Migration and Income Diversification

Evidence from Burkina Faso

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1. Introduction

This paper uses econometric methods and new data from Burkina Faso to explore the relationship between migration and rural income diversification. Rural households in Burkina Faso send out migrants within the African continent but also inter-continentally, primarily to Europe. Many also diversify their household production into cash crops, livestock, and non-farm activities. We test separately the effects of African and inter-continental migration on both participation and income from cash crop, livestock and non-farm activities. The analysis uses unique new data collected by one of the authors (Wouterse) in a 2003 survey of households in four villages situated on the Central Plateau of Burkina Faso.

We begin by presenting, in Part 2, a discussion of the role of migration in the context of missing or incomplete rural markets, as posited by the new economics of labour migration (NELM). Part 3 presents an agricultural household model, which provides the conceptual basis for the analysis. The econometric model used to determine the role of continental and inter-continental migration in determining household activity choice and activity-incomes appears in Part 4. Part 5 reports our econometric results. We conclude in Part 6 by discussing some of the implications of our findings for understanding the role of migration in rural income diversification and welfare.

2. Study sites and methodology

Agriculture is the primary activity of the survey households and cropping in Burkina Faso cropping is characterised by one short, single cropping season per year. The consequence of engaging in rainfed agriculture in a drought-prone environment is that households face

substantial risk. Formal crop insurance is not available to mitigate this risk 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 *et al.*, 1992).

Uncertainty combined with missing markets for risk creates incentives to diversity income activities; however, investment options are constrained by an incomplete credit market. Limited collateral and collateral substitutes severely limit rural households' access to formal credit, in West Africa and elsewhere (Binswanger and Rosenzweig, 1986; Binswanger *et al.*, 1989; Reardon *et al.*, 1992; Fafchamps *et al.*, 1998). The lack of collateral is compounded by a missing land market. In Burkina Faso commercial land market transactions were found to be extremely rare (Ouedgraogo *et al.*, 1996). The lack of commercial land market transactions implies that land cannot function as collateral for credit.

In addition to a missing market for land, the use of hired labour in agriculture is extremely rare in the surveyed villages, representing approximately one per cent of total labour use (measured in worker days) in the four villages. A missing market for labour is characteristic of rural areas characterized by a lack of a landless class and high homogeneity in factor endowments (De Janvry *et al.*, 1991).

Missing or imperfect markets for credit and insurance imply that risk cannot be mitigated through formal institutions. Diversification of productive activities enables a household to reduce the risk it faces through generating income from sources not correlated with cropping income. Households in the study area were found to diversify by engaging in migration, cash cropping, livestock production and non-farm activities. The

diversification options for the survey households differ in their input requirements. Non-farm activities as well as cash cropping are generally labour-intensive and capital-extensive. Livestock production requires substantial investment and is labour-extensive.

When credit and insurance markets are imperfect, migration, as a diversification option, can influence household choices among income activities and technologies. According to the NELM theory, migration is likely to have multiple and counteracting impacts on the productive activities of the household due to the constraining effect of imperfect market mechanisms. Migrants can be considered as financial intermediaries providing the remaining household members with a source of liquidity, through remittances. At the same time, migration implies a loss of household labour to distant labour markets.

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 activities. As a substitute for formal or informal credit, migrant remittances may enable households to overcome liquidity constraints on investing in new technologies and activities. However, by reducing the supply of household labour available for these activities, migration may negatively affect investment and production in labour-intensive activities when a labour market is missing.

In the context of Burkina Faso, continental and inter-continental migration may affect household risk, liquidity and labour constraints differently. Inter-continental migration to distant labour markets usually entails a relatively long-term loss of labour and entails risks associated with international border crossings, which often are attempted

without documents. However, average remittances from inter-continental migrants are considerably larger than those from continental migrants. Thus, inter-continental migration is a more efficient strategy to overcome liquidity constraints on farm and non-farm investments.

