A Test of the New Economics of Labor Migration

Hypothesis: Evidence from Rural Kenya

Kirimi Sindi[1]
and
Lilian Kirimi

Department of Agricultural Economics
Michigan State University
East Lansing, MI 48824-1039, U.S.A.

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[1] Lilian Kirimi (**kirimili@msu.edu**) and Kirimi Sindi (**sindijul@msu.edu**) are Ph.D. candidates in the Department of Agricultural Economics at Michigan State University, East Lansing, Michigan, USA.

Abstract

The objective of this paper is to test the new economics of labor migration theory (NELM) using panel data on rural farm households in Kenya. There are is a significant migration-induced labor loss. Number of migrants has a negative influence crop and total farm income. These findings are consistent with other studies that crop income does decrease as migrants leave their households. The implication is that these findings support the predictions of NELM, that migration is associated with lost-labor effects and increased incomes from other sources. However, our findings do not support other studies conclusions that remittances may be partially or fully offset the lost income from labor constraint. However, study findings indicate that taken together, migration and remittances play a role in production activities of migrant-sending households.

Patterns of rural-urban migration in Kenya have changed since independence in 1963, specifically to more permanent settlement of males in cities and increased long-term circulation of females between areas of family settlement and economic opportunity (Thadani, 1982 cited in Brockerhoff and Biddlecom, 1999). Frequent movement between cities/towns and the rural home is a common practice among many Kenyans, particularly in search of rewarding economic opportunities.

International migration in Kenya has also increased especially in the last two decades. It has received considerable attention in literature especially with respect to brain drain of students and workers, the level of remittances and the range of money transfer services operating in Kenya. Kenyans in the diaspora are contributing an equivalent of 3.8 per cent of national income through remittances compared to 2 per cent the total foreign assistant (Ngunjiri, 2006).

However, there are only a few studies on internal migration in Kenya. Such studies tend to focus on determinants of migration decisions and remittance flows from migrants in small and specific geographical areas e.g., (Barber, 1988, Hoddinott, 1994, Hoddinott, 1992). Although useful research exists, there remains a need for deeper understanding of internal migration and its impact on rural livelihoods. Moreover, no study in Kenya has sought to test the new economics of labor migration hypothesis.

Migration has competing effects on households which send migrants out. On one hand, households may face a labor constraint when members migrate from the village. This reduction in labor may lead to decreased crop production and yields, and therefore cropping income. On the other hand remittances directly may increase income available for consumption, and/or raise incomes through on-and off-farm activities. Migrants play the

role of financial intermediaries, enabling rural households to overcome credit and risk constraints to participate in commercial production (Taylor et al, 2003). Where formal credit markets do not function well, households are forced to self-finance investments in production assets (e.g., farm implements and inputs) and off-farm activities, as well as self-insure against various risks. Therefore, remittances play an effective role in overcoming these constraints.

The new economics of labor migration (NELM) theory indicates that migration and migrants remittances have competing effects; they can relax or tighten labor and credit constraints for rural households. A finding of a significant effect of remittances on any non-migration source of household income or agricultural productivity would be evidence in support of the NELM theory. In particular, negative effects would imply that migration exacerbates labor shortages, while positive effects would indicate that migration complements productivity or household income by relaxing credit or risk constraints.

A few tests of the hypothesis can be found in literature (Dwayne, 1998) finds that remittances relax risk constraints on household farm investments. A study by (Taylor, 2003) finds that labor shortages due to migration negatively affect cropping income of migrant-sending households. However, they also show that migrant remittances positively compensate for the lost labor, contributing to household incomes directly and also indirectly by stimulating crop and possibly self-employment production. Lost labor due to migration has been found to have a negative impact on maize production in China, but remittances partially offset some of these losses (Rozelle et al, 1999). Therefore, there is no clear cut answer to the effect of immigration on farm productivity and incomes.

