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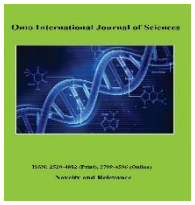

Research Article

Analyzing the impact of remittances on household food security in protracted crisis settings: Evidence from North Wollo Zone, Ethiopia

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Abstract

Remittance flows through migrant networks constitute an important livelihood strategy for households facing persistent shocks, contributing to improved welfare and reduced vulnerability, particularly in protracted crisis contexts. This study examines the effect of remittances on household food security in the North Wollo Zone of Ethiopia. A stratified multi-stage cluster sampling technique was employed to select 384 households, comprising both remittance recipients and non-recipients, from five purposively chosen kebeles. Primary data were collected through structured household surveys, complemented by key informant interviews and focus group discussions. The analysis integrates descriptive statistics with econometric estimation using Propensity Score Matching (PSM) to identify the causal impact of remittance income on food security outcomes. The findings reveal that remittances have a statistically significant and positive effect on household food security. Specifically, 8.3% of remittance-receiving households were food secure, compared to only 2.5% among non-receiving households. The estimated average treatment effect on the treated (ATT = -2.7, $p < 0.001$) indicates a meaningful reduction in food insecurity attributable to remittance inflows. Food security outcomes also vary across household characteristics. Older-headed households (aged 60 and above) demonstrate relatively better food security status, while land ownership and participation in non-farm income-generating activities are positively associated with improved outcomes. Thus, remittances function as informal social protection mechanisms in crisis-affected settings, enhancing household resilience to food insecurity. The results indicate that remittances strengthen household resilience against food insecurity, but their efficacy depends on more general socioeconomic and contextual conditions, thus they should not be seen as a sufficient or assured condition.

Keywords: Ethiopia; Food security; North Wollo; Protracted crises; Remittances; Resilience

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1. Introduction

Migration is a fundamental feature of human existence, and people have relocated from one place to another for social, economic, or political motives since early human development,

and is commonly analyzed across spatiotemporal dimensions (Khalid, 2016). It is defined as individuals' movement across an administrative boundary, such as a village, town, district, or country. Kock (1999) noted that a migrant refers to any individual who is in the process of moving or has relocated across an international border or within a State away from his or her usual place of residence, irrespective of legal status, whether the movement is voluntary or forced, the underlying drivers, or the duration of stay.

Globally, there were approximately 55 million migrants by the end of 2020, of which about 48 million were displaced due to crises and conflict. Sub-Saharan Africa, particularly in the Democratic Republic of the Congo and Ethiopia, accounted for a significant share of new displacements (Aryal & Zhu, 2020).

Africa has long faced food insecurity. The region hosts a large share of the world's severely food-insecure populations, driven by recurrent conflict, macroeconomic volatility, widespread poverty, and exposure to climate shocks (Sleet, 2020). To address their food insecurity, the leading African recipients of remittance inflows in 2019 included Egypt ($26,791 million), Nigeria ($23,800 million), Morocco ($6,669 million), Ghana ($t3,521 million), and Kenya ($2,819 million), while Ethiopia's remittance inflow were estimated at 2.5 billion dollars by the national Bank of Ethiopia in 2020 andUS$504 million by the World Bank's 2020 projection. Over 90% of cross-border remittances received in Ethiopia through formal channels are withdrawn as cash within the same year. Only a small share is saved in the bank accounts or transferred through mobile money platforms (Sleet, 2020).

In fragile and crisis-affected settings (FCS), remittance flows are estimated to be around $70 billion (8.8 % GDP) in 2022, which is greater than the volume of official aid received by remittance recipient countries. Remittances to people impacted by war are projected to be over $50 billion, or an average 6.3 % of GDP, and remittances to those living in situations with institutional and social instability are projected to be around $20 billion, or 11.4 % of GDP (Bahri et al., 2024). The ICRC has been engaged in responding to both prolonged and short-term crises over the past seven decades. From 1945 onward, the ICRC has addressed long-lasting humanitarian crises in countries including Ethiopia, Mozambique, Angola, Guatemala, Colombia, Cambodia, Sudan, South Sudan, Liberia, Sierra Leone, the former Yugoslavia, the Democratic Republic of Congo (DRC), Lebanon, the Iran–Iraq conflict, the Israel–Palestine conflict, Afghanistan, and Somalia. In addition, shorter conflicts such as the Six-Day War and the Yom Kippur War between Israel and Arab states, the Falkland/Malvinas conflict, the 1991

Gulf War, and international armed confrontations in Southern Lebanon in 2006 and Georgia in 2008 have also marked the post-1945 period (Adger et al., 2002; Cotroneo & Pawlak, 2016).

