	-2.33	0.37 (0.49)	-1.14
Education level of household head (years)	0.57 (1.78)	0.47 (1.49)	0.41	0.88 (3.37)	-0.62
Primary education (number of adults)	0.59 (0.97)	1.13 (1.71)	-2.53	1.69 (1.94)	-3.95
Secondary education (number of adults)	0.19 (0.75)	0.49 (0.90)	-2.43	0.38 (0.66)	-1.22
Physical capital					
Land (hectares)	4.24 (3.06)	4.38 (2.77)	-0.34	7.40 (6.12)	-3.62
Cattle, lagged	0.86 (1.34)	1.19 (1.45)	-1.76	6.03 (8.16)	-5.97
Value farm equipment, lagged (FCFA)[d]	34078 (53822)	40050 (54162)	-0.75	53708 (47550)	-1.80
Irrigated land (m^2)	161 (617)	608 (1587)	-2.40	851 (2498)	-2.30

Source: Author's survey

Notes: [a] standard deviation in parentheses

[b] non-migrant versus continental migrant households

[c] non-migrant versus intercontinental migrant households

[d] 168 FCFA=1$(PPP 2002) (World Bank, 2005)

Table 4. Probit Estimation Results for Activity Choice

Variables	***Cash cropping***	***Livestock purchase***	***Non-farm activities***
Constant	0.49 (0.52) [a]	-1.65 (0.44)**	0.21 (0.39)
Household composition			
Household size	-0.04 (0.04)	0.06 (0.03)*	0.02 (0.03)
Dependents	-0.01 (0.06)	-0.05 (0.05)	-0.00 (0.05)
Age household head	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Stock of continental migrants, lagged	-0.01 (0.11)	0.03 (0.08)	-0.05 (0.09)
Stock of intercontinental migrants, lagged	-0.10 (0.19)	0.25 (0.15)*	-0.31 (0.16)*
Human capital			
Past absentees	0.10 (0.24)	0.16 (0.21)	0.31 (0.20)
Education level head	-0.06 (0.07)	0.01 (0.06)	0.07 (0.08)
Primary education (number of adults)	-0.06 (0.09)	-0.06 (0.07)	-0.00 (0.08)
Secondary education (number of adults)	-0.01 (0.14)	0.23 (0.14)*	0.26 (0.11)**
Physical capital			
Land (hectares)	0.11 (0.06)* [b]	-0.00 (0.04)	0.04 (0.04)
Cattle, lagged	0.05 (0.08)	-0.01 (0.03)	-0.01 (0.06)
Log value farm equipment, lagged	0.02 (0.03)	0.02 (0.02)	-0.00 (0.02)
Log irrigated land (m^2)	0.49 (0.13)**	0.07 (0.04)**	-0.03 (0.04)
Village characteristics			
Location dummy	-0.53 (0.29)*	0.52 (0.23)**	0.71 (0.22)**
Pseudo R-squared	0.43	0.13	0.14
Number of observations	223	223	223

Notes: [a] robust standard error in parentheses
[b] * denotes significance at the 10% level, ** denotes significance at 5% level

Table 5. 2SLS Estimates of Net Income Regressions (FCFA/10.000)

