

Full Length Research Paper

Migration and agricultural production in Burkina Faso

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Accepted 9 March, 2011

This article analyzes the relationship between migration and agricultural production in Burkina Faso. It lies on the model of the New Economics of Labor Migration, and uses the 2003 to 2004 cropping season data collected in the Sudanese area. The results show that the majority of rural households in Burkina Faso are involved in migration, and migration is an important part of their income. The results obtained from the analysis come to validate partially the assumptions of the New Economics of Labor Migration; which highlight some weaknesses in the way markets function in the rural area notably the labor market.

Key words: Migration, remittances, agricultural production, new economics of labor migration, Burkina Faso.

INTRODUCTION

The labor migration topic is one of the major issues in the international news, and it receives a particular consideration. A lot of literature has endeavored to find out the causes of the migration trends, and many causes have been identified in the economic literature to explain why households are more prone to migrate:

- (i) The behavior offered by the other economical areas;
- (ii) The behavior of risk management and;
- (iii) The failure of some economic institutions mainly credit markets and insurance to help to compensate the variations in agricultural income.

The household undertakes migration of some of its members with expectation that, remittances will finance their agricultural investments (Quinn, 2009). Even though a lot of economic literature are made available on the migration phenomena (Vanderkamp, 1971; Stark, 1991; Jayet, 1996), the rapid growth of migration flux throughout the world, especially from developing countries to industrialized countries, suggests to go on with the research by laying a special emphasis on the impact of these migrations on the economies of the migrant countries and particularly on their level of development. Remittances sent by migrants to their countries of origin represent a non-neglectable part of the private capital in the developing countries and these

funds are more important given the level of poverty of the country. The World Bank already stated in 2003 that for one dollar of private capital, six other dollars are sent by the migrant workers. These transfers are an undeniable advantage because they provide more stability than the private capital. They have a stabilization effect because they increase in economic crisis time (in their country of origin) whereas at that same period, the private capital slows down. Remittances have become one of the largest sources of foreign exchange for countries like Mexico (Quinn, 2009). In countries where investment opportunities are poor or too risky, remittances are used to meet punctual needs. Remittances are used for production activities when the situation is suitable to investments.

Study on the relationship between labor migration and rural development led to an economic literature boom. The neoclassical theory states that the labor migration between two economical areas is linked to the difference in the salary received and that migration flux will remain sustainable as long as the salary differential is high for potential migrants (Lewis, 1954; Ranis and Fei, 1961; Todaro, 1969; Harris and Todaro, 1970). According to this approach, the decision to migrate is individual and is based on a rational calculation on the part of the migrant. For the other authors in the New Economics of Labor Migration (Stark, 1991; Stark and Bloom, 1985; Taylor,

1992), migration is not a result of a decision taken by one single individual but a collective decision at the household level, which adopts it as a response to precarious environmental conditions and when there is an incomplete or lack of labor, credit and insurance markets. In particular, the migration at the household's level is undertaken to face the insufficiency and/or the instability of income to reduce poverty. The literature proposes that migration and remittances may increase agricultural technology use by reducing household risk and credit constraint (Quinn, 2009).

Data available on poverty show that it is more accentuated in the rural area than in urban area in the developing countries. In these countries, three quarters of the poor live in rural area (World Bank, 2008). In the case of Burkina Faso, the studies carried out by INSD (1998 and 2003) show that, more than 90% of the poor live in rural area. To cope with poverty, rural households generally combine three strategies: agriculture, non agricultural activities and migration (World Bank, 2008). Labor migration is considered as a crucial strategy for households to survive, particularly in Africa. Recent studies suggest that the members of households who migrate can easily help their families invest in new activities with the cash provided in form of remittances. Migration can help rural households to protect themselves against the flows of the credits and insurance markets.

While transfers sent back by migrants to the farm household can help relax capital and risks constraints, it should be noted that the relationship between migration and agricultural productivity is complex (World Bank, 2008). The absence of household members reduces the agricultural labor supply. Agricultural productivity can therefore fall in the short run but rise in the long run as household with migrants shift to less labor intensive, but possibly equally profitable, crops or livestock (World Bank, 2008).