This paper seeks to test the NELM hypothesis. The approach used to test this hypothesis draws heavily from Taylor (2003). The aggregate effect of migration on household production will play a role in determining the way migration affects different sources of household income. In order to test the NELM hypothesis, we estimate the net effect of migration and remittances on household income. The questions addressed are: (i) does migration-induced labor loss reduce crop income?; (ii) what is the effect of remittances on crop production income?; and (iii) how do remittances affect other income sources?

The econometric model is based on a set of inter-related equations on household income sources, remittances and migration. If a household faces production constraints, and if migration and remittances are important in shaping these constraints, then the vector of household income sources depends on migration and remittances, as well as various individual, household and community characteristics. On the other hand, remittances are generated by migrant family members and given migration, they are a function of human capital and household characteristics. Migration is in turn a function of individual, household and community characteristics. These equations form a recursive system and will be estimated using simultaneous-equation econometric methods. Remittances and migration are determined endogenously along with income sources. To control for endogeneity, instruments are used to identify remittances and migration.

No other study has used a longer panel dataset to analyze determinants of migration and remittances and test the NELM hypothesis in Sub-Saharan Africa. Therefore, this paper makes an important contribution to empirical literature on internal migration in

Kenya. Results will provide insights into the competing effects that migration has on rural farm households in Kenya.

Role of migration and remittances in development

This paper looks at the role/impacts of migration and remittances in the context of migrant-sending households. There are several theories that aim to explain why people migrate. The oldest and perhaps best-known is the macro theory of neoclassical economics. This focuses on "pull" and "push" factors, where migration is caused by differences in the supply of and demand for labor in sending and receiving regions (Harris, 1970).   The micro theory of neoclassical economics also known as the rational choice theory states that individuals are rational actors and decide to migrate after a cost-benefit analysis guarantees a positive net return from migration (Todaro, 1987). Demographic and sociological literature has focused on the social network theory (Massey, 1994, Massey, 1993). Network theory hypothesizes that migrant networks in origin and destination regions increase the likelihood of migration by lowering the risks/costs of newcomers**,** providing a support network for them and facilitating their integration in the labor market of the destination areas.

The new economics of labor migration (NELM) (Stark, 1991) defines migration as a tool that households use to overcome market failures. By sending a family member away from home to work, a household makes an investment that will be recovered if the migrant's remit some income later. These remittances are very important where there are poorly functioning local markets for capital, credit, and insurance. According to NELM, missing, inefficient, or poorly functioning markets are necessary for the migration of labor

to occur. Others have argued that there exists an implicit or explicit contractual arrangement between the family and the migrant (Stark and Lucas, 1988). Migration is not the result of a decision made by an isolated individual; it is part of a family strategy (Hoddinott, 1994, Stark, 1991).

Regardless of the theories relevant in any context, migration may have significant effects on household economic activities. Migration is associated with loss of human resources for the migrant-sending households which may translate into a loss in production. Households face a labor constraint when their members migrate. This reduction in labor may lead to decreased crop production and yields, or cropping income. It is also argued that if migrants take capital (human or financial) with them, migrant-sending households suffer additional losses in decreased capital stock. This in turn may adversely affect the productivity of other complementary inputs including labor (Taylor, 1999). These capital and labor losses may negatively affect welfare of migrant-sending households and economic growth of migrant-sending regions.

Migrant-sending households are often recipients of remittances from migrants, which can be considered as a payment for the labor services they export (Stark and Lucas, 1988, Stevens, 1999, Taylor, 1999). As Taylor et al (2003) indicate, migrants are usually attached to their rural homes and as a result of their "homeward" focus, they have economic incentives to promote and enhance the welfare of those left behind. This is possible, either through remittances or savings that they bring back when they return. In the literature, there exist different theoretical explanations of remittance behavior. These include: (i) altruism, which suggests that remittances rise when the economic needs of families back home increase (Becker, 1974); (ii) self-interest, where the migrants'

motivation is based on expectation to inherit land or other wealth. In this case, migrants

make investments in their homes that are taken care of by non-migrating family members;

(iii) the concept of exchange, in which migrants are viewed as effectively paying back

family and relatives for investments in the education or travel of the migrant (Cox, 1987)

and; (iv) the notion of co-insurance, where both migrant and family provide monetary and

in-kind transfers to ensure each other against temporary shocks (Lucas, 1985). Taylor et.

al. (1999) refers to this motivation to remit as the NELM motive where "migrants and their

households are bound together by mutually beneficial, informal contracts, including an

agreement to provide income insurance to one another".