Despite increasing global recognition of the importance of remittances as informal safety nets during crises, there remains a significant gap in empirical research linking remittance flows to household food security in the context of protracted crisis settings. Existing studies have primarily focused on broader issues of conflict and displacement in Ethiopia. For instance, Berhan et al. (2023) examined how civil and armed conflicts have exacerbated COVID-19-related health crises; Tufa et al. (2021) explored the dynamics of protracted displacement and trans-local connections among Eritreans in Ethiopia, and Yigzaw and Abitew (2019) analyzed the drivers and impacts of internal displacement. While these studies provide valuable insights into the consequences of conflict and displacement, no one explicitly addresses the role of remittances in enhancing household food security for non-displaced populations living in crisis-affected zones. The absence of empirical evidence is predominantly concerning, given the ever-increasing humanitarian crisis in areas such as Kobo town in the north Wollo Zone of the Amhara Region. These areas are highly affected by armed conflict, brutally disrupting their livelihoods, market systems, and traditional social support networks. In such settings, remittances can serve as a vital coping mechanism for households that remain in conflict-affected areas. However, these populations are often overlooked in both academic research and policy discourse. The study offers empirical evidence from Kobo town, where the intersection of armed conflict and food insecurity posed severe challenges. By focusing on this under-researched geographic context, the study offered a timely and original contribution to the literature on remittances, food security, and crisis resilience. The findings hold practical implications for policy formulation and humanitarian interventions in fragile and conflict-affected settings.

2. Materials and Methods

2.1. Description of the study area

The study area is located in the Amhara Region in northern Ethiopia (Figure 1). The Amhara Region is one of the thirteen (13) regional states of the Federal Democratic Republic of Ethiopia and has historically experienced repeated episodes of protracted crises and armed conflict particularly Amhara and Tigray. In addition, the recent conflict that has persisted in the region since November 2020 is another major factor that has contributed to a significant deterioration in household food security. The study area lies in a zone that has become increasingly vulnerable to multiple long-term shocks, including economic fluctuations, violent

conflict, and people's displacement to natural hazards like droughts and floods. The resilience of household food security has been severely weakened by these crises, which have exacerbated the protracted armed struggle. The livelihoods in north Wollo are also characterized by migration, both internal and international, particularly to the Middle East. Kobo is located between 12°18′15 N and 12°38′15″ E as per astronomical coordinates. Furthermore, the average temperature in the study area ranges between 16°C and 26°C, and the location lies at an elevation of approximately 1500 meters above sea level. The dominant soil groups in this agroecological zone include Fluvisols, Vertisols, and Cambisols. Most soils are characterized by loam and silty loam textures with clay loam composition (Aragie & Genanu, 2017).

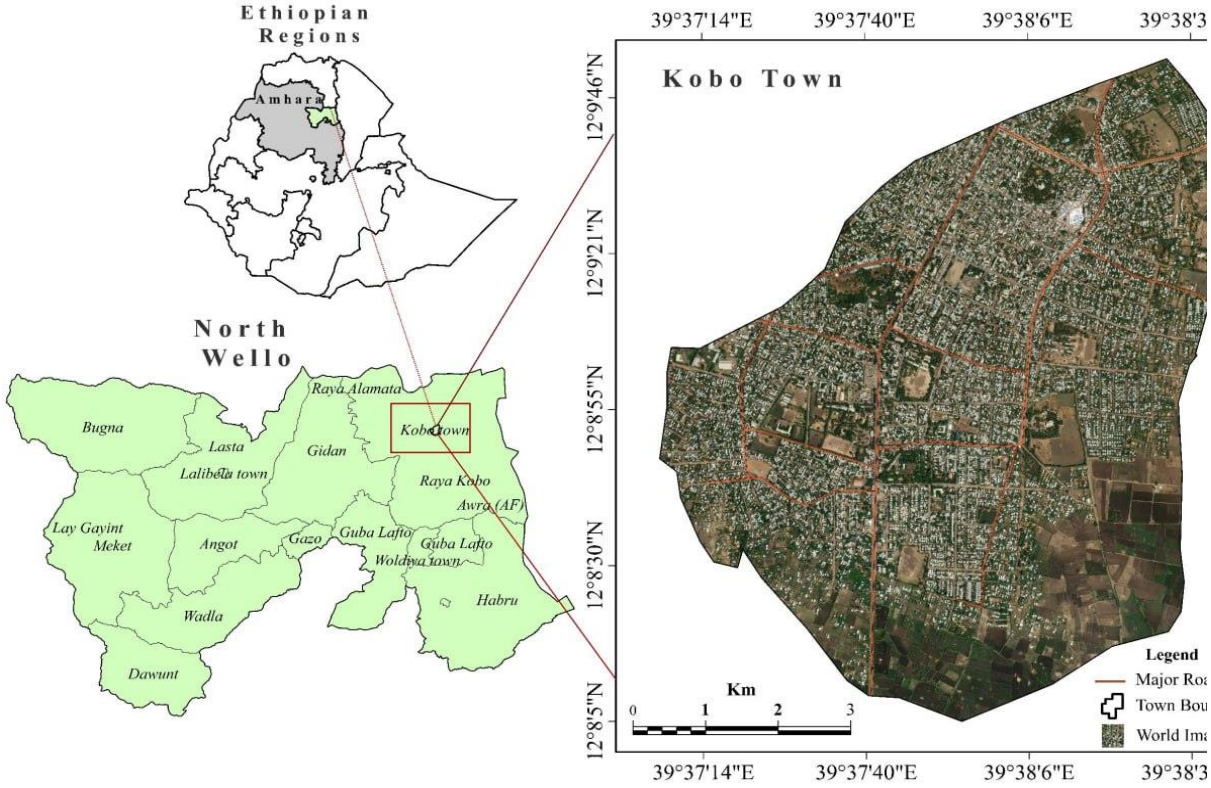

Figure 1. Map of the study area.