Variables	***Staple cropping***	***Cash cropping***	***Livestock***	***Non-farm activities***
Constant	-10.91 (3.00)[a]**[b]	-0.21 (2.11)	-78.82 (59.20)	-18.50 (17.45)
Household composition				
Household size	1.18 (0.31)**	-0.07 (0.14)	1.93 (1.32)	0.72 (0.45)
Dependents	-0.50 (0.42)	0.10 (0.20)	-1.99 (1.12)*	-0.11 (0.52)
Age household head	0.09 (0.05)*	0.02 (0.03)	-0.30 (0.19)	-0.33 (0.18)*
Stock of continental migrants, lagged	-0.92 (0.73)	-0.23 (0.20)	0.13 (0.75)	-2.10 (0.99)**
Stock of intercontinental migrants, lagged	-2.77 (1.40)**	0.29 (0.90)	9.86 (5.60)*	-9.73 (5.60)*
Human capital				
Past absentees	-1.44 (1.66)	-0.34 (0.63)	5.63 (3.67)	7.72 (4.24)*
Education level head	0.42 (0.44)	-0.43 (0.17)**	-0.11 (0.46)	1.82 (1.14)
Primary education (number of adults)	-1.45 (0.55)**	0.21 (0.29)	-1.55 (1.38)	0.12 (0.74)
Secondary education (number of adults)	-0.97 (0.68)	-0.47 (0.33)	8.93 (5.51)*	9.33 (3.37)**
Physical capital				
Land (hectares)	2.17 (0.48)**	0.34 (0.29)**	0.14 (0.26)	2.49 (0.73)**
Cattle, lagged	0.67 (0.42)*	-0.06 (0.18)	1.53 (0.60)**	-0.62 (0.26)**
Log value farm equipment, lagged	0.26 (0.15)*	0.14 (0.08)*	0.55 (0.57)	0.26 (0.19)
Log irrigated land (m^2)	-0.13 (0.34)	1.31 (0.49)**	2.59 (1.64)	-0.65 (0.58)
Village characteristics				
Location dummy	10.74 (1.90)**	-3.74 (1.43)**	19.95(12.19)*	8.90 (9.99)
IMR (cash cropping)		-1.66 (2.99)	~	~
IMR (livestock keeping)		~	-38..51 (29.11)	~
IMR (non-farm activities)		~	~	-32.72 (25.34)
R-squared	0.60	0.42	0.45	0.28
Number of observations	223	223	223	223

Notes: [a] robust standard error in parentheses

[b] * denotes significance at the 10% level, ** denotes significance at the 5% level

Table 6. Migration-Asset Interaction Effects on Activity Incomes (FCFA/10.000)

	Staple cropping	***Cash cropping***	***Livestock***	***Non-farm activities***
		I. Interaction: Land		
Land x continental migrants	0.09 (0.14)	-0.03 (0.06)	0.01 (0.06)	-0.21 (0.19)
Land x intercontinental migrants	-0.47 (0.37)	0.24 (0.34)	0.94 (0.41)**	0.75 (0.45)*
Land	2.22 (0.67)**	0.28 (0.35)	-0.21 (0.25)	2.73 (0.86)**
Continental migrants	-1.49 (1.01)	0.01 (0.38)	0.08 (1.04)	-0.87 (1.50)
Intercontinental migrants	0.31 (2.67)	-1.23 (1.68)	3.52 (7.23)	-16.72 (6.94)**
		II. Interaction: Irrigated land		
Irrigated land x continental migrants	2.14 (1.68)	-1.10 (0.63)*	-0.20 (0.96)	-2.55 (1.86)
Irrigated land x intercontinental migrants	0.68 (2.09)	2.63 (1.20)**	4.98 (1.60) **	-0.07 (2.18)
Irrigated land	-0.47 (0.42)	1.27 (0.50)**	2.33 (1.75)	-0.29 (0.66)
Continental migrants	-1.63 (0.74)**	0.22 (0.22)	0.25 (0.86)	-1.26 (1.07)
Intercontinental migrants	-2.99 (2.11)	-1.69 (0.51)**	5.75 (5.69)	-10.30 (5.56)*
		III. Interaction: Farm equipment		
Equipment x continental migrants	0.21 (0.10)**	-0.06 (0.04)	0.06 (0.08)	-0.03 (0.12)
Equipment x intercontinental migrants	-0.13 (0.20)	0.09 (0.15)	-0.10 (0.23)	0.14 (0.23)
Equipment	0.08 (0.19)	0.19 (0.09)**	0.44 (0.65)	0.26 (0.22)
Continental migrants	-2.38 (0.75)**	0.24 (0.32)	-0.39 (1.10)	-1.92 (1.16)*
Intercontinental migrants	-1.99 (1.84)	-0.27 (0.49)	9.79 (5.78)*	10.51 (5.34)*
		IV. Interaction: Cattle		
Cattle x continental migrants	0.07 (0.37)	-0.12 (0.22)	0.01 (0.23)	-0.24 (0.32)
Cattle x intercontinental migrants	0.56 (0.34)*	0.44 (0.33)	1.15 (0.34)**	-0.32 (0.72)
Initial cattle	-0.21 (0.75)	-0.30 (0.19)	-0.08 (0.32)	0.04 (0.29)
Continental migrants	-0.91 (0.94)	0.22 (0.37)	-0.08 (0.80)	-2.19 (1.15)*
Intercontinental migrants	-4.40 (1.81)**	0.48 (0.74)	3.14 (6.02)	-8.88 (5.86)