3. Theoretical Considerations

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

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

where C is a vector of consumption goods, X_l is leisure, and Z_U is a vector of household characteristics influencing utility. 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 household 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:

$$y_s = p_s g_s(L_s; A) + \eta_s \quad (3)$$

L_s is household labour 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 the 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:

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

where p_{ns} is the output price of non-staple products; L_{ns} is household labour 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 labour investments on production risk (Just and Pope, 1979). (For simplicity, we assume that $K_i = 0$ for staple production. All households in the data set used for our empirical analysis were engaged in staple production). Following the NELM theory, the entry constraint may be modelled 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 other assets, Z_K :

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

If perfect labour markets do not exist, labour availability for production and migration is constrained by household-labour supply; i.e.,

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

4. Empirical Analysis of Migration and Diversification

Imperfect markets imply that the constrained vector of income sources depends on migration and remittances. 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, entry 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 able to overcome the entry constraint, if binding (i.e., those that can afford K_{ns}) will allocate labour 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 labour 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. If migration influences liquidity constraints, labour availability or considerations of risk, the effect of migration may be either positive or negative, depending upon which effects dominate. 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.

Observation of activity incomes is conditional upon participation. To correct for censorship, the equations in (8) were estimated jointly controlling for activity choice utilizing Lee's (1978) generalisation of Amemiya's (1974) two-stage estimator. This procedure consists of first estimating a probit regression for participation in each non-staple activity, using the complete set of explanatory variables in equations (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 $\theta(\cdot)$ denotes the cumulative normal distribution function. In the second stage of estimation, these inverse Mills ratios are included as an additional explanatory variable in the activity-income regressions for cash cropping, livestock, and non-agricultural production; i.e.,

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

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, the quantity of which is assumed to be exogenously given, and the number of cattle at the start of the survey year); a dummy for access to irrigated land; and household characteristics (human capital variables such as age of the head of the household, number of adults with primary and secondary education, and the number of past absentees, i.e., household members who have migrated in the past but have 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 and 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.[3]

5. Results

The results of the probit estimation for activity choices are given in table 1. The table reports the estimated percentage point change in the probability of participating in a particular activity associated with a one-unit change in the corresponding explanatory variable. The relationship between inter-continental migration and participation in livestock production is positive and significant. As mentioned previously, remittances from inter-continental migration are much larger than those from continental migration. The finding that inter-continental migration increases participation in livestock is consistent with the hypothesis that having inter-continental migrants enables households to overcome liquidity and/or risk constraints on livestock investments. Inter-continental migration has a significant effect on participation in non-farm activities. These activities are often labour intensive and could thus be expected to compete with long-term inter-continental migration for household labour. The positive and significant coefficient on

[3] One could argue that, although the migration variables are pre-determined, they may be stochastically related to activity incomes and participation over time; for example, all three could be correlated with unobserved household variables. One way to deal with this problem is to estimate fixed-effects models; however, this is not possible using cross-section data. No other candidates for migration instruments are available from the survey.

the location dummy, which is set to one for the easy access villages Boussouma and Korsimoro, suggests that market access stimulates non-farm activities (a large market is held regularly in Korsimoro).

Table 1 Probit estimation results for activity choice

Variables	***Cash cropping***	***Livestock purchase***	***Non-farm activities***
Constant	0.27 (0.53) [a]	-1.79 (0.47)**	0.23 (0.43)
Household composition			
Household size	-0.04 (0.05)	0.06 (0.04)*	0.00 (0.04)
Inactive members	0.02 (0.07)	-0.06 (0.05)	0.02 (0.05)
Age household head	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Stock of continental migrants, lagged	0.01 (0.10)	0.03 (0.09)	0.03 (0.09)
Stock of intercontinental migrants, lagged	-0.21 (0.26)	0.26 (0.15)*	-0.31 (0.17)*
Human capital			
Past absentees	0.14 (0.25)	0.16 (0.22)	0.30 (0.21)
Education level head	-0.07 (0.08)	-0.11 (0.08)	0.10 (0.07)
Primary education (number of adults)	-0.03 (0.10)	0.01 (0.08)	-0.01 (0.07)
Secondary education (number of adults)	-0.05 (0.22)	0.23 (0.13)*	0.25 (0.15)*
Physical capital			
Land (hectares)	0.10 (0.06)*[b]	-0.01 (0.03)	0.05 (0.04)
Cattle, lagged	0.02 (0.07)	-0.03 (0.04)	-0.01 (0.06)
Log value farm equipment, lagged	0.02 (0.03)	0.03 (0.02)	-0.00 (0.02)
Dummy for irrigated land	2.75 (0.47)**	0.52 (0.26)*	-0.18 (0.23)
Village characteristics			
Location dummy	-0.32 (0.32)	0.68 (0.28)**	0.61 (0.25)**
Pseudo R-squared	0.44	0.14	0.14
Number of observations	223	223	223

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

The results of the estimation of the income equations given participation, which correspond to the second stage of the model, are given in Table 2. The findings in Table 2

reinforce those of Table 1 with respect to the effects of migration on staple and non-staple incomes.