2.2. Sampling strategy, data collection and analysis

An explanatory mixed-methods design was used in this investigation. The influence of remittances on household food security was estimated quantitatively using econometric models, and the quantitative results were explained and contextualized in the qualitative phase. This method made it possible to comprehend how and why remittances affect household food security in long-term crisis situations more thoroughly. Kobo town, situated in the North Wollo Zone of the Amhara Region in northern Ethiopia, was purposively chosen as the study area.

Although the protracted crisis has affected the entire region to varying degrees, Kobo presents a sole combination of contextual relevance and logistical feasibility. The town has been a focal point of sustained conflict, principally as a result of the Tigray war and recurring border skirmishes, making it a representative and compelling case for studying crisis-affected households. Despite its exposure to conflict, Kobo remained relatively accessible for systematic fieldworks, unlike other severely impacted areas. Additionally, international migration is a widespread livelihood strategy in the area, with a substantial number of households depending on remittances as a primary source of income.

This socio-economic feature closely aligns with the study's objective of assessing how remittance flows contribute to household food security under lengthy crisis conditions. Thus, Kobo town provides a strategically relevant and empirically rich setting for investigating remittance-supported resilience in fragile and conflict-affected environments. Five Kebeles, namely (01, 02, 03, 04 and Kobo Zuria) were purposely selected and again these, were chosen using a simple random sampling technique from a total of five Kebeles in Kobo Town. Although the protracted crises affected all zones and districts of the Amhara region to different magnitudes and intensities, this study is limited only to Kobo town due to insecurity and inaccessibility. The study site was selected due to its exposure to a protracted crisis following the Tigray war, compounded by ongoing border skirmishes. In this context, households widely rely on international migration as a key livelihood strategy. In this study, a concurrent data collection strategy was employed to ensure that both quantitative and qualitative data were gathered simultaneously, minimizing potential biases and discrepancies that could arise from collecting data separately. The sample size was computed using the following formula (Eq. 1) with an equal number of households to be interviewed from the two groups (Szabo et al., 2022):

$$n \geq 2 \times \frac{Z_{\frac{\alpha}{2}}^2 p(1-p)}{e^2} = 2 \times \frac{1.96^2 \times 0.128(1-0.128)}{0.05^2} \cong 344 \quad (1)$$

The above formula clearly divulged that at least there must be 344 households from both remittance receivers' and non-receivers'

Where n is the total sample size, Z is the 95th percentile value of the standard normal variate, p is prior to any assessment of food security status, households were chosen using a random sampling technique. Following data collection, households' food security status was assessed using the FCS and HFIAS indicators, p=12.8% (Szabo et al., 2022), and e is a degree of precision. With a 10% contingency for non-response, the minimum required sample size was 380 households.

According to Szabo et al. (2022), the sample size determination formula was used to estimate the required sample size. For an infinite population, the formula is given by Szabo et al. (2022), with a 0.5 estimated proportion of respondents, 95% confidence interval, and 0.05 margin of error) were used, and the sample size determination formula developed by (2022) was used to estimate the sample size of the finite population, which is presented as follows.

Accordingly, a total of 384 households were selected using a stratified simple random sampling technique. Within each selected Kebele, the sample was proportionally allocated between remittance-recipient and non-recipient households. The household survey questionnaire was pilot tested to ensure clarity and reliability and subsequently administered using the KoBo Toolbox digital data collection platform. In addition to the household survey, qualitative data were gathered through purposively selected (KIIs) and these participants were selected for their community knowledge, leadership roles, and direct involvement in community decision-making, which provided valuable insights into community-level dynamics from the office of disaster risk management and early warring office, women and youth, children affair office, Ethiopia Red cross society woreda office and Focus Group Discussions (FGD).

A total of five heterogeneous FGD sessions, each with 6–8 participants, were organized, i.e., one in each kebele. The groups ensured gender balance and included both remittance-receiving and non-receiving households. Discussions continued until data saturation was reached, complementing the quantitative findings. With 20 KIIs, the study achieved data saturation, capturing a diverse range of experiences essential for qualitative research. Including key informants enriched the findings by bridging individual experiences with broader community perspectives on the impact of remittances on household food security in protracted crisis settings.

Ethical considerations remained essential throughout the sampling process. Participants were fully informed about the study's purpose, guaranteed confidentiality, and allowed to withdraw at any time, ensuring compliance with ethical research standards (Creswell & Creswell, 2017). This pragmatic approach allowed the collection of experience-driven data, making it well-suited for understanding the impact of remittance on food security employed by households who survived in protracted crisis settings. Descriptive statistical analyses, including means and percentages, were employed to summarize the survey data. Furthermore, Propensity Score Matching (PSM) was applied to estimate the effect of remittance on household food security outcomes by controlling for selection bias.

To estimate the effect of remittances on household food security, we first estimate the propensity score, which is the probability of receiving remittances, conditional on observed covariates. To estimate the effect of remittances on household food security, we first estimate the propensity score, which is the probability of receiving remittances, conditional on observed covariates. The propensity score is defined as (Eq. 2):

$$e(X_i) = P(R_i = 1|X_i) \quad (2)$$

Where Ri= {1, if household i receives remittances; 0, otherwise), Xi= Vector of observed covariates (e.g., household size, education, age, income, education level of the respondent, etc.).