The New Economics of Labor Migration generally holds that, the effects of migration on the choice of the activity and production is important in an environment characterized by incomplete markets. This is in contradiction with the forecasts of the separable household's models which assumes that, migration simply increases the decaying of the work rented and remittances affect only consumption, but they have no real change on production and investment decisions. In a context of uncompleted markets, migration can influence the choice of the activities made by the household and the income obtained. Recent studies show that, remittances have been used not only for consumption, but also for investments in household business and agriculture (Massey and Parrado, 1994; Durand et al., 1996). The purpose of migration is to insure the household against the risk of agricultural failure. If the household adopts a new technology and the crop falls,

then the migrants can send increased remittances to the household to compensate the agricultural losses (Quinn, 2009). Rozelle et al. (1999) found that migration and transfers affect agricultural production in China. Taylor et al. (2003) showed that in addition to these effects, migration affects non agricultural activities of rural area households.

There are differences in the effects generated by migration according to the time line considered, the activities and the destination of migrants (Taylor, 1992; Wouterse and Taylor, 2008). Migration reduces subsistence agricultural production in the short term, but transfers will improve agricultural productivity and capital accumulation in the long term (Lucas, 1987). Continental migration does not have significant effect over the agricultural activities, but have a negative impact on the non agricultural activities. Intercontinental migrations generate substantial effects and stimulate agricultural activities (Wouterse and Taylor, 2008). Migration is an important phenomenon in rural Burkina Faso. The studies led by the INSD suggest that, transfers provided 33% of household's income in 1994 and 19% in 1998 (INSD, 1998). Recent studies conducted in the rural area show that, transfers of income from urban or outside to rural areas are important, comprising up to 22% of the households income in the drought-prone zones of Burkina Faso (Zahonogo, 2002). In the rural area of Burkina, producers operate in a high risk environment: climate risks and agricultural products price volatility.

In such an environment, innovation remains weak because the use of fertilizers becomes less profitable than in a risk free environment. Faced with these risks, the alternatives for farmers are few. That is due to the fact that, the common mechanisms to combat risk are no more appropriate. Mainly, insurance is precluded because of high geographic covariance in terms of risk, high moral hazard and the limitation of credit because of lack of collateral. In such conditions, one of the solutions for the household to cope with the risk is to help some of his members to migrate.

Fundamental issues related to the relationship between migration and development in Burkina Faso is still raised: (i) what are the factors which determine migration and motivate the migrant to transfer funds back to his family of origin? (ii) How migration affects agricultural production? (iii) Do transfers made by migrant compensate the loss created by the departure of the labor force from their community of origin? These questions are very important from both theoretical and practical point of view. From the theoretical perspective, this research will allow to propose a framework of migration analysis and its effects on the rural development. From the practical point of view, the study should provide interesting solutions for development policies in Burkina Faso. This paper empirically tests the impact of migration and remittances on household main

crops production in Burkina Faso.

The objective of this paper is to find out in which way the participation of households to migration affects agricultural production in the rural area in Burkina Faso.

MATERIALS AND METHODS

Model

The paper illustrates the impact of labor migration on the total agricultural production in Burkina Faso. The model of analysis uses the approach of the New Economics of Labor Migration, which is based on the model developed by Stark (1991) and used by Rozelle et al. (1999) in the case of China. The fundamental assumption used by Stark (1991) to develop his model implies that migrants play the role of financial intermediaries enabling rural households to overcome the constraints based on their ability to achieve the transition from familial to commercial production. The credit hypothesis holds that remittances is a crucial factor as it provides the necessary funding to the credit-constrained household, to purchase the new technology (Taylor and Yanez-Naude, 1999; Taylor, 1987; Taylor and Martin; 2001).

Household may invest a fixed resource \bar{T} (land or family labor), in either a low or high-productivity technology. Production Q_i depends on the amount invested and on the household's characteristics (Z_Y), $Q_i = f_i(\bar{T}, Z_Y)$. At relative price $P = \frac{P_1}{P_0}$ (p₁ price of the high-productivity technology and p₀ price of the low-productivity technology), the household will specialize in the high-productivity technology and its output will be $Q^* = f_1(\bar{T}, Z_Y)$.

However, if it is assumed that the household faces a market constraint on investing in the high-productivity technology, in such a case we should have $c(T_1) \leq K$, $c'(T_1) > 0$. In the case of a credit or cash constraint, $c(T_1)$ would denote the sunk cost related to the adoption, the high productivity technology and K would represent the household's available credit or cash to invest in this technology. For a risk constraint, $c(T_1)$ would be a measure of risk (for example the output variance) associated to the high productivity technology and K would be the maximum level of risk the household would be willing to bear in this technology. Family migrants (M) could contribute to productivity relaxing the credit constraints through remittances (R) or by allaying the risk constraint through remittances or a willingness to remit in the event that, the household suffers income loss. The potential effect of migration on production constraints however, is not always positive.

