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Journal

Journal of International Development, 35(8)

ISSN

0954-1748

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Publication Date

2023-11-01

DOI

10.1002/jid.3781

Peer reviewed

HHS Public Access

Author manuscript

J Int Dev. Author manuscript; available in PMC 2024 November 01.

Published in final edited form as:

J Int Dev. 2023 November ; 35(8): 2332–2350. doi:10.1002/jid.3781.

Labour migration and food security in rural Mozambique: Do agricultural investment, asset building and local employment matter?

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Abstract

Connections between labour migration and food security of left-behind households are still poorly understood. Using data from two waves of a longitudinal survey conducted among ever-married women in rural Mozambique, we employ multi-level ordered logit and negative binomial regressions to examine over time three possible pathways linking men's migration and its economic success to food security of left-behind households—agricultural investment, household material assets and women's local gainful employment. Our analyses find a significant positive association between migration's success, proxied by remittances, and food security and show that this association is largely mediated by household's possession of material assets.

Keywords

agricultural investment; asset building; food security; labour migration; local employment; Mozambique; rural Africa

1 | INTRODUCTION

Food insecurity is among basic manifestations of poverty and inequality and is a major barrier to development in resource-limited settings, such as rural sub-Saharan Africa (Food and Agriculture Organization of the United Nations [FAO] et al., 2018). Labour out-migration, typically of men, is often thought of as a household strategy to ensure food security in rural areas, especially as climate change makes agricultural yields increasingly erratic and unpredictable (Flato et al., 2017; Grace et al., 2012). Yet connections between labour migration and food security are still poorly understood (Antón, 2010; Crush, 2013; Crush & Caesar, 2016, 2017; Thow et al., 2016), especially with

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CONFLICT OF INTEREST STATEMENT

No conflict of interest to declare.

respect to the pathways through which labour migration may affect food security. One particularly important question is how agricultural and non-agricultural investments by migrants in home communities may mediate the relationship between labour migration and food security. Previous studies on links of labour migration with agricultural and non-agricultural investments have produced mixed findings. Some studies have suggested a positive association between migrant remittances and investment in agriculture and livestock (Bohme, 2013; Taylor & Lopez-Feldman, 2010; VanWey et al., 2012) and in non-agricultural economic enterprises (de Haas, 2006; Kagochi & Kiambigi, 2012; Mercandalli, 2018) in sending communities. Yet other studies have reported that migrant remittances are more likely to be used for consumption than to be invested in agricultural activities (Agadjanian & Sevoyan, 2014; Damon, 2010; Davis et al., 2010) or other non-agricultural business ventures (Amuedo-Dorantes & Pozo, 2006). Assessing and understanding these pathways in rural sub-Saharan Africa, where labour migration is widespread and growing yet its economic outcomes are increasingly uncertain (Awumbila, 2017), is of great scholarly and policy importance.

Sub-Saharan Africa is the region of the world with the highest prevalence of undernutrition (FAO, 2020; Hetherington et al., 2017), which has adverse consequences for health of adults (Alebel et al., 2021; Fuseini et al., 2021) and of children (Drammeh et al., 2019; Hetherington et al., 2017), including for cognitive abilities and social development (Bain et al., 2013; Boah et al., 2019; Drammeh et al., 2019; Hetherington et al., 2017). Food diversity and particularly animal protein consumption are limited in the region (Assan, 2014; Bartter et al., 2018; Fraval et al., 2019). Although excessive animal protein intake, especially of red meats, has been linked to negative health outcomes (Leroy et al., 2022; Lokuruka, 2010), it has been argued that in the sub-Sahara increasing consumption of animal food products which are rich in protein may help to reduce the region's chronic problems of food insecurity and inadequate nutrient supply (Assan, 2014; FAO, 2020; Herrero et al., 2014; Leroy et al., 2022; Marinda et al., 2018; Mosites et al., 2017; Parikh et al., 2021).

While most research linking labour migration and food security relies on cross-sectional data, in this study, we use longitudinal data to examine the association between male labour migration and food security of sending households in rural Mozambique, where large-scale male labour out-migration has been going on for generations (De Vletter, 2007; Harris, 1960) and food security is a persistent major concern. Indeed, several parts of Mozambique are characterized by considerable food insecurity (Famine Early Warning Systems Network Mozambique [FEWS NET Mozambique], 2020) and 43% of children under 5 years of age in the country are malnourished (Ministerio da Saude [MISAU] et al., 2013). We examine pathways through which labour migration may be linked to food security in sending households, focusing in particular on the potential role of household's agricultural investments, consumer asset building and local employment. We compare households of migrant men to those of non-migrant men while also disaggregating the former according to the level of migration economic success, defined on the basis of remittances that migrants sent home. To have a full spectrum of household types in a typical sub-Saharan rural setting, we also include households headed by not-married women, which are typically characterized by particularly high probability of food insecurity (Doss et al., 2018; Jung et al., 2016). Overall, we not only find a positive association between labour migration and food security

in sending communities but also detect an instructive variation according to the degree of migration success and the level of household's asset building.

