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Impact of Urban Expansion on the Asset and Food Security Status of Peri-urban Farmers in Injibara Town, Amhara Region, Ethiopia

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Abstract

Both city administrators and academics studying urban and regional affairs have serious concerns about the issue of unchecked urban expansion and its inexorable effects on the peri-urban and rural areas, particularly in developing nations. Scientific studies that measure the actual impact of such expansion and provide national and local governments and other stakeholders with information are essential at least to limit the negative consequences. In order to estimate and quantify the impact of urban expansion on the asset and food security of peri-urban families, we, selected 283 households (130 displaced and 153 non-displaced) from Injibara Town, one of the fastest-expanding townships in the Amhara region. We employed an endogenous switching regression approach, which is one of the increasingly popular techniques for resolving the selection bias issue in impact studies. Our findings show that urban expansion has a significant negative impact on the asset and food security status of peri-urban farmers and makes them worst off for being displaced. The adaptation of context-specific urban development and planning models by town administrations, including major stakeholders is therefore necessary in order to create win-win scenarios and improve the livelihoods of both urban people and peri-urban farmers.

Keywords: Endogenous switching regression; food security; livelihood assets; Injibara Town; peri-urban farmers; urban expansion

1 INTRODUCTION

The incidents and processes of urban expansion are everywhere in the world and are accelerating in developing nations. Particularly, Africa is fast becoming one of the most urbanized continents in the world, with some of the fastest rates of urban growth seen in its cities (United Nations Economic Commission for Africa (UNECA), 2014). Even though Ethiopia has low level of urbanization (21%) (World Bank, 2023), the country is undergoing a fast urbanization growth (Ayele & Tarekegn, 2020). Urban growth has taken a colossal amount (millions of ha) of farmland and forestland around the world, and the pattern will continue as towns persist to multiply (Van Vliet, 2019). However, there have been intense debates, both theoretically and empirically, over the direction and magnitude of the impact of urban growth on rural development generally and the welfare and livelihoods of peri-urban communities in particular (Parnell & Walawege, 2011).

At the theoretical level, the arguments fall into two extreme continuums: pro-urban and pro-rural. Pro-urbanists embrace urban expansion because, according to them, it is a necessary shift from a backward agricultural society and economy to a modern industrial society and economy capable of mass production, mainly food, and because it allows for the avoidance of potential losses to the environment and agro ecosystems (Debela, 2016). They contend that the logical outcome of urban development is the conversion of land, and that by utilizing capital-intensive production methods and contemporary technologies, the reduction in agricultural output may be offset in the food production networks (Debela, 2016; Zhang et al., 2020). Contrariwise, proponents of rural contend that conversion of agricultural land has detrimental effects on rural to urban migration, agricultural employments, and agro-ecosystems. As a result, it would have a major adverse impact on community livelihood schemes, agricultural production, and food security (Nguyen et al., 2019). They go on arguing that urbanization is always harmful, that it needs to be stopped immediately, and that farmlands should be preserved to ensure agricultural output (mainly food) and the welfare of rural communities (Azadi et al., 2012).

At the empirical level, the results are consistent with theoretical discussions, in which both positive and negative effects have been documented. For example, several scholars have reported the devastating impact of development-induced displacement, such as urban expansion on farmland and other natural resources (Cernea, 2021) and livelihoods of peri-urban communities (Alamneh et al., 2023; Argaie et al., 2022). The increased vulnerability of affected communities to various socioeconomic shocks (Busho et al., 2021; Mohammed et al., 2020), widened income inequality (Oyvat, 2016), and reduced farm production (Dedewanou & Kpekou Tossou, 2022) are also found to be adverse impacts of urban expansion. In contrast, numerous studies have documented the positive effects of urban expansion on peri-urban communities' standard of living. The reported benefits include, for instance, increased income, living standards, and food security (Crush & Caesar, 2018; Kankwamba & Kornher, 2019; Tadesse et al., 2018), as well as enhanced food production (Wang, 2018). Others have reported the positive impact of urban expansion on labor productivity and agricultural value chain (Tadesse et al., 2018) and human capital (Allen, 2009; Andersson, 2015).

As noted by Alamneh et al. (2023), most of previous studies in Ethiopia have, however, focused on big cities (national and regional capital cities) and underestimated the dynamisms of urban expansions and their impacts on peri-urban farming community around small and medium-sized cities. Besides, some studies have utilized suitable impact estimation methods (such as endogenous switching regression) but concentrated on a single outcome (income) in their attempts to understand the issue of urban enlargement and its effects on peri-urban agriculturalists in small and medium-sized cities (Alamneh et al., 2023). Some of them addressed the impacts on some of the components of livelihood assets and food production through descriptive or qualitative analysis (Belay, 2014; Debela, 2016). Further, most of studies mentioned above (and beyond) except Alamneh et al. (2023) have used propensity score matching (PSM) to examine the impact of urban expansion on peri-urban agriculturalists, which is often criticized for its inability to address endogeneity and selection bias issues (Alamneh et al., 2023). Therefore, this study is initiated to fill these gaps. Putting it simply, the main objective of our research is to quantify the impact of urban expansion on various components of assets (natural, financial, physical, and human) as well as food security (availability and access) of peri-urban farmers. The remaining parts of the manuscript are structured in the following ways: Section 2 articulates the conceptual and theoretical sketches. Research methods, data gathering, and scrutiny methods are described in Section 3. Section 4 describes the main findings and discussions. The last section presents the conclusion and policy suggestions of the results.

2 Theoretical and Conceptual Framework

2.1 Theoretical framework

There are various pro-rural, pro-urban, and middle path/integrative theories that explain urban growth. Pro-urban theorists generally view the urbanization process and its effects as beneficial and favorable for rural and pre-urban farmers. The "growth pole model" and the Lewis two-sector model (of the

1950s and 1960s) are the most widely discussed models in this category. Conversely, pro-rural thinkers consider urban areas as remote or parasitic to rural interests and always have a harmful effect on rural and peri-urban expanses. The "core-periphery" and "spatial polarization" theories of the 1970s could be mentioned here. However, in the 1980s, it was realized that the pro-rural-pro-urban continuum development models had failed to produce the expected economic development. Consequently, a new model of development known as "rural-urban linkages" or "network model" emerged. This model underscores the reciprocal progress of both rural and urban areas by supposing that the two areas are mutually dependent environs characterized by the movement of capital, resources, services, and other ties (Douglass, 1998; Unwin, 2017). This new model proposed by Douglass considers rural and urban relations as mutually reinforcing, promotes cooperation rather than strife, focuses on rural-urban dynamics rather than urban nodes, and considers the multi-sectoral and spatial nature of local development rather than promoting a single-minded (either industry or agriculture, urban or rural) approach (Douglass, 1998). We found this theory to be relevant to our research because it could guide us in determining if urban expansion is improving the impacted farmers' standard of living.

