Research article

Impact of urban expansion to peri-urban smallholder farmers' poverty in Tigray, North Ethiopia

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ABSTRACT

Urban expansion in African and other developing countries occurred and happening by encroaching fertile agricultural land. As a result, close to fifteen million people are displaced every year. This paper examines the consequences of urban expansion on peri-urban farmers' poverty. Data was generated from 341 (101 treated, 240 control) smallholder Peri-urban farmers'. Inferential statistics, propensity score matching (PSM), econometric models, and poverty measurements were applied and analyzed using Stata version 14 software. The impact assessment estimation showed the prevalence of poverty was higher by 5% poverty than non-displaced households. The intensity and incidence of poverty were also found higher among displaced households. Displaced and non-displaced households were deprived 49.4% and 46.5% of weighted indicators respectively, while the incidence of poverty was found 69% and 59% respectively. In sum, 34.1% of displaced and 27.4% of non-displaced households were poor. Besides the overall percentage of contribution of education, health, and living standard dimensions were 15.4%, 28.8%, and 55.8% among displaced households respectively. While percentage contribution of education, health, and living standard among non-displaced households were 15.1%, 26%, and 58.9% respectively. Therefore, the prevalence of poverty was higher in displaced households than in non-displaced households. The binary logistic regression also revealed out of the 13 covariates only four variables were found statistically significant. Of the four variables, except treatment effect or being displaced the rest variables family size, farming experience, and market distance were negatively affect household poverty. In conclusion, in all aspects, the result indicated that the prevalence of poverty was higher among evicted farmers. Therefore, government bodies should design strong strategies to avert the impact of urban expansion on peri-urban farmers. A separate department should be established which follow and provide training on time, and horizontal urban expansion should be changed to vertical expansion.

1. Introduction

Urban expansion in African and other developing countries occurred and happening by encroaching fertile agricultural land (Firman, 2009). 'In several developing countries, this has been noted increasing ecological and social vulnerability and left people displaced, disempowered and destitute' (Aboda et al., 2019, p. 1). As a result, about fifteen million people are displaced every year (Terminski, 2013). He strengthened this displacement has a salient impact on old people, Women, and children. Seto et al. (2011) reported farming land converted to urban expansion reached 58,000 km^2 between 1970 and 2000, and the highest expansion recorded in Asia and Africa. Similarly, D'Amour et al. (2017) evidenced

fertile land, which was 1.77 times more productive compared to the world average, was continuously converted to built-up. And land devoted to crop production is squeezed and food production is declined (Chen et al., 2009; Jiang et al., 2013).

United Nations Development Program (UNDP) and Oxford Poverty & Human Development Initiative (OPHI (2019) stated at the global level, poverty is failing though the disparity is growing". In the report, out of 101 countries including Ethiopia, 23.1% of the population deprived in two or more dimensions and half of this percent were children. In general, globally, one out of six adults and one out of three children were multidimensionally poor. Of the multidimensionally poor, 57.5% were found in Sub-Saharan African countries. Variation in economic growth,

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conflict, poor urban expansion plan, low educational achievement, weak institutions, heavy exploitation of natural resources, and repeated natural disasters were predisposing factors (World Bank, 2018). Similarly, revealed poor quality water, lack of electricity, dispersed and lack of health facility, low educational performance, and coverage, lack of job opportunity, population density, marginalize females in development projects, climate variability, and policies in favor of elites are challenging the continent.

Ethiopia is known for its minimal level of urbanization in Africa with an agriculture-based economy (Alacia, 2010). Surprisingly, now urban expansion in Ethiopia is booming. Annually, urban population is increasing at a rate of 5% (Ministry of Urban Development and Housing (MoUDH, 2016). The same report showed Ethiopia's total population was about 90 million in 2015 of which urban population was 18 million people. However, in 2025 and 2035 urban population is expected to be 30–35 million and 49–55 million people respectively (MoUDH, 2016). Imagine how much burden will be created in the peri-urban farming land. Logically, urban expansion is inevitable and has a significant role in transforming the economy of countries. However, in countries like Ethiopia, where agriculture has a lion's share in the economic growth of the people, urban expansion should be handled in ways that restore the economy and social well-being of the urban and peri-urban communities. Because urban expansion provides more room for the non-food producer, it also creates an extra burden on food demand (Satterthwaite et al., 2010). Unless urban expansion is systematically managed, it will be a driving force to poverty (MoUDH, 2016).

Ethiopia hosts about 102 million (83.5 %) multidimensionally poor people and ranked in the last three countries followed by India and Nigeria. It is home to more than half of the multidimensionally poor households were malnourished and did not finish six years of schooling, $1/3^{rd}$ of the population were multidimensionally poor where their children are not attended school, $3/4^{th}$ of the multidimensional poor have not electricity, and 80 % of the multidimensional poor did not have sanitation facilities Contrarily, the report showed, on monetary bases ($1.90 a day) only 27.3% of the population was poor (UNDP & OPHI, 2019, p. 15, p. 15).

Different perspectives are growing on the impact of development-induced displacement on household poverty. Economic and social theory are among the theories which focus on how urban area is formed. Economic theories strongly argue that urban area is formed by producing surplus marketable agricultural products (Harvey, 1973). This, in turn, facilitates the growth of small towns to exchange excess products and to get other services. The social theory does not deny the importance of economic importance, but the core element for urban formation is through strong human and interpersonal interactions and social and cultural ties which encourage people to live compactly and concentrate in space (Clark, 2004).

Furthermore, theories like growth pole theory, urban-bias theory, and central place theories also try to link its consequences with the poverty of the people. A proponent of growth pole theory argues that eradicating poverty in developing countries is realized through capital-intensive industries in the core and regional cities. This industry will have gradual changes in economic growth and performance of rural people by trickle-down effect, though it seems a top-down approach (Rondinelli, 2019; Unwin, 2017). Most of the time, its backwash effect is greater than its spread-out-effect by the exploitation of rural resources and expands rural poverty by creating a core-periphery relationship (Unwin, 2017; Zeleke et al., 2007). In general, though it is challenging to apply in populous countries, it is still working in developing countries as urban areas are considered as the center of modernity and technologies. Central place theory focuses on promoting market towns in rural areas to access goods and services to minimize the distance in getting goods and services between urban and rural areas (Webster, 2002). The main theme of this theory distance from the central area, those who are close to central

location have a large population and better access to goods and services than those found apart (Davies, 1992; Preston, 1971). This theory also does not consider purchasing capacity and price variation among market centers and the diversity of goods and services they get. In sum, the above theories, some of them are explaining how urban area is formed. The two theories are tried to link their role in addressing poverty through market integration and industrialization in urban areas. Therefore, compared to the above-stated theories, rural-urban linkage and Impoverishment Risks and Reconstruction (IRR) are the appropriate theoretical foundation and shows the association of urban expansion and its possible ramifications to poverty.

