The migration paradox: Why remittances fail to stimulate agricultural investment in Nepal's Terai plains

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Abstract

Nepal receives one of the highest remittance-to-GDP ratios globally, yet agricultural investment and productivity remain stagnant. Using primary survey data from 273 households in Nepal's Terai plains, this paper examines how international and internal migration shape land rental participation and fertilizer use intensity. Probit and Tobit estimates show that international migration significantly reduces both leasing-in and leasing-out of land and lowers fertilizer application by nearly 200 kg/ha. These findings contradict the New Economics of Labor Migration (NELM) prediction that remittances relax liquidity constraints and stimulate agricultural investment. Instead, the results suggest that migration-induced labor shortages and supervision constraints dominate capital inflows. The study highlights the limitations of remittance-led development strategies in settings with thin labor markets, weak mechanization, and supervision-intensive farming systems. Keywords: Migration; Remittances; Fertilizer use; Land rental markets; Nepal.

1. Introduction

Nepal presents a striking paradox in the migration–development relationship. Remittances account for nearly one-quarter of national GDP, placing Nepal among the most remittance-dependent economies in the world (Bank, 2023). The New Economics of Labor Migration (NELM) argues that migration allows households to overcome credit and insurance constraints, with remittances financing productive investments, including modern agricultural inputs, irrigation, and land expansion (Stark and Bloom, 1985; Taylor, 1999). A large literature finds that remittances can raise agricultural productivity when combined with adequate infrastructure and human capital (Saha et al., 2025; Chandio and Jiang, 2023; Bassie, 2022; Etim et al., 2020).

Yet Nepal's agricultural sector has not undergone the kind of transformation that NELM would predict. Agricultural productivity growth has been sluggish, input use remains uneven, and food imports have increased over time (Roka, 2017). The paradox is especially pronounced in the Terai plains, where soils, irrigation potential, and market access are relatively favorable. If remittances were relaxing binding credit constraints, we would expect households in the Terai to intensify cultivation and expand operations. Instead, migrant households often appear less engaged in agriculture.

This paper examines why substantial remittance inflows have not translated into higher agricultural investment in Nepal's Terai plains. Using primary survey data from 273 households in three Terai districts, we study how international and internal migration affect both land rental participation and fertilizer use intensity. The analysis distinguishes between international migration, which is associated with high remittance inflows and substantial labor loss, and internal migration, which involves shorter-term moves and partial retention of family labor.

The results show that international migration significantly reduces land rental participation—both leasing in and leasing out—and lowers fertilizer intensity by nearly 200 kg/ha. Internal migration, by contrast, has weaker and qualitatively different effects. These findings support the view that migration-induced labor shortages and supervision constraints outweigh any credit-relaxing benefits from remittances in this setting. In other words, labor—rather than liquidity—appears to be the binding constraint on agricultural investment in the Terai.

The contribution of this paper is threefold. First, it provides household-level evidence on the agricultural impacts of migration in Nepal's primary grain-producing region, complementing macro-level studies from other remittance-receiving economies. Second, it jointly analyzes land rental behavior and fertilizer intensity, capturing both extensive and intensive margins of agricultural engagement. Third, by comparing international and internal migration, it sheds light on the mechanisms through which labor loss and remittances interact in shaping agricultural decisions.

2. Conceptual Framework

NELM conceptualizes migration as a household strategy to manage risk and relax credit constraints (Stark and Bloom, 1985; Taylor, 1999). Consider a household with agricultural output $Y = f(L, K, A)$, where L is labor, K capital inputs (including fertilizer), and A land.

In the absence of migration, the household faces a credit constraint limiting input use: $K \leq \bar{K}(W)$, where $\bar{K}(\cdot)$ is an increasing function of wealth W. International migration generates remittances R, which can increase effective wealth and relax the constraint: $K \leq \bar{K}(W + R)$. Under this credit-relaxation channel, remittances should allow households to lease in more land and increase fertilizer use.