However, scholars like Cernea contend that social inequities and persistent inadequacies in polices and planning approached caused forced displacement as a result of development initiatives like urban growth (Cernea, 2000). He observed how forced displacement ostracizes and exaggerates multifaceted destitution in developing countries. Cernea developed a model known as "Impoverishment Risks and Reconstruction" (IRR), a theoretical exemplary of threat and renovation, to address the injustices brought by displacement and allow impacted communities to benefit from development (Cernea, 2000). According to Cernea (2000), some degree of population displacement is sometimes unavoidable, but an unfair distribution of profits, losses, and pains is not inevitable nor justified. He contends that it is both feasible and essential, on economic and moral bases, to address the threats and injustices brought up by displacement and to provide impacted communities with opportunities to benefit (Cernea, 2000, 2021). We have observed forced displacement in the study area, where reconstruction programs are either inadequate or nonexistent. We therefore found this theoretical model relevant to our study.

2.2 Conceptual Framework

The channels through which peri-urban agriculturalists are impacted by urban expansion and the anticipated results of such expansion are depicted in Figure 1. The explanation of network theory is used to describe the factors (flows) that connect rural and urban areas on the left side of the framework. We argue that urban expansion can only result in win-win situations (beneficial outcomes that increase the standard of living for both rural and urban communities) if high-quality institutions are in place and spatial development planning is done correctly.

Conversely, the IRR model is used to illustrate the possibility of involuntary displacement and the associated unfavorable effects on the right side of the framework. The argument is that urban expansion invariably results in the forced and excessive displacement of peri-urban farmers, negatively affecting their livelihoods, if social injustices are widespread, if government and market failures (poor institutions) are extensive, and if spatial planning is inadequate or nonexistent. Thus, the framework implies that factors like development strategy, planning approach, institutional quality, urbanization size, and proximity to urban centers (Gutu, 2023), and socioeconomic and infrastructure (Dorosh & Thurlow, 2012) conditions determine the extent and direction of the impacts of urban expansion.

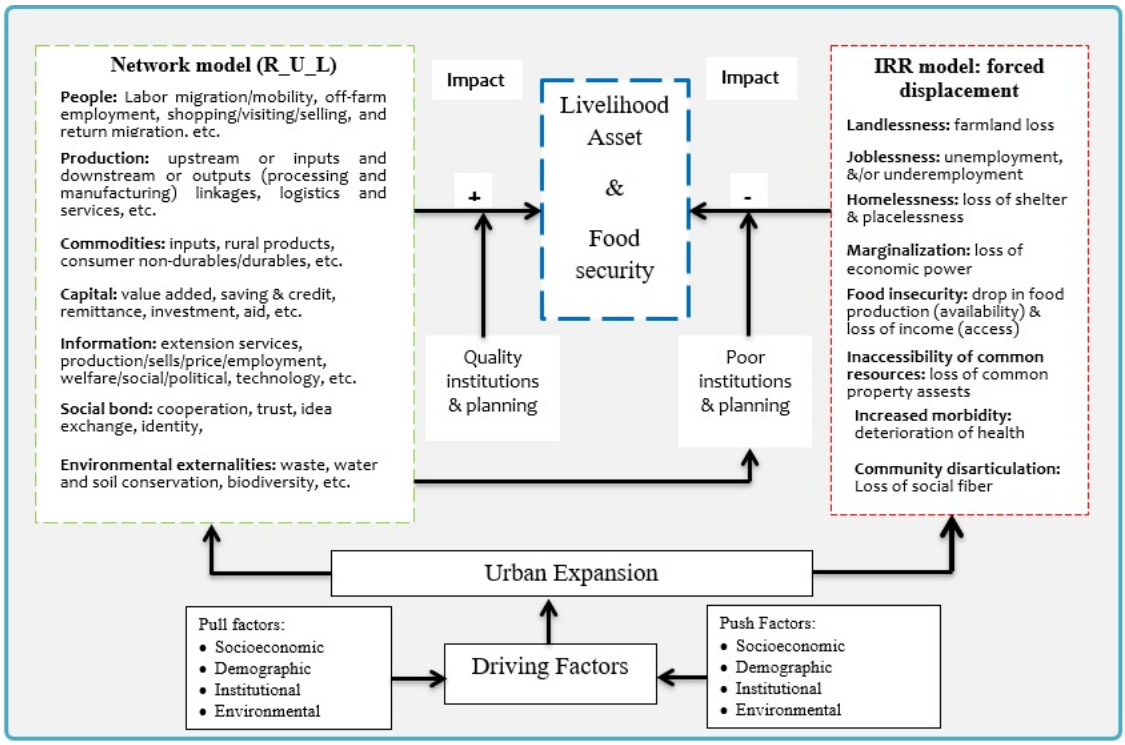

Figure 1: Conceptual Framework
[Source: Own construction based on the literature]

3 Materials and Methods

3.1 Brief Account of the Research Site

Injibara Town is situated 135 kilometers south-west of Bahir Dar, the headquarters of the Amhara region, and 420 miles northwest of Addis Ababa, the capital city of Ethiopia. The town serves as the administrative hub of the Awi Zone in the Amhara Region. Injibara's overall population was 21,065 based on the 2007 census, with 10,596 men and 10,469 women. However, in 2023, that number is expected to have increased to 56,723—a more than twofold rise in just 15 years. The town is among the fastest urbanizing towns in Amhara region with 7.41 annual growth rates (Alamneh et al., 2023).

3.2 Sampling technique and sample size

We used a step-by-step sampling strategy to choose study participants. First, we purposefully selected Injibara Town due to the high pace of urban expansion observed in the town. As mentioned above, the town is among the top three fastest-urbanizing towns in the Amahara region. Then, we purposefully selected four peri-urban Kebeles (Basa, Akayta, Bata, and Chabana Gissa). These kebeles were selected because of the high level of displacement owing to urban expansion. The town is expanding towards these Kebeles from all directions and swallowing them. Due to this, the loss of farmland, other properties, and displacement remained high in these kebeles. Thirdly, based on the sampling frame obtained from the concerned administrative bodies, households were categorized into displaced and non-non-displaced. Finally, 283 households (130 displaced and 153 non-displaced) were chosen using a systematic sampling technique. To determine the required sample size, we used (Yamane, 1967)

technique, described as follows:

$$n = \frac{N}{1 + N(e)^2}, = \frac{969}{1 + 969(0.05)^2} = 283 \quad (1)$$

where n indicates size of sample, N denotes our target populace (viz., 969 households), e is the precision level (0.05), and 1 is the likelihood of the occurrence of an episode. The proportional of sample that we took from each kebele (village) is presented in Table 1.

Table 1: Target Population and Sample size

No	Kebele	Total No. of HH	Total displaced HH	Sample size	Total non-displaced HH	Sample size
1	Bata 5	258	118	34	140	41
2	Akayta 4	192	83	24	109	31
3	Basa 1	221	105	30	116	33
4	Chabana Gissa 02	298	145	42	153	48
	Total	969	451	130	518	153

Source: Own calculation constructed on evidence acquired from *Injibara Municipality office & Banja woreda office*, 2023.