Table 2 2SLS estimates of net income regressions (CFA/10.000)

Variables	***Staple cropping***	***Cash cropping***	***Livestock keeping***	***Non-farm activities***
Constant	-16.04 (18.20)[a]**[b]	-2.96 (3.53)	-55.66 (34.32)*	- 1.41 (8.94)
Household composition				
Household size	0.92 (0.45)**	- 0.18 (0.19)	1.47 (0.85)*	0.60 (0.36)
Inactive members	-0.68 (0.66)	0.13 (0.27)	-1.75 (0.78)**	- 0.27 (0.53)
Age household head	0.15 (0.10)	0.09 (0.04)*	-0.20 (0.11)*	- 0.17 (0.10)
Stock of continental migrants, lagged	-0.51 (1.06)	0.30 (0.44)	0.78 (0.56)	- 1.68 (0.84)**
Stock of intercontinental migrants, lagged	- 6.19 (2.16)**	0.81 (0.90)	2.70 (1.44)*	- 5.93 (2.64)**
Human capital				
Past absentees	0.63 (2.66)	1.40 (1.11)	3.39 (2.18)	3.38 (2.81)
Education level head	0.64 (0.91)	-0.53 (0.38)	-0.17 (0.44)	1.25 (0.80)
Primary education (number of adults)	- 2.19 (0.96)**	0.08 (0.40)	-0.58 (0.70)	0.01 (0.76)
Secondary education (number of adults)	-1.93 (1.67)	- 1.01 (0.69)	5.56 (2.42)**	6.43 (1.93)**
Physical capital				
Land (hectares)	3.75 (0.49)**	0.40 (0.22)*	0.20 (0.23)	1.87 (0.48)**
Cattle, lagged	1.91 (0.46)**	-0.18 (0.19)	1.81 (0.21)**	-0.71 (0.37)*
Value productive assets	0.57 (0.25)**	0.22 (0.11)*	0.31 (0.34)	0.35 (0.20)*
Dummy for irrigated land	2.48 (8.16)	6.19 (3.39)*	13.26 (6.07)**	- 1.48 (2.61)
Village characteristics				
Location dummy	10.66 (3.14)**	- 1.79 (1.36)	15.10 (6.96)**	- 0.83 (4.70)
IMR (cash cropping)		0.33 (3.40)	~	~
IMR (livestock keeping)		~	-25..37 (16.25)	~
IMR (non-farm activities)		~	~	- 7.74 (11.38)
R-square	0.54	0.28	0.42	0.27
Number of observations	223	223	223	223

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

An additional inter-continental migrant, *ceteris paribus*, reduces net income from staple production by 61.900 CFA[4] consistent with the existence of an imperfect labour market. There is evidence in the data of some labour substitution through equipment hire; however, use of labour-saving equipment increases the costs of staple cropping. A negative effect of inter-continental migration on staple income is also consistent with a risk explanation. Households with inter-continental migrants may reduce the effort they invest in staple cropping as an income-insurance strategy, knowing that they can rely on remittances should shortfalls occur.

In contrast to staples, inter-continental migration has a significant and positive association with livestock production. Households with inter-continental migrants are more likely not only to purchase livestock but also to invest more in livestock production than households without inter-continental migrants. These findings are consistent with liquidity constraints that are binding in households without inter-continental migrants but loosened by remittances sent home from abroad.

Both continental and inter-continental migration have a significant negative effect on income from non-farm activities, but the effect of inter-continental migration is about three times larger. This result is not unexpected given the labour intensity of most non-farm activities. A loss of household labour 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.

[4] 168 FCFA=1$ (PPP 2002) World Bank. (2005).

6. Conclusions

In a context of missing or incomplete markets, migration activities that absorb household labour while contributing liquidity through remittances may influence both activity choice and activity incomes. The NELM theory points to the important role that migration can play in enabling households to overcome credit constraints and facilitate investment in relatively high return activities. Our analysis controls for activity choice while testing for an effect 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 was 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 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 labour constraints that create a trade-off between long-term, inter-continental migration and relatively labor intensive activities. 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.

These findings, in combination, offer tentative support for the 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. Negative influences of migration on non-farm and staple activities suggest that migration may lead households to diversify less when production activities are labour-intensive.

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