Rural-urban linkage focus on the mutual benefits of urban and rural communities. The proponent underpinned the exchange of raw materials and services among them creates a positive virtuous economic growth. As a result, displaced households improve their income sources and purchasing power thereby reduces impoverishment in peri-urban farmers (Christiaensen et al., 2013). Contrarily, advocates of the Impoverishment Risks and Reconstruction (IRR) model argue involuntary eviction marginalize and intensifies poverty and faced all-around impoverishment (Cernea, 1999, 2006). Prenzel and Vanclay (2014) proved people failed to respond and revive from the negative consequences and make people permanently poor and vulnerable to various shocks. Similarly, Adusah-karikari (2015) and Tsikata (2009) posited denying farming people to productive assets particularly farming land has an immediate and devastating impact on household poverty. Terminski (2013) strictly argues that it is a matter of socioeconomic issue where loss of access to farming land and other common resources like grazing land, forests Water, and social integrations exacerbate poverty in displaced households. Aboda et al. (2019) indicated that in developing countries displaced people are exposed to impoverishment than enriched. To this end, the study hypothesized, whether urban expansion improves or escalated poverty across displaced peri-urban farmers?

In Tigray, where the study was conducted, development-induced displacement is commonly practiced. Like other countries and other parts of Ethiopia, prime agricultural land is taken for the construction of residential houses. This creates pressure on peri-urban farmers' livelihood as there are no industries to host ample labor created due to displacement. In other countries, farmers were displaced from their farmland and being displaced mainly to establish large processing plants or dams that have a direct positive impact on the community by creating job opportunities. In general, the effect of development-induced displacement was observed in the study area. Besides, unlike rural and urban areas, less attention was provided to peri-urban farmers by concerned bodies. So far studies (Abdissa, 2005; Addisu, 2015; Bekele, 2010; Ekpenyong, 2015; Mengistu, 2016; Mezgebo, 2014) had been conducted on urban expansion nexus; land use, income diversification, food farming, environment and farmers perception in Ethiopia and other countries. However, urban expansion and its implications to poverty is not studied yet. Therefore, this research investigates the impact of urban expansion on peri-urban farmers' poverty and address the outlined research questions:

1. Does urban expansion have a positive or negative impact on peri-urban smallholder farmers' poverty?
2. What are the intensity and incidence of multidimensional poverty among displaced and non – displaced households?
3. Which dimensions and indicators are contributing more to household multidimensional poverty?
4. What are the determinants of multidimensional poverty?

2. Empirical findings on the determinants of rural poverty

Though urban expansion and its impact is a pressing issue, few studies have been conducted. A study conducted in Brazil by Randell (2016) reported that of the respondents 70 percent of displaced farmers
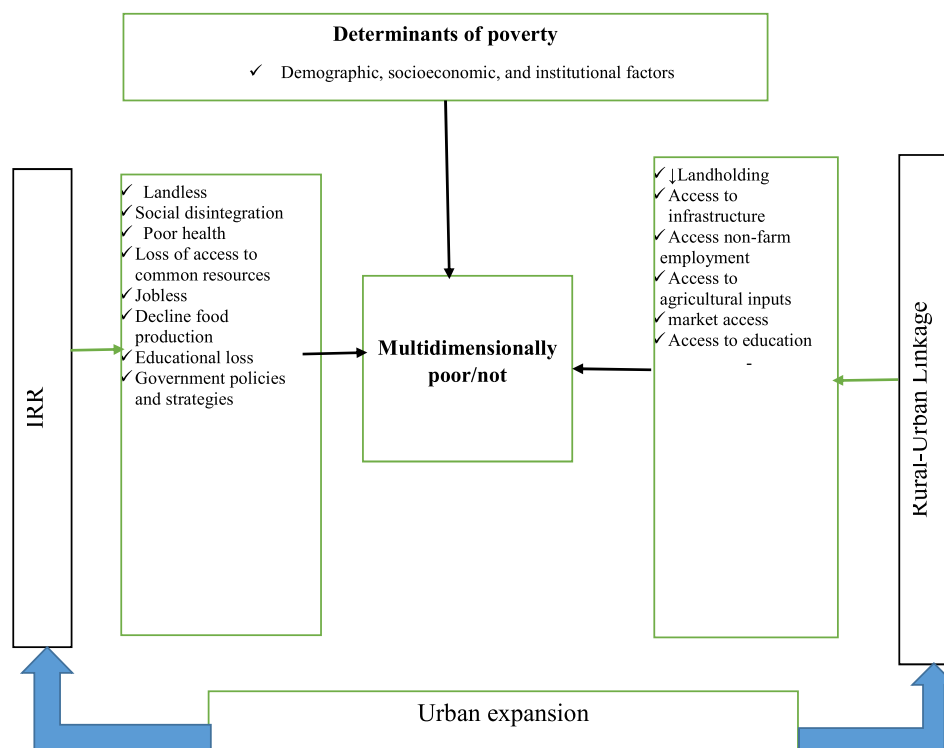
Figure 1. The analytical framework of urban expansion and its implications to poverty (Source: Depicted by the researcher from a literature review and own understanding, 2019).

registered better subjective well-being but smallholder farmers experienced severe poverty than before displaced. Other findings from India also showed 75 percent of development-induced displaced smallholder farmers were found below the poverty line (Cernea, 2000). Guha (2007) evidenced in Singur displaced smallholder farmers' income was dropped by 40 percent. Previous and recent research findings from China proved 60 percent of development-induced displaced households were exposed to poverty (Robinson, 2003), and a significant negative ramification of displacement on employment, income level, and income resource, and overall well-being was reported (Huang et al., 2018). A study conducted by Mezgebo (2014) in Tigray also found a negative impact of displacement on household welfare. Contrarily, a study conducted in Nigeria by Oruonye (2012) found 62 percent of displaced households were enriched than ever before. In sum, previous studies had not concluded whether urban expansion enhances or limit peri-urban farmers' poverty.

Several studies have been conducted on determinants of rural poverty but few studies have been conducted on determinants of peri-urban multidimensional poverty. Empirical study conducted in Ethiopia showed family size, sex of households, dependency ratio, and livestock ownership are the most important determinants of rural poverty (Ermiyas et al., 2019). They verified that livestock ownership and sex of households were negatively related to poverty while family size and dependency ratios were positively affected the poverty status of households. Similarly, Afera (2015) and Bogale et al. (2005) found family size and dependency ratio have a positive association with the poverty of households and statistically significant. Whereas, farmland size, livestock owned (TLU), educational status of the household head, access to credit, and access to off-farm income were negatively related to household poverty and statistically significant. In general, like Ethiopia where their means of livelihood is subsistence farming, households who owned substantial agricultural land were more likely to exit from poverty (Deressa and Sharma, 2014). But female-headed households, large family size, and high dependency ratio households were vulnerable to poverty too. A study conducted in the Philippines and Indonesia by

Quetulio-navarra et al. (2014) came with an uncommon result where the prevalence of poverty was increased as household head educational level increases.

