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Impact of Small-Holders' Cattle Fattening on Household Income Generation in Fadis District of Eastern Hararghe Zone, Oromia, Ethiopia

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Abstract

At the household level, livestock plays a critical economic and social role in pastoralists and at the household level, livestock plays a critical economic and social role in pastoralists and smallholder farm households. The objectives of this study were to analyze factors affecting participation in cattle fattening and its impacts on household income in Fadis district of Eastern Hararghe. Both primary and secondary data were used. The data were collected by means of a semi-structured questionnaire from 124 samples during the period of April 20-May20/ 2017. Logit estimation revealed that participation in cattle fattening is significantly influenced by five variables. Age of household head, labor force in family member, market information, access to agricultural extension services and number of livestock are significant variables which affect the participation of the household in cattle fattening practices. Propensity score matching method was applied to analyze the impact of the cattle fattening on the household income generation. In matching processes, kernel matching with 0.25 band width was resulted in relatively low pseudo-R^2 with best balancing test was found to be the best matching algorithm. This method was checked for standardized bias, t-test, and joint significance level. Propensity score matching results revealed that household participated in cattle fattening practice have got 14,071 more farm income and 12,617 total household income in Ethiopian Birr (ETB) than those household that were not participated in fattening practices. This income difference shows how non-farm and off-farm income compensated for income obtained from cattle fattening activities with farm income.

Keywords:
cattle fattening, Logit regression, propensity score matching, household income

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INTRODUCTION

World meat production is anticipated to record a modest expansion in 2015 to 318.7 million tones, 1.3 percent, or 4 million tones, above 2014. Even if, the cattle population in the majority of tropical country is higher, there is a strong unsatisfied demand, due to the increment of population growth in the majority of tropical countries, for milk and meat (FAO, 2015).

Livestock is an integral part of Ethiopia's agricultural sector and plays a vital role in the national economy. At present, livestock contributes about 20% of the growth domestic product (GDP), supporting the livelihoods of 70% of the population and the sub sector also account 11% of annual export earnings (SPS-LMM, 2010). Ethiopia is endowed with largest livestock production, which ranks first in Africa and tenth in the world, it has much to gain from the growing global markets for livestock products. It is also known that Ethiopia is characterized by a high livestock population with lowproductivity of animal products, in terms of conventional products such as meat and milk. Despite the large number of livestock, there has been a decline in national and per capita production of livestock, livestock products, export earnings from livestock and per capita consumption of food from livestock (CSA, 2013). Meat production and consumption is important in the Ethiopianeconomy and ruminants contribute over 3.2 million tons, representing over 72% of the total meat production (Belete et al., 2010).

Livestock production is of strategic economic importance, not only for its number and diversity, but also for majority of the rural people use livestock for various other activities like farming and transportation of people and products (MoARD, 2006). In areas where mixed farming (crops and livestock production) undertaken, farmers use livestock for coping with adverse situations during crises of crop failure by selling animal products, as 72 percent of the households own cattle. With regard to direct food supply and/or cash income generation, livestock play an increasingly significant role (MoARD, 2007).

At the household level, livestock plays a critical economic and social role in the lives of pastoralists, agro-pastoralists, and smallholder farm households. In the case of smallholder mixed farming systems, livestock provides nutritious food, additional emergency and cash income, transportation, farm outputs and inputs, and fuels for cooking food. The government recognizes the importance of livestock in poverty alleviation and has increased its emphasis on modernizing and commercializing the livestock sub-sector in recent years. Eastern Hararghe is well known for its best practices and indigenous knowledge in cattle fattening. Enhancing the production and productivity in the area with available indigenous technical knowledge will help the improvement of the sector in increasing the sector contribution to national and agricultural GDP. The subsectors contribute about 16.5% of national Growth Domestic Product (GDP) and 35.6% of agricultural GDP (Metaferia et al. 2011).

The livestock production system in East Hararghe is market oriented. In the study area, there is little information available on determinants of cattle fattening and impacts of smallholder cattle fattening on households' income generation. Fattening is commonly practiced by some farmers in different places of the area. Farmers keep a small number of oxen which are mainly purchased from market, fattened and sold for beef after a few month of work. Therefore, to plan and develop improved cattle fattening and information sharing is very important to identify the existing cattle fattening practices, determinants of cattle fattening and its impacts on household income generation in selected study area. So the specific objectives of the study were to identify factors affecting smallholders cattle fattening practice and analyze impacts of cattle fattening on household income generation in the study area.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Fadis districts of eastern Hararghe zone of Oromia region. It is found in around 30 km distance from Harar town. The climate of the area is characterized by warm and dry weather with relatively low precipitation. Agriculture is the major source of

livelihood of the community. However, its productivity is dependent on the merit of rain-fed agriculture. The farming system is subsistence type dominated by smallholder farmers. Sorghum and maize crops take the largest proportion of crop production. Similarly, chat and groundnut are also the main cash crops in the area. Even though livestock keeping constitutes an important activity, many households lost their livestock assets due to recurrent drought.

Fedis district is also found at latitude between 8°22' and 9°14' north and longitude between 42°02' and42°19' east, in middle and low land areas: altitude range is from 1200-1600 m.a.s.l meters,witha prevalence of low lands. The area receives average annual rain fall of 400 - 804 mm. The minimum and maximum temperature of the area is 20-25°C and 30-35°C, respectively (EHZARDO, 2015). The population's livelihood mainly consists of agriculture, husbandry and small-scale trade. The farm units are small family holdings with an average agricultural land area of less than one hectare. Agriculture is mainly rain fed. Similar to areas in the Horn of Africa, two rainy seasons characterize the Fedis district's climate: the first, named Belg, is the shortest one and takes place between March and May, while the second and most important,named Meher, is between July and October. The rainfall distribution during the year is then bi-modal, with a dry spell period during the months of June and July, depending on its duration, may affect crop growth. The Meher (Main) season is the most important one; when the intensity of farm practices and production increase.

Sampling technique and method of data collection

Both primarily and secondary data sources were used for this study. The data required for this study were collected from sample respondents using a questionnaire. One day tutorial was given to the enumerators about method of data collection and the contents of the questionnaire. Secondary data that could supplement the primary data were collected from published and unpublished documents obtained from Eastern Hararghe zone. Total rural kebele in selected districts were identified and arranged. The total rural kebeles that are found in the Fadis district were categorized. Total sample size for each kebele was categorized as cattle fattening participant and non-participant for each sampled kebele.To select sample respondents from selected kebeles, first the household heads in the sampled kebeles was identified and stratified in to two strata: cattle fattening participant and non-participant. Then the samples from each stratum were selected randomly using simple random sampling technique. Since the number of household heads in the two groups was almost proportional, related number of sample was drawn from each group, i.e. 70 participants and 54 non-participants were selected. Then total of 124 respondents were interviewed using questionnaire

Data analysis

Based on the objectives of the study, both descriptive statistics and econometric models were employed to analyze both qualitative and quantitative data. From econometric model, logit model was applied to analyze factors affecting small-holder cattle fattening and propensity score matching method (PSM) was also used for impact analysis.