2 | BACKGROUND AND CONCEPTUALIZATION

Studies in sub-Saharan Africa and other developing settings have documented the important role of labour migration remittances for food security in sending households. For example, Kangmennaang et al. (2018) found that households with migrant members were more likely to be food secure compared to households of non-migrants in Malawi. Crush (2013) reported that across southern Africa, over 50% of the average household income spent on food by sending households come from migrant remittances. Yet studies have also argued that despite the growth and diversification of labour migration in sub-Saharan Africa, its economic returns are becoming increasingly unpredictable and uneven (Awumbila, 2017; De Vletter, 2007; Muanamoha et al., 2010). These variations may be consequential for food security: Thus, Sulemana et al. (2019) showed that across the sub-continent, households that receive migration remittances frequently are more likely to be food secure in comparison to households that rarely receive remittances. Hence, considering both the overall impact of migration and variations in this impact, we hypothesize that households of migrants will have greater food security, compared to households of non-migrants and of not-married women, and that the migrant households' advantage will be concentrated among households of economically successful migrants, that is, households that receive regular remittances (Hypothesis 1).

Previous studies have also identified the need for a better understanding of pathways linking labour migration, and labour migration-induced expenditures and investments, with food security in sending communities (Crush, 2013; Crush & Caesar, 2016, 2017; Thow et al., 2016). In rural areas, where farm production is the primary source of food, several studies demonstrated that the size of cultivated land is positively associated with household food security (Bogale & Shimelis, 2009; Feleke et al., 2005; Tefera & Tefera, 2014). Using hired labour in agriculture also showed a positive relationship with household food security (Enete et al., 2005). Similarly, ownership of livestock is also positively correlated with food security (Bogale & Shimelis, 2009; Tefera & Tefera, 2014). Agricultural investments may mediate the connection between labour migration and food security of sending households in multiple ways. For example, migrants' households may invest the income from migration in their agricultural activities, whether it is the expansion of the cultivated farm land, acquisition of pasture for livestock rearing (Jokisch, 2002) or increasing the quantity of livestock they own (Bohme, 2013; De Vletter, 2007; Lucas, 1987; Maphosa, 2007; Taylor & Lopez-Feldman, 2010). Migration remittances may also be applied to introduce improved agricultural techniques that help to raise agricultural production and thus benefit household food security status (Lucas, 1987; Maphosa, 2007). Furthermore, migrant households receiving remittances may use part of those remittances to hire additional labour for their farming activities (Jokisch, 2002; Maphosa, 2007; Mercandalli, 2018). Although previous studies have reported mixed findings (Bohme, 2013; Damon, 2010; Davis et al., 2010), these investments may affect food production and enhance the quality of food available to migrants' families. We therefore hypothesize that the association between labour migration

and food security will be mediated by household's agricultural investments, including the expansion of farming production and an increase in the quantity of livestock (Hypothesis 2).

Understandably, a substantial share of migrant remittances is directly used for food acquisition (Crush & Caesar, 2016; De Vletter, 2007; Moniruzzaman, 2022; Pendleton et al., 2006; Zezza et al., 2011). Yet the portion of remittances available or allocated for food acquisition may be contingent on household's other material needs. Previous studies indicate that household assets (Mabiso et al., 2014; Pitoro & Chagomoka, 2017), including possession of a good quality house (Pitoro & Chagomoka, 2017), may be associated with household food security. Thus, migrants' households that have already improved their housing conditions and secured basic non-productive assets may use a larger share of remittances to increase the amount and diversity of food consumed by their members. In this sense, the advantages of migrants' households in food security relative to households of non-migrants are likely to vary by the degree of migration economic success as measured by remittances. Because migrant remittances are spent on diverse household needs, we expect that migrants' households with a more established non-productive asset base, that is, those with better housing and possessing more consumer items, can channel a larger share of migrant transfers toward food acquisition and diversification. Hence, we hypothesize that household's possession of material assets will mediate the relationship between labour migration and food security (Hypothesis 3).

Engagement in off-farm employment may contribute to generating cash that can be used for acquiring food (Babatunde & Qaim, 2010). Yet the relationship between off-farm employment and household food security tends to be context specific, with a statistically significant association found in some settings (Dzanku, 2019) but not in others (Feleke et al., 2005). If non-migrating women in migrant-sending households are engaged in paid employment, it may also affect the amount of migrant remittances allocated for food acquisition. Successful labour migration resulting in a steady flow of remittances may discourage migrants' wives from engaging in gainful employment (Agadjanian, Hayford, & Oh, 2021), while women from households with rare and meagre migrant transfers may be pushed into such employment outside of subsistence agriculture to compensate for remittance scarcity. We therefore hypothesize that women's involvement in paid work will mediate the association between men's labour migration and food security (Hypothesis 4).

Whereas our primary analyses focus on the overall level of household food security, we also conduct secondary analyses modelling the effects of migration on animal protein intake as measured by frequency of consumption of meat, chicken and fish per week. The cited earlier previous research has reported deficiencies in protein intake in sub-Saharan Africa (Assan, 2014; Bartter et al., 2018; Fraval et al., 2019), and we use this outcome, a proxy for the quality of household nutrition. The hypotheses for this outcome are the same as for our primary outcome.

3 | THE SETTING

Mozambique, a nation in southeast Africa with approximately 33 million inhabitants (Population Reference Bureau [PRB], 2022), became independent from Portugal in 1975.

Soon after independence, it went through a brutal economically and socially destructive civil war between 1976 and 1992 (Cliff & Noormahomed, 1993). After the end of the civil war, and despite being cyclically hit by natural disasters, such as droughts and cyclones (Mondlane, 2004; World Bank, 2019a), Mozambique experienced a strong economic recovery (International Monetary Fund, 2014). Between 2001 and 2015, the economy of Mozambique grew at an average rate of about 8% annually, with the growth slowing down to below 3% in the following 6 years (World Bank, 2022a) mainly because of a reduction in public and foreign direct investment (Barletta et al., 2022). This economic contraction was exacerbated by natural disasters (Mugabe et al., 2021; World Bank, 2019b) and the military conflict in the northern region of the country (Barletta et al., 2022). As all over the world, the COVID-19 pandemic aggravated the nation's economic situation by negatively affecting businesses and households.