This is estimated to be using a logistic regression model (Eq. 3):

$$logit\big(P(R_i = 1)\big) = \alpha_0 + \alpha_1 x_{1i} + \alpha_2 x_{2i} + \cdots + \alpha_k x_{ki} \quad (3)$$

After estimating e(Xi), treated households (those receiving remittances) are matched to control households (those not receiving remittances) using a Nearest Neighbor Matching algorithm. Covariate balance between treatment and control groups is assessed post-matching using standardized mean differences as well as variance ratios.

After achieving covariate balance, the average treatment effect on the treated (ATT) is estimated using a regression outcome regression model (Eq. 4):

$$Y_i = \beta_0 + \beta_1 R_i + \beta_2^T X_i + \varepsilon_i \quad (4)$$

Where Yi=Household food security score (continuous outcome), Ri=Treatment indicator as defined above, Xi=Covariate vector, β1=Captures the effect of remittances on household food security, εi ~ N(0, σ2)= Error term.

Households were classified into four food security categories based on their total HFIAS score: food secure (0–1) which include rarely, if ever, worries about food; consumes preferred, adequate diets. Mildly food insecure (2–7) that include worries occasionally about not having enough food; rarely forced to eat undesirable foods, moderately food insecure (8–14) often forced to eat a poor variety of foods or smaller meals than desired and severely food insecure (15–27) frequently experiences a lack of food; regularly goes to sleep hungry or goes entire days without eating. Higher HFIAS scores indicate greater food insecurity. The Household Food Insecurity Access Scale (HFIAS) was applied as a standardized instrument to evaluate the food security status of the households surveyed. The HFIAS is straightforward, adaptable across diverse socioeconomic and cultural settings, and serves as a reliable proxy for continuous measurement of household food security. It captures information on household food access, anxiety related to food availability, dietary preferences, and gaps in both the quantity and quality of food over the previous 30 days. The overall HFIAS score is calculated by summing responses to nine questions (Q1a–Q9a), yielding a possible range of 0–27, which

reflects the severity and prevalence of food insecurity among sampled households. Based on their responses, households were classified into three categories: mild, moderate, and severe food insecurity. A household was considered increasingly food insecure if it reported experiencing more severe conditions or encountering these conditions more frequently. To complement this, the Food Consumption Score (FCS) was employed to assess food security from the utilization perspective, taking into account eight distinct food groups over seven days. The FCS was calculated by multiplying the number of days each food group was consumed in the past 7 days by its assigned weight and summing the results. Two complementing measures of household food security are used in this study. While the FCS gauges dietary diversity and frequency of food consumption, the Household Food Insecurity Access Scale (HFIAS) records households' experiences of food access limitations. To give a thorough grasp of the aspects of food security, the two indicators were examined independently.

2.3. Ethical considerations

The study obtained ethical clearance from the IRB of College of Development Studies, Addis Ababa University (Ref No. 089/10/2024). After obtaining respondents' verbal assent, interviews were held. To further protect respondent anonymity, individual identifiers and respondent names were excluded from the final data.

3. Results and Discussions

3.1. Demographic and socio-economic features

Notable differences emerge across age groups. A significantly higher proportion of non-recipients fall within the younger age brackets, particularly the 18–29 age group (21.3% compared to 11.4%) and the 30–39 group (30.5% vs. 24.9%). In contrast, remittance-receiving households are more concentrated in the 40–49 age category (34.2% vs. 26.4%) and the 50–59 group (19.7% vs. 13.2%), suggesting that remittance receipt may be associated with relatively older household heads. The proportion of respondents aged 60 and above is comparable across both groups (Table 1).

Both groups of the sample showed a symmetric distribution. Males constitute the majority in both remittance (60.1%) and non-remittance households (61.9%). This showed the absence of a significant gender-based difference in remittance receipt by sex. A third of the non-recipient households are illiterate (34.5%), whereas one in five remittance recipients reported basic literacy without formal schooling (20.7%). Primary education is more prevalent among non-recipients (24.4%) than recipients (17.6%). Whereas a slightly higher percentage of

remittance recipients report education above secondary level (15.5%). Possession of cultivated land is slightly more common among remittance-receiving households (64.8%) compared to non-recipients (59.4%). Additionally, engagement in income-generating activities is relatively higher among remittance receivers (50.3%) as compared to non-recipients (46.7%) (Table 1).

Table 1. Household characteristics based on remittance and non-remittance receivers

Items	Remittance and non-remittance receiver		
	Yes (%)	No (%)	Total (%)
N	193 (49.5)	197 (50.5)	390 (100.0)
Age group			
18-29	22 (11.4)	42 (21.3)	64 (16.4)
30-39	48 (24.9)	60 (30.5)	108 (27.7)
40-49	66 (34.2)	52 (26.4)	118 (30.)
50-59	38 (19.7)	26 (13.2)	64 (16.4)
60 and above	19 (9.8)	17 (8.6)	36 (9.2)
Age	43.6 (11.6)	40.1 (12.4)	41.8 (12.1)
Household size	2.446 (1.0)	2.391 (0.8)	2.418 (0.9)
Sex of the respondent			
Male	116 (60.1)	122 (61.9)	238 (61.0)
Female	77 (39.9)	75 (38.1)	152 (39.0)
Educational level			
Can't read or write	55 (28.5)	68 (34.5)	123 (31.5)
Read and write	40 (20.7)	26 (13.2)	66 (16.9)
Primary	34 (17.6)	48 (24.4)	82 (21.0)
Secondary	34 (17.6)	31 (15.7)	65 (16.7)
Above secondary	30 (15.5)	24 (12.2)	54 (13.8)
Household has a cultivated land	125 (64.8)	117 (59.4)	242 (62.1)
IGA other than agriculture	97 (50.3)	92 (46.7)	189 (48.5)