Remittances are generally viewed as a source of income, insurance, and capital

accumulation and thus constitute the biggest direct effect of migration on migrant-sending

households. Taylor (1999) indicates that remittances can reduce or even reverse the

negative effects of labor and capital losses associated with migration. Remittances can

contribute directly to incomes of migrant-sending households, as long as remittances are

greater than the value of production lost due to migration. In addition, remittances can

indirectly contribute to incomes and production of migrant-sending households. This is

because remittances facilitate households to overcome capital and risk constraints on

production activities. In the absence of credit markets, households can utilize remittances

to purchase production inputs that could improve on-farm and off-farm production

activities. Hence remittances are a source of scarce capital for households and provide

insurance against risks emanating from new production activities and technologies. The

magnitude and importance of the indirect effects of remittances hinges on how tight the

constraints that households face are. In situations where these constraints are binding,

households' incentives to send migrants and the attendant indirect effects on incomes, may be large. From the aforementioned, it is clear that the magnitude and direction of the net effects of migration cannot be determined *a priori* and is therefore an empirical question.

The New Economics of Labor Migration (NELM) Theory[2]

The new economics of migration theory as mentioned earlier asserts that migration decisions are made by households and not by individual actors. Households attempt to maximize income and minimize risks resulting from market failures in unstable economies to improve their income relative to the rest of the community (Stark, 1991). The migration decisions result from the volatility or failures of local markets, as portrayed by lack of access to credit and livelihood risk insurance. These imperfect or incomplete markets typically characterize rural areas in developing countries. Therefore, in NELM, households are hypothesized to use migration as a means to overcome missing markets or market failures locally, which compel households to self-finance investments in production and self-insure against income risk. Households send migrants out as part of a strategy to diversify income sources, obtain capital for investment and provide insurance against production and income risks for non-migrating household members. Taylor (1999) argues that remittances set in motion a development dynamic by relaxing production and investment constraints that households face. Remittances may be used to boost production through financing of inputs, new production technologies and activities. They also act as insurance by providing households with income that may be uncorrelated, negatively correlated or not highly correlated with farm income.

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[2] This section as well as the following section on estimation draw heavily from Taylor <u>et al</u> (2003).

The NELM theory leads to specific hypotheses about effects of remittances on migrant-sending households. If credit and risk constraints are binding, and migration helps households to ease these constraints, then migration and remittances should have a positive effect on local production and incomes of migrant-sending households. The more liquidity-constrained a household is the greater is the marginal income effect of remittances.

This theory analyzes migration as a household decision rather than an individual decision. Continuing interactions between migrants and rural households imply that a household model would be more suitable than an individual level model of migration decisions.

Taylor (1999) explains that NELM entails a new view about how interactions between migration and development are conceptualized and modeled. Earlier research tended to separate the determinants of migration from the impacts of migration on migrant sending households. However, in NELM, the origin of migration (represented by households' desire to overcome credit and risk constraints) implies certain outcomes of migration for development. For instance, migration is expected to have a positive effect on local production, as remittances enable households to overcome production constraints. An implication of NELM is that there are potential correlations between migration and other income sources, and therefore migration cannot be modeled separately from other aspects of the farm household.

Further, Taylor (1999) points out that "often, the factors encouraging people to migrate also limit the productive potential of migrant remittances. Poor public services and infrastructure seriously limit the potential for remittances to contribute to local production". It is also argued that migration is likely to have a larger impact on

development where local institutions are in place to channel savings from migrant-sending households to local producers. This is where "migrants do not have to play the simultaneous roles of workers, savers, investors, and producers" (Taylor, 1999).