New Economics of Labor Migration assumes that $K = \theta(R, M)$. The constrained resource allocation to the high productivity technology with a constraint is $T_1^c = \phi(K)$ where $\phi_K > 0$. Constrained output under the high productivity technology is $Q_1^c = f_1(T_1^c, Z_Y)$, and under the low productivity technology is $Q_0^c = f_0(\bar{T} - T_1^c, Z_Y)$. Constrained output per unit \bar{T} is given by:

$$Y^c = (Q_1^c + Q_0^c)/\bar{T} \quad (1)$$

Where $Y^c < Y$, the unconstrained output.

As a result of the fact that, the signs of θ_R and θ_M are undetermined, the impact of migration on productivity remains ambiguous. In the event of market, the model of rural households becomes inseparable, and the market is no more an efficient mechanism for resources allocation for the households. In these conditions, the impact of migration on the production is not null. The assumption of the New Economics of Labor Migration is to test the statistical importance of these coefficients. The economic literature shows that few tests have been carried out for that purpose (Lucas, 1987; Rozelle et al., 1999; Taylor et al., 2003). This study proposes to test the assumptions in the case of Burkina Faso by using the model proposed by Rozelle et al. (1999).

If production is constrained and migration (M) and remittances (R) are important in shaping production constraint, constrained production Y^c depends on migration (M), remittances (R) and the household's characteristics (Z_Y):

$$Y^c = \gamma_0 + \gamma_1 M + \gamma_2 R + \gamma_3 Z_Y + \varepsilon_Y \quad (2)$$

The null assumption associated with the New Economics of Labor Migration is that neither migration nor remittances affect productivity (that is, $\gamma_1 = \gamma_2 = 0$).

Remittances are produced by allocating family members to labor migration; they are shaped by human capital and household characteristics affecting migrant's success and motivations to remit (Z_R):

$$R = \alpha_0 + \alpha_1 M + \alpha_2 Z_R + \varepsilon_R \quad (3)$$

Migration is represented in reduced form as:

$$M = \beta_0 + \beta_1 Z_M + \varepsilon_M \quad (4)$$

With Z_M representing the characteristics of the household affecting the migration. The stochastic terms ε_i , $i = Y, M, R$ are assumed to be normally and independently distributed with variance σ_i^2 .

The socio demographic variables include the income (non agricultural and agricultural income), the production technology and the demographic variables (age, size of the household and level of education). The literature provided some empirical evidences for returns to schooling and other human capital in crop production (Jamison and Lau, 1986) and migration (Taylor and Martin, 1999). In the case of Burkina, Savadogo et al. (1998) demonstrated the influence of production technology and income on the rural household production. Equations (2) to (4) constitute a recursive system with an estimate that raises econometric issues discussed as follows.

Econometric considerations

The system of Equations (2) to (4) is part of the framework of mix system of equations with some limited dependent variables. The econometric models addressing these issues were introduced by Amemiya (1974), Heckman (1976a, b, 1977), Lee (1976, 1977), Nelson and Olsen (1977). Lee (1990) leads to a unified treatment to

the estimated principles of these equations developed by Amemiya. This research uses the formalization developed by Lee (1990).

By following this formulation, the system can be rewritten as:

$$Y_i = Y_i B + X_i \Gamma + \varepsilon_i \quad (5)$$

$i = 1, \dots, N$, where Y_i is $1 \times G$ row vector of endogenous variable, X_i is a $1 \times k$ vector of exogenous variables, $I-B$ is a $G \times G$ non singular matrix, Γ is a $k \times G$ matrix and ε_i follows the normal law of null average and of Σ variance. We assume that $0 \leq G_1 \leq G_2 \leq G_3 \leq G$ and:

- (i) The first G_1 variables Y_{1i}, \dots, Y_{G1i} are observable continuous variables;
- (ii) The next G_2-G_1 variables $Y_{G1+1i}, \dots, Y_{G2i}$ are limited dependent variables, that is one can observe it only when $Y_{ji} > 0$;
- (iii) The next G_3-G_2 variables $Y_{G2+1i}, \dots, Y_{G3i}$ are unobservable latent variables.