IGA = Income-generating activity

3.2. Household food security status

Remittance-receiving households were more likely to be food secure (8.3%) than non-receivers (2.5%). Remittance receipt and household food security were positively correlated, as evidenced by the statistically significant difference ($p < 0.05$). Although the proportion of mild food insecure households is low in both groups, it is slightly higher among remittance recipients (3.1%) than non-recipients (1.0%). Notably, 26.4% of remittance-receiving households experience moderate food insecurity, compared to 20.3% of non-recipients, which may recommend that these households are in a transitional phase, moving away from severe food insecurity but have not yet attained full food security. Most significantly, the prevalence of severe food insecurity is significantly lower among remittance recipients (62.2%) than non-recipients (76.1%), reflecting a 13.9 % point reduction **(**Figure 2).

These quantitative results are supported by qualitative data from FGDs with non-remittance recipient households. Participants vibrantly described their lived experiences of compounded crises, emphasizing that community members without remittance support were

disproportionately affected by food insecurity. They described that social risk- sharing mechanisms and mutual support networks were severely interrupted due to the crisis, exacerbating their vulnerability. Additionally, participants highlighted that increasing food grain prices further limited their access to adequate food, intensifying the severity of food insecurity in these households.

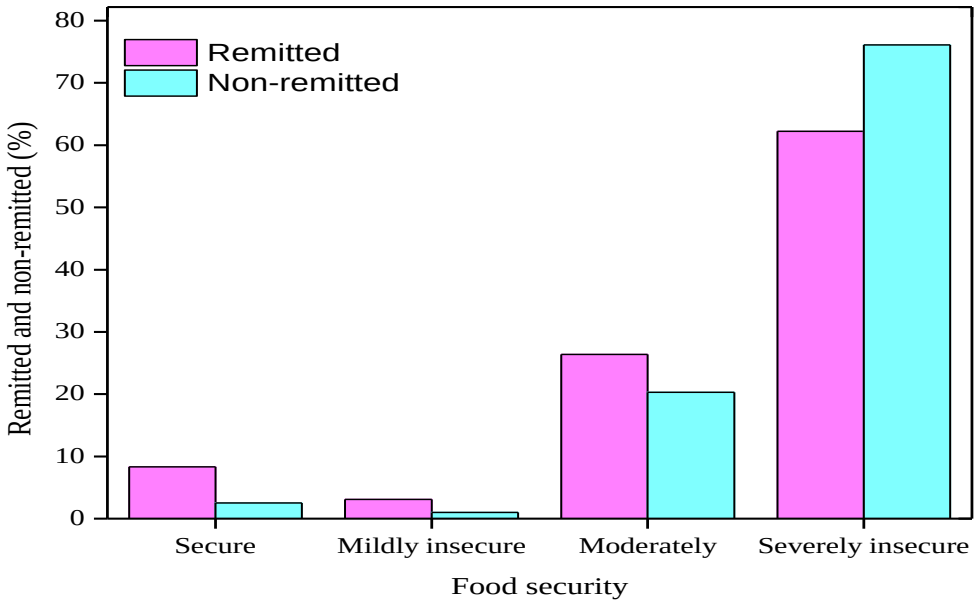

Figure 2. Household food security by remittance receipt status.

The result highlights how social isolation and economic vulnerability worsen food insecurity for non-remittance households. The absence of remittance inflows limits the capacity of households to cope with shocks, leading to severe food insecurity. Summarily, evidence suggests that remittances act as a vigorous financial buffer that enhances household resilience.

3.3. The impact of remittances on household food security

3.3.1 Age of the respondents

Table 2 shows the existence of differences in household food security status across age groups. The observed pattern showed a nonlinear relationship between age and vulnerability to food insecurity. Households headed by middle-aged households (30–49) individuals demonstrate the most favorable food security profile. In these groups, 16.67% were classified as food secure and 33.33% experiencing severe food insecurity. This stands in stark contrast to households headed by individuals aged 30–39. In these young adult groups, 85.19% are severely food insecure and none reported being food secure. Similarly, the youth group exhibited a high prevalence of severe food insecurity (71.88%). Among the youth, 9.38% of households are classified as food secures (Table 2).

3.3.2. Sex of the respondent

The prevalence of food insecurity also differed by the sex of the household head. Households headed by males experienced an elevated level of severe food insecurity (75.63%) compared to those headed by females (59.21%). Similarly, female-headed households show a higher occurrence of moderate food insecurity (32.89%) than male-headed households (17.23%). The percentage of food-secure households is nearly equal (5.46% for males vs. 5.26% for females). These results suggest that while male-headed households are more likely to be in severely food-insecure households, female-headed households may be more likely to fall into the moderate food insecurity category (Table 2). This align with key informant interviews and FGDs also revealed that female family heads prioritize food consumption and basic household necessities, allocating available resources more carefully. Participants observed that women are typically more inclined to carefully manage their limited income and cut back on unnecessary spending, which helps keep the household from experiencing acute food insecurity.

