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Factors Affecting Irrigation Participation and Its Effect on Income: The Case of Fentale Irrigation Scheme

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Abstract. This paper analyzed the Factors Affecting Irrigation Participation and Its Effect on Income. The study result depends on cross-sectional data collected from a sample of 305 households of which 218 irrigators and 87 non-irrigators using a combination of Two Stage Sampling Method, and Simple random sampling. The study analysis used descriptive and logistic regression model. The variable in regression model used to identify the factors that affect irrigation participation and its effect on income using propensity score matching, and treatment effect analysis to see the effect. The Result revealed that irrigation participation has intense impact on improving household income and crop production. The study identified the factors affect irrigation participation to income of households were shortage of waters, market problems and input supply problems. It was observed that among the variables in logistic regression age, income and distance from market have affected irrigation participation positively and significant. It shall be great and rewarding if policy makers, designers, implementers, and any funding agencies with similar interest further capitalize and scale up the scheme to achieve the development plan and objective.

Keywords: Fentale, irrigation development, income, irrigation scheme, and propensity score matching.

Introduction

Agriculture contributes substantially to the economic growth of many low-income countries especially sub-Saharan countries. Because Ethiopia is an agrarian country, agriculture is the leading sector as source of income, employment

and foreign exchange and national economic growth is determined by the performance of agriculture (Getaneh, 2015). Agricultural irrigation development is crucial to improve smallholder livelihood and income in Ethiopia, since irrigation can help farmers increase their crop production, increase crop variety, and lengthen their agricultural seasons (Sesen, 2013).. Agricultural irrigation development is crucial to improve smallholder livelihood and income in Ethiopia, since irrigation can help farmers increase their crop production, increase crop variety, and lengthen their agricultural seasons (Sesen, 2013).The emergence and spread of Irrigation supports successful crop growing and stabilizes crop yields, increase income of farmers. In other words, Irrigation increases agricultural productivity and farm income per hectare (Abraham et al., 2015).Ethiopia has set itself an ambitious task to achieve an irrigation target of 1.8 million hector for irrigation development. The challenges includes amongst others: closing the gap between planning and implementation of irrigation projects; improving the performance of existing irrigation schemes; removing constraints on the scale-up of irrigation projects; and ensuring the sustainability of water resources for irrigation (Seleshi et al., 2010). Oromia is one of the largest regional states in Ethiopia with respect to population number and areal coverage. Despite of its relatively better natural setting, most part of the region is suffering from food insecurity; one third of the region is low land that is prone to drought. Due the drought and unreliability of rainfall, Fentale, Boset, Merti and Jeju were the chronically food in-secured districts in the region (Adam, 2013).However, these agricultural activities outputs were too low as results of scarcity of rainfall in the areas. Both crop & Livestock Production were not able to support the food demand of the community & hence dependent on food aid. As a result, food shortage was common year-to-year problem in the areas.In that regard, Irrigation Based Integrated Development was found the best alternative to divert that trend and to bring radical transformation in the community tradition. Therefore, the Oromia Irrigation Development Authority / OIDA decided to intervene in the situation, through the Fentale Irrigation Based Integrated Development Projects, that aimed to the improvement of agricultural production and or increasing income with a view to realize the objective of food self-sufficiency or food security and hence improvement of social facilities (Adam, 2013). However, as expect Fentale Irrigation scheme will not improve income of farmers (OIDA, 2013). As result the researcher initiated or inspired to study the factors affecting irrigation participation and its effect on income of the study area.

The study is pertinent in providing adequate information and data that can help capitalize factors and work on the solutions to improve farmers livelihood and income, and it could be used as reference for other researchers for further studies on this area.

Methodology

Fentale is located in the great Ethiopian mid rift valley under the east Shoa zonal administrative division of Oromia regional state crossed by the Kesem and Awash River. It is 193 km east of the capital Addis Ababa on the highway to Djibouti. It is boarded on the southeast by the Arsi Zone, on the southwest by Boset district, on the northwest by the Amhara Regional states, and on the northeast by the Afar Regional states. Fentale district located between 8°45′N to 39°50′E which is in tropical climatic zone. The approximate total area of Fentale District is 1340 Km2 and Metehara town is the capital town and administrative center of the District. Fentalle district found in The Northern section of Oromia Rift system ranges in altitude from 1500m2000m. The major ethnic groups inhabited in Fentale district are

Kereyu and Ittu Oromo's and few Somali ethnic minorities. Out of 18 kebeles located in Fentale district 11 are considered pure pastoralist (FDSEP, 2013). According to 22 years climate data of National Metrological Agency from 1989-2011 the District climate is Hot-semi Arid, characterized by step type of vegetation with less fall and more coarse grasses. The mean annual temperature and rainfall of Fentale district varies between 180C and 340C and 377 mm-742 mm respectively with mean annual rainfall of 572 mm.