However, binary indicators I_{ji} are observable and are determined by the latent variable Y_{ji} as follows:

$$I_{ji} = 1 \text{ if } Y_{ji} > 0$$

$$I_{ji} = 0 \text{ otherwise}$$

$$j = G_2 + 1, \dots, G_3$$

- (iv) The last $G-G_3$ variables are censored dependent variables.

B and Γ can be identified based under rank condition and suitable normalization rules (Lee, 1997). To estimate Equation 5, maximum likelihood methods are too complicated to be useful (Lee, 1990). The methods proposed by Heckman (1976, 1977), Lee (1977), Maddala and Lee (1976), Nelson and Olson (1977) can be easily extended. Alternative estimates can also be derived from Amemiya's principle (Amemiya, 1977a, b). All those methods require estimation of reduced form parameters at the first stage. For Equation 5, reduced form equations always exist:

$$Y_i = X_i \Pi + u_i \quad (6)$$

Where $\Pi = \Gamma(I - B)^{-1}$ and $u_i = \varepsilon_i(I - B)^{-1}$.

Equation 6 can be estimated by a single equation method such as probit or tobit maximum likelihood methods depending on the nature of the dependent variable. The second stage consists to estimate the structural parameters. To simplify the notations, each single equation is specified as:

$$Y_i = R_i \delta_0 + Y_i^* \delta_1 + \varepsilon_i \quad (7)$$

Where Y_i^* is a sub vector of endogenous variables other than Y_i in Y_i . Equation 7 can be rewritten as:

$$Y_i = R_i \delta_0 + (X_i \Pi^*) \delta_1 + v_i \quad (8)$$

Where $Y_i^* = X_i \Pi^* + u_i^*$. With consistent estimators derived in the first stage, the second stage in the methods proposed by Lee

(1976, 1977) is to estimate (δ_0, δ_1) from the following equation:

$$Y_i = R_i \delta_0 + (X_i \hat{\Pi}^*) \delta_1 + w_i \quad (9)$$

Where $w_i = v_i + X_i (\Pi^* - \hat{\Pi}^*) \delta_1$. Equation 9 is estimated by a probit, a tobit, and so on, depending on the nature of Y_i .

The New Economics of Labor Migration states that, migration and remittances are endogenous variables; but they appear in the equations of the production as regressors. This situation could create a bias of endogeneity in the estimation. To solve the endogeneity bias, it is suggested to use instrumental variables. The condition for instrumental variables being valid are twofold: the variables must have explanatory power with regards to the variable they are instrumenting (migration and remittances) and they should not have explanatory power with regards to the variable of interest in the analysis (the main crops production). We assume that in addition to the human capital, migration depends on the migration experience which exists in some villages. The existence of migration experience increases the probability of migration. We approximate migration experience by the percentage of adults from the community with migration experience. For remittance equation, the norm of the village is used as instrument. We use the average amount of remittances (by subtracting the remittances per households considered) to approximate village norm.

For the migration equation, the factor of non-negativity should be taken into account. For that purpose, a model for count data is used. The basic model of the econometric literature for the representation and analysis of model for count data is the Poisson model. The endogenous variable, M_i the number of migrants, is supposed to follow a Poisson law. The probability for a household i to have M migrants is:

$$\text{Prob}(M_i = M) = \frac{e^{-\lambda_i} \lambda_i^M}{M!} \quad (10)$$

$M \in \mathbb{N}$, $\lambda_i > 0$, $i = 1, \dots, n$

λ is the Poisson distribution parameters:

$$E(M_i) = \text{Var}(M_i) = \lambda$$

This parameter is linked to p endogenous variables by the following log-linear form:

$$\log \lambda_i = x_i \beta \quad (11)$$

$$i = 1, 2, \dots, n.$$

The choice of the log-linear specification can be mainly explained by the necessity to have λ_i positive parameters. The individual data are characterized by a problem of non observable heterogeneity which can lead to results robustness problems, if an appropriate method is not used for the estimation. The specification most often used to tackle heterogeneity problem is the regression model of the negative binomial law (or NegBin model: Negative Binomial Model) introduced by Haussman, Hall and Griliches (1984). In this model, M_i always follows the Poisson law, but its mathematical expectancy is marked by an error term noted ε_i which captures many errors of specifications, like to forget the explanation of variables independent to the x or non observable heterogeneity. So M_i follows a Poisson parameter law:

$$\mu_i = e^{(x_i \beta + \varepsilon_i)} = \lambda_i e^{\varepsilon_i} \text{ with } e^{\varepsilon_i} = u_i.$$