About two thirds of Mozambique's population live in rural areas and rely mostly on rain-dependent subsistence agriculture for their livelihood (Instituto Nacional de Estatística [INE], 2019). Although the poverty level has been declining, about 46% of Mozambicans lived below the poverty line in 2015, with about 72% of the poor residing in rural areas (Ministério de Economia e Finanças, 2016). Mozambique ranks near the bottom of the United Nations' Human Development Index (United Nations Development Programme [UNDP], 2022) with a Gross National Income (GNI) per capita of 480 USD (World Bank, 2022b). The country suffers from persistent food insecurity (Mabiso et al., 2014; Matavel et al., 2022) with some households, particularly in arid and semi-arid areas, including parts of southern Mozambique, often forced to reduce amounts and number of daily meals due to lack of income and depletion of food stocks (FEWS NET Mozambique, 2020).

Data used in this study were collected in rural parts of four districts of Gaza province in southern Mozambique with a total population of approximately 700 000 inhabitants. In the study area, rain-dependent subsistence agriculture is the mainstay of local economy, farm land is generally abundant and access to it is typically determined through customary law. Most farm work is done by women. Like in other parts of southern Mozambique, in the study area, cattle, small animals (e.g., goats and pigs) and family poultry rearing are common (Boogaard & Moyo, 2015; INE, 2020; Mabiso et al., 2014).

The study area has a long tradition of male labour out-migration, mainly to the neighbouring Republic of South Africa. This migration started in the colonial era, mainly as a state-organized supply of Mozambican workers to the South African mining industry, and it has continued and grown after Mozambique's independence. While growing in scale, labour out-migration has also become increasingly diverse in forms and economic outcomes (De Vletter, 2007; Muanamoha et al., 2010). Although South Africa has remained the primary migration destination, some migrants from the area work in Mozambique's capital Maputo and other urban centres of this country. Regardless of destination, labour migration is typically a long-term practice, with migrant men spending many years working away from home, while typically returning to their families for brief periods of time, usually during holidays. Likewise, men's local off-farm employment, however limited, is usually an enduring commitment rather than an option that alternates intermittently with labour out-migration (Agadjanian, Hayford, & Oh, 2021). And labour migration, and variations in

its economic outcomes, have been shown to affect various aspects of sending households' well-being, including mortality (Agadjanian, Hayford, & Jansen, 2021; Yabiku et al., 2012), sexual and reproductive health (Agadjanian et al., 2011) and children's schooling (Yabiku & Agadjanian, 2017).

4 | MATERIALS AND METHODS

The study uses data from a longitudinal household survey of ever-married women conducted as part of the Men's Migrations and Women's Lives (MMWL) project. The original MMWL survey sample was drawn in 2006 (Wave 1) following a multistage sampling procedure in which 56 villages (14 per district) were first randomly selected, and then, 30 women aged 18–40 married to migrants or non-migrants were chosen in each of those villages for face-to-face interview. In total, 1678 women were interviewed in Wave 1. The sample was refreshed in Waves 2 (2009) and 3 (2011) to replace women who had died or migrated outside of the study area; if any of the absent respondents were later found and interviewed, substitute respondents were still retained in the sample. Wave 4, a short bridge survey, was carried out in 2014. Wave 5 took place in 2017–2018. In all the waves, most data collection was carried out at about the same time of year (during the dry season). Table A1 summarizes the main statistics and content of each wave (additional information can be obtained from the authors upon request). The MMWL data collection was approved by the Institutional Review Boards of Arizona State University and the University of Kansas (USA).

In this analysis, we use data from Waves 3 and 5 of MMWL. In both waves, detailed information on women's and their household's demographic and socio-economic characteristics were collected, and the Wave 5 survey also included a battery of questions on their households' food security. The analytic sample ($N = 1579$) excludes women who migrated outside of the study area (mainly to urban centres, with minimal farming opportunities) between the two waves, those whose marital status changed during that period and those with missing information on variables of interest.

Our primary outcome of interest is whether a household is food secure in Wave 5. This measure is based on respondent's answers to the following question: *Speaking of food consumption, in the past 6 months, more or less how many times did the following happen?: (i) there was a shortage of food in your household?; (ii) there was little variety of food for children in your household?; (iii) you were worried that you would not have enough to eat? (iv) you ate less than what you thought you should eat?; and (v) you skipped a meal because of lack of food?* Responses to each of these sub-questions could be 'many times', 'sometimes' or 'never'. An average score from the responses to all the sub-questions was estimated for each household, and a three-level measure was created: Households with a score of 2 or lower were classified as 'very food insecure', those with scores between 2 and 3 as 'somewhat food insecure' and those with a score equal or greater than 3 as 'food secure'. Because our indicator of food security is an additive average of responses to the five sub-questions, it applies to all households including those without children (item 'ii' from the above list of questions was excluded in computing this indicator for such households).

The secondary outcome in our study, also measured in Wave 5, is the number of days per week a respondent consumed animal protein. This outcome is based on responses to the following question: *In the past 7 days, approximately how many days did you eat chicken, meat or fish?* Accordingly, it is a continuous measure ranging from 0 to 5.