Descriptive statistics

By applying descriptive statistics, one can compare and contrast different categories of sample units with respect to the desired characteristics. It is used to explain the different socio-economic, institutional and other characteristics of the sample households. These include mean, percentage, standard deviation and frequency for fattening participants (treated group) and non-participants (non-treated group) farmers.

Households' income measure

Annual household income included both agricultural (farming and non-farming) and non-agricultural off-farm incomes. The non-agricultural or income obtained from off-farm activities was considered because, income that could be obtained from cattle fattening activity can be compensated by non-agricultural or off-farm activities. The contribution of cattle fattening

to household income might be exaggerated if the inclusion of non-agricultural or income obtained from off-farm activities is ignored. It means that if the household income from non-agricultural or off-farm activities is omitted and only agricultural income is considered the share of income obtained from cattle fattening activities might be higher than when income from both agricultural and non-agricultural or off-farm activities are considered. Therefore, as much as possible, it is plausible to include every source that can generate income to household.

Econometrics analysis

Econometric analysis for factors affecting participation in cattle fattening

The logit and probit are the two most commonly used models for assessing the effects of various factors that affect the probability of cattle fattening of a given practice. These models can also provide the predicted probability of cattle fattening practice. Both models usually yield similar results. However, the logit model is simpler in estimation than probit model (Aldrich & Nelson, 1984). Hence, the logit model was used in this study to analyze the determinants of small-holders' cattle fattening. Following Liao (1994), Gujarati (2003) and Aldrich and Nelson (1984) the logistic distribution function for the practices of small scale cattle fattening:

$$P_i = \frac{1}{1+e^{-Zi}} = \frac{e^{Zi}}{1+e^{Zi}} \quad (1)$$

where, Pi = is a probability of practicing small-scale cattle fattening for the ith farmer and it ranges from 0-1.

e^{zi} = stands for the irrational number e to the power of Zi.

Zi = a function of n-explanatory variables which is also expressed as:

$$Zi = B_0 + B_1X_1 + B_2X_2 + \ldots + B_nX_n \quad (2)$$

where, $X_1, X_2 \ldots X_n$ are explanatory variables.

B0- is the intercept, $B_1, B_2 \ldots; B_n$ are the logit parameters (slopes) of the equation in the model.

The slopes tell how the log-odds ratio in favor of practicing small-holder cattle fattening changes as an independent variable changes. The unobservable stimulus index *Zi* assumes any values and is actually a linear function of factors influencing decision of small-holder cattle fattening. It is easy to verify that *Zi* ranges from -∞ to ∞, Pi ranges between 0 and 1 and that Pi is non-linear related to the explanatory variables, thus satisfying two requirements:

As *Xi* increases *Pi* increases but never steps outside the 0 and 1 interval; and

The relationship between *Pi* and *Xi* is non-linear, i.e., one which approaches zero at slower and slower rates as *Xi* gets small and approaches one at slower and slower rate as *Xi* gets very large. But it seems that in satisfying these requirements, an estimation problem has been created because *Pi* is not only non-linear in *Xi* but also in the B's as well, as can be seen clearly below.

$$Pi = \frac{1}{1 + e^{-(B0 + B1X1 + B2X2 + \ldots + Bn)}} \quad (3)$$

This means the familiar OLS procedure cannot be used to estimate the parameters. But this problem is more apparent than real because this equation is intrinsically linear. The interpretation of logistic regression coefficients (bi) is considered by using odds ratio *(Pi/(1-Pi)* and log of the odds ratio ln *(Pi/(1-Pi)* (Liao, 1994). The odds value gives the expectedchange in the odds ratio of adopting the given farm activity versus not adopting it per unit change in an explanatory variable, other things being equal. The same interpretation applies to both dummy and continuous variables (Liao, 1994). In this study, if Pi is the probability of practicing a given small-holders' cattle fattening then *(1-Pi)*, the probability of not practicing, can be written as:

$$1-Pi = 1/(1+e^{Zi})$$

Therefore, the odds ratio can be written as:

$$Pi/(1-Pi) = (1+e^{Zi})/(1+e^{-Zi}) = e^{Zi}$$

Now Pi/(1-Pi)is simply the odds ratio in favor

of practicing small-holder cattle fattening. It is the ratio of the probability that the farmer would practice the cattle fattening to the probability that he/she would not adopt it. Finally, taking the natural log of equation 5, the log of odds ratio can be written as:

$$Li = \ln\left(\frac{Pi}{1-Pi}\right) = ln(e^{Bo+\sum_{i=1}^{n} BiXi}) = Zi = Bo + \sum_{i=1}^{n} BiXi$$

where, Li is log of the odds ratio in favor of small-holder cattle fattening practices, which is not only linear in Xi, but also linear in the parameters. Thus, if the stochastic disturbance term, (Ui), is introduced, the logit model becomes:

$$Zi = B_0 + B_1X_1 + B_2X_2 + \ldots + B_nX_n + Ui \quad (7)$$

Impact evaluation methods using propensity score matching (PSM) method

The first step in PSM method is to estimate the propensity scores. A logistic model is used to estimate propensity scores using a composite of pre-participation characteristics of the sampled households (Rosenbaum & Robin, 1983) and matching is then performed using propensity scores of each observation. The propensity scores themselves serve only as devices to balance the observed distribution of covariates between the treated and comparison groups. The success of propensity score estimation is therefore assessed by the resultant balance rather than by the fit of the models used to create the estimated propensity scores (Lee, 2006). Using predicted probabilities of participation in a given farm program (i.e. propensity score)match pairs are constructed using alternative methods of matching estimators. In this study, to analyze the factors affecting households' participation in cattle fattening practice, dependent variable is dichotomous in nature and represents the observed cattle fattening. It was represented in the model as treated group (CatFat) =1 for a household that participated in cattle fattening and non-participated=0 for a household that do not practice cattle fattening. In this study a Variance Inflation Factors (VIF (Xi) technique was employed to detect the problem of multicollinearity for all explanatory variables as (Gujarati, 2003).

The impact of small-holder cattle fattening on household income generation is the difference in households' mean of farm income of the participant farmers and non-participant farmers in cattle fattening. Thus, the fundamental problem of such an impact evaluation is a missing data problem. Hence, this study applies a propensity score matching technique, which is a widely applied impact evaluation instrument in the absence of baseline survey data for impact evaluation. According to Caliendo and Kopeinig (2005), there are steps in implementing PSM. These are estimation of the propensity scores, choosing a matching algorism, checking on common support condition and testing the matching quality. Imposing a common support condition ensures that any combination of characteristics observed in the treatment group can also be observed among the control group (Bryson et al., 2002). The common support region is the area which contains the minimum and maximum propensity scores of treatment and control group households, respectively.