3.3 Data sources and collection instrument

We gathered data from both primary and secondary sources. Primary data were gathered from the selected households using an interview schedule survey questionnaire. The survey was initially developed in English. It then translated to Amharic language to facilitate the data collection process and understanding. Secondary data were obtained from pertinent materials as well as published and unpublished journal articles.

3.4 Empirical Framework

To measure the impact of urbanization on the livelihoods of peri-urban farmers, we employed natural, physical, human, and financial capital to capture asset base and total production and Household Food Insecurity Access Scale (HFIAS) to address food security. However, identifying and estimating the causal impacts of urbanization is not straight-forward; rather, it is very complex. The main problem could arise from the endogeneity problem, and it is hard to identify the counterfactual (Kumar et al., 2021). Besides, since displacement is a forced intervention, those farmers who are displaced are expected to be different from those who do not. Therefore, to correctly evaluate the impacts, it is required to use a random selection of pre-urban farmers for treatment to account for both observable and unobservable characteristics. This study uses the endogenous switching regression (ERS) approach, which frequently employs the full information maximum likelihood (FIML) technique to simultaneously determine the selection and outcome equations to resolve the endogeneity problem (Lark et al., 2020).

We assessed the impact of urban expansion on asset and food security in two phases: the first phase specifies the selection equation (the chance to be displaced) (Eq. 2), and the second stage specifies two regimes that explain the outcome of our interest: one for displaced households and another for non-displaced ones (Eqs. 3 & 4). The selection equation for displaced household is modeled as:

$$D_i^* = X_i + \epsilon_i; withDi = \begin{matrix} 1 & if & D_i^*>0 \\ 0, & other & wise \end{matrix} \quad (2)$$

where $Di = 1$ if a household is displaced and $Di = 0$ otherwise; X_i denotes a vector of variables that influence peri-urban household displacement, including demographic, socioeconomic, and institutional factors; α is a coefficient to be estimated; and i is an error term, which is supposed to be normally dispersed with a zero mean. As shown below, we estimated the outcome equation independently for individual regime of displacement based on the results of

Eq. 2. The association between covariates, X_i and the outcome variable, Y_i, can be denoted by $Y_i = f(X)$. Following this, the two regimes can be specified as:

$$Regime1 : Y_{1i} = \beta_1 X_i + 1iifD_i = 1(Displaced) \tag{3}$$

$$Regime2 : Y_{2i} = \beta_2 X_i + 2iifM_i = 0(non - displaced), \tag{4}$$

where Y_1 and Y_2 are the outcomes of interest for displaced (in regime 1) and non-displaced (in regime 2), respectively; X_i denotes the set of covariates as explained previously; β_1 and β_2 are coefficients to be measured; and ⊠1i and ⊠2i are error terms associated to the asset and food security. The full information maximum likelihood (FIML) approach was used to get reliable estimations (Greene, 2008; Lokshin Sajaia, 2004). Thus, the outcome equations are re-modeled as:

$$Y_{1i} = \beta_1 X_i + \sigma_{1\epsilon}\gamma_{1i} + 1iifD_i = 1(Displaced) \tag{5}$$

$$Y_{2i} = \beta_2 X_i + \sigma_{2\epsilon}\gamma_{2i} + 2iifD_i = 0(Non - displaced), \tag{6}$$

where $1i$ and $2i$ are error terms with conditional zero means.

It is frequently advised to employ a minimum of one instrumental variable in order to correctly determine and use the ESR model. The instrumental variable(s) need to have a direct impact on the displacement selection variable, but not the asset and food security outcome variables (Kumar et al., 2021). This study employs three instrumental variables (IVs): geographic proximity (proximity of the farmland to the town) (Alamneh et al., 2023), legal proximity (land use right legal document or land tenure system) (Fitawek & Hendriks, 2021), and knowledge proximity (pre-urban farmer's awareness about how to acclimate to the conditions of town life style or livelihood system).

The first instrument is supported by the presumption that farmers own lands near to the town are more vulnerable to being displaced by urban expansions. Being near to an urban area is thought to be connected with the displacement of households but not likely to directly influence the asset and dietary security variables, as being close to an urban area does not directly enhance farmers' asset and food security status (Alamneh et al., 2023). The intuition for the choice of the second instrumental variable is that having a land rights certificate may have affected the displacement choice of the pre-urban farmers. The core point is that pre-urban farmers who lack a legal document that ensures their land rights are more likely to be completely displaced and excluded from compensation packages (if any). Particularly, those farmers who either rented farmland and/or acquired it through informal land transactions could be victims of urban expansion. Therefore, the chance of farmers suffering the loss of their farmland rights and displacement could be higher for those who lack legal documents for land use rights (Fitawek & Hendriks, 2021). However, mere possession of a legal document might not directly affect the asset and food security, but it can indirectly affect them through displacement. The third instrument variable is knowledge proximity. Proactive farmers are aware of urban livelihood systems and are therefore less likely to be displaced because they are more likely to adapt and engage in urban and market-oriented production and marketing activities. Studies have also shown that most pre-urban populations lack the knowledge and experience needed to adapt to the conditions of urban life (Mohammed et al., 2020). These farmers' livelihood strategies could, therefore, be exposed to the destructive effects of urban expansion that result in destitution. Nevertheless, mere awareness about urban life styles and livelihood systems could not directly influence the asset and food security, though they could indirectly influence them through displacement.

To check the level of statistical significance of IVs for each equation, we independently ran the logit regression model for selection equation (2) and the OLS model for outcome Eqs. (3 and 4). The findings indicate that the coefficients of the three instruments are statistically significant for the selection Eq. 2, but insignificant for most of the outcomes for non-displaced households. For the purpose of succinctness, the results are not shown here, although they are available upon request. This confirms the expectation that farmers with farmland far from the town, who lack awareness about urban life styles, and lack farmland use rights are more likely to be displaced.

We employed the coefficients generated via the ESR technique to estimate the actual and counterfactual outcomes. Following Adjin et al. (2020), the actual observed and concealed counterfactual outcomes for displaced and non-displaced pre-urban peri-urban farming households can be expressed as:

$$E(Y_{1i}|D=1) = \beta_1 X_i + \sigma_{1\epsilon}\lambda_{1i} \tag{7}$$
$$E(Y_{2i}|D=0) = \beta_2 X_i + \sigma_{2\epsilon}\lambda_{2i} \tag{8}$$
$$E(Y_{2i}|D=1) = \beta_2 X_i + \sigma_{2\epsilon}\lambda_{1i} \tag{9}$$
$$E(Y_{1i}|D=0) = \beta_1 X_i + \sigma_{1\epsilon}\lambda_{2i} \tag{10}$$

Based on the results, we calculated the observed outcome (a) for displaced farmers using Eq. 7 and the observed outcome (b) for non-displaced farmers employing Eq. 8. Eq. 9 calculates the anticipated outcome (c) to address the counterfactual for the observed outcome (a) in Eq. 7. Likewise, Eq. 10 computes the counterfactual outcome (d) for the revealed outcome (b) in Eq. 8. After that, we calculated two treatment effects: (1) the average treatment effect on treated (displaced) households (ATT), which is calculated by taking the difference between Eqs. 7 and 9 or cell(a)–cell(c) and (2) the average treatment effect on untreated non-displaced households (ATU), which is computed by taking the difference between Eqs. 10 and 8 or cell(d)–cell(b) (See Table 2).