Migration, however, also reduces the household labor supply. Let m denote the number of migrants. Effective household labor becomes $L = L_0 - m$. When labor and capital are complementary, the loss of family labor can lower the marginal productivity of purchased inputs. Supervision-intensive tasks—including fertilizer application, weeding, irrigation scheduling, and pest monitoring—depend heavily on family labor, especially in smallholder systems with thin labor markets and imperfect monitoring of hired workers.

We can express capital input choice as an implicit function of remittances, the credit constraint, and household labor: $K = K(R, \bar{K}(W), L = L_0 - m)$. The net effect of migration on capital use can be written as

$$\frac{dK}{dm} = \frac{\partial K}{\partial R} \cdot \frac{dR}{dm} - \frac{\partial K}{\partial L} \cdot \frac{dL}{dm}. (1)$$

The first term captures remittance-driven expansion of input use; the second term captures labor-loss effects. When labor markets are thin and mechanization is limited, the second term is likely to dominate, leading to lower input intensity despite larger cash inflows. Evidence from Sub-Saharan Africa and South Asia supports this intuition: migration can reduce farm labor use, land cultivation, and profitability even in remittance-receiving households (Wonyra and Ametoglo, 2020; Amare et al., 2021; Paudel and Tiwari, 2024; Ali and Jan, 2023).

In Nepal's Terai, mechanization remains modest and many operations are still performed manually. Labor markets are fragmented and households often express reluctance to rely on hired labor for supervision-sensitive tasks. In such a setting, we expect international migration to reduce land rental participation and fertilizer use intensity if labor becomes the binding constraint.

3. Data and Methods

3.1 Study Area and Sampling

The Terai plains account for nearly 60% of Nepal's cereal production (Acharya et al., 2019) and exhibit high rates of international labor migration (Jaquet et al., 2021). This study uses primary data collected between December 2016 and January 2017 from three Terai districts: Mahottari in the east, Nawalparasi in the center, and Chitwan in the west. These districts were selected to capture heterogeneity in migration intensity, irrigation, and market access. A multi-stage sampling design was employed. Village Development Committees (VDCs) were selected within each district, wards were chosen within VDCs, and farming households were randomly sampled from ward-level lists. The initial sample comprised 291 households. After data cleaning, 273 households remained, of which 143 (52.4%) had at least one international migrant.

3.2 Variables

The analysis focuses on two dimensions of agricultural investment: land rental behavior and fertilizer intensity. Land rental decisions are captured through binary indicators for leasing in and leasing out land in the past year, as well as continuous measures of the share of land rented in or rented out relative to operational or owned holdings. Fertilizer intensity is measured as total NPK (kg/ha) applied to cultivated land. The key explanatory variables are the number of international migrants and the number of internal (domestic) migrants in each household. This distinction allows us to compare high-remittance, high-labor-loss migration with lower-remittance, lower-labor-loss migration. All regressions control for a common set of household and farm characteristics: household head age, gender, education; the number of adult members; operational landholding; access to credit; access to agricultural extension services; membership in farmer groups; caste fixed effects; and district fixed effects.

Among households with international migrants in our sample, more than 82% reported receiving remittances in the previous year. Among remittance-receiving households, remittances account for a large share of total household income, with an average of about 70% and a median share of 60%. By contrast, remittance receipt is less common among households with internal migrants, with approximately 59% reporting transfers, and remittances comprise a substantially smaller share of household income than in internationally migrant households. These descriptive patterns indicate a strong association between migration, particularly international migration, and intensive remittance inflows in our sample.

3.3 Econometric Strategy

Binary leasing decisions (lease in, lease out) are modeled using probit specifications: $P(\text{Lease}_i = 1) = \Phi(\beta_0 + \beta_1 \text{Migrant}_{for,i} + \beta_2 \text{Migrant}_{nat,i} + \mathbf{X}_i'\boldsymbol{\gamma})$, where $\Phi(\cdot)$ is the standard normal cumulative distribution function, $\text{Migrant}_{for,i}$ and $\text{Migrant}_{nat,i}$ denote the numbers of international and internal migrants respectively, and $\mathbf{X}_i$ is the vector of controls. The intensity of land rented in or out and fertilizer use are estimated using Tobit models, given that these variables are left-censored at zero: $Y_i^* = \alpha_0 + \alpha_1 \text{Migrant}_{for,i} + \alpha_2 \text{Migrant}_{nat,i} + \mathbf{X}_i'\boldsymbol{\delta} + u_i$, with $Y_i = \max(0, Y_i^*)$ for each continuous outcome. Because the data are cross-sectional, the estimates should be interpreted as conditional associations rather than causal effects. Nonetheless, the inclusion of detailed controls and fixed effects improves comparability between migrant and non-migrant households.