Theoretical model

Following Rozelle (1999)) and Taylor et. al. (2003), consider a household that may invest a fixed input $(\bar{I})$ like land or labor in either a low-return or a high-return activity. Let Q_i, for i=0, 1 be the output from these two activities, respectively. The returns from these activities are influenced by a vector of household characteristics (Z_{HH}). Given relative prices p_1/p_0, the household will specialize in the high-return activity, obtaining an output $Q^* = f_1(\bar{I}, Z_{HH})$, and an income $Y^* = g(Q^*)$. Assume the household faces a market constraint in investing in the high-return activity, $c(.) = I_1$, with $I_1 < \bar{I}$ and where $c(.)$ represents a constraint such as lack of formal credit that limits the household to invest only I_1 of the fixed input. Migrants (M) could ease the credit constraint through remittances, (R). The effect of migration on production constraints may not always be positive. For instance, if households face a missing or imperfect labor market, migration may tighten the constraint on investing in high-return activity by forcing the household to rely on the now reduced family labor.

The new economics of labor migration theory hypothesizes that the constraint to investing in a high-return activity is a function of migration and remittances, such that $c(R, M) = I_1$. Further, we can hypothesize that $c_M < 0$ and $c_R > 0$, since migration reduces household labor and provides capital for production. Under this binding constraint,

the household's constrained output from the high-return activity is $Q_1^c = f_1(I_1, Z_{HH})$, while that from the low-return activity is $Q_0^c = f_0(\bar{I} - I_1, Z_{HH})$. The household achieves a constrained income of $Y^c = g(Q_1^c, Q_0^c)$, with $Y^c < Y^*$, the unconstrained income.

Under imperfect markets, we expect migration to have non-zero impacts on household income. However, since the relative magnitudes of derivatives c_M and c_R are unknown, the overall effect of migration on total household income is ambiguous. A finding of a significant effect of migration and remittances on any non-migration source of income in the migrant-sending household would be evidence in support of the NELM theory. In particular, negative effects would imply that migration exacerbates labor shortages, while positive effects would mean that migration complements productivity or household income by relaxing credit or risk constraints.

Econometric Model and Estimation Strategy

Following the work of Taylor <u>et al</u> (2003), suppose a household faces production constraints, and migration (M) and remittances (R) influence these constraints. Then a vector of non-remittance household income sources (Y) depends on M and R, as well as various individual, household and community characteristics (X_Y):

$$Y = \beta_0 + \beta_1 M + \beta_2 R + \beta_3 X_Y + \varepsilon_Y \tag{1}$$

Through production, migration and remittances may have differential effects on different income sources. The income components considered are total farm, crop, off-farm and business income. The objective of this paper is to determine the impact of migration and remittances on household income from various sources. Therefore we will estimate equation (1) for each income source. The null hypotheses associated with the NELM

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theory is that neither migration nor remittances affect household income sources; i.e.

$\beta_1, \beta_2 = 0$, in each of the income equations.

Remittances are generated by migrant family members. Given migration, they are a function of human capital (individual) and household characteristics (X_R):

$$R = \delta_0 + \delta_1 M + \delta_2 X_R + \varepsilon_R \tag{2}$$

The vector of variables, X_R affect a migrant's motives and ability to send remittances back home.

Migration is in turn a function of individual, household and community characteristics (X_M), such that:

$$M = \alpha_0 + \alpha X_M + \varepsilon_M \tag{3}$$

The econometric model is based on a set of inter-related equations on household income sources, remittances and migration. Equations (1-3) form a recursive system and will be estimated using simultaneous-equation econometric methods. Given that the number of migrants per household is a non-negative number, and not every household sends migrants while some households send out more than one migrant, the migration decision is represented as a Poisson process.