3. Conceptual framework

The conceptual framework portrays the ramification of urban expansion on peri-urban farmers' poverty. At the top, factors that enhance or limit household poverty was listed. In most cases, age, educational, farmland, family size, livestock, gender, access to infrastructure, market access, and credit access, and agricultural inputs are listed as demographic, socio-economic, and institutional factors. At the bottom, urban expansion and possible effects were presented, and social risks were identified coming from development induced displacement "landlessness, joblessness, homelessness, marginalization, food insecurity, increasing morbidity, loss of access to common property resources, education loss, and social disarticulation" (Cernea, 2000, pp. 6–10). In conclusion, this conceptual framework hypothesized, whether urban expansion improves or escalated poverty across displaced peri-urban farmers (See Figure 1).

4. Research approach

4.1. Physical description of the research area

The study was conducted in Tigray Regional State-Northern Ethiopia (See Map, Figure 2)[1]. Agroecology of the woreda dominantly woinadega with a small portion of *kolla*. The elevation varies from 1,375–2,105 m above sea level and suited at a latitude of 1400′0″-1401′230″ and longitude of 38032′30′-38052′30″. It is home to rugged and gentle slope arable lands. It has a temperature of 18–25 °C and an average rainfall of 937.4 mm (National Metrological Agency of Ethiopia [NMAE], 2019).
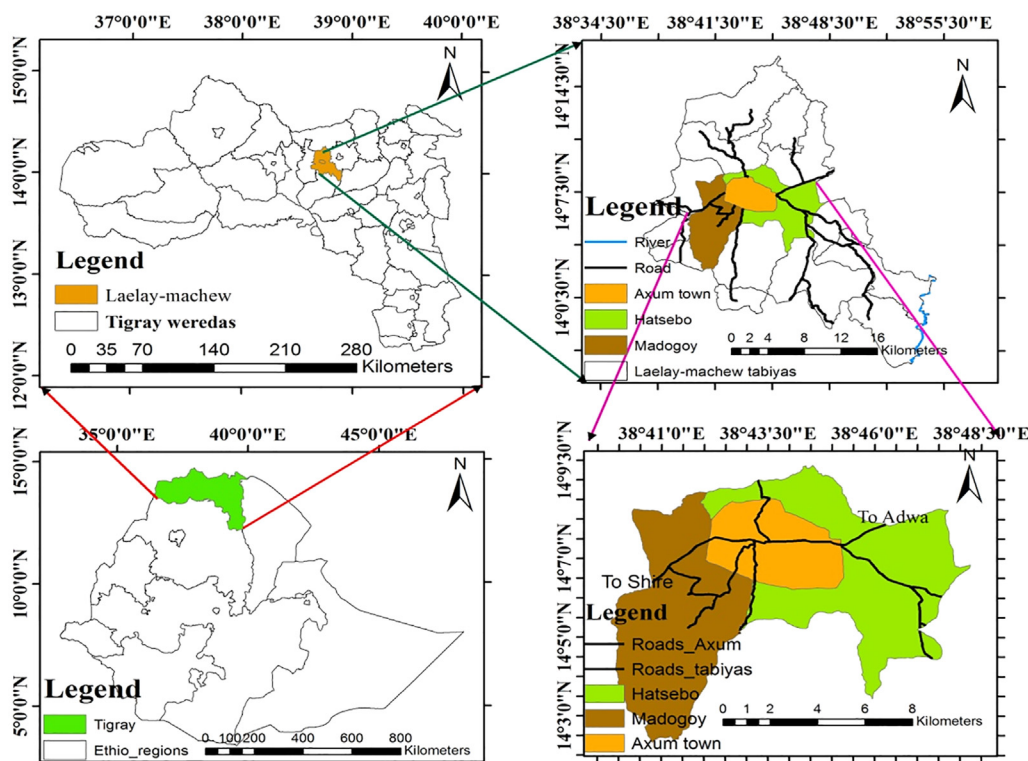
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[1] Color print required.

Figure 2. Study area map (Source: Authors' own construction).

4.2. Sampling procedures and data sources

Different stages of sampling were applied to select the research area, *Tabias*, and representative of the target group. Population and unit of analysis of the study was households in the peri-urban *Tabias* which have common boundaries with Axum town. Hence, Hatsebo and Modegue were selected purposively because the town is expanding only to these two *Tabias*. Households are stratified into displaced/partially (their livelihood mainly depends on farming) and non-displaced to see the effects and the associated impact of displacement. Chochran (1977) sample size determination method was applied. $n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$, accordingly, 341 households were taken of whom 101 partially displaced and 240 non-displaced (Table 1). Quantitative and qualitative data were generated using a structured survey questionnaire and document review. The questionnaire was developed in English and interviewed in Tigrigna. A pilot test was conducted to check whether the questionnaire is well understood by the interviewee. A structured questionnaire is crucial to avoid variations among the respondents' understanding of the questions to collect reliable data. This study excluded displaced peri-urban farmers whose main livelihood is not farming because the PSM model applies to households with similar characteristics.

4.3. Tools and techniques of data analysis

Inferential statistics and econometric models were employed and Stata version 14 software was used to manage and analyze data. The impact of displacement on household poverty was analyzed using propensity score matching (PSM). Several socio-demographic and other related variables were fed to match individuals irrespective of being displaced or not. Observation in both treated and control groups will have similar characteristics such that comparison on the outcome variable using a t-test could be possible using different algorithms. The whole steps of impact assessment were taken from (Rosenbaum and Rubin,

1983)[2]. Therefore, the population is categorized as treatment and control groups, the treatment indicator D_i will assume 1 for those who are in the treatment group (Partially displaced from their land) and zero otherwise. So the outcome will be given as $Y(D_i)$ for each individual i, where $i = 1...N$ and N refers to the total population. Thus, the treatment effect for an individual i can be given as. $T_i = Y_i(1) - Y_i(0)$

Generally, to conduct impact assessment common support and Confoundedness Independence Assumption (CIA) should be achieved.

Therefore, to estimate the impact on household poverty Multidimensional poverty Index (MPI) was used as an outcome variable. Alkire's foster method[3] was applied to measure poverty.

This method has three dimensions with equal weight and ten indicators, indicators within the same dimension have equal weight, and participants were grouped into Multidimensional poor or not depending on the number of deprivations. Deprivations experienced by each household were summed. the score lies between 0 and 1, with 1 as the highest deprivation, and 0 no deprivation. Deprivation increases from 0 to 1. Respondents scored $=\geq 1/3$ is poor otherwise not. Incidence and intensity of deprivation was determined using the formula, $H = \frac{q}{n}$ Where H, multidimensional headcount ratio, q represents the number of multidimensional poor households, n total sampled, and A intensity or breadth of poverty. Therefore, $A = \frac{\sum_{i-1}^{n} ci(K)}{q}$ (Alkire et al., 2011, pp. 3–5).

$$P(x) = \left\{ \begin{array}{l} 0 \, not \, multidimension \, poor \\ 1 \, multidimensional \, poor \end{array} \right\}$$

5. Results and discussion

5.1. Characteristics of respondents

Theoretical and empirical findings proved demographic and socioeconomic characteristics are key to improve or worsen poverty. The

[2] For detail see Rosenbaum and Rubin (1983)..

[3] See for detail Alkire et al. (2011)..

Table 1. Household population size and sampled households.