4. Results

4.1 Descriptive Patterns

Table I presents descriptive statistics on land tenancy status by migration status. Migrant and non-migrant households are similarly distributed across leasing-in categories, but leasing-out shows a clear divergence: 64.52% of leasing-out households are non-migrants, compared with only 35.48% migrants. This suggests that migrant households are less likely to be active in land rental markets, particularly on the leasing-out margin.

Descriptive comparisons (not shown) indicate that non-migrant households also apply substantially more fertilizer per hectare than migrant households, with gaps on the order of

Table I. Land Tenancy Status by Migration Status

Land Tenancy	Migrant (%)	Non-migrant (%)
Not Leased In	51.79	48.21
Leased In	53.85	46.15
Not Leased Out	54.55	45.45
Leased Out	35.48	64.52

Note: Migrant households hold an average of 0.69 hectares (median 0.34 ha) in owned land, compared with 0.87 hectares (median 0.44 ha) for non-migrant households—indicating that migrants have land available to lease out should they choose to do so, suggesting the lower leasing-out activity reflects labor constraints rather than land scarcity.

300 kg/ha. These patterns motivate a more formal examination of migration's association with land rental decisions and fertilizer use.

4.2 Migration and Land Rental Markets

Table II reports probit and Tobit estimates of the relationship between migration and land rental behavior. International migration is significantly and negatively associated with both leasing-in and leasing-out decisions and with the intensity of land rented in or out. The coefficients on foreign migrants suggest sizable declines in participation and intensity.

Households with more international migrants are less likely to lease in land and less likely to lease out land, and they rent smaller shares of land on both margins. This pattern is consistent with the idea that labor shortages discourage both expansion and flexible adjustment via rental markets. Internal migration, by contrast, tends to increase leasing out and renting out, suggesting that domestic migrants adjust holdings when temporarily absent but retain more flexibility and local labor ties than international migrants.

4.3 Migration and Fertilizer Use Intensity

Table III reports Tobit estimates of the association between migration and fertilizer intensity. International migration is strongly and negatively related to NPK application per hectare.

The coefficient implies that each additional international migrant is associated with a reduction of about 198 kg/ha of fertilizer, a large effect relative to typical application rates in the sample. To put this magnitude in perspective, the average fertilizer application among non-migrant households in the sample is 872 kg/ha. The estimated reduction of 198 kg/ha thus represents approximately 23% of the baseline fertilizer intensity, a substantial effect on agricultural intensification.Internal migration has no statistically significant effect. These results reinforce the conceptual argument that fertilizer application is supervision-intensive, and that the absence of family labor reduces households' capacity to manage input-intensive cultivation. Robustness checks using alternative agricultural outcomes including cropping

Table II. Migration and Land Tenancy: Probit and Tobit Results

	(1) Lease In	(2) Lease Out	(3) Rent In	(4) Rent Out
Foreign Migrants	-0.238*	-0.537***	-0.152**	-0.426***
	(-1.92)	(-2.82)	(-2.18)	(-2.79)
National Migrants	-0.156	0.319**	-0.102	0.207**
	(-0.90)	(2.00)	(-0.87)	(1.99)
Controls	✓	✓	✓	✓
Observations	273	225	273	273
Pseudo R^2	0.304	0.193	0.249	0.211

Notes: Columns (1) and (2) report probit estimates for leasing-in and leasing-out decisions; columns (3) and (4) report Tobit estimates for the share of land rented in and rented out. t-statistics in parentheses.