Conditionally to x_i and u_i , the distribution of M_i is always a Poisson law:

$$\Pr \text{ob } (M_i = M / x_i, u_i) = \frac{e^{-\lambda_i u_i} (\lambda_i u_i)^M}{M!} \quad (12)$$

The NegBin model is the one used for the migration equation. It is estimated by the maximum of likelihood. The other equations (remittances and production equations) are estimated by the method of Double Least Squares.

Data

The data used in this article are from surveys conducted by the Japan International Center for Agricultural Sciences (JIRCAS) in rural households in the Sudanese zone of Burkina Faso. That zone was chosen because it is well known as a migration zone. Two villages were selected based on the criteria of accessibility. So, a landlocked village (Ouonon) and a relatively open up village (Kolbila) were identified. In each village, we conducted an exhaustive households census. The households were split into three categories according to the level of equipment and use of the agricultural material because, the production technology is supposed to modulate the behavior of the household, mainly the way it uses its labor force. Inside each category, the households are selected in a random way. So, thirty two households were selected per village to be surveyed. The information collected include data on the socio economic characteristics of the household, the number of migrants per household, the different sources of income and the household remittances.

RESULTS AND DISCUSSION

Socioeconomic characteristics

Table 1 presents household's socioeconomic characteristics.

Involvement of the households in migration

Table 1 shows the distribution of the households according to the migration status and the number of migrants per household. For the sample, 77% of households are involved in migration with on average 2 migrants per household.

Level and structure of the household's income

The total average income per adult equivalent (we use the adult-equivalent concept because the use of the size is subject to discrepancies. For example, two households with 3 members are not the same if the first has 3 adults (1 man and 2 women) whereas the second has 1 adult (one woman) and 2 babies) is estimated to be 35000

FCFA for the whole sample. The agricultural income constitute the main source of income with more than 60% of the total income followed by the transfer income (19%) and the non agricultural income.

The socio demographic variables include the level of education and age of the head of the household, size of the household and production technology used by the household. The statistics on these variables show that, there are differences between households with migrants and those without migrants. The households with migrants have an average rate of animal traction use higher than those without migrant (71 against 50%) whereas the average age of the head of the household is higher in the households without migrants than in the households with migrants (about 65 against 53 years). The average size of the households is higher for the households with migrants than for households without migrants. Otherwise, big size households have more chances to have more migrants than the other types of households. The statistics on the education show that, the households with migrants have the best indicators compared with the other households.

Main crops production and yield

The analysis of the main crops production in the zone (sorghum and millet) shows that, the average production per household is estimated to be 1829 kg of grains for a total area of 10.61 ha with more important yield for the sorghum and higher than the millet yields. The households without migrants have a higher level of production and areas than the households with migrants. That assumes that migration would have a negative effect on the level of agricultural production. However, the incidence of migration on the production is not clearly stated, the households with migrants have more important yield for sorghum whereas the other households show more important yields for millet.

Migration and household income

The analysis of the agricultural and non-agricultural income informs that, the households with migrants have an average agricultural income lower than the income got by an average household without migrants; but the average non agricultural income of households with migrants is higher than the income got by the households without migrants. This result suggests that migration has a negative impact on the agricultural income but has a positive impact on non-agricultural activities in rural area.

Econometric results

The econometric results are presented in three levels:

Table 1. Household's socioeconomic characteristics.

Variables	Households with migrant	Household without migrant	Sample
Migration			
Migration distribution (%)			77.72
Migrants (number)			2.42
Socio-demographic characteristics			
Animal traction (%)	71.43	50.00	
Men (unit)	2.27	1.64	
Children (unit)	6.49	5.57	
Women (unit)	3.76	4.14	
Age (years)	52.82	64.79	
None education level (%)	95.92	100.00	
Primary education(%)	2.04	0.00	
Secondary education (%)	2.04	0.00	
Main crops production and yields			
Sorghum Production (Kg)	1633.48	2025.73	1829.61
Millet Production (Kg)	517.16	598.45	557.81
Sorghum yield (Kg/ha)	449.04	363.35	406.20
Millet yield (Kg/ha)	334.40	358.56	346.48
Total area (ha)	9.96	11.25	10.61
Household income structure (FCFA)			
Agricultural income			22245.09
Non agricultural income			6140.76
Transfer income			6668.40
Total income			35054.25
Household income per migration status			
Agricultural income (FCFA)	18612.52	19109.60	
Non agricultural income	5562.52	4427.78	

Source: Survey data.