For any cattle fattening practicing household, there should be non-practicing household with closest propensity score as the match. To accomplish the match, the nearest neighbor (equal weights version) was tested. The nearest neighbor method simply identifies for each household the closest twin in the opposite fattening group. Caliper matching which means that an individual from the comparison (non-treated) group was also tested as a matching partner for a treated individual that lies within a given caliper (propensity score range) and is closest in terms of propensity score and kernel matching estimators was also tested. However, for this specific study kernel matching was used to evaluate impact of cattle fattening on households income generation. This is matching method whereby all treated units are matched with a weighted average of all controls with weights which are inversely proportional to the distance between the propensity scores of treated and controls Becker and Ichino (2002) Venetoklis (2004). It then computes an estimate of the cattle fattening effect as the average difference in households' outcome variable between

each pair of matched households. The impact of cattle fattening for an individual i, noted δi, is defined as the difference between the potential outcome in case of cattle fattening and the potential outcome in absence of small-holder cattle fattening group using PSM.

$$\delta i = Y_{1i} - Y_{0i} \quad (8)$$

In general, an evaluation seeks to estimate the mean impact of the cattle fattening practice is obtained by averaging the impact across all the individuals in the population. This parameter is known as Average Treatment Effect or ATE:

$$ATE = E(\delta) = E(Y_1 - Y_0) \quad (9)$$

Where E(.) represents the average (or expected value). Another quantity of interest is the Average Treatment Effect on the Treated or ATT, which measures the impact of the treatment on those individuals who participated:

$$ATT = E(Y_1 - Y_0 \mid D = 1) \quad (10)$$

Finally, the Average Treatment Effect on the Untreated (ATU) measures the impact that the treatment would have had on those who did not participate in cattle fattening practice:

$$ATU = E(Y_1 - Y_0 \mid D = 0) \quad (11)$$

The problem is that, all of these parameters are not observable, since they depend on counterfactual outcomes. For instance, using the fact that the average of a difference is the difference of the averages, the ATT can be rewritten as:

$$ATT = E(Y_1 \mid D = 1) - E(Y_0 \mid D = 1) \quad (12)$$

The second term, $E(Y_0 \mid D = 1)$ is the average outcome that the treated individuals would have obtained in absence of treatment, which is not observed. However, we do observe the term $E(Y_0 \mid D = 0)$ that is, the value of Y0for the untreated individuals.

$$ATT = E(Y_1 \mid D = 1) - E(Y_0 \mid D = 0) \quad (13)$$

RESULTS AND DISCUSION

Descriptive statistics results

Households' demographic and socio-economic characteristics

Table 1 shows descriptive statistics results of sample household based on participation in small scale cattle fattening practices. In the study area the average age of all sample respondents was 39.14. On average participant household head have 37.3 years while that of non-participants of cattle fattening have 41.48 years. There is a significant difference in their age years. The survey results showed that mean difference between participants households in cattle fattening and non-participants were found to be significant at 5 % significant level based on household head age in years. Similarly, the average year of formal schooling of participant is around grade 3 while that of non-participant in cattle fattening is around grade 2. The mean difference of the two groups is statistically significant at 5% of probability level. It shows that, on average participant household have more year of formal schooling compared to that of non-participants in cattle fattening practice.

Farm size refers to the total area of farmland that a farm HH owned in hectares. In agriculture, land is one of the major factors of production. The average cultivated land of all sample respondents was 1 ha. On average participant household have 1 ha while non-participants have 0.91ha.There is a significant difference in their cultivated land size. The survey results showed that mean difference between participant and non-participant in cattle fattening was found to be significant at 5% significant level based on cultivated land.

Livestock is very important asset in farm household. In this study, the average livestock holding of sampled household is 1.89 in TLU. On average participant household have 2.17 while that of non-participant in cattle fattening is 1.52 in TLU. Participant households have larger livestock compared to non-participant households. The survey result revealed that, the mean difference between participant household in cattle fattening and non-participant household was significant at 1% level of significance based

Table 1
Socioeconomic Characteristics of Sampled Respondents

All Variables	All samples HH(N=124)		Participants HH(N=70)		Non-participants HH(N=54)		Mean difference	
	Mean	SD	Mean	SD	Mean	SD	Mean	t-value
Age of HH	39.14	10.371	37.33	10.615	41.48	9.644	4.15	2.246**
Education of HH	2.21	2.257	2.61	2.561	1.69	1.669	-0.93	2.312**
Market distance	6.97	2.590	6.99	2.629	6.94	2.564	-0.04	0.08
Family Size	5.75	0.195	5.94	2.126	5.50	2.230	-0.44	1.13
labor force	3.19	1.389	3.50	1.432	2.80	1.234	-0.70	2.88***
Farm size in ha	1.03	0.614	1.13	0.631	0.91	0.571	-0.23	2.06**
Qty Produced	8.74	5.892	8.90	6.510	8.53	5.031	-0.37	0.35
Livestock(TLU)	1.89	1.256	2.17	1.217	1.53	1.222	-0.64	2.92***
Fod short month	5.15	1.482	5.03	1.372	5.31	1.612	0.29	1.07

*** p<0.01 and ** p<0.05

on livestock holding in tropical livestock unit. Similarly, the cattle fattening participants have a larger number of labor force compared to non-participants. The average number of labor force of participants was 3 persons and that of non-participant is 2 persons. The result showed that, the mean difference between numbers of labor forces of participants and nun-participants were also found to be significant at 1% significance level.

The descriptive results in Table 2 revealed that, based on the source of market information for agricultural production, sample respondents that dot accessed market information in the area account for about 72.7 % of the total non-participant of the cattle fattening respondents; while other group of the respondents that dot accessed market information accounts for 26.3 % of participants in cattle fattening in the area Table 4. Similarly, it showed that, sample respondents that accessed market information from development agent account for about 69.2 % of the non-participant and 30.8 % of participants. Other group of non-participant that obtain market information by observing other market participant in the market accounts for 33.3 % while that of participant in cattle marketing accounts for 66.7 %. Brokers and local farmers themselves also service as the source of market information for other farmers in the study area. The comparison of the two groups depicted that a higher proportion of respondents that access market information

Table 2
Source of Market Information for Agricultural Product in the Study Area

Source of info.		Household categories on fattening		Total
		Non-participant	Participant	
Non	Count	28	10	38
	% within source of information	73.70	26.30	100.00
DA	Count	9	4	13
	% within source of information	69.20	30.80	100.00
Market	Count	10	20	30
	% within source of information	33.30	66.70	100.00
Broker	Count	2	28	30
	% within source of information	6.70	93.30	100.00
Other	Count	1	2	3
	% within source of information	33.30	66.70	100.00
local farmers	Count	4	6	10
	% within source of information	40.00	60.00	100.00
Total	Count	54	70	124
	% within source of information	43.50	56.50	100.00
	Chi^2 = 35.58, p-value = 0.000, df =5			

Table 3
Main Source of Household Income in the Study Area

Source of income		Household categories on fattening		Total
		Non-participant	Participant	
Chat/coffee production	Count	36	28	70
	% within HH categories on fattening	66.7	40	51.6
Groundnut production	Count	14	15	29
	% within HH categories on fattening	25.9	21.4	23.4
Chat trading	Count	1	2	3
	% within HH categories on fattening	1.9	2.9	2.4
Livestock trading	Count	1	1	2
	% within HH categories on fattening	1.9	1.4	1.6
Cattle fattening	Count	0	19	19
	% within HH categories on fattening	0.0	27.1	15.3
Other	Count	2	5	7
	% within HH categories on fattening	3.7	7.1	5.6
Total	Count	54	70	124
	% within HH categories on fattening	100	100	100
	% of total	43.5	56.5	100
	Chi^2 = 19.92, p-value = 0.001, df=5			

Source: Own survey results

are participants of cattle fattening practice than that of not-participant of the fattening. This difference is found to be statistically significant and the association between access to market information for agricultural product and participation characteristics of the sample respondents was found to be significant at 1 percent probability level for cross tabulation chi-square test.