Table 2: Heterogeneity and Treatment Effect

	Decision stage		
Groups	Displaced	Non-displaced	Treatment effect
Displaced	(a) $E(Y_{1i}\|D_i=1)$	(c) $E(Y_{2i}\|D_i=1)$	ATT
Non-displaced	(d) $E(Y_{1i}\|D_i=0)$	(b) $E(Y_{2i}\|D_i=0)$	ATU
Heterogeneity effects	BH^1	BH^2	TH

Notes: cells (a) and (b) exemplify actual anticipated outcomes; cells (c) and (d) are counterfactual anticipated outcomes. D_i, Y_{1i}, and Y_{2i} as stated before; Treatment effect on treated farmers (that is, the impact of urban expansion on displaced households) is denoted by TT; treatment effect on untreated farmers (that is, the impact of urban expansion on non-displaced households) is denoted by TU; base heterogeneity effect for displaced farmers ($D_i = 1$) and non-displaced farmers ($D_i = 0$) is represented by BHi; and transitional heterogeneity (i.e., TT - TU) is denoted by TH.

Thus, the estimated change in the level of asset and food security status for displaced farmers (ATT) can be modeled as:

$$ATT = E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 1] \tag{11}$$

Correspondingly, the anticipated change in the level of asset and food security status for non-displaced farmers (ATU) can be specified as:

$$ATU = E[Y_{1i}|D_i = 0] - E[Y_{0i}|D_i = 0] \tag{12}$$

Following this, we computed the base heterogeneity effects (BH_1) for displaced farmers as the differences between (a) and (d), while we calculated them for non-displaced farmers (BH_2) as the differences between (c) and (b). Lastly, we estimated the transitional heterogeneity (TH) as the difference between ATT and ATU ($ATT - ATU$) to comprehend if the impact of farmers' displacement is larger or smaller for those that were displaced.

3.5 Asset indicators

In this study, we operationalized assets as resources such as natural, financial, physical, and human owned or possessed by peri-urban farmers. Natural capital is operationalized as the natural resource base of peri-urban farmers and is measured in terms of land size and the ownership or planting of

perennial trees such as eucalyptus and bamboo (which have high commercial and construction values). Financial capital in the context of this study is the total amount of earnings that flow into a peri-urban farmer's account from all sources. It is measured by cash flows from all sources, including remittances, savings, and the monetary value of in-kind materials. Physical capital is operationalized as tangible farm implements, equipment, tools, and properties owned by peri-urban farmers. Ownership of farming tools, TVs, and houses were used as indicators to capture this category of asset. Likewise, human capital is conceptualized as a peri-urban farmer's educational level and health status. It is measured by the peri-urban faming households' educational level, access to training, and self-reported health status. We employed principal component analysis (PCA) method to create an index for each category of capital. The findings are presented in Table 3.

Table 3: PCA requirement tests

Asset category	No of variables	Eigenvalue	% of Variance explained	Components retained	KMO & Bartlett's Test (Sig.)
Natural capital	3	2.146	71.531	1	0.675(0.000)
Physical capital	3	2.395	79.832	1	0.667(0.000)
Human capital	3	1.225	70.585	1	0.553(0.018)

Source: own survey, 2023

Food security indicators

We conceptualized household food security as the ability of a household to adequately meet dietary needs of the family through internal production and some market purchases (Degaga, 2005). Food availability is conceptualized as the actual availability of diet in the neighborhood or for the family from every single source. Besides, we operationalized access to diet as a household's capacity (resources) to obtain the amount of food required to live a healthy lifestyle. Thus, we measured availability dimension in terms of yearly total farm production and food from other sources in Kilograms. To capture access to food, we used household food insecurity access scale (HFIAS). HFIAS often assesses the level of food insecurity brought on by limited access to resources (Coates et al., 2007).

4 Results and Discussion

4.1 Descriptive statistics

The results of descriptive statistics of major variables are presented Table 4. The finding shows that displaced peri-urban households constituted 45.9% of the total sample. The pooled averages of natural, financial, physical and human assets were found to be 36.1%, 45,547 Birr, 27.8%, and 40.6%, respectively. Likewise, the average farm production and HFIAS values were 1503 kg per year and 9.08, respectively. The comparison of mean values and their corresponding tests showed the presence of statistically significant differences in outcome variables among displaced and non-displaced households. The findings revealed that all asset components and farm production values of displaced ménages are considerably lower than those of their counterparts. Of the total displaced sample households, 73% were men, while non-displaced sample men represented about 63%. The mean age of the sampled ménages was found to be 46.9 years, showing that most peri-urban households were in their productive years. Besides, about 88% of households were married, with an average family size of 5 members and 3.52 mean years of schooling.

Regarding institutional variables, about 56%, 42%, 59%, and 51% of peri-urban farm households have credit, farm inputs, extension services, and information access, respectively. The sample households, on average, own 4.75 tropical livestock units and travel 3.23 km to get to a nearby market. The level of network work among the sampled households is found to be moderate (with a mean value of 1.1), which is relatively good among displaced households (1.34) compared to their counterparts (0.82).

About 33%, 73.5%, and 34% of the households reported that their farmland is very close to the town, have land use right legal document, and are aware of urban life style, respectively.