Notes: [a] robust standard error in parentheses

[b] * denotes significance at the 10% level, ** denotes significance at the 5% level

Appendix
Model Derivations

Objective Function

$$U = Eu(C, X_l; Z_U) \tag{1a}$$

Constraints

$$C = \sum_i y_i + R_C(M_C) + R_I(M_I) \tag{2a}$$

$$y_s = p_s g_s(L_s; A) + \eta_s \tag{3a}$$

$$y_{ns} = \left[p_{ns} g_{ns}(L_{ns}; A) + v_{ns}(L_{ns}; A)\eta_{ns}\right] | K_{ns} \tag{4a}$$

$$\sum_{ns} K_i \leq W^{max}, W^{max} = g_W(M_C, M_I, Z_K) \tag{5a}$$

$$\sum_i L_i \leq T - M_C - M_I - X_l \tag{6a}$$

Lagrangian

$$L = Eu(p_s g_s(L_s; A) + \eta_s + \left[p_{ns} g_{ns}(L_{ns}; A) + v_{ns}(L_{ns}; A)\eta_{ns}\right] \left| K_{ns} + R_C(M_C) + R_I(M_I), T \div L_s \div L_{ns} \div M_C \div M_I; Z_U\right) + \lambda(W^{\max} \div \sum_{ns} K_i) \tag{7a}$$

$$\lambda = 0 \text{ if } \sum_{ns} K_i < W^{max}, \lambda > 0 \text{ if } \sum_{ns} K_i = W^{max} \tag{8a}$$

FOC for labor supply in staple and non-staple activities

$$\frac{\partial L}{\partial L_s} = Eu_C p_s \frac{dg_s}{dL_s} = 0 \tag{9a}$$

$$\frac{\partial L}{\partial L_{ns}} = Eu_C p_{ns} \frac{dg_{ns}}{dL_{ns}} + \frac{dv_{ns}}{dL_{ns}} \eta_{ns} \mid K_{ns} = 0 \tag{10a}$$

$$\frac{W^{max}}{\sum_{ns} K_i} \geqslant 1 \tag{11a}$$

$$E[u_C p_{ns} \frac{dg_{ns}}{dL_{ns}} + \frac{dv_{ns}}{dL_{ns}} \eta_{ns} \mid \frac{W^{max}}{\sum_{ns} K_i} \geqslant u_C p_s \frac{dg_s}{dL_s}] \tag{12a}$$

$$E[\ \ u_C \frac{dC}{dL_{ns}}] \mid \frac{W^{max}}{K_{ns}} \geqslant E[u_C \frac{dC}{dL_s}] \tag{13a}$$

Endnotes

[1] Discussions of migration theories and their implications appear in Massey, et al. (1988) and Taylor and Martin (2001[0]).

[2] The sample is slightly smaller for Béguédo, where 43 households were surveyed.

[3] Women who left the household upon marriage were not considered as migrants.

[4] Within the group of continental migrants a t-test reveals that remittances of migrants within and outside Burkina Faso (but within Africa) do not differ significantly, supporting the joining of these forms of migration into one group.

[5] There are only a limited number of observations on costs of migration. Households spent about 200,000 FCFA per inter-continental migrant and between 3,000 and 7,000 FCFA per continental migrant.

[6] A cross-section sample of households face similar prices; thus, prices do not appear as right-hand-side variables in (9).

[7] 168 FCFA=1$(PPP 2002)(World Bank, 2005).

[8] Fixed effects models also suffer from some limitations, including their inability to test for the effects of time-invariant variables (e.g., land) on activity incomes. It is not possible to include fixed effects in a probit model.