In moisture stress area of Eastern Hararghe zone, farmers use different sources of income generating activities to diversify their source of income. The descriptive results presented in Table 3 revealed that, out of total non-participant of cattle fattening practice, sample respondents that use chat as main source of income account for 66.7 % while other group account for 25.9 %, 1.9%, 1.9 % and 3.7 % from groundnut production, chat trading, livestock trading and other source of income generating activity, respectively. On the other hand, out of total participant of cattle fattening practice, participant respondents that use chat as main source of income account for 40 % while other group account for 21.4 %, 2.9 %, 1.4 %, 27.1 % and 7.1 % from groundnut production, chat trading, livestock trading, cattle fattening and other source of income generating activity, respectively. The comparison of the two groups depicted that a higher proportion of respondents that use non-cattle fattening as their main source income are non-participants of cattle fattening practice than that of participant of the fattening. This difference is shown by cross tabulation chi-square test that found to be statistically significant and the association between main source of farm household income and participation characteristics of the sample respondents was found to be statistically significant at 1 percent probability level.

In the study area of Eastern Hararghe zone, farmers are facing different agricultural production constraints that challenge them in one or other ways. The descriptive results presented in table 4 above revealed that, out of total non-participant of cattle fattening practice, sample respondents that replied oxen shortage as the main production constraints account for 16.7 % while other group account for 11.1 %, 55.6 %, 7.4 % and 3.7 % as labor shortage, disease, drought, weed and shortage of farm land as main constraints of agricultural production, respectively. On the other hand, out of the total participant of cattle fattening practice, sample respondents that replied oxen shortage as the main production constraints account for 15.7 % while other groups account for 19 %, 7.1

Table 4
Agricultural Production Constraints for Sampled Respondents in the Area

Production Constraints		Household categories on fattening		Total
		Non-participant	Participant	
Oxen shortage	% within HH categories on fattening	16.7	15.7	16.1
	% of total	7.3	8.9	16.1
Labor shortage	% within HH categories on fattening	5.6	10.0	8.1
	% of total	2.4	5.6	8.1
Disease	% within HH categories on fattening	11.1	7.1	8.9
	% of total	4.8	4.0	8.9
Drought	% within HH categories on fattening	55.6	54.3	54.8
	% of total	24.2	30.6	54.8
Weeds	% within HH categories on fattening	7.4	8.6	8.1
	% of total	3.2	4.8	8.1
Lack of pest & herb side	% within HH categories on fattening	0.0	4.3	2.4
	% of Total	0.0	2.4	2.4
Shortage of Land	% within HH categories on fattening	3.7	0.0	1.6
	% of Total	1.6	0.0	1.6
Total	Count	54	70	124
	% within HH categories on fattening	100	100	100
	$Chi^2 = 6.27$, p-value = 0.39, df=6			

%, 54.3 %, 8.6 % and 4.3 % as labor shortage, disease, drought, weed and lack of pesticide and herbicide as main constraints of agricultural production, respectively. The comparison of the two groups depicted that proportion of respondents that faced different agricultural production constraints to non-participants of cattle fattening practice and that of participant of the cattle fattening are almost equal. This difference is shown by cross tabulation chi-square test that is found to be insignificant and the association between the main agricultural production constraints and the participation characteristics of the sample respondents was found to be insignificant by probability level. This implies that, sample respondents are facing similar agricultural production constraints even if the level of challenge differs between both groups.

Non-agricultural or income obtained from off-farm activities was considered because, income that could be obtained from cattle fattening activity can be compensated by non-agricultural or off-farm activities. The contribution of cattle fattening to household income might be exaggerated if the inclusion of non-agricultural or income obtained from off-farm activities is ignored. Therefore, both off-farm income and non-farm income that obtained from both ac-

Table 5
Respondents Access to off-Farm Activity to Generate Income in the Study Area

Access to off-farm activity		Household categories on fattening		Total
		Non-participant	Participant	
Not-Access	Count	40	57	97
	% within off-farm activity	41.2	58.8	100
	% of total	32.3	46.0	78.2
Yes-Access	Count	14	13	27
	% within off-farm activity	51.9	48.1	100
	% of total	11.3	10.5	21.8
Total	Count	54	70	124
	% within off-farm activity	43.5	56.5	100
	% of total	43.5	56.5	100

Table 6
Respondents Access to Non-Farm Activity to Generate Income in the Study Area

Access to off-farm activity		Household categories on cattle fattening		Total
		Non-participant	Participant	
Non-Access	Count	46	58	104
	% within non-farm activity	44.2	55.8	100
	% of total	37.1	46.8	83.9
yes-Access	Count	8	12	20
	% within non-farm activity	40.0	60.0	100
	% of total	6.50	9.7	16.1
Total	Count	54	70	124
	% within non-farm activity	43.5	56.5	100
	% of total	43.5	56.5	100

Table 7
Description of Sampled Participants and Non-Participants' Income

All Variables	All samples HH(N= 124)		Participants HH(N=70)		Non-participants HH(N=54)		Mean difference	
	Mean	SD	Mean	SD	Mean	SD	Mean	T-Value
Non-Farm Income	1689	5669	1205	2934	2315	7914	1110	1.08
Off-Farm Income	892	3275	533	2054	1358	4361	825	1.39*
Farm Income	26791	15945	34258	16058	17111	9232	17147	7***

tivities were gathered from sample respondents and analyzed. Table 5 revealed that, out of the total non-participants of cattle fattening 85.2 % did not participate in non-farm activities whereas 14.8 percent of them participated in non-farm activities. On the other hand, 82.9 percent of participants in cattle fattening did not participate in non-farm activities while 17.1 percent of them participated in non-farm activities to generate addition income for household. This implies that non-participants of cattle fattening mostly covered their family expenditure by non-farm income that can be obtained from non-farm activities as described in Table 6 below. The same is true for off-farm activities to generate off-farm income.

This study focused on the income that household generate by participating in cattle fattening. The benefits which they gain from doing so and the constraints they face in successful income generation will help to draw out the potential role of fattening in achieving beneficial income generation and identify the kind of interventions needed to support this. Total household income used in this analysis was the sum of total farm income, non-farm and off-farm income generated by farm household in the year.

The result presented in Table 7 above shows significant difference in their farm and off-farm income. The survey results showed that mean difference between participant households in cattle fattening and non-participants were found to be significant at 10 and 1 percent significant level based on the respondents' farm and off-farm income, respectively.