The effects of migration on family well-being, including food consumption, are typically cumulative and therefore are best captured over time (Chen et al., 2019; Jatrana et al., 2018; Lu, 2010; Melzer, 2011). We take advantage of the longitudinal nature of our data to estimate these possible longer term effects of the investments that labour migrants make in their households. Our predictors are all measured at Wave 3. The main predictor of interest is household migration status. Households of migrants are subdivided into three categories based on migration economic returns to the household, initially defined using frequency of remittances received in the previous 12 months—no remittances received; remittances received one to three times; remittances received four times or more often. This classification is then adjusted using the amounts of those remittances, the amount of money husband left during his last visit home and the amount of money a woman received from her husband when she last visited him at his place of work (if such a visit occurred). Using these amounts, for all migrant households, we computed the approximate total amount of money received from the migrant by his household in the preceding year. Then, households of migrants that received a total of 10 000 Mozambican meticais (approximately USD317, based on exchange rate at the time of Wave 3) or more were included into the high remittance category (i.e., into the same category that households receiving remittances four times or more) even if they received remittances less often; those that received less than 10 000 meticais in total were included into the second category regardless of the frequency of remittances. None of those that received less than 10 000 meticais in total were included in the lowest category as this category is formed by those with no remittances received. Below, we also refer to these three categories in terms of migration success (assessed from the sending household's perspective rather than as a marker of migrant's actual earnings) —most successful, average and least successful. Given that amounts of remittances may not be accurately reported, when creating the measure of labour migration, we combined information on frequency of remittances received and amounts of remittances.

To test Hypothesis 1, our main predictor is household's migration status, with households of migrants divided according to the degree of migration economic success: migrant's households with large transfers (most successful)—the reference, migrant's households with some transfers (averagely successful), migrant's households with no or few transfers (least successful), non-migrant's households and not-married woman's households. For testing Hypothesis 2, we use the same main predictor and add four household's agricultural investments indicators. Three of them are operationalized as continuous variables—the size of the household's farming land (in hectares), the quantity of cattle that the household possesses and the quantity of smaller domestic animals (e.g., sheep, goats and poultry) owned by the household. The fourth indicator is a dichotomous measure of whether or not the household employed remunerated labour for its agricultural activities. To test Hypothesis 3, we add a proxy measure of the need for food-unrelated consumer spending which may affect the amount of money available to acquire food. It is captured through the household's housing conditions and possession of durable non-productive assets in working

condition, also assessed in Wave 3. It is an additive measure created on the basis of the following items: household residence's walls made of blocks or bricks, having electricity, having a safe source of drinking water at or near the residence, having flush toilet or improved latrine, ownership of a metal or wooden bed with a mattress, ownership of a radio and ownership of a cellular phone. Finally, to test Hypothesis 4, a measure of woman's engagement in paid local employment outside subsistence agriculture at Wave 3 is added. It is operationalized as a dichotomous variable: whether or not in 30 days preceding the survey date the respondent was engaged in any activity with the purpose of gaining money, products or goods (regardless of her involvement in subsistence farming in that period). The last, full model has all the hypothesized pathways of links between labour migration and food security included.

All the models control for woman's age, education and decision-making autonomy and for household dependency ratio. These variables are included given their potential connections with food security. Thus, woman's age has shown a positive association with food security status (Tefera & Tefera, 2014; Tibesigwa & Visser, 2016). This variable is operationalized as five categories: 21–25, 26–30, 31–35, 36–40 and 41+ years old. Respondent's education is included as education of household adult members is an important positive predictor of household food security status (Mutisya et al., 2016; Pieters et al., 2013; Pitoro & Chagomoka, 2017; Sulemana et al., 2019). Education, especially of women, may also positively affect food security of other household members (Burchi, 2010; Pieters et al., 2013). Woman's education has three categories in our analyses: no education, 1 to 4 years of schooling and 5+ years of schooling. Women's decision-making autonomy has demonstrated a positive relationship with household food security (Dzanku, 2019; Komatsu et al., 2018; Pieters et al., 2013). Women with higher autonomy may possess greater control of household resources (Dzanku, 2019) and are more likely to have knowledge about dietary intake needs (Pieters et al., 2013). This variable is operationalized as a continuous variable based on Wave 3. Finally, household dependency ratio at Wave 3 was included as a control because this ratio has shown an inverse connection to household food security (Bogale & Shimelis, 2009; Feleke et al., 2005; Mutisya et al., 2016). Household dependency ratio at Wave 3 is obtained by dividing the number of household members aged 0 to 14 years and those aged 65 years or older by the number of household members aged 15 to 64 years. Table 1 shows the distribution of all variables used in the analyses.

In testing the hypotheses, we fit ordered logistic regression to predict the level of food security and negative binomial regression to predict frequency of animal protein intake. Ordered logistic regression is appropriate when the outcome is operationalized as an ordinal variable, while negative binomial regression is best suited for the kind of count data that frequency of protein intake represents (Allison, 2009). For all multivariable analyses, we use a multi-level approach (Raman & Hedeker, 2005; Tirore et al., 2020) fitting two-level regression models, with households as Level 1 and village as Level 2, thus accounting for unobserved village-level characteristics. The multi-level ordered logistic regression models have the following form:

$$\log[P_{ijc}/(1 - P_{ijc})] = c - (\beta X_{ij} + U_j).$$

where $\log[P_{ijc}/(1 - P_{ij,c})]$ is ordered log-odds of being at c level of food security for woman i in a jth village; c is a model threshold or intercept for $c - 1$ level of food security, and it is a fixed parameter. It indicates the log-odds of being at or below $c - 1$ level of food security, c indicates the number of categories of food security (three in our case), β is the vector of coefficients, X_{ij} is the vector of women- and village-level covariates and U_j is village-level random effect. The multi-level negative binomial regression models are as follows:

$$\log \lambda_{ij} = \beta X_{ij} + \varepsilon_{ij} + U_j .$$

where $\log \lambda_{ij}$ is the logged count of days of animal protein intake per week for a woman i in a jth village, β is the vector of coefficients, X_{ij} is the vector of women- and village-level covariates and ε_{ij} and U_j are woman- and village-level random effects, respectively. All analyses are done in STATA.