Remittances and migration are determined endogenously along with income sources. To control for endogeneity, instruments are used to identify remittances and migration. We use three variables to identify migration. The first is the annual total precipitation to total potential evapotranspiration ratio. Potential evapotranspiration is a representation of the environmental demand for evapotranspiration. Therefore, this ratio is an aridity index; a numerical indicator of the degree of dryness (harshness) of the climate at a given location. The second is the population density, while the third is the education

attainment of the most educated male and female adults in the household. These variables are chosen since in Kenya, most urban-rural migration occurs typically in areas with harsh climate, or high population density. Also, other things being equal, more educated people are more likely to migrate because they may find better employment opportunities outside the village.

As mentioned before, many factors influence the willingness to send remittances back home. Taylor et al (2003) indicate that migrant remittances may be influenced by village norms to remit. To identify remittances, we use the average level of remittances among households in the village as a proxy for the village norm, the number of people in a household with a formal job and divisional dummies. The latter are meant to capture broader cultural and ethnic group-related norms to remit.

Data

Data used is from a three-wave rural household panel collected by the Tegemeo Institute of Agricultural Policy and Development, Egerton University, Kenya. The household surveys collected information from rural households in Kenya over a seven-year period, with surveys carried out in 1997, 2000, and 2004. There are 1,500, 1,446 and 1,397 households in each of these years, respectively. The data contains information on household farm production and off-farm activities as well as individual, household and community characteristics.

A migrant is defined as a household member who has been away from home for at least one month, working outside the village but not in school. The independent variables used in the analysis are as shown in table A1.

Results

Tables 1 and 2 report the econometric results. The parameter estimates of the migration equation are generally consistent with the expected effects of the explanatory variables on migration. Larger households send more migrants since they have more labor to allocate across various activities. Also, households with a female head and more educated adult members (both male and female), and with security of land tenure are more likely to send migrants. Also, wealthier households, as proxied by value of non-productive assets, send out more migrants. Although the coefficient on wealth is very small, wealth may be a proxy for networks, information and access to outside economic opportunities that enable wealthy households to send out more migrants. However, households with more land per capita that can earn a decent living from the farm are less likely to send migrants. This is because they need more labor for their larger farms, and especially where cropping system is intensive in family labor and perfect hired substitutes are not available. Households residing in villages where opportunities for work are available, send fewer migrants. The variables that identify migration are significant. More migrants are expected from areas with harsh climatic conditions and high population density as well as from households with more educated adults.

The results in tables 1 and 2 show different remittance equations, each of which is estimated jointly with a different source of household income. For instance, column (2) of Table 1 shows determinants of remittances, when remittances and crop income equations are jointly estimated. The results in the remittance equations are generally comparable in terms of signs and magnitude across all the specifications. As expected, remittances are a

positive function of number of migrants, although the effects are not statistically significant in any of the specifications. Female-headed households receive more remittances than male-headed households. Evidence from our estimates in the income models show that they earn lower incomes. Therefore, our finding is consistent with the notion that female-headed households are poorer, and are in need of more financial support. In general, poorer households as represented by the estimate for non-productive assets, receive more remittances.

Land per capita has a large positive effect on remittances. Migrants from households with more land tend to remit more money. This is consistent with the expectation that households that own more land are more likely to be wealthier and provide their children with better education. As a result, the children get higher paying jobs and have incentives to invest in their land. The variables chosen to identify remittances i.e., mean village remittances and number of people with a formal job, are significant and positively related to remittances.

The number of migrants is negatively and significantly related to crop income and farm income while remittances are positively related to these income sources, but are not significant. This is consistent with findings from other studies that crop income decreases as migrants leave their households. This finding supports one of the predictions of NELM, that migration is associated with lost-labor effects. Migration tightens the labor constraints in migrant-sending households. The measure of remittances in our data may not be very accurate, particularly because it is hard to obtain precise amounts of remittances from recall data. Rather, from our data, it seems like the number of people with formal job is a better measure of the level of remittances. These results do not provide a clear and direct

support of the NELM hypothesis that remittances loosen capital constraints on crop production or farm production in general. Therefore, unlike in other studies we do not observe a situation where remittances offset labor-lost effects as a result of migration. Estimates from the crop and farm income models in table 1 indicate that wealthier households and those with more labor or land are able to generate more income. Contrary to our expectations, security of land tenure is associated with lower incomes. Instead of capturing incentives to invest in land, this variable may be capturing dynamics related to commercial farm production. Only 13 percent of households do not have security of tenure and it is possible that a large proportion of these households hire land for commercial purposes. Consequently, they tend to generate far greater crop and farm incomes compared to those who own the land.