3.3.3. Educational level

Education level appears to be strongly allied with food security. Households where the respondent can only read and write or has secondary education show particularly higher food security (10.77% and 4.55%, respectively) and lower levels of severe food insecurity (53.03% and 64.62%) compared to those with no education (5.69% food secure; 74.80% severely food insecure). Interestingly, those with above secondary level of education show the lowest food security (1.85%) and the highest severe food insecurity (75.93%). This is a potential disconnect between education and food security in crisis contexts, perhaps due to employment mismatch or migration. Households with basic literacy (read and write) show a more balanced distribution, with the lowest level of severe food insecurity (53.03%), indicating that even minimal education may buffer against the most extreme food insecurity (Table 2). Household education was found to have a positive and statistically significant effect on food security ($B = 0.290$, $p < 0.01$). Specifically, the likelihood of a household being food secure increased by a factor of 0.914 for each additional year of formal education. This finding suggests that households headed by individuals with higher educational attainment are more likely to maintain food security compared to those with lower or no education (Table 2).

Table 2. Result of a propensity score matching analysis for household food security

Characteristics	Categories	Household food security (%)				Model (PSM)		
		Food secure	Mildly-FI	Moderately-FI	Severely-FI	ATET	95% CI	p-value
Treatment	Non-remitted	5 (23.8)	2 (25.0)	40 (44.0)	150 (55.6)	Ref		
	Remittance receiver	16 (76.2)	6 (75.0)	51 (56.0)	120 (44.4)	-2.7	-3.7, -1.8	<0.001
Age group	18-29	6 (28.6)	-	12 (13.2)	46 (17.0)	Ref		
	30-39	-	2 (25.0)	14 (15.4)	92 (34.1)	-1.1	-2.5, 0.3	0.110
	40-49	6 (28.6)	4 (50.0)	31 (34.1)	77 (28.5)	-1.4	-3.0, 0.2	0.084
	50-59	3 (14.3)	1 (12.5)	17 (18.7)	43 (15.9)	-2.3	-4.5, -0.2	0.031
	60 and above	6 (28.6)	1 (12.5)	17 (18.7)	12 (4.4)	-4.2	-7.3, -1.1	0.010
Sex	Male	13 (61.9)	4 (50.0)	41 (45.1)	180 (66.7)	Ref		
	Female	8 (38.1)	4 (50.0)	50 (54.9)	90 (33.3)	-0.42	-1.6, 0.8	0.500
Education	Can't Read and Write	7 (33.3)	-	24 (26.4)	92 (34.1)	Ref		
	Read and write	3 (14.3)	4 (50.0)	24 (26.4)	35 (13.0)	-0.76	-2.3, 0.8	0.300
	Primary	3 (14.3)	1 (12.5)	18 (19.8)	60 (22.2)	-2.2	-3.6, -0.9	0.001
	Secondary	7 (33.3)	1 (12.5)	15 (16.5)	42 (15.6)	-3	-4.5, -1.5	<0.001
	Above Secondary	1 (4.8)	2 (25.0)	10 (11.0)	41 (15.2)	-1.1	-2.9, 0.6	0.200
Numbers of household members						0.02	-0.6, 0.7	>0.900
Household has a cultivated land	Yes	11 (52.4)	5 (62.5)	63 (69.2)	163 (60.4)	Ref		
	No	10 (47.6)	3 (37.5)	28 (30.8)	107 (39.6)	1.1	-0.1, 2.4	0.074
Income generating activity other than agriculture	Yes	14 (66.7)	6 (75.0)	47 (51.6)	122 (45.2)	Ref		
	No	7 (33.3)	2 (25.0)	44 (48.4)	148 (54.8)	0.88	-0.2, 2.0	0.120

FI=Food Insecure, CI = Confidence Interval, PSM = Propensity Score Matching, ATET = Average Treatment Effect on the Treated

3.3.4. Ownership of cultivated land

Households that own cultivated land exhibit lower levels of severe food insecurity (67.36%) compared to those without land (72.30%), and slightly higher food security (4.55% vs. 6.76%). While the differences are not large, the data suggest that land ownership offers some protection against severe food insecurity, likely by ensuring a minimum level of subsistence or income through agriculture (Table 2).

3.3.5. Engagement in non-agricultural income-generating activities

Households engaged in non-agricultural IGAs are more likely to be food secure (7.41%) and less likely to be severely food insecure (64.55%) compared to those without such activities (3.48% food secure; 73.63% severely food insecure). This highlights the positive role of income diversification in enhancing resilience to food insecurity, particularly during protracted crises. Similarly, households with non-farm income are (18.2%) more likely to be food secure than those without, and it has a significant association with food security, with a $p \leq 0.000$ (Table 2). These quantitative findings are supported by qualitative data from FGDs with remittance recipient households and one of the group discussants proudly and loudly said that ‘

> *My kind and generous daughter sent me money from Saudi Arabia, which I utilized to build a small shop, and the profits have helped me maintain my livelihood*’ and I’ve *started sewing clothes and selling them, but the problem is my customers hassle me to make a discount that can lead me to my business failure.*

3.4. Receipt for remittances

Households receiving remittances during the crisis show higher food security (8.29%) and lower severe food insecurity (62.18%) than non-recipient households (2.54% food secure; 76.14% severely food insecure). The 13.96 % difference in severe food insecurity underlines the significant protective effect of remittances, consistent with the findings from the PSM analysis. Moderate and mild food insecurity is also more prevalent among remittance-receiving households, suggesting that remittances may shift households away from extreme food insecurity toward more moderate levels (Table 2). There is a finding that witness remittance-receiving households have1.07% less probability of severe food insecurity, 2.06% less probability of moderate food insecurity, 2.79% less probability of mild food insecurity, and 5.92% more probability of food security.