Participation in cattle fattening and best practice in the study area

Information documentation and sharing experiences among the stakeholders would be an effective strategy. Farmers demonstrate the best technique to farmers in other areas. Farmers should share information on this best practice. Farmers in the same area with a given resource may practice differently in different areas because of the lack of information and other technical support.

In the study area, cattle fattening was found to be one of the household income diversification strategies

Table 8
Description of Fattening Experience and Average Fattening Month

Variable	Obser.	Mean	SD	Min	Max
Fattening Experience	70	6.37	2.54337	1	14
Average fattening month	70	3.51	1.05971	2	7

Table 9
Description of Cattle Fattening Opportunity in the Study Area

Fattening opportunity	Frequency	Percent	Cumulative percent
Non-participants with no response	54	43.5	43.5
Access to Road	21	16.9	60.5
Higher demand for cattle	24	19.4	79.8
Presence of Somalia traders	17	13.7	93.5
Access to Market	1	0.8	94.4
Other opportunity	7	5.6	100
Total	124	100	

that was used to minimize the drought risk that leads to farm income lose in the area. Farmers in the area use different techniques to reduce fattening duration and increase benefit that obtained from sold fattened cattle. This practice varies from farmers to farmers depending on the capacity and skill of the farmers. Some farmers start fattening in the rainy seasons when animal feed like grass and shrubs are adequate in the area. Similarly, other groups of the farmers start fattening when their plot maize starts to be rape as to increase body of cattle then reduce fattening duration. Other groups of the farmers use industrial by-products as main feed and mix other supplementary feed that accelerate fattening. These supplementary feeds are mixed from sugar, fenugreek seed, maize powder, sorghum powder and other left of their own food after meal. Best practice on what they feed, how they feed and cattle management practice for fattening cattle was observed by other farmers as best practice.

Regarding why farmers select cattle fattening, respondents replied that 71.4 % of cattle fattening participants replied that they select fattening due to its higher profit while 25.7 % of participants have chosen for its short term income generation. Similarly, around 2.8 percent of the participant farmers have selected cattle fattening for its simplicity of management. On the other hand, participant farmers were using different sources of cattle fattening information. Around 51.4% of the participants replied that they obtain mostly cattle fattening information from other farmers as the sources of information while 34.3% used their neighbors as the source of fattening information. Other farmers replied as they used district information while 12.9 % of the participants replied as they used extension workers information as main sources.

In the study area, the average cattle fattening experience of participant farmer was found to be around 6 years which ranges from 1 year to 14 years. Similarly, the average cattle fattening duration of participant farmer was found to be around 3.5 months which ranges from 2 months to 7 months.

Cattle production and fattening can significantly benefit the farmers of the Eastern Hararghe Zone in general and Fadis district in particular. Availability of the best fattening competition among the farmers, suitable fattening weather and good indigenous knowledge of fattening, higher demand for their cattle or popularity of fattened Harar bull in the country were an opportunity for cattle fattening in the study area. Farmers in the area were also participating in cattle fattening due to the presence of Somalia traders in the area and road facility to transport cattle in all direction. Farmers using improved cattle management and fattening practices in reducing fattening duration because they were believed that this improved cattle management will improve their efficiency and increased their income generating opportunity in the study area.

Table 10
Market Constraints for Cattle Fattening Participants in the Study Area

Market constraints	Frequency	Percent	Cumulative percent
Lack of good market	7	10	10
Low price for Cattle	36	51.43	61.43
Lack of Market Information	11	15.71	77.14
Broker problem	16	22.86	100
Total	70	100	

Table 11
When Cattle Fattening Participants Sell Their Cattle

Time of cattle sale	Frequency	Percent	Cumulative percent
At fixed month(Eid - Adeha)	10	14.29	14.29
When fatten observed	12	17.14	31.43
Depend on price rise	44	62.86	94.29
As soon as money required	4	5.71	100
Total	70	100	

The descriptive results presented in Table 10 above revealed that, out of total participant of cattle fattening practice, sample respondents that replied lack of good market as main cattle fattening constraints account for 10%while other groups account for 51.43%, 15.71% and 22.86% as low price for cattle, lack of market information and broker problem as main constraints of cattle fattening in the study area, respectively.

Regarding when participants sell their cattle, the participants sell their cattle at different times for various reasons. The descriptive results presented in Table 11 above revealed that, out of the total participant of cattle fattening practice, sample respondents that replied they sell their cattle at fixed month of Eidul-Arefa (when a large number of cattle are slaughtered by Muslim community both in the country and Somali area) account for 14.29% while other groups account for 17.14%, 62.86 % and 5.71% that sell when fatten observed, depend on price rise andsell as soon as money required, respectively for time of selling cattle in the study area.

Results of econometric analysis for factor affecting participation in cattle fattening

Before proceeding to analyze factors affecting small-holder cattle fattening, Variance Inflation Factor (VIF) was applied to test for the presence of strong multicollinearity problem among the explanatory variables. There was no explanatory variable dropped from the estimated model since no serious problem of multicollinearity was detected from the VIF results. Similarly, heteroscedasticity was tested by using Breusch-Pagen test. This test resulted in rejection of the existence of heteroscedasticity hypothesis as ($p= 0.346$) using STATA 11. The pseudo- R^2 indicates how well the regresses explain the participation probability. After matching there should be no systematic differences in the distribution of covariates between both groups and therefore, the pseudo- R^2 should be fairly low (Caliendo & Kopeinig, 2005).

It was found that participation in cattle fattening was significantly influenced by five explanatory variables. Age of household head, labor force in family member, size of livestock in tropical livestock unit, market information and access to agricultural extension service are significant variables which affect the participation of the household in cattle fattening practice. Age of household head shows negative relation with participation in small scale cattle fattening practice. This implies that an increase in age of household head tends to decrease participation in cattle fattening practice. This is possible because older farmers have not been capable to manage cattle for fattening and resist to expenses for cattle. They lack the use of best practice and better planning than the younger ones. As the age of household head increases the probability

Table 12
Logistic Regression Results for Factor Affecting Participation in Cattle Fattening

Variable	Coef.	Odds Ratio	Std. Err	Z
Age of HH	-0.068	0.93	0.025	-2.7***
Sex of HH	-0.094	0.91	0.626	-0.15
Education of HH	0.125	1.13	0.122	1.03
MrketDistance	-0.026	0.97	0.092	-0.28
Family Size	-0.076	0.93	0.142	-0.53
Labor Force	0.731	2.08	0.255	2.87***
Farm Size	0.410	1.51	0.416	0.99
Livestock(TLU)	0.395	1.48	0.206	1.92*
Market Information	1.537	4.65	0.533	2.89***
Access Extension	1.089	2.97	0.509	2.14**
Qtty Produced	0.002	1.00	0.042	0.04
Food Shortage Month	-0.058	0.94	0.159	-0.37
_cons	-1.593		1.712	-0.93

Number of obser	= 124	LR $Ch^2(12)$ = 49.35	
Pseudo-R^2	= 0.291	Prob> Ch^2 = 000	
Log likelihood	= -60.2398		

***, ** and * means significant at the 1%, 5% and 10 % probability levels, respectively

of household participation in cattle fattening practice decreases. The interpretation of the odds ratio also implies that if other factors are held constant, the odds ratio in favor of participation in cattle fattening practice decrease by a factor of 0.93 as the age of the household head increases by one year (Table 12).