Sample was drawn from the two populations, irrigation users and non-users. Two- stage, stratified and random sampling technique was used. This was achieved in sub sampling that divide the population into clusters, then select a sample from peasants association using simple random sampling based on distance from market and access to water and then, from each of selected cluster, select a sample of respondents or target population using simple random sampling in which each element of the population has an equal chance of being selected into the sample by using lottery methods where each member of the population at hand is assigned a unique odd numbers starting from one.

Source of Data

In this study the primary and secondary data type or source were used. Primary data was collected through questionnaire interview and focus group discussion. Secondary data was collected from published documents, and directives, policies and regulations (regarding irrigation agriculture), books and journals and performance reports through checklist and review of documents.

Methods of Data Analysis

The analysis part was done by using descriptive statistics such as mean, frequency distribution, percentage, and logistic regression. Quantitative data was analysed using SPSS and STATA software. The qualitative data collected using key informant interviews, and focus group discussion was analyzed with narrative explanation. Two group of households were compared to analyze the impact of irrigation scheme. These groups are user household (treatment group) and non-user household (control group). The non-user household was used as a comparison group to examine the impact of Boset-Fentalle irrigation scheme on users' household.

Model Specification

To generate statistically acceptable matched pairs between irrigation users and non-users, Propensity Score Matching (PSM) econometric model was used**.**

ASThe propensity score is defined as the probability of receiving treatment based on measured Covariates: e(x) = P (Z=1 | X).The covariates are used to predict treatment assignment using logistic regression The following represents the equation: $ln\left[\frac{\mathrm{p(z=1|x1\ldots\ldots,xj)}y}{1-\mathrm{p(z=1|x1\ldots\ldots,xj)}}\right] = \beta_0 + \sum_{\mathbf{I}j=1}^{p} \beta \mathrm{j}\mathrm{X}\mathrm{j}$. Average treatment effect over the treated (ATT): was used to evaluate impact of irrigation on income, it is computed as:

$$\mathrm{ATT} = E(Yi^T - Yi^C \mid D = 1) = E(Yi^T \mid D = 1) - E(Yi^C \mid D = 1)$$

Results and Discussion

Socioeconomic characteristics

The socio economic characteristic of the surveyed household is summarized in Table 1. It shows that among the presented features; age, education level, farm experience, education level, total livestock unit, and family sizes shows significant difference for participants of irrigation users.

Table1. Summary of statistics and distribution of continues variables.

Variable	N	Minimum	Maximum	Mean	Std. Dev.
Age	305	24	60	38.56	6.416
Education	305	0	1	.69	.465
Farm experience	305	0	10	2.30	2.246
Family size	305	2	18	7.86	2.358
Livestock owned	305	0	45	13.09	6.804

Age: as reveal on Table 1 indicate that the mean age of total respondents was 38.56 years old. The result shows that younger household heads being involved in irrigation activities than the older household heads.

Education: as reveal on Table 1 the mean education level of respondent is 2.30. This indicate about 28.5% of user respondents were illiterate. The survey result shows that a higher percentage of respondent were illiterate. Therefore, education was one of the important criteria to accept and apply irrigation activity that have positive impact.

Farming experience: as shown on table 1, mean of farming experience of the agriculture participation is 12.10. This implies as there was farming experience in irrigation participation that positively affect and significant on income of household.

Livestock owned: as result in Table 1 shows that the mean livestock (cow and oxen) of respondent 13.09 numbers. Therefore, respondents who have large number of oxen have better opportunity to use irrigation and ploughing more land on time than that of respondents who do not have no oxen.

The model specification and inferential statistics output of the surveyed household is summarized in Table 1. It shows that among the presented features; age, farm experience, total livestock unit and market Information are significant at $p<0.05$.

Determinant of participation in irrigation. Out of the 12 variables, four are found statistically significant at ($p<0.05$). The statistically significant variables include, age, farm experience, total land owned, and total livestock unit.

