

Household income difference between irrigation user and non-users: Evidences in Southern Tigray, Ethiopia

Moges Girmay Phogella*, Workie Sahlu Anbaw

Phogella MG, Anbaw WS. Household income difference between irrigation user and non-users: Evidences in southern Tigray, Ethiopia. *AGBIR*. 2023; 39(2):479-481.

Agricultural production in Ethiopia is mainly rainfed, which is characterized by its erratic and often inadequate nature. To solve the challenge, it is crucial to shift and expand irrigation agriculture. The aim of this study is to analyse the role of small-scale irrigation on household income improvement in Ayba and Atsela kebelles of Southern Tigray. To achieve its objective, this study used descriptive statistics such as mean, standard deviation, frequency of appearance and Propensity Score Matching (PSM) econometric model.

The ATT show that the farm income is highly affected when the smallholder farmers are participated in small-scale irrigated farming. In conclusion, this empirical finding suggests that access to irrigation was improved income of treated households in a significant way. Therefore, to make considerable improvement on household income actions should be taken by household heads, government of Ethiopia, national and international organizations to increase households' participation in irrigation activities.

Key Words: *Income; Small-scale irrigation; Household*

INTRODUCTION

Agriculture contributes key role to the economic growth of many low-income countries. It is often the leading sector of the economy as source of income, employment and foreign exchange. More than half of the less developed countries population gets their food from own-production. Agricultural output also is used as an input for industries so it can stimulate the growth of industrialization. Improving agricultural productivity thus contributes to income growth [1].

Agriculture in Ethiopia is heavily dependent on rainfall, which is highly varies both spatially and temporally. In many parts of Ethiopia, agricultural development is obstructed by recurrent droughts, which over the years have increased both in frequency and severity in many parts of the country. In the past 30 years, the drought incidence has become common pattern every two to three years [2]. This, therefore, calls for different interventions, irrigation being one of the options, which could help in adapting strategies to cope up with the challenging drought. Tigray is one of the most land-degraded states of Ethiopia. The region is characterized by subsistence farming households raising predominantly cereal and vegetable crops for local consumption and sale. Crop production in the region has failed to keep pace with population growth due to recurrent droughts, environmental degradation and wars, including the most recent conflict with Eritrea [3].

Irrigation in Ethiopia contributes to increase farmers' income, household resilience and buffering. Irrigation contributes to livelihood improvement through its direct and indirect benefits. The direct benefits of irrigations are; high productivity, lower risk of crop failure, and higher and year-round farm and non-farm employment, increased income, food security, and poverty reduction. Irrigation enables smallholders to adopt more diversified cropping patterns, and diversify income base sources. Indirectly irrigation benefits as a potential to become 'nuclei of growth' which are attractive for inward investments in other infrastructure and services such as banking to facilitate this growth [4].

The government of Ethiopia has placed great emphasis on the development of irrigation facilities so as to increase agricultural production and productivity. This may help farmers overcome the cost problem for modern irrigation construction and overcome the problem of shortage of moisture for production. In line with this goal, the government also has planned to

undertake a medium and large-scale irrigation study and designing activities and making them ready for concerned relevant stakeholders [5].

According to the Bureau of Water Resources (BoWR), the Tigray Region (northern Ethiopia), where the study took place, has an irrigation potential of 36.4% (about 340,000 ha of the estimated 933,000 ha cultivable land owned by small holder farmers. Moreover, there was little or no documentation on the economic benefits of small-scale irrigation technologies for women-headed households. Therefore, the aim of this study is to analyse the role of small-scale irrigation on household income improvement in Ayba and Atsela kebelles of Southern Tigray.

METHODOLOGY

Data collection and sample size

This study was based on both primary and secondary data collected from households in Ayba and Atsela Kebele of Emba Alaje district in Southern Zone, Tigray Regional State, Ethiopia. For the primary data collection, on participant and non-participant households' socio-economic and demographic features, interview by enumerators with a pre-tested semi structured questionnaire was used. While for the secondary data, government institutions, non-governmental offices, community-based organizations, research centers were used as main sources.

This study used a multi stage sampling technique of purposively selecting the Ayba and Atsela Kebele, due to the implementation of the small-scale irrigation scheme, followed by two-stage random sampling. In the first stage, the name of households was obtained from the Kebele office and stratified into two groups of irrigation user and non-users. In the second stage, 70 non-irrigation user households and 67 irrigation users in the kebeles were randomly.