Household demographic and human capital variables have a significant effect on crop and farm income. Households with younger families generate lower crop and farm incomes. This is may be because a significant amount of their wealth is invested in their children, particularly in education. This is in direct competition with investment in farm production activities. Education and experience of a household head improve incomes.

Road infrastructure plays a role in rural income generation. In particular, compared to an international road, a provincial or a district road is associated with lower incomes. However, a local road is positively associated with crop and farm income. The type of road indicates how remote an area is. Hence, the more remote an area is, the more important is income from the farm.

Table 1. Determinants of migration and remittances and their effects on household income sources

	(1) Migration	(2) Remittance (crop)	(3) Crop income	(4) Remittance (farm)	(5) Farm income
Predicted no. of migrants		445.371	-9,968.10***	445.339	-12,465.75***
		(1.25)	(3.11)	(1.25)	(3.72)
Remittances			0.382		0.414
			(0.89)		(0.92)
Household size	0.140***	106.008	14,335.46***	103.277	17,861.62***
	(23.09)	(0.43)	(6.56)	(0.42)	(7.81)
No. of children < 6 years	-0.104***	-36.934	-10,154.1***	-34.707	-13,377.94***
	(6.77)	(0.11)	(3.24)	(0.10)	(4.08)
No. of children 6-14 years	-0.093***	27.639	-4,148.349	29.727	-6,857.84**
	(8.21)	(0.10)	(1.60)	(0.11)	(2.53)
Male head (dummy)	-0.078*	-3,206.280***	7,016.473	-3,219.282***	9,985.973
	(1.83)	(3.82)	(0.88)	(3.84)	(1.19)
Education of head	-0.000	160.307*	1,964.338**	161.606*	2,422.422***
	(0.07)	(1.86)	(2.46)	(1.88)	(2.90)
Experience of head	0.004***	42.772**	243.978	43.154**	352.525*
	(2.74)	(1.97)	(1.19)	(1.99)	(1.65)
Land per capita	-0.148***	3,677.615***	21,234.33***	3,669.873***	25,668.847***
	(6.08)	(14.15)	(7.26)	(14.12)	(8.39)
Non-productive assets	6.2e-08*	-0.002***	0.040***	-0.002***	0.056***
	(1.95)	(4.30)	(7.65)	(4.29)	(10.08)
Land tenure (dummy)	0.099**		-20,201.73**		-19,294.712**
	(1.97)		(2.51)		(2.29)
No. of villagers earning a wage	-0.001***	-0.206	-433.84***	-0.214	-537.641***
	(2.64)	(0.02)	(6.29)	(0.03)	(7.45)
Adult death	0.064	-1,127.509	12,202.14	-1,124.722	14,536.487
	(1.34)	(0.98)	(1.13)	(0.98)	(1.28)
Distance to fertilizer store	-0.004**		22.658		92.494
	(2.43)		(0.10)		(0.39)
Provincial road (dummy)[a]	0.170**	-588.715	-21,057.73*	-478.498	-20,851.27
	(2.52)	(0.17)	(1.70)	(0.14)	(1.61)
District road (dummy)	0.037	507.684	-8,481.18	605.685	-12,477.11
	(0.76)	(0.32)	(0.94)	(0.39)	(1.32)
Local road (dummy)	0.027	-335.494	28,178.35***	-251.603	22,442.374***
	(0.60)	(0.20)	(3.58)	(0.15)	(2.73)
Population density	0.0002***				
	(3.57)				
Precipitation/evapotranspiration ratio	-0.853***				
	(8.72)				
Male highest education in household	0.041***				
	(7.46)				
Female highest education in household	0.037***				
	(7.23)				
Village mean remittances		0.927***		0.925***	
		(18.10)		(18.07)	
No. of people with a formal job		2,644.803***		2,639.721***	
		(7.14)		(7.13)	
Productive assets			0.105***		0.116***
			(10.70)		(11.30)
Maize stocks, lagged			4,879.313***		6,295.499***
			(5.42)		(6.69)