5 | RESULTS

5.1 | Descriptive results

Table 2 shows descriptive results for food security and animal protein intake by household marital and migration status. It also includes the distributions of the potential mediators. Among households of migrant men, 24% are food secure, compared to about 20% of households of non-migrant men and only 10% of households headed by not-married women. As for animal protein intake, women in households of migrant men display the highest mean number of days of protein intake per week (1.7 days), closely followed by women in households of non-migrants (1.6 days), and women in not-married women's households (1.1 days). When we look at households of migrants by migration success, those receiving large transfers (i.e., of most successful migrants) have the highest share of those that are food secure (about 27%), followed closely by migrant households with some transfers (i.e., averagely successful, 25%) and lastly those with no or few transfers (i.e., least successful male migrants, 17%). With respect to animal protein intake, on average, women in households of most successful migrants reported 2.0 days of protein intake per week, those in households of migrants of average success 1.6 days and those in households of least successful migrants 1.3 days (Table 2). It should be noted that households of least successful migrants have lower levels of both food security (17% vs. 20%) and protein intake (1.3 vs. 1.6) than those of non-migrants.

For potential mediators of the influence of migration, Table 2 shows that households of migrants, relative to households of non-migrant men, overall have a higher mean level of household's housing conditions and assets, a higher mean number of small domestic animals and a higher percentage of households that hire paid agricultural labour. Non-migrant men's households, in comparison, display a higher mean quantity of cattle but a very similar mean size of farming land. Among households of migrants, those of most successful migrants are above the level of other migrant household categories in all measures of potential mediators, except for farm size in which households of most successful migrants are similar to households of averagely successful ones. It is worth of note that on such measures as land size, number of cattle and number of small animals, households of most successful

migrants are at or above the level of non-migrants' households. Finally, the share of women involvement in gainful employment outside subsistence agriculture is higher among migrant households with no or few transfers, second only to the corresponding share among the households of not-married women.

5.2 | Multivariable results

We fit multivariable regressions comparing households of women married to most successful migrants, those married to averagely successful migrants, least successful migrants and non-migrants. The results of the multi-level ordered logit models for food security are presented in Table 3, and the results of the multi-level mixed-effects negative binomial regression models for animal protein intake are presented in Table 4. We acknowledge that our models, while demonstrating associations between predictors and outcomes across time, do not formally assess the causal nature of these associations. In Table 3, Model 1, we find that households of women married to non-migrants are significantly disadvantaged relative to those of women married to most successful migrants (i.e., those receiving large transfers), net of other factors (OR = 0.61, $p < 0.01$). Analyses with migrant households combined show that households of non-migrants have significantly lower food security compared to households of migrants, net of other factors (results not shown but available under request). While these findings are consisted with our first hypothesis that households of women married to migrants should enjoy the highest level of food security, pairwise comparisons indicate that households of women married to migrant men with some transfers (i.e., of average migration success) are not statistically different from those of women married to non-migrant men (results not shown but are available under request). Our model also shows that not-married women are distinctively disadvantaged in food security status.

Next, we test for a potential mediating role of households' agricultural resources and investment—size of arable land, quantity of livestock and use of hired agricultural labour. Although the size of arable land and hiring agricultural labour show a positive and statistically significant association with food security, none of the three measures of agricultural resources and investment appear to mediate the link between labour migration and food security: With the addition of these measures, the disadvantage of non-migrants' households remains almost unchanged (Model 2). Therefore, Hypothesis 2 is not supported.

We then assess a possible mediating role of households' non-productive assets. We find that with the inclusion of the household assets variable, the disadvantage of living in a non-migrant's household, relative to living in a most successful migrant's household decreases in magnitude and becomes not significant (Model 3). These analyses lend some support to Hypothesis 3, which posited that the acquisition of assets would mediate the link between labour migration and food security, because the inclusion of the household assets base effaced any significant difference between households of most successful migrants and those of non-migrants. Finally, we examined women's involvement in paid employment outside subsistence agriculture as a potential mediator. Although women's employment is positively associated with food security, the corresponding coefficient is not statistically significant, and the addition of this covariate does not change the effect of migration status (Model 4). Hypothesis 4 is therefore not supported. It is worth of note that even when the three potential

mediators are jointly considered, the disadvantage of households of non-migrants relative to those of most successful migrants is significant (Model 5). We suggest that households' investment in agricultural resources and their members' local gainful employment, together work to offset the mediating role of households' possession of material assets.

Table 4 shows the results of the analysis predicting the number of days in the past week a respondent consumed animal protein. We find that women in households of non-migrants and those in households of migrants with no or few transfers have significantly fewer days of animal protein consumption compared to women in households of migrants with large transfers (Model 1). At the same time, households of migrants with some transfers are not statistically different from those of non-migrant men in their wives' animal protein intake (results not shown but are available under request). These results provide partial support for Hypothesis 1.