Methods of data analysis

To achieve its objective, this study used both descriptive statistics and econometric analysis. By applying descriptive statistics such as mean, standard deviation, frequency of appearance etc. One can compare and contrast different categories of sample units (in this case farm households) with respect to the desired characters so as to draw some important

Department of Rural Development and Agricultural Extension, College of Agriculture and Natural Resource, Mekdela Amba University, PO Box: 32, Tuluawilya, Ethiopia

Correspondence: Phogella MG, Department of Rural Development and Agricultural Extension, College of Agriculture and Natural Resource, Mekdela Amba University, PO Box: 32, Tuluawilya, Ethiopia, E-mail: mogesgirmay0@gmail.com

Received: 27-Jan-2023, Manuscript No. AGBIR-23-87591; **Editor assigned:** 31-Jan-2023, Pre QC No. AGBIR-23-87591 (PQ); **Reviewed:** 15-Feb-2023, QC No. AGBIR-23-87591; **Revised:** 24-Feb-2023, Manuscript No. AGBIR-23-87591 (R); **Published:** 03-Mar-2023, DOI:10.35248/0970-1907.23.39.479-481



This open-access article is distributed under the terms of the Creative Commons Attribution Non-Commercial License (CC BY-NC) (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits reuse, distribution and reproduction of the article, provided that the original work is properly cited and the reuse is restricted to noncommercial purposes. For commercial reuse, contact reprints@pulsus.com

conclusions. To explore the impact of the small-scale irrigation on household income, the Propensity Score Matching (PSM) econometric model was used.

RESULTS AND DISCUSSION

Income source of sample households

From the survey results, in Table 1 the minimum and maximum net income from crop production of the total sample respondents was 1600 and 71300 ETB respectively. The mean crop income for the irrigation users was found to be 35027.39 ETB whereas the average income from crop for that of non-users was 11366.43 ETB. The mean comparison for the two groups showed that there is a statistically significant difference between two groups in terms of crop income at 1 percent significance level.

This shows that irrigation-users had a better crop income than those non-irrigation user households. In Ethiopia, Mengistie and Kidane [6] found that the use of irrigation technology significantly improved crop income.

TABLE 1

Distributions of sample household head by sources of income

Sources of income	Irrigation-user		Non-irrigation user		t-value	P-value	
	Mean	SD	Mean	SD			
On farm income	Crop income	35027.39	15620.79	11366.43	5939.06	11.81	0.0000***
	Livestock income	17446.03	29603.47	7304.71	14593.64	2.55	0.0116**
Off-farm income	PSNP income	1135.8	2427	1042.8	2517.5	0.21	0.82
Non-farm income	Petty trade income	1549.2	3283.1	1387.14	3241.44	0.29	0.77
	Remittance income	1470.1	3756.69	892.85	2594.4	1.05	0.29
Total household income		56920.87	23154.36	26138.6	30258.95	6.66	0.0000***

Note: Source: Own survey result; **, *** means significant at 5% and 1% significance level respectively.

Ulsido [7] also has the same submission on the positive and significant impact of irrigation technology use on crop income.

Income from livestock and livestock products is the major source of income for the sample households next to crop production. The mean livestock income for the irrigation user's household is found to be 17,446.03 ETB whereas the mean livestock income for that of non-users was 7304.71 ETB. The mean comparison for the two groups showed that

TABLE 2

Distributions of sample household head by sources of income

Matching method	Treated	control	ATT	Std. err.	T
Nearest-neighbour matching	67	20	33295.11	5407.45	6.157***
Radius matching	64	52	31275.6	6763.12	4.624***
Kernel matching	67	63	31007.89	2840.58	10.916***

Note: Source: Own survey result, *** means significant at 1% significance level respectively.

there is a statistically significant difference between the two groups in terms of livestock income at 5 percent significance level. This shows that irrigation users had a better livestock income compared to their non-user counterpart [8]. Table 1 presented that, the annual average income of irrigation users obtained from safety net program, petty trade and remittance was 1135.8, 1549.2 and 1470.1 ETB respectively, while

remittance income sources activities between irrigation users and irrigation non-users.

The total annual income of irrigation user and non-user households respectively were 56920.87 (± 23154.36) and 26138.6 (± 30258.95) ETB respectively (Table 1). The result of t-test shows that, there is statistically significant at 1% significance level. In conclusion, this empirical finding suggests that access to irrigation was improved income of treated households in a significant way.