In Ethiopia, as in most of other developing countries, labor is one of the most extensively used inputs of agricultural production. These are household members found between age of 15 and 64. Furthermore; family is the major and sole source of agricultural labor. Households with large number of economically active members have more number of agricultural labors and hence, have more agricultural production and more income provided that there is sufficient land to employ the existing labor. Cattle fattening requires a large number of labor force in rural areas. Households that have a larger number of working group members were more likely to be included in small-scale cattle fattening practice in the study area. As it is reveled from estimation of the logit regression analysis indicates that, participation in cattle fattening has a positive and statistically significant association with the use of higher labor, most likely due to the higher level of labor requirement during management and feeding activities involved in the cattle fattening. The interpretation of the odds ratio also implies that if other factors are held constant, the odds ratio in favor of participating in cattle fattening increases by factor of 2.08 as the number of working family member increases

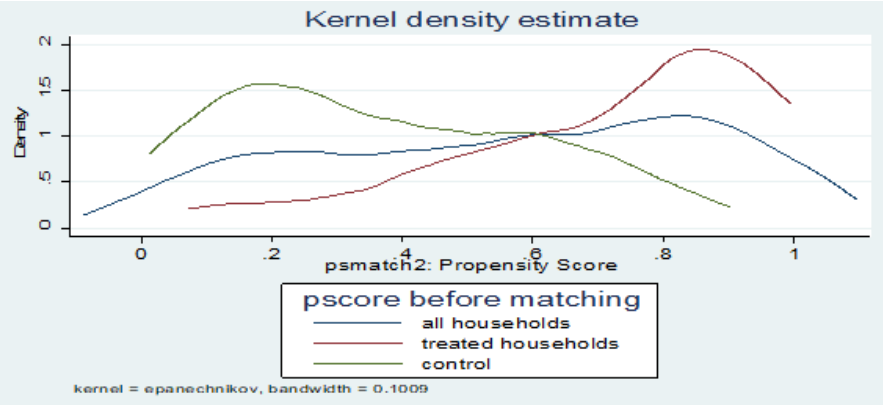

Figure 1. Kernel density of propensity score distribution

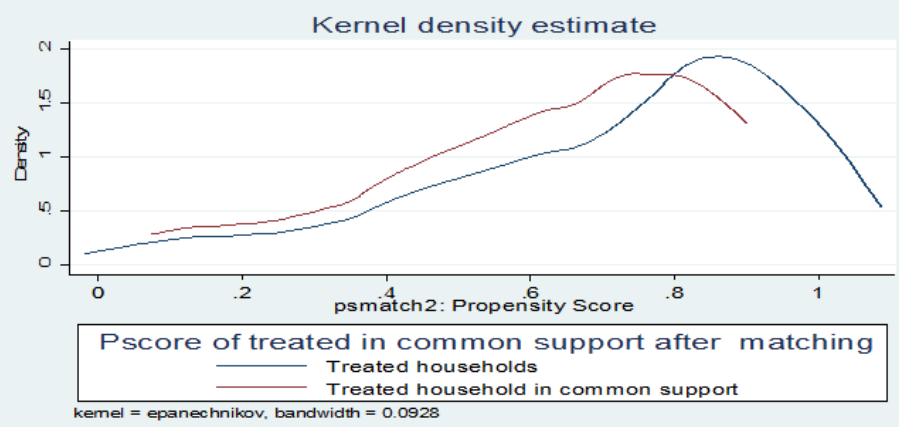

Figure 2. Kernel density of propensity scores of participant households

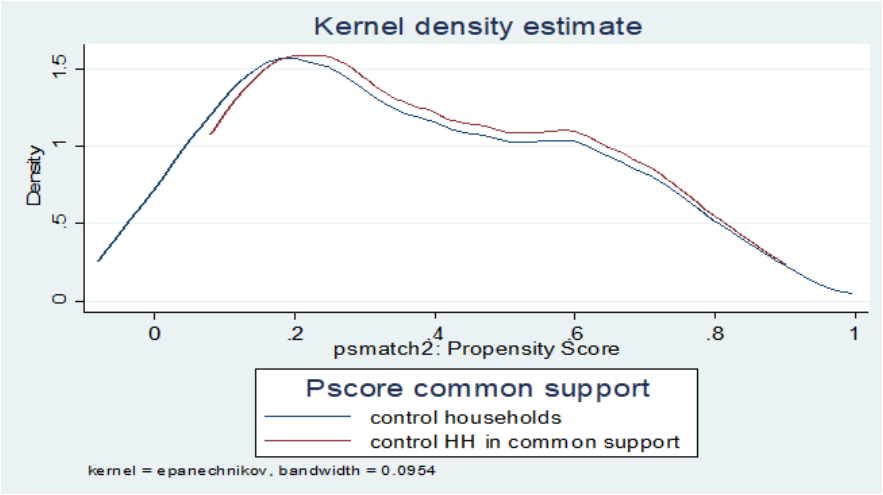

Figure 3. Kernel density of propensity scores of non-participant households

by one person.

Households who have a larger number of livestock in tropical livestock unit were more likely to be included in the small scale-cattle fattening. This variable was found to influence participation of household in cattle fattening positively and significantly. The implication of the result was that livestock are an important source of cash in rural areas to allow purchase of important feed, medicine and other management that can be used to reduce the duration of cattle fattening. Farmers who have a large number of livestock might consider their asset base as a mechanism of insuring any risk associated with cattle fattening practice. Given this potential contribution of livestock to sustainable household farm input supply and cash generation, they encourage adoption of best practice in cattle fattening. The odds ratio of 1.48 implies that, other things kept constant, the odds ratio in favor of participation in cattle fattening increases by a factor of 1.48 for each increase in livestock in TLU (Table 12). This implies that livestock holding has an influence on the adoption of best fattening practice in different areas.

Market information is a dummy variable taking 1 if the respondents had access to market information and zero otherwise. It is hypothesized that updated market information is positively related to participation in cattle fattening practice (Table 12). Access to market information was found to influence participation of household in cattle fattening positively and significantly at 1 percent probability level. Keeping other things constant, the odds ratio in favor of participation in cattle fattening increases by a factor of 4.65 as a household has access to market information service in the study area.

Access extension service is a dummy independent variable taking the value 1 if a household

had access to extension services and 0 otherwise. It is expected that farm extension service widens household knowledge with regard to the use of the best farm technology that enhances household income generation activity. Access to extension services on cattle fattening such as feeding system, cattle management and other best practice in cattle fattening received by households positively and significantly affected participation in cattle fattening at less than 5 percent probability level. Holding other things constant, the odds ratio in favor of participation in cattle fattening increases by a factor of 2.97 as a household has access to extension service.