- (i) The results of migration equation estimation;
- (ii) The results of remittances equation estimation and;
- (iii) The results of the agricultural production equation estimation.

Results of migration equation estimation

The results of the estimation of migration equation are summarized in Table 2. In rural Burkina Faso, the age of the head of the household, the level of education, the number of men and children in the household, the agricultural income and migration experience have a significant effect on the household members migration. However, the number of women and the non-agricultural income have no influence on the members of the household migration. The results show that, the agricultural income acts negatively on migration. Otherwise, a decrease of the agricultural income incites

households to push their members to migrate; this result conforms to the a priori expectations and confirms that, migration is a business to compensate the weakness of the agricultural income, suggesting that the policies for household's income improvement can contribute to reduce the migrations influx. The age of the head of the household has a positive influence on migration. The more the age of the head of the household increases, the luckier are the members of the household to migrate. Indeed, the sign of the quadratic term shows that, the chances of the members of the households to migrate increase up to a certain age and decrease.

In other words, from a certain age, the chances for the members of the households to migrate decreases and the much younger heads of households have more chances to see some of their members migrate comparatively to those heads of households who are older. The level of education of the head of the household has a positive impact on the number of migrants per

Table 2. Results of migration equation estimation.

Variable	Coefficient	Statistics z	Marginal effect
Constant	-0.955	-0.97	
Age	0.063*	1.87	0.131
Age ²	-0.001**	-2.18	-0.001
Education	0.966**	1.99	3.351
Number of children	0.061*	1.72	0.128
Number of women	-0.010	-0.13	-0.021
Number of men	0.159*	1.91	0.332
Agricultural income	-8.77E-07*	-1.88	-1.83E-06
Non agricultural income	-6.09E-07	-1.21	-1.27E-06
Migration experience	0375**	2.19	0.378
Log likelihood	-124.947		
Prob > chi2	0.0004		
Pseudo R ²	0.1077		

Source: Survey data, ** significant at 5% * significant at 10%.

Table 3. Results of remittances equation estimation.

Variable	Coefficient	Statistics t
Constant	8.442	17.650
Number of migrants	0.012***	3.010
Agricultural income	-3.37E-06**	-2.400
Non agricultural income	-1.10E-05	-0.560
Transfers norm	7.09E-06***	4.810
Household size	-0.081	-0.200
Age	0.010	1.580
Education	0.107	0.110
R ²	0.347	
F	16.200	
Prob>F	0.000	

Source : Survey data, *** significant at 1% ** Significant at 5%.

household. The head of households with more education incite their members to migrate. The number of children and men in the household has a positive impact on the number of migrants per household. The households with more men and children are more involved in migration activity. This result suggests that, when there is no labor market or when it does not operate appropriately, migration helps the households to maximize their income through the promotion of all the opportunities which come to it, including the management of its labor force by distributing the labor force between the domestic activities and migration. Migration experience has positive effect on migration. This means that, if in the village there are more adults with migration experience, household members are more likely to migrate.

Results of remittances equation estimation

The results of the estimation of remittances equation are

reported in Table 3. The results suggest a good adequate model with regard to the value R² and the statistic F. The selected variables contribute therefore to explain the volume of remittances that the households receive in the Sudanese zone of Burkina Faso. The number of migrants, the agricultural income and the transfer norms in the village have a significant effect on the volume of remittances whereas the non agricultural income, the size of the household, the age and level of education of the head of the household have no statistical influence on the transfers received by the households.

The agricultural income plays a negative and significant influence on transfers. When the household agricultural income decreases, the household tends to receive more transfers. This result reinforces the previous results on the impact of agricultural income on the number of household migrants. So the migrants transfer some funds back to their household of origin, in order to compensate the insufficiency of agricultural income. This result shows that one of the fundamental objectives of migration in Burkina Faso rural area is to make up for the insufficiency and/or instability of the household agricultural income. The number of migrants in the household and the norm of transfer in the village have a positive influence on transfers received by the household. We anticipate that, a household with a lot of migrants get more transfers than a household with fewer migrants. The norm of the village in terms of transfer has a positive and significant influence on the volume of transfers received by the household. The migrants are therefore influenced by their origin area in the way they behave, what explains the importance of social values in the way individuals behave in the rural area in Burkina Faso.