Tabias	Population size			Sampled households			Displaced	Non-displaced	total
	Male	Female	Total	Male	Female	Total			
Hatsebo	1,183	491	1,674	133	55	188	101	240	341
Medogue	995	368	1,363	112	41	153			
Total	2,178	859	3,037	245	96	341			

Source: Computed from authors' field survey, 2019

Table 2. Distribution of mean, standard deviation, and range by treatment.

Variable	HH status	Mean	Std.Dev
Age of household head	Not-displaced	50.0	12.9
	Displaced	60.9	13.3
Educational status of the household head	Not-displaced	3.0	3.6
	Displaced	1.6	2.7
Family size	Not-displaced	5.0	2.2
	Displaced	6.0	2.4
Farmland size	Not-displaced	0.67	0.28
	Displaced	0.59	0.33
Non-farm income	Not-displaced	5429.0	4450.0
	Displaced	8512.0	3839.0
Tropical livestock unit (TLU)	Not-displaced	2.0	1.5
	Displaced	3.0	2.0
Market distance	Not-displaced	5.0	1.5
	Displaced	1.7	0.65

Source: Computed from authors' field survey, 2019

descriptive result showed that the percentage of single, divorced, and widower was higher among non-displaced compared to displaced households and the reverse is true for married and widowed households. Similarly, non-displaced households had more children than displaced households. Of the total displaced households, 0.02% did not receive compensation for a different reason.

Respondents were asked for what purpose did they use the compensation. Accordingly, a large amount of money was spent on more than two purposes (68.5%) followed by house construction (15.3%) and purchasing food items (11.2%). Surprisingly, one household has wrongly used the money for usury. Of the sampled households few household members were migrated of whom displaced households' takes the lead. Households were migrated from their natal place due to diverse reasons of which shortage of land and searching for better work and life were the most. The result indicated that searching for a better life (40.7%) followed by searching better work (37%) was the dominant cause in the study area.

Supplementing rain-fed agriculture is one strategic plan in Ethiopia to move out of poverty and achieve food security. The result shows that of the sampled households about 25.2 percent were used irrigation where the majority of them were non-displaced households. The area is potential for groundwater however households practicing irrigation were small compared to the total sampled households. Similarly, compared to the displaced households, the percentage of non-displaced households involved in irrigation was higher.

Subsistence agriculture is the prime means of livelihood of the households followed by two or more sources. The percentage of displaced households who led their livelihood by farming was higher compared to non-displaced. Surprisingly, there were not displaced households who opened business rather they get some amount of money from the remittance. Financial accessibility is important to diversify their income sources and achieve food security. In general most of the respondents did not take credit. However, compared to displaced households large percent of non-displaced households took credit from financial institutions. The focus group discussant mentioned that high-interest rate is

the limiting factor not take credit from financial institutions. On-farm research outputs proved that agricultural inputs boost agricultural food production. The result showed non-displaced households were better in the adoption of agricultural inputs compared to displaced households. Similarly, the percentage of households benefited from PSNP and have access to extension service were higher among non-displaced households than in displaced households.

Table 2 shows the average age of displaced households was higher than in non-displaced households. The average age of not-displaced households is 50 years and the standard deviation of 12.9 years with a range of 27–87 years. While the mean age of displaced households is 61 years with a standard deviation of 13.3 years. This indicates that age variation is higher among displaced households than non-displaced households. The mean educational level also showed non-displaced households were achieved higher educational levels than displaced households. The mean educational level of non-displaced and displaced households were grade three and two, respectively. Likewise, the standard deviation is also higher among non-displaced households than in displaced households. Therefore, the difference in the educational level was higher among on-displaced than displaced households.

Furthermore, the average family size of displaced households was higher than non-displaced households. The age difference among households was higher in displaced than non-displaced households. In general, the average family size of the study area is higher than the national average family size of 4.6 (EDHS, 2016). The average farmland size is also higher among non-displaced households than displaced households. However, though the landholding of non-displaced households is large, it is below the regional average landholding of 0.94 (TSA, 2020). The average non-farm income was higher among displaced than non-displaced households. The limited landholding of displaced households is an opportunity to participate in other income-generating activities. Unexpectedly, the average TLU was higher among displaced than non-displaced households. The focus group discussant evidenced that displaced households were engaged in modern livestock farming compared to non-displaced households. The mean market distance also showed non-displaced households were too far from the market than displaced households. Therefore, displaced households have better access to agricultural inputs and outputs.

5.2. Impact assessment

MPI was used as a dependent variable to estimate the impact. Households displaced from their farming land were assigned as treated otherwise a control group. Variables that are not imposed by the treatment effect were chosen to evaluate the impact. Heckman et al. (1997) substantiated including too many variables and omitting important variables highly bias the result. Poverty is influenced by various demographic and socio-economic factors but household head age, household head educational achievement, marital status of household head, Tropical Livestock Unit/TLU, credit access, remittance, and the family size were identified. A t and chi-test were conducted to endorse if mean differences existed between the treated and control group before matching. Except for family size, the rest covariates have a mean difference and statistically significant. Therefore, there is clear evidence that the mean age, education, remittance, and TLU in the population are

Table 3. Statistical summary of t-test distribution.

Explanatory variables	Mean values			P-values
	Non-Displaced/ control	Displaced/treated	Combined	
Household head age	50.0	61.0	53.2	0.0000***
Family size	5.2	5.5	5.3	0.2275
Household educational achievement	3.1	1.7	2.7	0.0005***
Remittance	687.5	2287.1	1161.3	0.0557*
TLU	2.4	2.8	0.1	0.0207**

***, **, and * indicates significant level, source: Computed from authors' field survey, 2019.

different from zero. The mean age of displaced households was higher than in non-displaced households. Similarly, the mean income generated from remittance, and the mean TLU possession were higher in the treated group. However, the mean educational level was found higher among the control group (Table 3). Mezgebo (2014) found a similar result, where the different covariates across the treatment and control group showed significant differences.

Furthermore, the chi-square test result revealed that only marital status is statistically significant at 1 %. Therefore, there is a difference in the percentage of marital status categories among displaced and non-displaced households before matching (Table 4).

Overall, more than half of the covariates had differences, therefore matching participates will be necessary to have a homogenous group. Hence a series and repeated tests were conducted to decide which variables to be included that satisfy the PSM assumptions. As indicated above five continuous and two categorical variables a total of seven variables were selected based on the percentage of mean bias and β value. Because after matching the mean bias should be <5% (Caliendo and Kopeinig, 2005). As prested in Table 5 before matching there is a statistical significance association, the Mean bias and β value are above 5% and 25% respectively. However, after the matching no significant association was reported, the Mean bias and β are below 5% and 25% respectively, which ensures the matching is good.

5.2.1. Estimation of propensity score

The probit regression result shows most of the covariates are insignificant though age, family size, and marital status are highly significant (Table 6). As presented below low R^2 value minimizes the unique characteristics of treated households. This is an opportunity to match treated

Table 4. Statistical summary of chi square-test distribution.