Table 4: Definition of demographic, socio-economic, and institutional variables and their mean differences

Variables	Description and measurement	Pooled (1)	Displaced (2)	Non-displaced (3)	Diff. (4)
	Dependent variable				
Treatment	Displacement due to urbanization (1=yes, 0=no)	0.459(0.499)			
	Outcome variables				
Natural capital	Natural capital index (continuous)	36.1(1.83)	16.55(1.87)	52.7(2.24)	-36.15***
Financial capital	Total annual income in Birr (continuous)	45547.8(31058.6)	17861.56(9599.5)	69071.95(22334.6)	-51210.39***
Physical capital	Physical capital index (continuous)	27.81(25.94)	11.3(8.2)	41.84(27.6)	-30.5***
Human capital	Human capital index (continuous)	40.59(27.58)	23.65(19.95)	54.97(24.89)	-31.32***
Farm production	Total annual production of major crops(Cont.)	1503.18(2211.56)	478.04(429.62)	2374.22(2693.49)	-1896.18***
HFIAS	HFIAS score (continues)	9.08(5.35)	13.78(2.86)	5.09(3.34)	8.69***
	Covariates				
Gender	Household head is a man, dummy (1=yes)	0.675(0.47)	0.73(0.44)	0.63(0.48)	-0.103*
Age	Age of ménage head (years)	46.88(12.74)	46.38(10.53)	47.30(14.38)	-0.92
Marital status	Household is married, dummy (1=yes)	0.88(0.325)	0.92(0.267)	0.84(0.36)	0.08**
Education	Schooling (years), continuous	3.52(3.76)	3.88(3.68)	3.21(3.81)	0.67
Household size	Number of persons residing in household, continuous	5.04(1.57)	5.18(1.64)	4.92(1.49)	0.26
Credit access	Credit access, dummy (1=yes)	0.56(0.5))	0.35(0.48)	0.73(0.44)	-0.38***
Farm input	Access to farm input use, dummy (1=yes)	0.42(0.49)	0.24(0.43)	0.58(0.50)	-0.34***
Ext. access	Access to ext. service, dummy (1=yes)	0.592(0.49)	0.777(0.42)	0.43(0.497)	0.35***
TLU	Livestock (Tropical Livestock Unit), continuous	4.75(2.92)	4.33(2.47)	5.09(3.22)	-0.76**
Market distance	Distance to Market from home (km)	3.23(0.597)	3.35(0.51)	3.14(0.65)	0.21**
Access to info.	Access to information, dummy (1=yes)	0.51(0.50)	0.40(0.49)	0.61(0.49)	-0.21***
Networks	Networks, ordinal (0=weak, 1=moderate, 2=strong)	1.1(0.93)	1.34(0.88)	0.82(0.911)	0.52***
	Instrumental variables				
Farm proxy	Proximity of the farm to the town, dummy (1=yes)	0.33(0.47)	0.56(0.50)	0.12(0.33)	0.44***
Legal_R	Legal land use rights, dummy (1=yes)	0.735(0.44)	0.7310.44)	0.739(0.44)	-0.008
Aware_UL	Awareness about urban life style(1=yes)	0.34(0.47)	0.33(0.47)	0.35(0.48)	-0.02
N		283	130	153	

Source: own survey, 2023. Note: Standard deviations are in parenthesis.

In general, the results presented in Table 4 show that displaced and non-displaced peri-urban households are methodically dissimilar in studied demographic, socioeconomic, and institutional features. Nonetheless, since households are forced to displace, the differences are inconclusive and inadequate with respect to comprehending the impact of urban expansion on livelihood assets and the dietary security status of the displaced households. Put another way, without accounting for additional confounding variables, it is not possible to draw conclusions about how urban expansion affected the assets and dietary security status of peri-urban households based solely on the results of the descriptive statistics. We therefore, used ESR model.

4.2 Econometrics (ESR) Results

Tables 5, 6, and 7 present the coefficient estimations of the ESR model. The second and fifth columns in all tables report the outputs of the selection equation that show factors that influence displacement. The results indicate that variables, for instance, marital status, credit and farm input access, livestock ownership, and distance to markets, and networks influence displacement. Besides, all the three instrumentals are statistically significant, though the signs of the coefficients are different. The coefficient is positive for the proximity of the farm to the town, implying that peri-urban farmers whose farmland is closer to the town are more likely to be displaced. For legal land use rights document and awareness about urban life styles, the coefficients are negative. That is, households that have legal documents are less likely to be fully affected due to the possibility of getting replacement land and/or compensation packages that may be unavailable for those who lack such documents.

Besides, peri-urban farmers who are aware of and try to adapt their livelihood activities to urban life styles are less likely to be affected by urban expansion. These confirm our expectations and justifications for employing the variables as instruments. Additionally, columns 3, 4, 6, and 7 of Tables 5, 7, and 7, present the second stage of the estimations, reporting the results of the separate outcome equations for displaced and non-displaced ménages for natural, financial, physical, human, food production, and

HFIAS outcomes, respectively.

The probability ratio test for independence is statistically significant at either 5% or 10% for almost all of the models, implying that the equations are jointly dependent (see the lower part of Tables 5, 6, and 7). This result provides proof for an endogeneity issue that has to be curbed through the ESR method. Likewise, differences were also observed between the outcome variable coefficients of displaced and non-displaced ménages in regimes 1 and 2, showing the existence of heterogeneity in the sample. All these results justify the application of proper impact evaluation methods (such as ESR) to generate valid and unbiased results.

At the bottom of tables mentioned above, the results of correlation figures ($\rho_1$and ρ_2) of covariance tags among error terms of the choice equation and that of the outcome equations are also presented. As can be seen from the tables, the estimated coefficients are negative and statistically significant for the natural, financial, human, and farm production of displaced households (regime 1) (ρ_1) but insignificant for non-members (regime 2)(ρ_2). However, the coefficients are positive and significant for physical capita and negative and significant for HFIAS in regime 2(ρ_2) but insignificant for displaced households (regime 1)(ρ_1). The results show the existence of selection bias owing to invisible factors that could bias the impact of urban enlargement on the asset and dietary security status of the displaced households if the correct impact estimation method is not used.

In addition, the negative sign for natural, financial, human, and farm production models in regime 1 shows a positive choice bias, that is, displaced households are in an absolute disadvantage position due to displacement. Conversely, the positive sign of ρ_2 for physical capital in regime 2 shows a negative selection bias; implying non-displaced households are in an advantage position. Likewise, the negative sign of ρ_2 for HFIAS in regime 2 shows a negative selection bias, implying that non-displaced households are in and advantage position (a higher HFIAS value is an indication of food insecurity). The results in either case show that displaced peri-urban farmers are worst off for being displaced.

Table 5: ESR Estimation of asset outcome variables (natural and financial capital)