Another group discussant who was from the non-recipient of remittance had bitterly expressed to obtain food for the family during the protracted crises:

> *If an unveiling is not a crime, food is a basic need; as a result, my family needed to eat, and don’t ask me how much it disturbs me when family members stay hungry*. *It is God’s*

quarrel that put me in this shambles of life, like a nighttime curfew that tied me to not work day and night. What a whip of hunger Pestilence God sent us! Said this, quivering on his lip.

3.5. Determinants of household food security

The propensity scores matching analysis reveals that receiving remittances has a statistically and practically significant effect on reducing household food insecurity. Both the ATET and ATE estimates show an identical coefficient for all predictors; as such, only ATET is reported. Accordingly, the results show a reduction of 2.7 points in the HFIAS score among remittance-receiving households compared to non-receivers ($\beta = -2.7$, 95% CI: -3.7 to -1.8; $p < 0.001$). This suggests that remittances substantially mitigate food insecurity and that the effect is consistent regardless of whether the estimate focuses solely on the treated group or the average population (Table 2).

Amongst demographic factors, age shows varying effects. Households with respondents aged 60 and above practice the most significant reduction in food insecurity ($\beta = -4.2$, 95% CI: -7.3 to -1.1; $p \leq 0.010$ [ATET], $p = 0.008$ [ATE]), indicating that remittance impact may be more pronounced among older adults. Similarly, the 50–59 age group also benefits significantly ($\beta = -2.3$, $p \leq 0.03$), whereas effects for younger age groups (30–49) are not statistically significant, although still pointing in the direction of reduced food insecurity (Table 2). In relations of education, significant improvements in food security are associated with primary ($\beta = -2.2$, $p \leq 0.001$) and secondary education levels ($\beta = -3.0$, $p \leq 0.001$). These findings suggest that even modest levels of formal education augment the benefits of remittances in reducing food insecurity. Sex of the respondent is not significantly associated with food insecurity outcomes after controlling remittance; both ATET and ATE estimates for females showing no meaningful difference ($\beta = -0.42$, $p \leq 0.5$) (Table 2).

Other household-level characteristics such as household size, cultivated land ownership, and engagement in non-agricultural income-generating activities did not produce statistically significant effects. Nevertheless, the absence of cultivated land ($\beta = 1.1$, $p \leq 0.07$) and lack of IGA ($\beta = 0.88$, $p \leq 0.10$) were marginally associated with higher food insecurity. This suggests the presence of potential vulnerabilities that merit further investigation. The consistency between ATET and ATE estimates across all variables confirms the robustness of the remittance effect on food security, both among those who actually receive remittances and at the broader population level (Table 2).

3.6. Implications of the findings

The study endeavored to analyze the impact of remittances on household food security in protracted crisis settings. The results demonstrated that remittance had a dynamic role in

preserving food security for households that reside in a protracted crisis situation. The survey participant profile indicates that remittance-receiving households are more likely to be headed by older and relatively more educated individuals, with slightly better access to cultivated land and higher participation in income-generating activities. These characteristics enhance household resilience to shocks, advance resource utilization, and contribute to more steady and sustained food access (Canton, 2021b; Haas, 2007). This proposes that remittances not only provide direct financial support but also play an enabling role in strengthening household food security through improved capacity and livelihood diversification (Adams & Page, 2005; FAO et al., 2017; Stromquist, 2019).

3.6.1. Remittance inflows and food security among recipient households

Households receiving remittances during the crisis show higher food security (8.29%) and lower severe food insecurity (62.18%) than non-recipient households (2.54% food secure; 76.14% severely food insecure). The 13.96 % difference in severe food insecurity underlines the significant protective effect of remittances, consistent with the findings from the PSM analysis. Moderate and mild food insecurity are also more prevalent among remittance-receiving households, suggesting that remittances may shift households away from extreme food insecurity toward more moderate levels. Specifically, the analysis indicates that households receiving remittances have a 1.07% lower probability of experiencing severe food insecurity, a 2.06% lower likelihood of moderate food insecurity, a 2.79% lower probability of mild food insecurity, and a 5.92% higher probability of being food secure. These patterns reflect the role of remittance of income as a stable and reliable financial resource. By supplementing household earnings with migrant income, remittances increase overall household income, enhance consumption capacity, and improve living standards, thereby strengthening household food security (Aftab et al., 2024).

