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 km² 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,
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 producing people, in time 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, 1/3rd of the population were multidimensionally poor where their children are not attended school, 3/4th 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 theories 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 backlash 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., 2015). 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, Adunsh-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 dums 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
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 14°00’–14°10’23” and longitude of 38°32’30”–38°052’30”. 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).

1 Color print required.
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. $n = \frac{n_0}{1 + \frac{n_0}{C_0}}$, 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). 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, 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 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, $A = \frac{\sum_{i=1}^{n} c_i(K)}{q}$ (Alkire et al., 2011, pp. 3–5).

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
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 non-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
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.

### 5.2.2. 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 wereda 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 dimension monotoniversity 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 wereda level, 29.2 percent were found poor. This result contradicts Gebrekidan’s (2019) work conducted in the Degua 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 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.

### Table 3. Statistical summary of t-test distribution.

| Explanatory variables | Mean values | P-values |
|-----------------------|-------------|----------|
|                       | Non-Displaced/Displaced/treated | Combined |
| Household head age (years) | 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 (USD) | 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.

### 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 | 0.0 |
|                        | Widowed | 19.6 | 36.6 | 27.3 | 0.0 |
| Access to credit | No | 90.0 | 69.4 | 30.6 | 0.224 |
|                        | Yes | 10.0 | 79.4 | 20.6 | 0.0 |

*** 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.
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 was 15.4, 28.8, and 55.8 percent respectively. While 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
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 8. Propensity score and covariate balance. |
|-----------------------------------------------|
| variables | Unmatched Mean | Matched Treated | Control | % bias | % reduction | bias | t | P | it |
| 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 | -2.51 | 0.001 |
| | M 1.625 | 2.1288 | 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 &nbsp; |

* 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 |
| | Yac | Asc | Mor | Nut | Ele | Sani | Dwa | Flo | Fuel | Ase |
| 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 | 0.99 | 0.52 | 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
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

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**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     |                     |       |
| 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    | 0.073     |                     |       |

*** 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 | -0.322 - 0.000 0.095  |
| Non-farm income              | -0.000| 0.000   | -1.16 | 0.245 | -0.097 - 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
LRT chi2 (13) 36.90
Prob > chi2 0.0004
Pseudo R2 0.0861

*a**, ** and *** indicates significant at 10, 5, ad 1 %. Source: Computed from authors’ field survey, 2019.
indicators also support this result. The overall deprivation matrix was large among displaced households. Severity to poverty was also out-numbered 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 significantly effective 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

Shibay Kahsay Weldaaregay: 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.

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The authors declare no conflict of interest.

Additional information

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