Explanatory variables	Categories	Sample Percentage	Non-Displaced %	Displaced %	Chi-Square
Marital status of the household head	Married	75.8	54.5	30.7	0.000***
	Divorced	4.6	8.9	0.0	
	Widowed	19.6	36.6	27.3	
Access to credit	No	90.0	69.4	30.6	0.224
	Yes	10.0	79.4	20.6	

*** indicates a 1 % significant level, Source: Computed from authors' field survey, 2019.

Table 5. Mean bias estimated result before and after matching.

Sample	Ps R2	LR chi2	p > chi2	Mean Bias	β
Unmatched	0.164	67.78	0.000	35.0	103.9*
Matched	0.008	2.02	0.959	3.7	20.4

Source: Computed from authors' field survey 2019.

and controlled groups easily. Overall the estimated regression result had not reverberated issues to conduct matching. Therefore, before estimating the ATT the covariates should be corrected.

5.2.2. Matching

The mean propensity score of all sampled households is 0.3. The mean score of the treated and control group is 0.4 and 0.2, respectively. While the minimum and maximum scores of the treated and control group are from 0.018-0.8 and 0.011–0.74. Therefore, according to minima and maxima criteria, 0.018–0.74 were the matching region (Table 7). Therefore, any household that lies out of this region is not considered for matching. For this reason, five respondents from the treatment group. Graphically the pscore is presented in Figure 3. From this, the pscore is higher in treated on support than untreated on support.

5.2.3. Testing the balance of propensity score and covariates

Before matching the percentage of bias ranges from 14.1-83.4 but after matching it ranges from 0.1-12.7 which is far from the critical level cutoff point of 25 %. Moreover, most of the variables had significant differences before matching across the group but after matching no statistical significance was reported between the treated and control group (Table 5). Furthermore, fairly low pseudo-R2 and statistical insignificance after matching prove the groups are alike. Therefore, the matching process exactly fits the requirement and balances the features in the study area (see Tables 8 and 9).

5.2.4. Matching algorithm

Caliendo and Kopeinig, 2005 confirmed that there is no single and commonly used matching algorithm that dominates and applicable in all data collected to evaluate impact. However, for this study kernel matching was applied. Because kernel matching matches observations that lie within the upper and lower limit scores. Being partially displaced increases the degree of poverty by 5%. Therefore, urban expansion intensifies household poverty. Therefore, the prevalence of multidimensional poverty was higher among displaced households.

5.3. Result of multidimensional poverty index of respondents

The average deprivation score was found 0.39 with a minimum and maximum value of 0.055 and 0.785 respectively. This implies that most of the households are poor. As presented in Table 10 the multidimensional headcount ratio was higher among displaced households than non-displaced households. But at *woreda* level, the incidence of poverty was found 61.9%. Similarly, the intensity of poverty also indicated that on average displaced and non-displaced poor people are deprived in 49.4%, and 46.5% of the weighted indicators. But in principle, the multidimensional headcount ratio does not fulfill the dimensional monotonicity poverty. Because those households with a poverty incidence of 69 or 59 percent it may or may not be all people are equally poor or 100 percent deprived in all the considered deprivations. So, MPI represents the product of intensity and incidence of poverty. The estimated result indicated that 34.1 and 27.4 percent of treated and control groups were poor, at *woreda* level, 29.2 percent were found poor. This result contradicts Gebrekidan's (2019) work conducted in the Degu'a Temben, Tigray region where 35% of the households were found poor. Besides, the percentage share of each indicator to MPI was identified. Of the education dimension, the contribution of school attendance was higher compared to years of schooling. And the percentage contribution of displaced households school attendance was higher than non-displaced households. Whereas of health dimension, the percentage contribution of displaced household child mortality was large though the percentage contribution of malnutrition was smaller.

Lastly, the percentage share of living standard indicators was higher on average among non-displaced households. Results showed 2.6, 10.1, 11.1, 4.2, 8.6, and 10.9 percent of electricity, sanitation, water, floor, cooking fuel, and asset ownership indicators contribute to the overall

Table 6. Probit regression of participation.

Treatment	Coef.	Std.Err.	Z	P > Z	95% Confidence Interval	
Access to credit	-0.261	0.286	-0.91	0.363	-0.821	0.300
Age of HH	0.039	0.007	5.47	0.000***	0.025	0.053
Educational status of HH	-0.005	0.030	-0.15	0.879	-0.063	0.054
Family size	0.107	0.044	2.41	0.016**	0.020	0.193
Marital status of HH	0.292	0.085	3.36	0.001***	0.122	0.462
Remittance	9.620	0.000	0.89	0.372	-0.000	0.000
TLU	0.023	0.056	0.40	0.686	-0.087	0.132
_cons	-3.769	0.543	-6.94	0.000	-4.834	-2.704
Log-likelihood	-173.299					
Number of obs	341					
LR chi2 (7)	67.78					
Prob > chi2	0.000					
Pseudo R2	0.164					

***, and **, indicates 1%, and 10% significant levels, respectively, source: Computed from authors' field survey, 2019.

Table 7. Distribution of estimated propensity scores.

Groups	Obs	Mean	Std.	Min	Max
Total HH	341	0.3	0.20	0.011	0.800
Treated HH	101	0.4	0.20	0.018	0.800
Control HH	240	0.2	0.17	0.011	0.740

Source: Computed from authors' field survey, 2019

poverty level of displaced households. While 5.3, 11.6, 11.3, 3, 10.8, 11.9, and 11.9 percent of electricity, sanitation, water, floor, cooking fuel, and asset ownership indicators contribute to the overall poverty level of non-displaced households. A similar contribution was also observed at the *woreda* level.

The percentage contribution of the living standard was highest followed by health and education (See Figure 4). Similarly, the percentage contribution of education, health, and living standard to the overall poverty of displaced households were 15.4, 28.8, and 55.8 percent respectively. While the percentage contribution of education, health, and living standard to the overall poverty of non-displaced households was 14.9, 24.6, and 60.5 percent each. At the *woreda* level, the percentage contribution of education, health, and living standard to overall poverty was 15.1, 26, and 58.9 percent respectively. Therefore, much effort is

expected to improve the living standard of the community to minimize the prevalence of multidimensional poor households.

The MPI was disaggregated into vulnerable to poverty and severe poverty to observe to what extent variation exists between them. Accordingly, 40.4 and 68.8 percent of treated and control groups were vulnerable to poverty. Moreover, 59.6 and 31.2 percent of the displaced and non-displaced households were exposed to severe poverty. Therefore, the severity of poverty was higher among displaced households. The overall picture also showed the prevalence of poverty was also higher at the *woreda* level (Table 7).

A t-test result (Table 11) showed there is a mean difference between treated and control groups. This implies the prevalence of multidimensional poor households was higher among displaced households than non-displaced households. Several empirical studies proved that rural poverty was deeply rooted among female-headed households than their counterpart in male-headed households. However, insignificant mean differences were recorded between female and male-headed households.