Applied for credit (dummy)			28,329.821***		30,314.62***
			(5.28)		(5.40)
Distance to extension			-710.691		-421.73
			(1.43)		(0.81)
Altitude			5.644***		10.82***
			(3.05)		(5.60)
Rainfall			31.669***		29.94***
			(3.44)		(3.11)
Constant		-6,246.069**	-63,241.240***	-6,256.917**	-87,693.01***
		(2.27)	(2.76)	(2.27)	(3.65)
Division dummies		yes		yes	
Observations	4333	4324	4324	4324	4324
Absolute value of z statistics in parentheses					
* significant at 10%; ** significant at 5%; *** significant at 1%					

Notes: [a] The reference is an international road

Productive assets, the stock of maize before harvest and a variable indicating that a household applied for credit are positively and significantly related to crop and farm income. These variables are measures of wealth, implying that wealthier households have more resources to invest in farm production. As expected, areas of higher altitude are associated with more rainfall which have better climatical conditions for diverse farm production.

Evidence from table 2 indicates that number of migrants is positively and significantly related to off-farm and business incomes. Remittances have a positive and significant effect on off-farm income but a negative and insignificant effect on business income. Unlike businesses, off-farm activities are often done on a small scale and do not provide regular income to the households. Therefore, households that engage in these activities still need additional support. Households with very young children (under 6 years) have less off-farm income. This is because the major component of off-farm activities is casual farm labor and care-giving for young children tightens time constraints in a household.

Households with male heads who are more educated have higher off-farm income. This possibly relates a small number of household heads with a formal job, particularly teachers and civil servants. Experience of a household head implies that older heads in rural areas are less likely to generate incomes from off-farm activities and businesses. Instead, they earn their income from farm production activities.

Land per capita is positively to business income while adult death and road dummy variables are negatively related to off-farm and business income. More productive assets promote generation of off-farm and business income while land tenure is positively related to off-farm income. As expected, higher altitude and more rainfall are negatively related to both off-farm and business income.

Table 2. Determinants of remittances and their effects on household income sources