Variables	Natural capital (outcome 1)			Financial capital (outcome 2)		
	Sel. equ. (1)	Displaced	Non-displaced	Sel. equ. (2)	Displaced	Non-displaced
Gender	0.06(0.21)	-9.64(4.42)**	3.29(4.46)	0.44(0.21)	-1668.8(1995.3)	-3179.1(3680.8)
Age	0.01(0.01)	0.13(0.18)	0.26(0.16)	0.01(0.01)	-34.6(83.4)	-6.05(136.4)
Education	0.03(0.03)	1.27(0.50)**	0.30(0.66)	0.04(0.03)	-155.3(226.0)	377.1(532.5)
Marital status	0.57(0.29)**	-3.75(6.89)	6.94(6.05)	0.62(0.29)**	-551.7(3099.2)	11706.4(4951.9)**
Family size	0.002(0.06)	-1.39(1.20)	0.05(1.5)	-0.01(0.06)	-114.8(544.3)	1776.7(1255.3)
Credit access	-0.80(0.20)***	-4.32(4.32)	6.07(5.94)	-0.82(0.21)***	-1159.6(1924.3)	6983.1(4728.9)
Farm input	-0.73(0.22)***	3.04(4.63)	-7.42(5.35)	-0.68(0.22)***	-1694.8(2070.7)	-33.8(4222.1)
Ext. access	-0.07(0.21)	-3.65(4.13)	10.94(4.89)**	0.04(0.21)	-2949.3(1874.0)	2094.8(4040.7)
TLU	-0.07(0.36)**	0.81(3.72)	-0.96(0.70)	-0.08(0.03)**	136.3(338.4)	-569.6(574.1)
Dist. market	0.35(0.16)**	-0.002(3.72)	-5.84(3.62)	0.35(0.16)	-1156.4(1670.8)	-3929.8(2931.5)
Info access	-0.24(0.19)	-5.42(3.89)	4.84(4.58)	-0.23(0.19)	-2028.8(1764.3)	-462.1(3720.7)
Network	0.66(0.13)***	-3.36(2.49)	1.88(2.86)	0.68(0.13)***	-3646.1(1068.4)***	-2926.4(2244.0)
Proxy(IV1)	1.06(0.22)***			1.13(0.21)***		
Legal_R(IV2)	-0.73(0.27)***			-0.76(0.27)**		
Aware_UL(IV3)	-0.69(0.22)***			-0.59(0.21)**		
Constant	-1.74(0.87)**	34.96(21.18)*	47.15(17.55)***	-1.71(0.88)**	3648(9321.8)***	62595.8(14450.1)***
σ_1		3.02(0.07)***			9.14(0.07)***	
σ_2			3.26(0.06)**			9.97(0.06)***
ρ_1		-0.50(0.26)**			-0.49(0.20)**	
ρ_2			0.26(0.32)			-0.07(0.23)
Log Likelihood	-1405.27			-3228.17		
Wald $\chi 2$	19.58*			18.82		
LR test $\chi 2$	3.43*			4.60**		
Observations	283	130	153	283	130	153

Source: own survey, 2023
Note: * p<0.10, ** p<0.05, ***p<0.01; IVi – instrumental variables; pi - (rho); σi- sigma

Table 8 presents the treatment effect of urban expansion under actual and counterfactual conditions on the assets (natural, financial, physical, and human) and food security (production and HFIAS). The predicted values of the outcome variables are indicated in cells (a) and (b), while the counterfactuals are shown in cells (c) and (d). Based on ESR model results, we computed ATU (the final variation between actual average outcomes of non-displaced farmers and their corresponding counterfactuals) and ATT (the final variation between the actual average outcomes of displaced households and their

corresponding counterfactuals). The expected values for natural (16.53), financial (17837.01), physical (11.29), human (23.6), and production (477.65) for displaced peri-urban farmers (a) were lower than those of non-displaced farmers natural (52.68), financial (69071.1), physical (41.79), human (62.32), and production (2373.82) (c), while the expected value of HFIAS for displaced farmers (13.77) (a) was higher than that for non-displaced ones (5.08) (c).

However, just simple comparisons of these values could be misleading in attributing the effect of urban enlargement to the outcome variables of displaced and non-displaced peri-urban farmers. Columns 5 and 6 in Table 8, therefore, present the treatment effect and the resultant percentage changes. In counterfactual scenario (c), the displaced peri-urban farmers would have a natural capital stock of about 61.8 if they had not been displaced. That is, urban expansion has reduced the natural capital of displaced peri-urban farmers by 45.28, or 73.26%. Likewise, the financial capital of the displaced peri-urban farmers, on average, is declining by 47134.3 birr, or 72.5%, due to urban expansion. Putting it simply, the financial capital of displaced farmers would have been 64971.3 birr if they had not been displaced.

Moreover, physical capital, human capital, and agricultural production of the displaced peri-urban farmers are shrunk by 45.13, 18.02, and 1997 kg, or by 79.9%, 43.2%, and 80.7%, respectively, due to urban expansion. In other words, the physical capital, human capital, and agricultural production of displaced farmers would have been 56.42, 41.62%, and 2474.85 kg, respectively, had they not been displaced. In terms of HFIAS, the coefficient is positive (that is, 11.7), implying that urban expansion has increased the food insecurity status of displaced households by about 85%. Explicitly, the HFIAS value of displaced households would have been 2.06 had they not been displaced.

In counterfactual circumstance (d), peri-urban households that did not displace would have natural, financial, physical, and human capital of about 24.77 (47.02%), 45494 birr (65.9%), 32.23 (77.1%), and 10.9 (17.5%) less than if they had displaced. In terms of food security, had non-displaced peri-urban farmers been forced to be displaced, their mean annual farm production would have been reduced by 1676.9 kg, or 70.6%. Likewise, had non-displaced peri-urban farmers been forced to be displaced, their food insecurity level would have increased by a HFIAS value of 6.95, or 57%. Therewithal, the TH effect results are presented in the third row of each outcome variable in Table 8. The results are negative for all outcome variables except HFIAS. The negative TH effects indicate that the negative impact of urban expansion on natural, financial, physical, human, and farm production are significantly higher for peri-urban farmers that are displaced compared to their counterpart. That is, urban expansion has significantly reduced the asset base and food production of displaced farmers. Besides, the positive TH effect for HFIAS shows that the effect of urban expansion on this variable is significantly higher for peri-urban farming ménages that are displaced compared with non-displaced farmers, implying that urban expansion has increased the food insecurity level of displaced farmers. The results of HT effects further strengthen the validity and significant negative impacts of urban amplification on peri-urban farming households.

Overall, the findings of our study are in line with the arguments of the Impoverishment Risks and Reconstruction (IRR) theory, which argues poor institutions and planning approaches, social injustices, and weak or absence of reconstruction initiatives often lead to forced displacement that eventually destroys the livelihoods of displaced individuals and pushes them into a vicious cycle of poverty. Several studies have also reported results that support this model. For example, inadequate compensation to rehabilitate displaced peri-urban farmers (Abdo, 2016; Adam, 2014; Ambaye, 2015; Belay, 2014; Mohammed et al., 2020; Wubneh, 2018) and poor spatial planning, implementation, and non-integrative approaches (Bulti & Abebe, 2020; Haregeweyn et al., 2012; Mohammed et al., 2020; Zewdie et al., 2018) are reported as reasons for the deterioration of displaced peri-urban farmers livelihoods. Factors such as unlawful and extra-legal land tracts and dealings (Ayele & Tarekegn, 2020) and a lack of proper controlling and coordination mechanisms for urban expansion (Addis, 2020; Artmann et al., 2019; Ayele & Tarekegn, 2020; Johnson et al., 2014) are also reported as major factors for the deterioration of the livelihoods of displaced peri-urban farmers. Besides, non-participatory and supportive methods (Gebreyehannes et al., 2022), low attention to the circumstances of peri-urban people (Argaie et al., 2022; Lark et al., 2020; Mohammed et al., 2020), inadequate implementation of the existing policies and regulations, and lack of stakeholders' involvement (Argaie et al., 2022) are also among the reasons for poor