5.4. Econometric results

The binary logistic regression result showed that of the 13 covariates, treatment, family size, farming experience, and market distance were found statistically significant (Table 12). Being displaced had positive and statistically significant at 5%. This complies with the theoretical
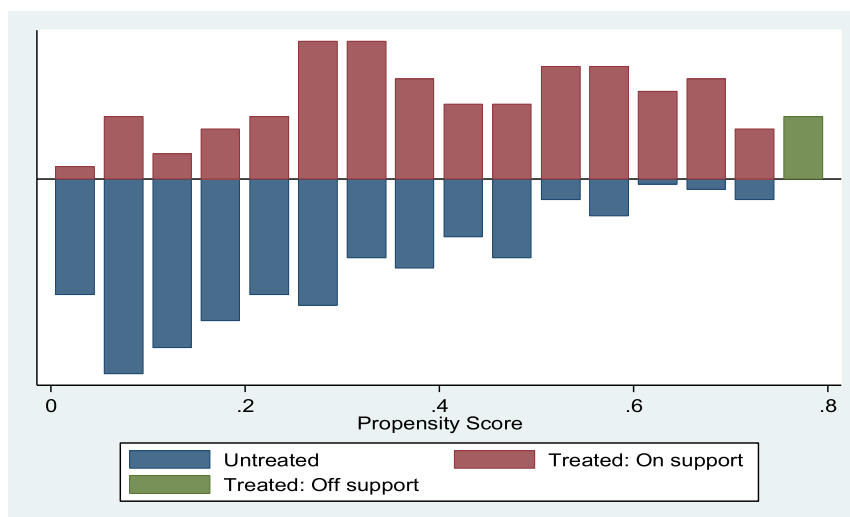

Figure 3. Distribution of propensity score, source: computed from the authors' field survey, 2019.

Table 8. Propensity score and covariate balance.

variables	Unmatched	Mean			T-test		
	Matched	Treated	Control	% bias	% reduction |bias|	t	P>|t|
Access to credit	U	.06931	.1125	-15.0	.	-1.21	0.225
	M	.07292	.0625	3.6	75.9	0.29	0.775
Household head age	U	60.891	49.971	83.2	.	7.05	0.000
	M	60.385	60.396	-0.1	99.9	-0.01	0.996
Educational status	U	1.6634	3.0708	-44.1	.	3.51	0.001
	M	1.625	1.2188	12.7	71.1	1.12	0.266
Marital status	U	1.8218	1.4375	44.0	.	3.84	0.000
	M	1.7604	1.7188	4.8	89.2	0.31	0.760
Family size	U	5.495	5.1708	14.1	.	1.21	0.228
	M	5.4583	5.4896	-1.4	90.4	-0.08	0.933
Remittance	U	2287.1	687.5	18.6	.	1.92	0.056
	M	1645.8	1859.4	-2.5	86.7	-0.16	0.871
TLU	U	2.8349	2.3653	25.7	.	2.32	0.021
	M	2.7794	2.7906	-0.6	97.6	-0.04	0.967

Source: Computed from authors' field survey, 2019

Table 9. ATT estimation.

Variable	sample	Treated	controlled	differences	S.E	T-stat
AMPI	Unmatched	0.42	0.38	0.04	0.02	2.63
	ATT	0.43	0.38	0.05	0.02	2.36**

* indicates a 5 % significant level. Source: Computed from authors' field survey, 2019

assumption of (Cernea, 2000). Empirical analysis in Tigray region proved urban expansion had an adverse effect on consumption expenditure that could be translated to household poverty (Mezgebo, 2014).

Family size is an important demographic factor that affects rural poverty. Households with larger family size were negatively correlated to poverty with statistical significance at 10%. Increasing family size decreases the probability of a household being multidimensionally poor. This indicates households might have larger economic active members and participate in different income-generating activities. This result is inline with (Adepoju, 2020; Birhanu et al., 2017; Deressa and Sharma, 2014). Other researchers also found a positive correlation. For instance, Ermiyas et al. (2019) reported a large family size increases the probability of households being entrenched in poverty. Because as the number of non-economic active members decreases the income generated also decreases and the prevalence of poor households increases. Besides food production, will insufficient as farmland is divided beyond its minimum limit.

Market distance was negatively correlated and statistically significant at 1%. As households apart from market centers the likelihood of households entering poverty decreases. This is because, households near to the market easily access agricultural inputs and outputs, and reduce extra costs associated with transports. This result is consistent with (Batu et al., 2017; Eyasu, 2020). But Tesfaye and Getachew (2018) found a neutral correlation.

The farming experience was found statistically significant and negatively related to the household being multidimensionally poor.

Table 10. The deprivation matrix and identification of the poor.

		Education		Health		Living standard					
		Yscl	Ascl	Mor	Nut	Ele	Sani	Dwa	Flo	Fuel	Asse
Displaced	Uncensored headcount ratio	0.03	0.28	0.53	0.05	0.84	0.88	0.29	0.74	0.96	0.98
	Censored headcount ratio	0.03	0.28	0.52	0.05	0.61	0.67	0.25	0.52	0.66	0.66
	Percentage of contribution	1.3	14.1	26.2	2.6	10.1	11.1	4.2	8.6	10.9	10.9
	H	0.69									
	A	0.494									
	MPI	0.341									
Non-displaced	Uncensored headcount ratio	0.03	0.22	0.31	0.09	0.97	0.95	0.17	0.87	0.99	0.99
	Censored headcount ratio	0.03	0.22	0.31	0.09	0.57	0.56	0.15	0.53	0.59	0.59
	Percentage of contribution	1.6	13.3	19.3	5.3	11.6	11.3	3	10.8	11.9	11.9
	H	0.59									
	A	.0.465									
	MPI	0.274									
Total	Uncensored headcount ratio	0.03	0.24	0.38	0.08	0.93	0.09	0.2	0.83	0.98	0.99
	Censored headcount ratio	0.03	0.24	0.38	0.08	0.58	0.59	0.18	0.52	0.61	0.61
	Percentage of contribution	1.6	13.5	21.7	4.3	11.1	11.2	3.4	9.9	11.6	11.6
	H	0.616									
	A	0.474									
	MPI	0.292									

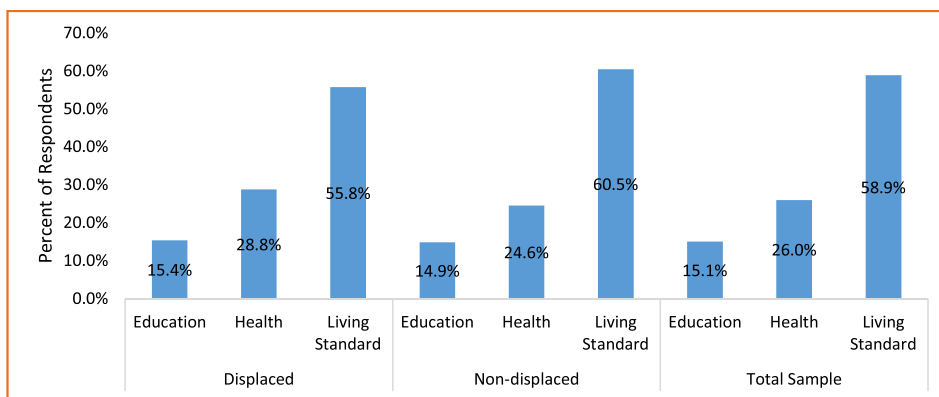Source: Computed from authors' field survey, 2019

Figure 4. Percentage contribution of each dimension to MPI, source: Computed from authors' field survey, 2019.