Results of production equation estimation

The results of the estimation of agricultural production

Table 4. Results of agricultural production equation estimation.

Variable	Coefficient	Statistics t
Constant	10.117	26.120
Number of migrants	-0.098**	-2.070
Transfer income	6.76E-06	0.360
Agricultural income	4.77E-05***	5.660
Non agricultural income	-8.32E-07	-0.060
Working force	0.138***	4.800
Animal traction	0.632**	2.500
Age	-0.008	-1.380
Education	-0.425	-0.510
R ²	0.732	
F	18.400	
Prob>F	0.000	

Source : Survey data; *** significant at 1%, ** significant at 5%.

equation are summarized in Table 4. These results show that, the variables used to explain the agricultural production, contribute to explain production variations with regard to the value R² and the statistics F. The number of migrants, agricultural income, working force and production technology has some influence on the agricultural production, whereas the remittances, non agricultural income, age and level of education of the head of the household have no significant influence on the agricultural production. The number of migrants has a negative and significant influence on the agricultural production. The departure of one member of the household contributes to a decrease in the level of the agricultural production.

This result is justifiable under the assumption on lack or inappropriate functioning of the labor market, which does not help to hire the labor, so as to compensate the departure of the valid members. The remittances have a positive effect on the agricultural production. Remittances offer some possibilities to the households to invest in more performing agricultural technologies which definitely help to increase the productivity. The effect of remittances tends to compensate the negative effect induced by the departure of the migrants. However, the effect of remittances is statistically non-significant. Under the hypothesis of the New Economics of Labor Migration, in the case of incompleteness of labor and credit markets, neither migration, nor transfers has an effect on the agricultural production. That means that when labor and credit markets work appropriately, the coefficients of the number of migrants and transfers is not significant. This hypothesis is partially verified for transfers but the number of migrants significantly affects the agricultural production. This result shows the lack or inappropriate functioning of the labor market in the rural Burkina Faso. If the market was working normally, the households with migrants could go for hired labor to compensate the loss of working force. The agricultural income has a positive

and significant effect on agricultural production. An increase of the agricultural income contributes to increase the level of agricultural production. This result shows that agricultural income determines agricultural production and household reinvest a part of their agricultural income on production.

This result is similar to the one found for Chili (World Bank, 2008). The number of working force has a positive influence on agricultural production. This result is in compliance with what can be expected in labor intensive economy and shows that, policies of promotion for agricultural production should include some actions aiming at having an influence on the number of valid members in the household mainly sanitation policies. The animal traction has also a positive influence on agricultural production. The use of animal traction contributes to increase the agricultural production. In that case, the policies aiming at promoting the agricultural activities should integrate policies for household to benefit from better agricultural equipments.

CONCLUSIONS AND IMPLICATIONS

Migration is an important phenomenon in the Sudanese zone of Burkina Faso involving a high number of households. Migration, through remittances, contributes to the diversification of income sources in that part of the country and the income generated by the transfers is an important part of the total income for the households. Households with migrants have much more important use of animal traction than those households without migrants, in which migration can contribute to a better access of production technologies and an increase of the agricultural productivity.

The analysis shows that migration and remittances are negatively correlated to the agricultural income. In other words, decisions to migrate are taken in order to make up

the insufficiency of the agricultural income of the households through funds transfers. In that case, policies to control the migration flow should be enforced, so as to stabilize the agricultural income. The policies should target actions to provide the producers with better agricultural equipments and to improve the health situation of the population because the results state that, the number of valid members in the household and the animal traction have a positive and significant influence on the level of agricultural production.

The results obtained from the study on the impact of migration on agricultural production, come to partially validate the assumption of the New Economics of Labor Migration. The significant impact of the number of migrants on agricultural production shows an inappropriate functioning of the markets in the rural areas and particularly the labor market. The economic policies should focus on the institutional aspects, by laying the emphasis on the organization of labor market in the rural areas, in order to avoid labor migration which could have a negative effect on agricultural production.

ACKNOWLEDGEMENTS

The author is grateful to Japan International Center for Agricultural Sciences (JIRCAS) for funding this research.

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