Table 6: ESR Estimation of asset outcome variables (physical and human capital)

Variables	Physical capital (outcome 3)			Human capital (outcome 4)		
	Sel. equ. (3)	Displaced	Non-displaced	Sel. equ. (4)	Displaced	Non-displaced
Gender	0.03(0.02)	-1.68(1.72)	-0.17(4.63)	0.09(0.20)	11.17(4.19)***	-4.85(3.91)
Age	0.01(0.01)	0.03(0.07)	0.06(0.17)	0.003(0.08)	-0.37(0.17)**	-0.43(0.13)***
Education	0.03(0.03)	0.23(0.19)	0.156(0.67)	NA	NA	NA
Marital status	0.57(0.29)**	-0.04(3.07)	8.41(6.28)	0.63(0.29)**	3.18(6.51)	-8.21(5.23)
Family size	-0.01(0.06)	-0.001(0.47)	1.77(1.58)	-0.03(0.06)	-0.75(1.19)	-1.70(1.33)
Credit access	-0.82(0.20)***	-2.32(2.1)	-0.21(5.95)	-0.84(0.20)***	-0.69(4.27)	8.89(5.36)*
Farm input	-0.71(0.22)***	-2.20(2.24)	-5.59(5.26)	-0.74(0.21)***	-8.26(4.59)	-4.83(4.81)
Ext. access	0.03(0.21)	-2.39(1.63)	-1.10(5.09)	0.01(0.21)	-0.068(3.94)	6.41(4.27)
TLU	-0.08(0.04)**	-0.37(0.30)	-0.52(0.73)	-0.07(0.03)**	-0.22(0.74)	0.49(0.61)
Dist. market	0.38(0.16)**	-0.64(1.68)	-4.19(3.68)	0.39(0.15)**	-3.31(3.49)	-9.27(3.27)***
Info access	-0.22(0.19)	-2.56(1.6)	7.15(4.65)	-0.17(0.19)	1.22(3.82)	-2.59(3.93)
Network	0.69(0.14)***	-0.68(1.22)	3.56(2.85)	0.62(0.14)***	3.76(2.71)	-4.06(2.64)
Proxy(IV1)	1.04(0.22)***			0.96(0.24)***		
Legal_R(IV2)	-0.89(0.27)**			-0.73(0.29)**		
Aware_UL(IV3)	-0.57(0.22)**			-0.64(0.21)***		
Constant	-1.59(0.89)*	18.69(10.52)*	40.5(18.3)**	-1.42(0.83)*	34.73(20.17)*	114.58(14.68)***
σ_1		2.05(0.06)***			3.02(0.09)***	
σ_2			3.31(0.07)***			3.14(0.07)***
ρ_1		0.04(0.50)			-0.87(0.44)**	
ρ_2			0.48(0.26)*			-0.36(0.29)
Log Likelihood	-1288.4			-1376.08		
Wald χ^2	12.93			18.41*		
LR test χ^2	2.76*			5.92**		
Observations	283	130	153	283	130	153

Source: own survey, 2023
Note: * p<0.10, ** p<0.05, ***p<0.01; IVi – instrumental variables; ρ_i - (rho); σ_i- sigma
NA stands for 'not applicable'. Since education is used as one of the indicators to compute human capital, it is excluded as a covariate for this variable.

urban expansion management and the resultant displacement. Some scholars mentioned problems of land tenure (state ownership of land) (Gebreyehannes et al., 2022) and lack of awareness and alternative livelihoods for peri-urban farmers (Gebreyehannes et al., 2022; Mohammed et al., 2020; Weldearegay et al., 2021) as reasons for displacement.

The rapid process of urban expansion is changing the way land is used in peri-urban expanses to suit the demands of urban areas and their growth (Gebreyehannes et al., 2022). Peri-urban farmers, in particular, are compelled to move and lose their farms, which are their sole source of money, resources, and food. The practice of being displaced owing to urban expansion is widespread in Injibara Town, as it is in Ethiopia's peri-urban expanses. Based on the aforementioned patterns, practices, and explanations, we discovered that urban growth had a negative impact on every metric used to assess the peri-urban farmers' asset and food security status.

Our findings are, therefore, in agreement with (and validate) the existing empirical studies carried out in developing countries, including Ethiopia, which reported the negative impacts of urbanization on peri-urban farmers' welfare and dietary security (Alamneh et al., 2023; Andrade et al., 2022; Belay, 2014; Bereket, 2020; Bren d'Amour et al., 2017; Cernea, 2021; Dadi et al., 2016; Gebreyehannes et al., 2022; Huang et al., 2018; Jiang et al., 2013; Labiso, 2020; Mohammed et al., 2020; Tassie & Duan, 2018; Weldearegay et al., 2021). However, our results are at odds with the ones that reported the opposite (please see the introduction and literature review section above).

5 Conclusions and policy implications

In this study, we have estimated the impact of urban expansion on the livelihood assets and food security of the peri-urban farming ménages in Enjibara Town. We employed an ESR model that address the issues of endogeneity, selection bias, and heterogeneity and capture the differential impacts of urban expansion on displaced and non-displaced peri-urban. We found that urban expansion declines the asset (natural, financial, physical, and human capital) and food security status of peri-urban farmers. When we disaggregate our results for displaced and non-displaced farmers, a remarkable pattern begin to emerge. That is, displaced peri-urban farmers inclined to have lower asset (natural, financial, phys-

Table 7: ESR Estimation of food security outcome variables (farm production and HFIAS)