Controls include: household head age, gender, education; number of adult household members; operational landholding; access to credit; access to agricultural extension; farmer group membership; caste fixed effects; district fixed effects.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

Table III. Migration and Fertilizer Use: Tobit Results

	NPK Intensity (kg/ha)
Foreign Migrants	-198.1**
	(-1.97)
National Migrants	-13.53
	(-0.09)
Controls	✓
Observations	273
Pseudo R^2	0.006

Notes: Tobit estimates of NPK intensity (kg/ha), left-censored at zero. t-statistics in parentheses.

Controls include: household head age, gender, education; number of adult household members; operational landholding; access to credit; access to agricultural extension; farmer group membership; caste fixed effects; district fixed effects.

**$p < 0.05$.

intensity, non-grain crop intensity, and crop diversification corroborate these findings. International migration consistently exhibits negative associations with input-intensive measures but does not significantly affect broader cropping patterns, suggesting that labor constraints primarily affect supervision-intensive activities rather than inducing wholesale changes in agricultural strategy.

5. Discussion

The empirical results provide consistent evidence that international migration is associated with reduced agricultural investment in Nepal's Terai plains. Migrant households are less involved in land rental markets and apply substantially less fertilizer per hectare than non-migrant households. These patterns contradict the core NELM prediction that remittances should relax liquidity constraints and stimulate agricultural intensification. Instead, they align with the labor-loss hypothesis emphasized in recent work from Sub-Saharan Africa and South Asia (Wonyra and Ametoglo, 2020; Amare et al., 2021; Paudel and Tiwari, 2024; Ali and Jan, 2023).

To explore whether these negative associations might be driven by weak migration-remittance linkages, we examined households receiving more than 50% of income from remittances. Among these high-remittance households, approximately 48% are migrant households and 52% are non-migrant households. Migrant households in this group applied an average of 566.1 kg/ha of fertilizer compared to 1088.8 kg/ha among non-migrant households—a difference of 522.7 kg/ha ($p = 0.068$). This observed gap among households heavily reliant on remittances is consistent with the possibility that labor constraints may operate even when liquidity is relatively abundant, and aligns with the patterns observed in the controlled estimates in Table III.

The contrast between international and internal migration is instructive. Internal migration is associated with increased leasing-out activity but does not significantly reduce fertilizer use. This suggests that internal migrants retain stronger ties to local agriculture and face lower supervision constraints, perhaps because their absence is temporary and households can adjust landholding in the short run. International migration, by contrast, entails more permanent labor loss and higher transaction costs for coordinating agricultural activities, leading to a more pronounced withdrawal from input-intensive farming.

These findings also help explain why macro-level studies find positive productivity effects of remittances in contexts such as Bangladesh, where remittances have been shown to increase agricultural labor productivity when combined with improvements in human capital, electrification, and mechanization (Saha et al., 2025). In those settings, households can use remittances to finance machinery, irrigation, and information technologies that substitute for family labor (Grabowski et al., 2022; Sackey et al., 2022; Subramanian et al., 2021; Onyeneke et al., 2023; Esteban et al., 2018; Do et al., 2023). By contrast, in Nepal's Terai, mechanization services remain relatively limited, rural labor markets are thin, and extension systems are weak. Under such structural constraints, family labor remains central, and the loss of household workers through international migration depresses the marginal productivity of purchased inputs.

6. Conclusion

This paper has examined why substantial remittance inflows do not translate into higher agricultural investment among migrant households in Nepal's Terai plains. Using household survey data and probit and Tobit models, it shows that international migration significantly reduces land rental participation and fertilizer intensity. The negative association between international migration and agricultural intensity suggests that labor losses and supervision constraints are more binding than liquidity constraints in this setting. The results carry important policy implications. Efforts to harness remittances for agricultural development are unlikely to succeed without parallel investments that ease labor constraints and improve the structural environment in which rural households operate. Expanding access to mechanization through rental markets, strengthening rural labor institutions, improving land rental contract enforcement, and investing in irrigation, electrification, and extension services could help households convert remittances into productive agricultural investments. Without such complementary reforms, remittances may continue to support consumption, education, and housing, but not the intensive agricultural engagement envisioned by optimistic migration–development narratives.

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