In Model 2, we assess a possible mediating role of household's investments in agricultural resources on the relationship between labour migration and animal protein intake. In Model 2, adding household's investment in agricultural resources, the disadvantages in animal protein intake of households of non-migrant men relative to those of most successful migrant men is not significant. Furthermore, no difference between households of most successful migrant men and those of migrants with average success in animal protein intake is found. Households of migrant men with no or few transfers display significantly lower levels of animal protein intake relative to those of most successful migrant men, net of other factors (Model 2). These findings offer some support to Hypothesis 2 as household's investment in agricultural resources appears to partially mediate relationship between labour migration and animal protein intake (the difference between households of most successful migrants and those of non-migrants is not statistically significant).

Next, we add household's housing conditions and assets index (Model 3). Adding household's investments in housing and consumer assets removes any difference in the level of animal protein intake between households of women married to most successful migrants and those of women married to non-migrants; furthermore, no statistically significant difference is found between households of most successful migrants and those of averagely successful migrants, net of other factors. Only households of women married to least successful migrant men (i.e., those with no or few transfers) are significantly disadvantaged in the level of animal protein intake, compared to households of most successful migrants (Model 3). These findings generally align with Hypothesis 3, as the inclusion of household's asset base explains away any statistically significant advantage in protein intake of women from migrants' households with large transfers relative to women in households of non-migrant men (Model 3). These findings also suggest a modification to Hypothesis 3 as possession of assets does not mediate the difference between the two extremes of migrants' households. Finally, with the inclusion of women's involvement in remunerated employment the disadvantage of women in households of non-migrant men remains unchanged relative to those of successful migrants (Model 4). Therefore, no evidence supporting Hypothesis 4 is found. It is of note that when the three mediators are jointly assessed (Model 5), they explain away any significant difference in protein intake between households of wives of

most successful migrants, those of women married to non-migrants and those of wives of least successful migrants.

In addition to the main findings, we should also note that households of not-married women are consistently most disadvantaged in protein intake relative to those of women married to most successful migrants. As for control variables, in both the food security and protein intake models, households of women with five or more years of completed schooling have a significant net advantage, compared to households of less educated women. At the same time, no significant net relationship of woman's age, woman's decision-making autonomy or household dependency ratio with either household food security or animal protein intake was detected.

6 | DISCUSSION AND CONCLUSION

How labour migration affects food security of sending families remains an important scholarly and policy concern. The presented analyses contribute to a better understanding of the migration—sending household's food security nexus in a case study of a typical rural sub-Saharan setting of high out-migration. Using unique longitudinal data, we first interrogated whether there are food security variations across households of women married to most successful migrants, to averagely successful migrants, to least successful migrants and to non-migrants. In descriptive analyses, we found that households of women married to most successful migrants, especially those receiving large transfers, enjoy greater food security than households of women married to non-migrants and those of women married to migrant men with no or few transfers. Multivariable analyses confirmed the advantages in food security status enjoyed by households of most successful migrants relative to those of non-migrants. Our analyses also looked at quality of households' nutrition as proxied by respondent's animal protein intake. No overall difference between households of women married to most successful migrants and those of women married to non-migrants was found. Although migration-related variation in the level of animal protein intake was detected—with women married to most successful migrant men displaying significantly higher levels of animal protein intake than women married to least successful migrants—this variation was explained away when considering all households' characteristics (Table 4, Model 5). The fact that no consistent variation in animal protein intake between households of women married to most successful migrants, women married to non-migrants and those married to men in other migrant categories was found is particularly illustrative because in this setting, as in many other parts of rural sub-Sahara, the rearing of poultry, which is a major source of protein, requires relatively minor investment (Gueye, 2000).

Our findings, particularly the net advantage in food security enjoyed by households of migrants with large transfers, illustrates the importance of the economic success of migration, rather than of migration per se, for the well-being of sending families. It therefore helps to refine the general argument that migration contributes positively to food security in sending communities in the sub-Saharan region that has been made in previous research (Crush, 2013; De Vletter, 2007; Kangmennaang et al., 2018; Pendleton et al., 2006).

Our analyses examined possible pathways through which labour migration, and variation in its success, may be associated with food security, focusing on the potential role of agricultural investment, material asset building and local employment. Although applying labour migration remittances toward agricultural resources and investment (e.g., expanding farming land, increasing the quantity of livestock owned or hiring agricultural labour) could enhance food security of sending families, our analyses did not find clear supporting evidence for that pathway. It could be that families of labour migrants choose not to invest much in some agricultural ventures. Our results, for example, showed that households of non-migrant men have plots of farming land and quantity of cattle that are almost similar in size to those of households of most successful migrant men. Yet households of most successful migrants hold a clear advantage on the quantity of other animals and on hiring paid agricultural labour. We acknowledge, however, that investing labour migration remittances in agriculture is context specific (Bohme, 2013; Damon, 2010; Maphosa, 2007).

Regarding the potential role of asset building in the labour migration—food security link, our analyses suggest that this factor may mediate the advantages of households of most successful migrant men relative to those of non-migrant men. Adding asset building erased the statistical difference between households of women married to non-migrants and those of women married to most successful migrants in food security and animal protein intake alike. Investing in asset building, such as constructing a house, improving housing conditions or acquiring non-productive durable assets, may absorb a substantial part of migrant remittances that could otherwise be used for food acquisition and diversification. In fact, some households of labour migrants may barely have resources for asset building.

With respect to the potential role of women's local gainful employment in sending communities as a pathway for the association between male labour migration and food security, our tests did not detect supporting evidence. Although some studies have found a relationship between labour migration and local employment among household members in sending communities (Agadjanian, Hayford, & Oh, 2021; Posso, 2012), as our results suggest, local employment does not mediate the effect of labour migration on food security. Overall, the inclusion of household material assets, agricultural resources and investment and local employment effaced the statistical difference between households of most successful migrants and those of non-migrants in animal protein intake (Table 4, Model 5) but not in food security (Table 3, Model 5), pointing to tangible net benefits of highly successful migration that extend beyond the potential mediating factors considered in our analyses.