Variables	Farm production (outcome 5)			HFIAS (outcome 6)		
	Sel. equ. (5)	Displaced	Non-displaced	Sel. equ. (6)	Displaced	Non-displaced
Gender	0.02(0.21)	-81.9(92.05)	-479.60(451.45)	0.11(0.20)	0.09(0.59)	-0.05(0.57)
Age	0.01(0.01)	-4.81(3.83)	15.45(16.74)	0.01(0.01)	0.04(0.02)	-0.01(0.02)
Education	0.04(0.03)	-3.52(10.4)	64.91(66.25)	0.03(0.02)	0.16(0.07)**	-0.08(0.08)
Marital status	0.59(0.29)**	131.69(143.7)	876.92(609.4)	0.51(0.29)*	-1.07(0.93)	-0.21(0.78)
Family size	0.05(0.06)	-23.62(25.0)	192.9(154.14)	0.01(0.06)	0.28(0.16)*	-0.34(0.19)*
Credit access	-0.83(0.20)***	-5.54(88.33)	399.03(593.8)	-0.90(0.20)***	-1.61(0.61)***	1.04(0.73)
Farm input	-0.72(0.22)***	-46.68(95.46)	378.79(531.59)	-0.67(0.22)***	0.19(0.65)	-0.55(0.69)
Ext. access	0.03(0.21)	-25.77(86.4)	263.67(495.85)	-0.01(0.21)	0.16(0.55)	-1.16(0.62)*
TLU	-0.08(0.035)**	15.11(15.64)	-21.83(71.37)	-0.07(0.04)**	-0.09(0.10)	0.12(0.09)
Dist. market	0.34(0.16)**	-81.58(77.47)	-208.34(362.92)	0.33(0.16)**	-0.08(0.52)	-0.27(0.47)
Info access	-0.19(0.19)	-70.42(81.27)	94.25(461.9)	-0.14(0.19)	0.47(0.52)	0.21(0.09)
Network	0.68(0.13)***	-77.16(49.59)	-72.14(285.64)	0.71(0.13)***	0.26(0.35)	-0.08(0.36)
Proxy(IV1)	1.10(0.21)***			0.91(0.25)***		
Legal_R(IV2)	-0.79(0.28)***			-0.89(0.26)***		
Aware_UL(IV3)	-0.59(0.21)***			-0.52(0.21)***		
Constant	-1.70(0.88)***	1241.4(436.03)***	305.91(1777.15)	-1.65(0.88)**	10.84(3.04)***	6.87(2.27)***
σ_1		6.06(0.07)***			0.99(0.07)***	
σ_2			7.87(0.06)***			1.24(0.09)***
ρ_1		-0.46(0.17)**			0.39(0.32)	
ρ_2			0.13(0.29)			-0.78(0.42)*
Log Likelihood	-2507.35			-824.05		
Wald χ^2	8.84			22.09**		
LR test χ^2	3.68*			3.64*		
Observations	283	130	153	283	130	153

Source: own survey, 2023
Note: * p<0.10, ** p<0.05, ***p<0.01; IVi – instrumental variables; ρ_i - (rho); σ_i - sigma

ical, and human capital) and food availability (production) and higher HFIAS value than those non-displaced ones in the counterfactual scenario. Besides loss of farmland, displaced peri-urban farmers might lost some unobserved traits (such as knowledge and skills, emotional intelligence, naturalistic intelligence, etc.) that make them less productive, poor, and food insecure. We also found that the negative impact of urban enlargement on asset and dietary security is higher for displaced peri-urban farmers than the impact would have been for non-displaced ones, in the counterfactual scenario, if they had had such experiences. That is, displaced peri-urban farmers are worst off for being displaced. Therefore, it is safe to conclude that urban expansion in the study has a significant harmful impact on the asset and dietary security status of displaced farmers and puts them in an absolute disadvantageous position.

The town administrations, therefore, need to adapt context-specific urban development and planning models such as network or rural-urban linkage, which could properly address and balance the livelihoods of both peri-urban farmers and urban dwellers and generate win-win situations for both. Given the fast rate of urban growth and expansion in Enjibara Town, concerned bodies need to think about shifting their approach from horizontal expansion to a more compressed and vertical development pattern that could at least limit the pace of expansion and displacement. Besides, a well-functioning land management and socially inclusive governance system needs to be established to address the existing unrestrained and chaotic pattern of urban expansion. Since urban expansion is an unavoidable phenomenon, the town administration and concerned stakeholders should prepare and capacitate peri-urban agriculturalists proactively to acclimate themselves to urban life styles and livelihood systems. Furthermore, designing adequate displacement rehabilitation and reconstruction packages that ensure sustainability of displaced farmers' livelihoods is indispensable. Finally, concerned government bodies (at national and regional levels) should consider revising the land tenure system to the extent that guarantees peri-urban agriculturalists the right to own, intercede, and vend their land at fair market value and invest their money in alternative livelihoods.

This study has a few limitations and offers intuition for further research. It is a cross-sectional study. That is, it did not address the dynamic features of urban expansion and the resultant displacement over time. Therefore, longitudinal studies that analyze and address the long-term impacts of urban enlargement on peri-urban livelihoods are required. This study is limited to one town. Hence, comparative studies that analyze the situation of successful urban areas (generate positive impacts) and identify

Table 8: Impact of urban expansion on the asset and food security

Outcome variable	Subsample	Decision stage		Treatment effect	% change
		Displaced	Not-displaced		
Natural capital	N	**3**	**4**	**5**	**6**
Displaced	130	(a) 16.53(0.73)	(c) 61.81(0.75)	ATT= -45.28(1.05)***	-73.26
Not-displaced	153	(d) 27.91(0.80)	(b) 52.68(0.78)	ATU= -24.77(1.11)***	-47.02
Heterogeneity effects		BH^1= -11.38	BH^2= 9.13	TH= -20.51***	
Financial capital					
Displaced	130	(a) 17837.01(307.5)	(c) 64971.3(630.2)	ATT= -47134.3(701.6)***	-72.5
Not-displaced	153	(d) 23576.2(328.2)	(b) 69071.1(498.3)	ATU= -45494.9(596.7)***	-65.9
Heterogeneity effects		BH^1= -5739.19	BH^2= -4099.8	TH= -1639.39***	
Physical capital					
Displaced	130	(a) 11.29(0.22)	(c) 56.42(0.67)	ATT= -45.13(0.70)***	-79.9
Not-displaced	153	(d) 9.56(0.23)	(b) 41.79(0.64)	ATU= -32.23(0.68)***	-77.1
Heterogeneity effects		BH^1= 1.73	BH^2= 14.63	TH= -12.9***	
Human capital					
Displaced	130	(a) 23.60(0.70)	(c) 41.62(0.82)	ATT= -18.02(1.08)***	-43.32
Not-displaced	153	(d) 51.42(0.62)	(b) 62.32(0.71)	ATU= -10.9(0.94)***	-17.5
Heterogeneity effects		BH^1= -18.73	BH^2= 19.19	TH= -37.92***	
Farm production					
Displaced	130	(a) 477.65(10.78)	(c) 2474.85(58.3)	ATT= -1997.2(59.29)***	-80.7
Not-displaced	153	(d) 696.92(12.56)	(b) 2373.82	ATU= -1676.9(48.52)***	-70.6
Heterogeneity effects		BH^1= -219.27	BH^2= 101.02	TH= -320.29***	
HFIAS					
Displaced	130	(a) 13.77(0.09)	(c) 2.06(0.09)	ATT= 11.71(10.13)***	85
Not-displaced	153	(d) 12.03(0.08)	(b) 5.08(0.09)	ATU= 6.95(0.12)***	57.8
Heterogeneity effects		BH^1= 1.74	BH^2= -3.02	TH= 4.76***	

Standard errors in brackets; *p<0.10, **p<0.05, ***p<0.01; Source: own survey, 2023.

success factors and those of failure (negative outcomes) are needed.

Authors' contributions

Dr. Amanuel designed the study, analyzed, and interpreted the data. He also developed the draft manuscript. Mr. Yeshiwas collected and entered the data into SPSS software.

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The authors declare that there are no conflicts of interest

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