Surprisingly, older household heads appear relatively more resilient, potentially due to several interlinked factors. First, older adults are more likely to receive regular remittances from adult children or extended kin working in urban areas or abroad, which enhances their purchasing power and cushions them from food insecurity (FAO et al., 2017; Haas, 2007). Second, they may possess accumulated physical and social assets, including livestock, land rights, and stronger community support systems, which can buffer against shocks such as market volatility or conflict (Barrett & Swallow, 2006; Frank, 2000).

3.6.2. Engagement in non-agricultural income-generating activities

On the aspects of households that own cultivated land exhibit lower levels of severe food insecurity (67.36%) compared to those without land (72.30%), and slightly higher food

security (4.55% vs. 6.76%). While the differences are not large, the data suggest that land ownership offers some protection against severe food insecurity, likely by ensuring a minimum level of subsistence or income through agriculture. The above finding contrast with the finding of Alemu & Ashenafi (2022), for it was done in normal time or in the absence of protracted crises which vividly stated that those households who own and those who don't own a cultivated land were food secure (61%) and were food insecure (16%) respectively. Existing evidence has shown that remittances have substantial positive effects on the food security status of developing countries (Sylvia et al., 2018). For example, Regmi et al., (2016) in their study focus on the impact of remittance income-generating and how it contributes to alleviating food insecurity in the rural areas with severe hunger accompanied by crises.

3.6.3. The influence of education and gender on remittance receipt

Middle-aged households (30–49), who often shoulder the economic burden of providing for dependents while managing volatile income sources, appear to be particularly exposed to livelihood stress. This group may lack access to stable remittance flows or face debt burdens, rising food costs, and constrained coping capacity, leading to higher food insecurity (Canton, 2021b; Maxwell et al., 2023). Moreover, middle-aged individuals are more likely to be engaged in precarious informal labor, which offers limited protection during periods of shock (WFP et al., 2020). For younger household heads (18–29), high food insecurity can be attributed to limited access to productive assets, lower employment stability, and weaker social capital. Nonetheless, a small portion of this group appears to be leveraging early-stage migration or informal economic opportunities to support food security, as reflected in the 9.38% food secure rate.

Overall, these age-specific patterns underscore the importance of designing food security interventions that are demographically targeted. While social protection and remittance-facilitating infrastructure may bolster resilience among the elderly, middle-aged households may require more robust livelihood diversification programs, credit access, and community-based safety nets to manage dual economic and caregiving pressures (Canton, 2021; Hendriks & Babu, 2024). Likewise, tailored youth employment and asset-building strategies are needed to address structural barriers affecting younger household heads). Male respondents' households experience higher levels of severe food insecurity (75.63%) compared to females (59.21%), while females show a higher prevalence of moderate food insecurity (32.89%) than males (17.23%). The above finding was supported by the finding of Aftab et al., (2024), which revealed that a male household is more likely to be food insecure than a female one.

The lower incidence of food insecurity observed in female-headed households highlights the critical role of women in household management and resource allocation. As noted by Hailu (2022), there is a strong connection between household food security and the educational attainment of household members. In particular, literate heads of subsistence farming households tend to perform better than their illiterate counterparts across multiple dimensions of farm and household management. Nonetheless, the contribution of indigenous knowledge to sustaining food security remains significant and should not be underestimated (Alemu, 2015). These findings are consistent with previous studies that reported a statistically significant positive association between household education levels and the likelihood of achieving food security (Bashir et al., 2012; Dawit & Zeray, 2017; Guyu & Muluneh, 2016; Mohammed et al., 2021)

3.6.4. Strengths and limitations of studies

Studying in protracted crises is not a simple task, for it can cause injury and death. Hence, this study tried to analyze the impact of remittances on household food security in protracted crisis settings. The study focused merely on households that receive remittance and not receive remittance. When collecting data at the time of protracted crises, there was a daunting challenge to obtain the consent of participants, yet the due and undue contacts with respondents permitted the collection of the data. Nevertheless, the study has some limitations that need to be acknowledged. For instance, postponing the appointment with participants due to chaotic conditions. In the time of protracted crises, it is hard to predict what will happen next; even what is happening in the morning is quite different in the afternoon.

The findings indicate that remittance inflows substantially strengthen household food security and resilience in protracted crisis contexts. The evidence underscores the importance of policy measures that enhance the efficiency and accessibility of remittance channels, incorporate remittance resources into broader food security and livelihood development frameworks, and provide targeted support to households that do not receive remittance income. Households benefiting from remittances exhibited markedly higher food security compared to non-recipient households, demonstrating the function of remittances as informal social protection mechanisms that mitigate the effects of economic shocks and income volatility. Additional factors associated with improved food security included land tenure, engagement in off-farm income-generating activities, and the presence of older household.

4. Conclusions

Studying and living in protracted crises is an exceptionally difficult and dangerous endeavor, often carrying the direct threat of injury and death. This study analyzed the specific

impact of remittances on household food security within these highly volatile settings, focusing on the North Wollo Zone of Ethiopia. The findings clearly demonstrate that remittances play a critical, stabilizing role in enhancing household resilience. Specifically, remittance recipients were found to be significantly more food secure than households that did not have access to these external financial flows. Ultimately, the study highlights that while remittances serve as a vital lifeline, addressing food insecurity in conflict-affected environments requires coordinated, multi-sectoral cooperation to protect vulnerable demographics and stabilize local food systems.

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Conflict of Interest

The authors declare no conflict of interest.

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