Table 2: Logit estimate of irrigation participation decisions

Category	Coefficient	Standard error	Z	P>|z|	
Constant	13.80071	2.918678	4.73	0.000	
Age	.317009	.1022014	3.10	0.002	
Sex	.7143108	.8337539	0.86	0.392	
Education level	-.089072	.1807209	-0.49	0.622	
Farm experience	-.9999786	.216793	-.4.61	0.000	
Total land owned	-.10.35809	2.228569	-4.65	0.000	
Family size	-.1793386	..1559949	-1.15	0.250	
Total livestock	-.197053	0498603	-3.95	0.000	
Training participation	1.77786	1.16356	1.53	0.127	
Market information	-.2.012312	.9287624	-2.17	0.030	
Field days	-.4.34198	3.032208	-1.43	0.152	
Distance of market	.0768668	.0348406	2.21	0.027	
Income total	0.80	0.33	2.41	0.16	
				Number Of Obs. =	305
				LR Chi2 (17) =	306.62
				Prob > Chi2 =	0.0000
Log Likelihood = -29.02883					Pseudo
R2= 0.8408					

Note: ***significant at 10%,and 5% of probability level of significance.

AGE: Age is found to be significantly and positively affecting irrigation participation at P<0.05.A unit increasing in age would increase participation in irrigated agriculture by 0.317.This means that people would better involve in irrigated agriculture as they become older.

Total land owned: It was hypothesized to affect participation in irrigation positively. The model output also indicated that it is significant (p<0.05) and related to participation in irrigation positively. Other factor constant it affects irrigation participation probable significant at 0% level even thought it coefficient is negative. This implies as shortage of water rise up, total irrigated land decline. Additionally, lacks of input also affect potential of irrigated land in study area. It results similar with study finding of (Ziba, 2015).

Tropical livestock unit: It was significantly affected participation. Assuming other factors constant, as the number of livestock owned decreases by one TLU, participation in irrigation increases by the odds of 0.00%. The result is statistically significant at p<0.05 level. This is probably implies as numbers of livestock increase irrigation participation.

The Impact of Irrigation Participation on Income

Different scholars use consumption expenditure as a measure of welfare in different countries, (Jema et al., 2013).In this section, efforts made to measure

household livelihood by looking at income. The result of propensity score matching treatment

assignment indicated that among 305 observation of the study, 247 observations used for estimation. The common support area results also revealed that 29 to 218 observations of the untreated (control) observation were found in the common support and 218 observations of treated was in the common support area depending on matching algorithm. Further, 29 to 218 observations were in the common support and used for the treatment effect analysis.

Table 3: ATT for income using Matching algorithm

Matching Algorithm	No. treated	No. control	Mean income		ATT	S.E	T-stat
			Matched treated	Matched control			
NNM	218	6	34407.58	30140.37	4267.216	1004.704	0.425*
Stratification	218	29			11434.135	3011.142	3.785*

Note: ***significant at 10% and 5% probability level of significance.

Table 3, provides the result of ATT Treatment effect on income with stratification method. It is statistically significant. The mean difference of household income between the averages matched treated and control groups ranges from 34407.58 to 30140.37 ETB depending on the matching algorithm under consideration. In estimating propensity score, the balance property imposed. The use of balancing property ensures that a comparison group constructed with observable characteristics distributed equivalently across quintiles in both the treatment and comparison group (Smith and Todd, 2005 as cited in Abdi,et al., 2016).ATT with NNM and the stratification matching method of the statistical comparison is ETB 11434.135 and ETB 4267.216 respectively. Further, with NN matching method the model result revealed that development of the irrigation project gave an income advantage of

42.67% (Table 3).The stratification-matching algorithm generated the highest mean income because of treatment effect. In relation to the matched pairs, stratification was relatively better and less restrictive as more than 29% of the control household judged to be comparable to the treatment household. On the contrary, NN matching algorithm found to be more conservative as it matched only 6% of control household with the treated household. In conclusion, this empirical finding suggests that participation of irrigation was improved income of treated households in a significant way. This result is similar with the findings of (Gebregziabher, etal, 2009, as cited in Ziba, 2015, Abdi, et al., 2016). However market problems, shortage of water and input supply are factors affect irrigation participation and this directly affect income of farmers in study area.

Irrigated problems identified

Table 4: Major problems face in irrigation farming to increase income.