	(1)	(2)	(3)	(4)
	Remittance (off-farm)	Off-farm income	Remittance (business)	Business income
Predicted no. of migrants	395.178	10,710.953***	386.749	3,863.447**
	(1.13)	(5.35)	(1.10)	(2.55)
Remittances		2.550***		-0.298
		(9.35)		(1.44)
Household size	-25.606	496.742	135.943	1,550.798
	(0.11)	(0.36)	(0.56)	(1.49)
No. of children <6 years	121.259	-3,500.062*	-23.744	-1,152.978
	(0.36)	(1.77)	(0.07)	(0.77)
No. of children 6-14 years	188.432	-601.635	11.285	150.404
	(0.68)	(0.37)	(0.04)	(0.12)
Male head (dummy)	-3,205.720***	13,270.941***	-3,186.172***	5,817.996
	(3.83)	(2.62)	(3.80)	(1.52)
Education of head	119.175	3,463.190***	162.520*	-471.179
	(1.39)	(6.83)	(1.89)	(1.23)
Experience of head	41.580*	-626.579***	43.481**	-308.463***
	(1.93)	(4.83)	(2.01)	(3.15)
Land per capita	3,687.354***	-2,638.584	3,648.499***	5,501.132***
	(14.25)	(1.42)	(14.05)	(3.92)
Non-productive assets	-0.002***	0.067***	-0.002***	0.062***
	(4.20)	(19.87)	(4.31)	(24.43)
No. of villagers earning a wage	5.890	-158.254***	0.653	-130.115***
	(0.72)	(3.65)	(0.08)	(3.97)
Adult death	-899.826	-15,599.753**	-1,145.974	-9,021.388*
	(0.78)	(2.27)	(1.00)	(1.74)
Provincial road (dummy)	-1,920.996	-17,496.650**	227.625	-13,282.442**
	(0.56)	(2.23)	(0.06)	(2.24)
District road (dummy)	722.210	-13,419.168**	452.665	-15,094.411***
	(0.47)	(2.36)	(0.29)	(3.51)
Local road (dummy)	-544.468	-7,839.867	106.048	-3,727.366
	(0.34)	(1.58)	(0.06)	(0.99)
Village mean remittances	0.845***		0.932***	
	(16.75)		(18.21)	
No. of people with a formal job	4,329.210***		2,726.144***	
	(12.15)		(7.36)	
Productive assets		0.044***		0.015***
		(7.37)		(3.28)
Land tenure (dummy)		8,676.861*		-2,724.038
		(1.77)		(0.71)
Applied for credit (dummy)		-3,465.159		-2,059.883
		(1.06)		(0.80)
Distance to fertilizer store		208.536		149.653
		(1.49)		(1.37)
Altitude		-5.330***		-3.976***
		(4.77)		(4.71)
Rainfall		-23.721***		-21.046***
		(4.11)		(4.79)
Constant	-6,744.917**	73,525.417***	-6,540.594**	69,626.207***
	(2.50)	(5.37)	(2.38)	(6.71)
Division dummies	yes		yes	
Observations	4333	4333	4333	4333

Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Conclusion

Findings from this study support the NELM hypothesis that migration is associated with lost-labor effects. However, unlike in other studies, we do not observe a situation where remittances offset labor-loss effects as a result of migration. In general, our results indicate that taken together, migration and remittances play a role in households' income generation activities.

It is also evident that better road infrastructure will promote generation of rural incomes, particularly from agriculture. Also, many farming households appear to be capital constrained, and migration and associated remittances are valuable in supporting migrant-sending households who rely mainly on farming income for their livelihood.

We acknowledge that this study may not capture all of the benefits of migration. As Taylor (1999) puts it, the impacts of remittances on migrant-sending households may be transferred to other households in the local area (community spill-over effects) or even to farther areas in the country through trade. Micro-economy wide modeling techniques may capture some of the missed effects of migration and remittances.

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Appendix

Table A1. Summary statistics for variables

	Mean	Std. Deviation
Number of migrants	1.12	1.59
Remittances per household	5273.88	19699.75
Crop income	89300.21	185778.48
Farm income	110470.64	200139.90
Business and informal income	26128.18	90783.96
Household size	7.75	3.20
Number of children less than 6 years	.84	1.06
Number of children 6-14 years	1.94	1.58
Education for head	6.26	4.42
Experience of head	39.21	17.28
Per capita land size	.71	1.23
Non productive asset	27173.88	539657.09
Value of productive assets	102421.70	295545.08
Number of villagers earning a wage	88.22	43.42
Working-age adult death (dummy)	.06	.25
Distance to where fertilizer is bought (km)	8.98	11.84
Provincial road dummy	.07	.26
District road dummy	.27	.44
Local road dummy	.51	.50
International road dummy	.13	.33
Population density	324.53	247.96
Annual total precipitation to total potential evapotranspiration ratio	.82	.17
Amount of long and short rainfall in a growing season	887.04	310.18
Altitude	5347.59	1597.55
Number of people in household with formal job	.68	.80
Household tried to obtain any credit (cash/in-kind)	.46	.50
Number of 90 kg bags of maize in stock from previous harvest	1.16	3.02
Male highest education attainment in household	9.24	3.60
Female highest education attainment in household	8.51	3.50
Village mean remittances	5273.88	6902.59
Distance to extension service (km)	5.37	5.58