Finally, beyond its primary focus on the link between migration and food security, our study also found that households headed by not-married women are particularly worse off in food security and nutrition quality relative to those of married women, whether the latter are married to migrants or non-migrants. The multifaceted vulnerability of households headed by not-married women, which often manifests itself in food insecurity, has been noted in other contexts (Dodson et al., 2012; Doss et al., 2018; Jung et al., 2016; Moyo & Kawewe, 2009) and should undoubtedly be a major reason for concern and a priority target for interventions.

Our study has limitations. Thus, our measures of labour migration and its economic impact possibly underestimate migration economic returns as it was not able to capture fully in-kind transfers (e.g., material objects or food). Previous evidence suggests that in-kind transfers may be a non-negligible part of labour migration remittances in sub-Saharan Africa (Crush & Caesar, 2016). However, quantifying in-kind transfers based on survey reports poses a major accuracy and comparability challenge. Instead, we sought to refine our measure of financial transfers by combining the information on both the frequency of receipt of remittances and the amounts of remittances. Our measures of food security and diversity, and of possible pathways connecting them to migration, are also constrained by available data. Future data collection efforts should refine and expand these measures. Despite these limitations, our findings point not only to a net positive association of labour migration with food security in sending households but also to instructive variations according to the degree of migration economic success. As both labour migration and food security are key contemporary societal issues in sub-Saharan Africa and similar developing settings, efforts to design better policies to maximize the benefits of labour migration for food security in sending communities need to take these complexities into consideration.

ACKNOWLEDGEMENTS

The support of the Eunice Kennedy Shriver National Institute of Child Health & Human Development for most of the data collection is gratefully acknowledged (Grant R01 HD058365). The second author also acknowledges support from UCLA's California Center for Population Research (NIH P2C-HD041022).

DATA AVAILABILITY STATEMENT

The MMWL data and supporting materials are available free of charge to interested researchers worldwide. Please contact Victor Agadjanian at agadjanian@soc.ucla.edu to obtain access.

APPENDIX A

TABLE A1

Men's Migrations and Women's Lives (MMWL) longitudinal project survey waves.

Wave	Sample size	Main content
W1 (2006)	1678	Marriage and fertility history; household composition and characteristics; husband's migration history. Community characteristics.
W2 (2009–2010)	1868 (W1 + refreshment)	Wave 1 content, plus updated marriage, fertility and husband's migration history, health, HIV testing and treatment. Community characteristics.
W3 (2011–2012)	2059 (W1 + W2 + refreshment)	Wave 1 content, plus updated marriage, fertility and husband's migration histories, health, HIV testing and treatment, children's co-residence, education and health. Community characteristics.
W4 (2014)	1972	Updated migration, marriage and fertility history, health, demographic data for adolescent children.
W5 (2017–2018)	1891	Updated migration, marriage and fertility history, economic activities and conditions (including food security), health and well-being, contacts with children and kin, support exchanges with kin and others. Community characteristics.

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TABLE 1

Distribution of variables (percentage, unless otherwise indicated), MMWL panel.

Variable	%	*n*
Outcomes (measured in Wave 5)		
HH's food security status		
HH is food secure	20.2	319
HH is somewhat food insecure	50.3	795
HH is very food insecure	29.5	465
Woman's mean number of days per week of protein intake (range, 0–5)[a]	1.6 (1.5)	1579
Predictors (measured in Wave 3)		
Migrant's HHs	31.8	502
Non-migrant's HHs	60.5	956
Not-married woman's HHs	7.7	121
Migrant's HHs transfers of remittances received		
Migrant's HHs with large transfers (most successful)	12.4	196
Migrant's HHs with some transfers (averagely successful)	13.4	212
Migrant's HHs with no or with few transfers (least successful)	6.0	94
Mediators (measured in Wave 3)		
HH's agricultural resources and investment		
HH's farm size (hectares) (range, 0.5–23)[a]	1.8 (1.3)	1579
HH's # of cattle (range, 0–350)[a]	3.1 (12.0)	1579
HH's # of small animals (range, 0–166)[a]	11.1 (13.4)	1579
HH hires paid agricultural labour	21.8	344
HH housing conditions and assets index (range, 0–7)[a]	3.4 (1.6)	1579
Woman is employed outside subsistence farming	34.8	549
Controls (measured in Wave 3)		
Woman's age[b]		
41 years or more	15.7	248
36–40 years	19.8	313
31–35 years	27.9	441
26–30 years	25.5	403
21–25 years	11.0	174
Woman's education		
5 years or more	27.3	431
1 to 4 years	46.0	726
No education	26.7	422
Woman's decision-making autonomy (range, 0–8)[a]	1.0 (1.5)	1579
HH dependency ratio (range, 0–16.5)[a]	1.8 (1.3)	1579
N		1579

Abbreviation: HH, household.

[a]Mean and standard deviations in parentheses.

[b] Percentages do not add up to hundred due to rounding.

TABLE 2

Predictors and mediators by type of household (percentage, unless otherwise indicated), MMWL panel.