Major problems face in irrigation	Frequency	Percent
Non irrigation users.	87	28.5
Market and input supply	88	28.8
Shortage of waters	130	42.6
Total	305	100.0

As indicated in Table 4, the major problems face irrigation farming in study area as to increase income of farmers was shortage of waters which responded about 42.6 % and market and input supply problems are face. So this direct related problems of irrigation infrastructure water and management problems which affecting on household participation

towards increment of the revenues in study area as well as minimize the production yield and have effect on income of household. This result is similar with the findings of (Tadele*et al.,* 2018). the major constraints that highly affect irrigation participation were shortage of water for irrigation uses ,market and input problems. Therefore it could positively affect irrigation participation and probably significant.

Conclusion and Recommendation.

Irrigation is an important driving tool to development effort to ensure better income if properly used. The study has substantiated that irrigation in the study area, has significant impact on income and productivity. Hence, the study result indicated a shortage of irrigation water and its management problems, problems of market and lack of input supply are major factors affect irrigation participation and its effect on income of farmers in study area. To sustain the progressive participation and to enable beneficiary households make an optimum use of the irrigation scheme and based on the empirical findings in this research, the following recommendation suggested. It shall be great and rewarding if policy makers, designers' implementers, and any funding agencies with similar interest further capitalize and scale up the scheme to achieve the development plan and objective the scheme. It shall be great if Fentale scheme administration and Fentale woreda work on market intervention in terms of either looking to different outlet, value addition, and or organization into marketing cooperative with linking to union and frequent consumers would encourage irrigation participation. Further, an improvement in road access and transportation facilities would also facilitate improved marketing and thereby, irrigation participation. As farmers demand efficient water in irrigation scheme, the Oromia Agriculture and Natural Resource Bureau shall work on reforming scheme management and administration that have duty on irrigation management, water allocation and distribution, operation and maintenance of irrigation infrastructure. The Office shall be encouraged capacity building of the water user association with developed concrete rule and regulation, and reduced the rivalries due to the common pool interest as well as creating market linkage with different stakeholder to solve the problems of market, facilitate the research institute that work on value chain and diversification to solve the problems and solving input supply problems and training the farmers to know how to use technology on farmi

References.

[1] Abdi.E,Girma.T& Feqadu.B. 2016. The Impact Of Boset-Fentalle Irrigation On The Income Of Agro Pastoralist In Fentalle District, Ethiopia.,pp 1.

[2] Adam. T. 2013. Hydraulic and Hydrologic Factors on Conveyance Efficiency: Case of Fantale and Tibila Irrigation Schemes. Addis Ababa University, Ethiopia**.** pp 2-3.

[3] Abraham.G,Addis. A &Mesfin.T. 2015. The Impact of Small – Scale Irrigation on Income of Rural Farm Households: Evidence from Ahferom Woreda in Tigray, Ethiopia. International Journal of Business and Economics Research. pp. 2.

[4] FDSEP. 2013. Fentalle District Socio-economic profile: district background information. 35p. (Unpublished).

[5] Getaneh.K. 2015. The Impact Of Selected Small-Scale Irrigation Schemes On Household Income And The Likelihood Of Poverty In The Lake Tana Basin Of Ethiopia, Cornell University.pp,1,6,11, 44 & 60.

[6] Jema Haji, Mahamed Aman, and Tewodros Hailu. 2013. Impact Analysis of Mede Telila Small Scale Irrigation Scheme on House Poverty Alleviation: Case of Goro Gutu District in Eastern Hararghe, Oromia National Regional State, Ethiopia. International Journal of Development and Economic Sustainability, 19(1): 15-30. UK. www.ea-journals.org.

[7] OIDA, 2013. Oromia Irrigation Development Authority: Analysis on Outcome of Community based Irrigation Scheme.19p.(Unpublished).

[8] Selseshi.B,Teklu.E&Regassa.N. 2010. Irrigation Potential in Ethiopia Constraints and Opportunities for enhancing the system. International Water Management Institute.Pp,16 &30.

[9] Tadele. G, Gamachu. A & Beyisa. M.2018. Assessment of Status of Irrigation Practice and Utilization in Western Hararghe Zone, Oromia, Ethiopia.Pp,1&11.

[10] Ziba. D.2015. The Impact Of Irrigation Schemes On Farmers' Income And Livelihoods In the Upper East Region Of Ghana. Kwame Nkrumah University Of Science And Technology, Ghana. Pp 13-31.