Table 11. Statistical Summary of t-test estimation.

Group	obs	Mean	Std.Err.	Std. Dev.	95 % conf. interval		Pr (|T| > |t|)
Female	96	0.395	0.012	0.124	0.370	0.421	0.9294
Male	245	0.394	0.009	0.139	0.376	0.411	
Combined	341	0.394	0.007	0.135	0.380	0.409	
Difference		0.001	0.016		-0.030	0.033	
Displaced	101	0.424	0.016	0.162	0.392	0.456	0.0089***
Non-displaced	240	0.382	0.008	0.119	0.367	0.397	
Combined	341	0.394	0.007	0.135	0.380	0.409	
Difference		0.042	0.016		0.011	0.073	

*** indicates statistically significant at 1 %, source: Computed from authors' field survey, 2019

Table 12. Determinants of multidimensional poverty.

Explanatory covariates	Coef.	Std.Err	Z	P > Z	[95% Conf. Interval		OR
Treatment	0.932	0.470	1.98	0.047**	0.010	1.853	0.932
Access to extension	-0.237	0.394	-0.60	0.547	-1.009	0.535	-0.237
Access to credit	0.059	0.323	0.18	0.856	-0.574	0.692	0.059
Household head age	0.016	0.038	0.42	0.674	-0.059	0.091	0.0160
Family size	-0.072	0.042	-1.71	0.087*	-0.155	0.011	-0.072
Farming experience	-0.132	0.075	-1.77	0.077*	-0.279	0.014	-0.132
Farmland size	-0.035	0.036	-0.97	0.334	-0.106	0.036	-0.035
Irrigated land	0.892	0.552	1.61	0.106	-0.191	1.973	0.892
Market distance	-0.801	0.287	-2.80	0.005***	-1.363	-0.240	-0.801
Educational achievement	0.095	0.098	0.97	0.332	-0.097	0.287	0.095
Non-farm income	-0.000	0.000	-1.16	0.245	-0.000	0.000	-0.000
Gender	-0.358	0.320	-1.09	0.277	-1.004	0.288	-0.358
Tropical Livestock Unit/TLU	-0.097	0.089	-1.08	0.278	-0.271	0.078	-0.097
_cons	1.400	1.147	1.22	0.222	-0.849	3.649	1.400
Log likelihood	-200.998						
Number of observations	341						
LR chi2 (13)	36.90						
Prob > chi2	0.0004						
Pseudo R2	0.0861						

*,** and *** indicates significant at 10, 5, ad 1 %. Source: Computed from authors' field survey, 2019.

Increasing farming experience reduces the probability of being poor. This indicates rural households with better experience know various agricultural practices like selecting seed crops, integrated pest management, season of growing and harvesting, and selecting animal breeds. This agreed with the finding of (Batu et al., 2017). Stated farm experience is a key element to increase the production and productivity of agricultural products.

6. Conclusion

The study evaluated the effect of urban expansion on peri-urban framers' poverty. The impact assessment estimation revealed urban expansion positively affects peri-urban framers poverty. Therefore, the Prevalence of poverty among displaced peri-urban farmers' was devastating compared to non-displaced households. Besides, different poverty

indicators also support this result. The overall deprivation matrix was large among displaced households. Severity to poverty was also outnumbered among displaced households. Similarly, the t-test result reported a mean difference with a statistically significant correlation between them. Lastly, the regression result showed being displaced positively influences peri-urban farmers' poverty. Whereas, family size, farming experience, and market distance were negatively and statistically significant effects on peri-urban farmers' poverty. Therefore, concerned governmental and non-governmental bodies should develop strong policies and strategies to minimize the ramifications of displacement on smallholder peri-urban farmers. In the short term, the government should provide adequate compensation and training on how to diversify their livelihoods and utilization of the money. Whereas, in the long term, a separate department should be established to strictly evaluate and monitor the condition of displaced households. Besides, the government should make a policy change regarding residential house construction from horizontal to vertical.

Declarations

Author contribution statement

Shishay Kahsay Weldearegay: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Messay Mulugeta Tefera: Analyzed and interpreted the data; Wrote the paper.

Solomon Tsehay Feleke: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

References

Abdissa, F., 2005. Urban Expansion and the Livelihood of the Peri-Urban Agricultural Community: the Case of Addis Ababa. (Issue June). Addis Ababa University.

Aboda, C., Mugagga, F., Byakagaba, P., Nabanoga, G., 2019. Development induced Displacement ; A review of risks faced by communities in developing countries. Sociol. Anthropol. 7 (2), 100–110.

Addisu, A., 2015. Urban expansion and farmers' perception in urban expansion in Axum town , Ethiopia. J. Sociol. 3 (9), 1–14.

Adepoju, 2020. Determinants of multidimensional poverty transitions among rural households in Nigeria. Rev. Agri. Appl. Econom. 23 (1), 55–64.

Adusah-karikari, A., 2015. The Extractive Industries and Society Black gold in Ghana : changing livelihoods for women in communities affected by oil production. Biochem. Pharmacol. 2 (1), 24–32.

Afera, N., 2015. Determinants of poverty in rural Tigray : Ethiopia evidence from rural households of Gulomekeda Wereda. J. Poverty, Invest. Dev. 10, 95–103.

Alacia, D.S.A., 2010. Regulating urbanisation in Sub-Saharan Africa through cluster settlements: lessons for urban mangers in Ethiopia. Theor. Empir. Res. Urban Manag. 5 (5), 20–34.

Alkire, S., Roche, J.M., Santos, M.E., Seth, S., 2011. Multidimensional Poverty Index 2011: Brief Methodological Note. Oxford Poverty and Human Development Initiative Publication, pp. 1–14. November.

Batu, M., Ketebo, J.H., Demissie, W.M., Ayalew, H.A., 2017. Determinants of poverty and their policy implications in rural areas of Jimma Zone : the case of woredas around Gilgel Gibe hydroelectric dam. Publ. Pol. Adm. Res. 7 (5), 42–49.

Bekele, F., 2010. The impact of horizontal urban expansion on Sub- urban agricultural community Livelihood : the case of Tabor sub-city , Hawassa city. Addis Ababa.

Birhanu, M.Y., Ambaw, A., Mulu, Y., 2017. Dynamics of Multidimensional Child Poverty and its Triggers : Evidence from Ethiopia Using Multilevel Mixed Effect Model (No. 79377).

Bogale, A., Hagedorn, K., Korf, B., 2005. Determinants of poverty in rural Ethiopia. Q. J. Int. Agric. 44 (2), 101–120.

Caliendo, M., Kopeinig, S., 2005. Some Practical Guidance for the Implementation of Propensity Score Matching (No. 1588; Issue 1588).

Cernea, M.M., 1999. Development's Painful Social Costs". Introductory Study to S. Parasuraman, the Development Dilemma, first ed. Mac Millan, London, pp. 1–25.

Cernea, M.M., 2000. Risks , safeguards and reconstruction A model for population displacement and resettlement. Econ. Polit. Wkly. 35 (41), 3659–3678.