			Remittances (transfers received)			
Predictors and mediators	**Non-migrant's HH**	**All migrant's HH**	**Migrant's HH with no or few transfers**	**Migrant's HH with some transfers**	**Migrant's HH with large transfers**	**Not-married woman's HH**
HH's food security status						
HH is food secure	19.5	24.1	17.0	25.0	26.5	9.9
HH is somewhat food insecure	50.4	52.2	54.3	47.6	56.1	42.2
HH is very food insecure	30.1	23.7	28.7	27.4	17.4	47.9
Woman's mean number of days per week of protein intake[a]	1.6 (1.5)	1.7 (1.5)	1.3 (1.4)	1.6 (1.4)	2.0 (1.6)	1.1 (1.4)
HH's agricultural resources and investment						
HH's farm size (hectares)[a]	1.9 (1.4)	1.8 (1.2)	1.5 (0.9)	1.9 (1.3)	1.8 (1.2)	1.7 (1.0)
HH's # of cattle[a]	3.5 (14.6)	2.8 (6.4)	1.7 (4.2)	2.7 (6.6)	3.5 (6.9)	1.4 (4.1)
HH's # of small animals[a]	11.1 (12.8)	11.6 (15.1)	7.6 (9.3)	12.4 (18.7)	12.8 (12.6)	8.0 (9.1)
HH hires paid agricultural labour	21.1	26.3	5.3	25.5	37.2	8.3
HH housing conditions and assets index[a]	3.3 (1.6)	3.9 (1.5)	3.1 (1.5)	3.8 (1.5)	4.3 (1.4)	2.6 (1.6)
Woman is employed outside subsistence farming	35.8	30.3	38.3	28.3	28.6	44.6

Abbreviation: HH, household.

[a]Means, standard deviations in parentheses.

TABLE 3

Multi-level ordered logistic regression of the association between labour migration and household food security, MMWL panel.

	Odds ratios				
Covariates	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
HH's migration status					
Migrant's HH with large transfers (Ref.)	1	1	1	1	1
Migrant's HH with some transfers	0.80	0.82	0.88	0.81	0.88
Migrant's HH with no or few transfers	0.65	0.72	0.80	0.65	0.82
Non-migrant's HH	0.61**	0.62**	0.73	0.61**	0.72*
Not-married woman's HH	0.21**	0.23**	0.30**	0.21**	0.29**
HH's agricultural resources and investment					
HH's farm size (hectares)		1.11*			1.09*
HH's # of cattle		1.00			1.00
HH's # of small animals		0.99			0.99
HH does not hire paid agricultural labour (Ref.)		1			1
HH hires paid agricultural labour		1.41*			1.20
HH housing conditions and assets index			1.30**		1.29**
Woman is employed outside subsistence farming					
No (Ref.)				1	1
Yes				1.05	1.08
Woman's age					
41 years or more (Ref.)	1	1	1	1	1
36–40 years	0.80	0.84	0.82	0.80	0.84
31–35 years	1.02	1.07	1.06	1.03	1.09
26–30 years	1.06	1.13	1.13	1.06	1.18
21–25 years	1.00	1.03	1.05	1.00	1.07
Woman's education					
5 years or more (Ref.)	1	1	1	1	1
1–4 years	0.61**	0.62**	0.72*	0.61**	0.72*
No education	0.49**	0.51**	0.64**	0.49**	0.64**
Woman's decision-making autonomy	0.96	0.96	0.96	0.96	0.95
HH dependency ratio	1.04	1.05	1.02	1.05	1.03
Village-level random intercept (variance)	0.80**	0.80**	0.83**	0.80**	0.83**
N	1579	1579	1579	1579	1579

Abbreviations: HH, household; Ref., reference.

*$p < 0.05$.

**$p < 0.01$.

TABLE 4

Multi-level mixed-effects negative binomial regression of the association between labour migration and respondent's number of days per week of animal protein intake, MMWL panel.

	Incidence-rate ratios				
Covariates	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
HH's migration status					
Migrant's HH with large transfers (Ref.)	1	1	1	1	1
Migrant's HH with some transfers	0.87	0.88	0.90	0.87	0.91
Migrant's HH with no or few transfers	0.71**	0.75*	0.78*	0.71**	0.80
Non-migrant's HH	0.86*	0.89	0.95	0.87*	0.96
Not-married woman's HH	0.57**	0.60**	0.67**	0.57**	0.67**
HH's agricultural resources and investment					
HH's farm size (hectares)		1.00			1.00
HH's # of cattle		1.00			1.00
HH's # of small animals		1.00*			1.00
HH does not hire paid agricultural labour (Ref.)		1			1
HH hires paid agricultural labour		1.12*			1.05
HH housing conditions and assets index			1.12**		1.11**
Woman is employed outside subsistence farming					
No (Ref.)				1	1
Yes				0.93	0.95
Woman's age					
41 years or more (Ref.)	1	1	1	1	1
36–40 years	1.02	1.04	1.03	1.02	1.04
31–35 years	1.06	1.07	1.07	1.05	1.07
26–30 years	1.00	1.02	1.03	0.99	1.03
21–25 years	1.00	1.02	1.01	0.99	1.02
Woman's education					
5 years or more (Ref.)	1	1	1	1	1
1–4 years	84**	0.86**	0.91	0.84**	0.91
No education	0.77**	0.79**	0.86*	0.77**	0.87*
Woman's decision-making autonomy	1.00	1.00	1.00	1.00	1.00
HH dependency ratio	1.00	0.98	0.98	0.98	0.97
Intercept	2.07**	1.80**	1.20	2.13**	1.20
Village-level random intercept (variance)	0.16**	0.16**	0.17**	0.16**	0.17**
N	1579	1579	1579	1579	1579

Abbreviations: HH, household; Ref., reference.

*$p < 0.05$.

**$p < 0.01$.