Impact Estimation

Results of propensity scores matching

The logistic regression model was used to estimate propensity score matching for participant and non-participants households in cattle fattening. The dependent variable in this model is a binary variable indicating whether the household was a participant in cattle fattening or not. The model was estimated with STATA 11.2 computing software using the propensity scores matching algorithm developed by Leuven and Sianesi (2003). Results presented in Table 12 above shows the estimated model appears to perform well for the intended matching exercise. The pseudo-R^2 value is 0.291. A low pseudo-R^2 value shows that participant households do not have much distinct characteristics overall and as such finding a good match between participants and non-treated households becomes simple.

Figure 1 portrays the distribution of the household with respect to the estimated propensity scores. In case of participant households, most of them are found in the right starting from the middle of the distributed propensity. On the other hand, most of the control or non-participants of cattle fattening households are partly found in the center and with the most part of distribution found in the left side.

Matching participant and non-participant households

Table 14
Balancing Test for Covariate for Matched and Unmatched Group

Variables	Samples	Mean		% reduce		t-test	
		Treated	Control	%bias	/bias/	t	p>/t/
_pscore	Unmatched	0.7157	0.36854	145.7		8.03	0
	Matched	0.6302	0.58629	18.4	87.4	1.02	0.311
Age of HH	Unmatched	37.329	41.481	-40.9		-2.25	0.026
	Matched	38.137	37.992	1.4	96.5	0.07	0.943
Sex of HH	Unmatched	0.85714	0.77778	20.5		1.14	0.255
	Matched	0.82353	0.84865	-6.5	68.3	-0.34	0.735
Eductn of HH	Unmatched	2.6143	1.6852	43		2.31	0.022
	Matched	2.3333	2.4946	-7.5	82.6	-0.37	0.713
MrketDistnce	Unmatched	6.9857	6.9444	1.6		0.09	0.93
	Matched	7.0588	7.1971	-5.3	-235.2	-0.24	0.808
Farm Size	Unmatched	1.131	0.90509	37.5		2.06	0.042
	Matched	1.0602	0.99154	11.4	69.6	0.57	0.573
Livestock(TLU)	Unmatched	2.1708	1.5263	52.9		2.92	0.004
	Matched	1.9693	1.9121	4.7	91.1	0.24	0.811
MrketInformtn	Unmatched	0.85714	0.5	82		4.64	0
	Matched	0.80392	0.76536	8.9	89.2	0.47	0.64
Access Extentn	Unmatched	0.8	0.59259	45.9		2.57	0.011
	Matched	0.7451	0.68391	13.5	70.5	0.68	0.499
Foodshortage month	Unmatched	5.0286	5.3148	-19.1		-1.07	0.288
	Matched	5.0784	4.9978	5.4	71.8	0.27	0.79
Family Size	Unmatched	5.9429	5.5	20.3		1.13	0.262
	Matched	5.8039	5.6709	6.1	70	0.31	0.76
Labor Force	Unmatched	3.5	2.7963	52.6		2.88	0.005
	Matched	3.0392	2.8991	10.5	80.1	0.61	0.5

Table 15
Chi-square Test for the Joint Significance of Variables

Sample	Pseudo-R^2	LR chi^2	p>chi^2
Unmatched	0.291	49.48	0
Matched	0.021	2.94	0.996

Three main tasks were accomplished before matching. First, predicted values of treatment participation (propensity scores) estimated for all participated households and non-participants. Second, a common support condition was imposed on the propensity score distributions of participant household in cattle fattening and non-participant household. Third, discard observations whose predicted propensity scores fall outside the range of the common support region.

Imposing a common support condition ensures that any combination of characteristics observed in the participant group can also be observed among the non-participant group (Bryson et al., 2002). The common support region is the area which contains the minimum and maximum propensity scores of participants or treated and control households, respectively. It requires deleting of all observations whose propensity scores is smaller than the minimum and larger than the maximum of participant and non-participant group, respectively (Caliendo&Kopeinig, 2005). For this study, the common support region would lie between0.0741972 and 0.8992712. In other words, households whose estimated propensity score is less than 0.0741972 and larger than 0.8992712 are not considered for the matching exercise. As a result of this restriction, 22 households (19 participant and 3 non-participant households) were discarded.

Balancing test is a test conducted to know whether there is statistically significant difference in mean value of the two groups of the respondents and preferred when there is no significant difference after matched.

Accordingly, matching estimators were evaluated via matching the participant and non-participant households in common support region. Therefore, a matching estimator having balanced or insignificant mean differences in all explanatory variables, bears a low pseudo- R^2 value and also the one that results in large matched sample size is preferred for matching exercise. In line with the above indicators of matching quality, kernel matching with 0.25 band width is resulted in relatively low pseudo-R^2 with best balancing test (all explanatory variables insignificant) and large matched sample size as compared to other alternative matching estimators indicated in Table 13. Then it was selected as a best fit matching estimator.

Testing the balance of propensity score and covariates

After choosing the best performing matching algorithm the next step is to check the balancing of propensity score and covariate using different procedures by applying the selected matching algorithm (in our case kernel matching). As indicated earlier, the main purpose of the propensity score estimation is not to obtain a precise prediction of selection into treatment or to participation, but rather to balance the distributions of relevant variables in both groups. The mean standardized bias before and after matching are shown in the fifth columns of Table 14, while column six reports the total bias reduction obtained by the matching procedure. In the present matching models, the standardized difference in covariate before matching is in the range of 1.6% and 82% in absolute value. After matching, the remaining standardized difference of covariate for almost all covariates lies between 1.4% and 13.5% which is below the critical level of 20% suggested by Rosenbaum and Rubin (1985). In all cases, it is evident that sample differences in the unmatched data significantly exceed those in the samples of matched cases. The process of matching thus creates a high degree of covariate balance between the participant and non-participant samples that are ready to use in the estimation procedure.

Similarly, t-values in Tables 14 shows that, before matching more than half of the chosen variables exhibited statistically significant differences while after matching all of the covariates

Table 16
Average Treatment Effect on Treated (ATT)

Variable	Sample	Treated	Controls	Difference	S.E.	t-stat
Total Farm Income	Unmatched	34257.86	17110.7	17147.12	2449.16	7
	ATT	32615.69	18544.7	14071.01	2702.58	5.2***
Total Hh Income	Unmatched	35684.9	20043.7	15641.15	2587.2	6.05
	ATT	34061.6	21444.2	12617.40	2949.8	4.28

were balanced and become statistically insignificant.

The low pseudo-R^2 and the insignificant likelihood ratio tests support the hypothesis that both groups have the same distribution in covariates after matching (see Table 15). These results clearly show that the matching procedure is able to balance the characteristics in the participant and the matched non-participant groups. We, therefore, used these results to evaluate the impact of cattle fattening on outcome variables among groups of households having similar observed characteristics. This allows comparing observed outcomes for participants with those of comparison groups sharing a common support.

Sianesi (2004) suggests re-estimating the propensity score on the matched sample, i.e. only on participants and matched non-participants, then comparing the pseudo-R^2 before and after matching is important. The pseudo-R^2 indicates how well the regressors explain the participation probability. After matching there should be no systematic differences in the distribution of covariates between both groups and therefore the pseudo-R^2 should be fairly low. The low pseudo-R^2 (compared with other pseudo-R^2 resulted using different matching estimators) and the insignificant likelihood ratio tests (indicated by the higher p-value after matching) support the hypothesis that both groups have the same distribution in covariates after matching. All of the above tests suggest that the matching algorithms that have chosen were relatively best with the data we have at hand. Thus, we can proceed to estimate ATT for households.