Cernea, M.M., 2006. Re-examining "displacement": a redefinition of concepts in development and conservation policies. Soc. Change 36 (1), 8–35.

Chen, Y., Li, X., Tian, Y., Tan, M., 2009. Structural change of agricultural land use intensity and its regional disparity in China. J. Geogr. Sci. 19 (5), 545.

Chochran, W.G., 1977. Sampling Techniques, third ed. John Wiley and Sons. Inc.

Christiaensen, L., De Weerdt, J., Todo, Y., 2013. Urbanization and Poverty Reduction-The Role of Rural Diversification and Secondary Towns. The World Bank.

Clark, D., 2004. Urban World/global City. Routledge.

D'Amour, C.B., Reitsma, F., Baiocchi, G., Barthel, S., Güneralp, B., Erb, K.H., Haberl, H., Creutzig, F., Seto, K.C., 2017. Future urban land expansion and implications for global croplands. Proc. Natl. Acad. Sci. U. S. A 114 (34), 8939–8944.

Davies, W.K.D., 1992. Berry, BJL 1967: Geography of market centers and retail distribution. Englewood Cliffs, NJ: prentice-Hall. Prog. Hum. Geogr. 16 (2), 219–222.

Deressa, T.K., Sharma, M.K., 2014. Determinant of poverty in Ethiopia. Ethiop. J. Econ. XXIII (1), 1–18.

Ekpenyong, A.S., 2015. Urbanization: its implication for sustainable food security, health and nutritional nexus in developing economies - a case study of Nigeria. J. Stud. Soc. Sci. 11 (1), 29–49.

Ermiyas, A., Batu, M., Teka, E., 2019. Determinants of rural poverty in Ethiopia : a household level analysis in the case of Dejen woreda. Arts Soc. Sci. J. 10 (2), 1–6.

Ethiopia Demographic and Health Survey [EDHS], 2016. Ethiopia Demographic and Health Survey Key Findings. Addis Ababa, Ethiopia.

Eyasu, A.M., 2020. Determinants of poverty in rural households: evidence from North-Western Ethiopia. Cogent Food Agri. 6 (1).

Firman, T., 2009. The continuity and change in mega-urbanization in Indonesia: a survey of Jakarta–Bandung Region (JBR) development. Habitat Int. 33 (4), 327–339.

Guha, A., 2007. Peasant resistance in West Bengal a decade before Singur and nandigram. Econ. Polit. Wkly. 42 (37), 15–21.

Harvey, D.W., 1973. Social Justice and the City. Edward Arnold, London.

Heckman, J.J., Ichimura, H., Todd, P.E., 1997. Training programme matching as an econometric evaluation Estimator : evidence from. Eval. Job Train. Program. 64 (4), 605–654.

Huang, Y., Lin, W., Li, S., Ning, Y., 2018. Social impacts of Dam-induced displacement and Resettlement : a comparative case study in China. Sustainability 10 (4018), 1–18.

Jiang, L., Deng, X., Seto, K.C., 2013. The impact of urban expansion on agricultural land use intensity in China. Land Use Pol. 35, 33–39.

Mengistu, T., 2016. Horizontal urban expansion and livelihood adjustment problem among ex-farmers in the Kebeles surrounding Jimma town: the case of Derba Kebele. Eur. Sci. J. 12 (14), 308.

Mezgebo, T.G., 2014. Urbanization Effects on Welfare and Income Diversification Strategies of Peri-Urban Farm Households in Tigray , Northern Ethiopia : an Empirical Analysis Tassew Woldehanna (PhD). University College Cork.

Ministry of Urban Development and Housing [MoUDH], 2016 Ministry of Urban Development and Housing [MoUDH], 2016. Urban Development Spatial Planning Addis Ababa, Ethiopia.

National Metrological Agency of Ethiopia[NMAE], 2019. Metrological Grid Data.

Oruonye, E.D., 2012. An assessment of the socio-economic impact of urban development-induced resettlement scheme in Nigerian Cities : a case study of the nyamusala – ATC road construction in Jalingo metropolis , Taraba state. Int. Rev. Soc. Sci. Humanit. 3 (1), 1–9.

Prenzel, P.V., Vanclay, F., 2014. How social impact assessment can contribute to con fl ict management. Environ. Impact Assess. Rev. 45, 30–37.

Preston, R., 1971. The structure of central place theory systems. J. Econ. Geogr. 47, 36–155.

Quetulio-navarra, M., Niehof, A., Horst, H. Van Der, Vaart, W. Van Der., 2014. Short-term risk experience of involuntary resettled households in the Philippines and Indonesia. Habitat Int. 41, 165–175.

Randell, H., 2016. The short-term impacts of development-induced displacement on wealth and subjective well-being in the Brazilian Amazon. World Dev. 87, 385–400.

Robinson, W.C., 2003. Risks and Rights : the Causes , Consequences , and Challenges of Development-Induced Displacement. The Brookings Institution-SAIS Project on Internal. The booking insritution, Washington, Dc.

Rondinelli, D.A., 2019. Applied Methods of Regional Analysis: the Spatial Dimensions of Development Policy. Routledge.

Rosenbaum, P.R., Rubin, D.B., 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70 (1), 41–55.

Satterthwaite, D., McGranahan, G., Tacoli, C., 2010. Urbanization and its implications for food and farming. Phil. Trans. Biol. Sci. 365 (1554), 2809–2820.

Seto, K.C., Fragkias, M., Güneralp, B., Reilly, M.K., 2011. A meta-analysis of global urban land expansion. PloS One 6 (8), e23777.

Terminski, B., 2013. Development-induced displacement and resettlement: theoretical frameworks and current challenges. Development 10, 101.

Tesfaye, D., Getachew, T., 2018. Determinants of rural households' poverty with selected link functions: the case of Soro District, Hadiya zone, SNNPR states, Ethiopia. Int. J. Econ. Manag. Sci. 7 (1), 1–6.

Tigray Statistical Agency [TSA], 2020 Tigray Statistical Agency [TSA], 2020.

Tsikata, D., 2009. Gender , Land and Labour Relations and Livelihoods in Sub-saharan Africa in the Era of Economic Liberalisation : towards a Research Agenda.

United Nations Development Program[UNDP], 2019 United Nations Development Program[UNDP], & Oxford Poverty Development Human Initiative [OPHI], 2019. POVERTY INDEX 2019 ILLUMINATING.

Unwin, T., 2017. Urban-rural interaction in developing countries: a theoretical perspective. In: The Geography of Urban-Rural Interaction in Developing Countries. Routledge, pp. 11–32.

Webster, D., 2002. On the Edge: Shaping the Future of Peri-Urban East Asia. Asia/Pacific Research Center Stanford.

World Bank, 2018. Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle (World Bank).

Zeleke, G., Trutmann, P., Denekew, A., 2007. Fostering new development pathways: harnessing rural-urban linkages (RUL) to reduce poverty and improve environment in the Highlands of Ethiopia. In: Proceedings of a Planning Workshop on Thematic Research Area of the Global Mountain Program (GMP).