Estimated average treatment effect

Annual household income: The impact estimation result presented in Table 2 provides supportive evidence of statistically significant effect of participation in small scale irrigated farming on annual farm income. On average, participation in small scale irrigated farming had impact on annual farm income of the participant households by Birr 33,295.11, 31,275.6, and 31,007.89 in Nearest-neighbour, Radius and Kernel matching methods respectively. This difference was statistically significant at 1% significance level respectively per household. One of the critical explanations for this is that the farm income is highly affected when the smallholder farmers are participated in small-scale irrigated farming. Because, participation in small-scale irrigated farming

the annual average income of non-irrigation users from safety net program, petty trade and remittance was 1042.8, 1387.14 and 892.85 ETB respectively. However, there is no significant difference in safety net program, petty trade and increases the opportunity to produce two times a year on the same farm and crop diversification, which increase annual income. This result is consistent with the findings of previous studies [9,10]. These all studies indicated that access to irrigation schemes has led to significant increase in household income.

CONCLUSION

This study examined the impact of small-scale irrigation on household income. The study used propensity score matching to explore the impact of small-scale irrigation on household income in the study area. The sample of 137 farm households selected by multi-stage sampling technique was used in

the analysis. The impact analysis of participation in small-scale irrigation on household income by propensity score matching using of Nearest-neighbour matching, Radius matching and Kernel matching algorithm revealed that there was a significant difference on the income of households between irrigation-user and non-irrigation-user due to participation in small-scale irrigated farming. The average treatment effect on the treated was ETB 33295.11, 31275.6 and 31007.89 respectively and it was significant at 1% significance level. The study findings show that small-scale irrigation significantly increases households' income from crop and vegetable production. This leads households to have access to more diversified food, health, and education services and improved housing. Therefore, participation in irrigation helps the households to generate additional income in the study area.

ACKNOWLEDGEMENT

The author thanks all respondents that participated in this research and appreciates agriculture offices and experts that supported in providing materials (documents) during the study.

I would also extend my gratitude to Mekelle University in general and the staff in department of Rural Development and Agricultural Extension in particular. Finally, I reserve my most gratitude to my family. Thank you for very much.

AUTHORS' CONTRIBUTION

Mr. Moges Girmay he was involved in literature search, figures, development of overall research plan, study design, data collection, data analysis, data interpretation hypothesis generation and idea development, he provided the validated questionnaires; Ms. Workie Sahlu was involved in data collection, data analysis, data interpretation, supervision and data analysis and revision of the paper; and she wrote the paper.

REFERENCES

1. Agerie NW. Determinants of smallholder rural farm households' participation in small scale irrigation and its effect on income in North Gondar zone: a cross-sectional approach (evidence from Dembia Woreda)(Doctoral dissertation, Mekelle University).
2. Iticha MD. Review on the impact of small scale irrigation scheme on household income and poverty reduction in Ethiopia. *J Resour Dev Manag.* 2019;57.
3. Aseyhegn K, Yirga C, Rajan S. Effect of small-scale irrigation on the income of rural farm households: The case of Laelay Maichew District, Central Tigray, Ethiopia.
4. Beyan A, Jema H, Adem K. Effect of small-scale irrigation on the farm households' income of rural farmers: The case of Girawa district, east Hararghe, Oromia, Ethiopia. *Asian J Agric Rural Dev.* 2014;4:257-266.
5. Hirko T, Ketema M, Beyene F. Evaluating the impact of small-scale irrigation practice on household income in Abay Chomen District of Oromia National Regional State, Ethiopia. *J Dev Agric Econ.* 2018;10(12): 384-393.
6. Mengistie D, Kidane D. Assessment of the impact of small-scale irrigation on household livelihood improvement at Gubalafto District, North Wollo, Ethiopia. *Agriculture.* 2016;6(3):27.
7. Ulsido MD, Alemu E. Irrigation water management in small scale irrigation schemes: The case of the Ethiopian rift valley lake basin. *Environ Res Eng Manag.* 2014;67(1):5-15.
8. Smur G, Teka K, Teklehaimanot A. Small-scale-irrigated agriculture empowered women-headed households in Tigray, Ethiopia. *Irrig Drain.* 2021;70(4):900-908.
9. Asrat D, Anteneh A. The determinants of irrigation participation and its impact on the pastoralist and agro-pastoralists income in Ethiopia: A review study. *Cogent food Agric.* 2019;5(1):1679700.
10. Kuwornu JK, Owusu ES. Irrigation access and per capita consumption expenditure in farm households: Evidence from Ghana. *J Dev Agric Econ.* 2012;4(3):78-92.