Estimating treatment effect on treated (ATT)

How additional income gained from cattle fattening is used depends on household priorities. For those earning small amounts of income only, meeting basic household needs for food and other expenses such as healthcare is usually the priority. With a little more income, households often make improvements in their standard of living by upgrading their dwelling in quality or size (e.g. constructing a new roof or adding a second building for son marriage), buying more and better quality food. All of these investments are likely to improve the overall health and welfare of the household. Households may also invest in livestock as a key asset for further insurance and income-generation. Another priority is often children's education.

In order to solve the second objective, the following impact indicators of the treatment effect have been performed using propensity score matching model. In this section, the PSM results provides evidence as to whether or not the cattle fattening practice has brought significant changes on households' total farm income and total household income (farm, off-farm and non-farm income) of households in Ethiopian Birr. The estimation result presented in Table 16 provides a supportive evidence of statistically significant effect of the cattle on household total farm income and Total household income (Farm, off-farm and non-farm income) in ETB.

After controlling for pre-participation differences in demographic, location and asset endowment characteristics of the participants in cattle fattening and non-participants in cattle fattening households it has been found that, on average, the participant households' have increased total farm income by 14071 ETB than that of non-participant households in cattle fattening. Similarly, the participant households' have increased total household income(farm, non-farm and off-farm income) of participating households by 12671.4 ETB than that of non-participant households in cattle fattening. This difference between farm income and total household income shows that non-farm and off-farm income generating activities area not equality

undertaken by treated group and control group of the respondents. Main source of non-farm income activities include petty trading in the village, salary, chat trading, groundnut trading, shopping and black smith were some the activities replied by sampled respondents.

Sensitivity analysis

Rosenbaum (2002) proposes using Rosenbaum bounding approach in order to check the sensitivity of the estimated average treatment effect on treated ATT. The basic question to be answered here is whether inference about treatment effects may be altered by unobserved factors. In order to control for unobservable biases shows the result of sensitivity of cattle fattening impacts on different income as outcome variables. Depending on Rosenbaum bounds it was calculated for cattle fattening impacts that are positive and significantly different from zero. The result shows those outcome variables which bear statistical difference between participant and non-participant households in this impact estimation. Results show that the inference for the effect of the fattening is not changing though the participants and non participant households has been allowed to differ in their odds of being treated up to (e γ = 3) in terms of unobserved covariates as shown by significant outcome variables with p-critical values (or the upper bound of Wilcoxon signify level - Sig+) at different critical value revealed. That means for all outcome variables estimated, at various level of critical value of e γ, the p- critical values are significant which further indicate that we have considered important covariates that affected both participation and outcome variables. We couldn't get the critical value e γ where the estimated ATT is questioned even if we have set largely up to 3, which larger value compared to the value is set in different literatures. Thus, we can conclude that our impact estimates (ATT) are insensitive to unobserved selection bias and are a pure effect of cattle fattening in the study area.

CONCLUSIONS AND RECOMMENDATIONS

To expand improved cattle fattening and marketing systems, it is very important to identify the existing cattle fattening practices and marketing systems in the study area. Based on the empirical findings reported in this paper, the following conclusion and recommendations are forwarded: The main objectives of this study are to analyze factors affecting participation in cattle fattening and its impacts on household income generation in Fadis District of Eastern Hararghe Zone. Both primary and secondary data were collected for the study. The data were collected by means of a semi-structured questionnaire from 124 sample respondents during the period of April 20-May 20/2017.The main research question of the study was "what would have been to the total household income and farm income if cattle fattening was not in place?" Hence, this study applies a propensity score matching technique, which is a widely applied impact evaluation instrument in the absence of baseline survey data for impact evaluation. Answering this question requires observing outcomes of participant after and before participation for the household. Beside PSM, logistic model was used to analyze the factors affecting participation in cattle fattening in the study area. The study implemented binary logit regression model to analyse factors affecting participation in cattle fattening. Binary logit regression estimation also revealed that participation in cattle fattening practice is significantly influenced by five explanatory variables. Age of household head, labor force in family member, number of livestock in tropical livestock unit, market information and access to agricultural extension service are significant variables which affect the participation of the household in cattle fattening practice.

For this study, the common support region would lie between 0.0741972 and 0.8992712. In other words, households whose estimated propensity score is less than 0.0741972 and larger than 0.8992712 are not considered for the matching exercise. As a result of this restriction, 22 households (19 participant and 3 non-participant households) were discarded. In doing so, propensity score matching has resulted in 51 participant households to be matched with 51 non-participant respondents after discarding households whose values were out of common support region. In other words, matched com-

parisons of different outcome of interest were performed on these respondents who shared similar pre-participation characteristics except the treatment participation effect. The resulting matches passed on many process of matching quality tests such as t-test, reduction in standard bias and chi-square test.

Propensity score matching method was applied to analyze the impact of the small-holders' cattle fattening on total household income and farm income obtained from only farm activities. In matching processes, kernel matching with 0.25 band width is resulted in relatively low pseudo-R2 with best balancing test was found to be the best matching algorithm. This method was checked for covariate balancing with a standardized bias, t-test, and joint significance level tests. Propensity score matching method results also revealed that household participated in cattle fattening practice have increased total farm income by 14071 ETB than that of non-participant households in cattle fattening. Similarly, the participant households' have increased total household income(farm, non-farm and off-farm income) of participating households by 12671.4 ETB than that of non-participant households in cattle fattening. The average treatment effect on treated was found to be significant at less than 1% of significant level. The impact estimation results then indicate that there are significant differences in participants in cattle fattening and comparison households, which could be attributable to the participation in cattle fattening.

The number of economically active members in the family was found to be positive and significant at 1% significant level with participation in cattle fattening practice. The model result also revealed that all other things being kept constant, the odds ratio in favor participation in cattle fattening practice increases by a factor of 2.08 as the number of economically active member of the farm family increase by one person. In the farm community cattle fattening activity requires adequate number of labor force in rural area. The results of logit models shows a positive and statistically significant relationship between cattle fattening and use of higher labor, most likely due to the higher level of labor requirement during cattle fattening management activities involved.

Households' who have a larger number of livestock in tropical livestock unit and numbers of oxen were more likely to participate in the cattle fattening. This variable was found to influence the cattle fattening practice positively and significant at 10 percent significance level. The result show that all other things being kept constant, the odds ratio in favor of participating in cattle fattening practice increases by a factor of 1.48 as the number of livestock increase by one in tropical livestock unit. The implication of the result was that livestock are an important source of cash in rural areas to allow purchase all feed that required for cattle fattening and reducing fattening duration. Farmers who have a large number of livestock might consider their asset base as a mechanism of controlling any risk associated with cattle fattening and managing. Given this potential contribution of livestock and oxen to cattle fattening, it encourages food security and household income generation. Therefore, it is concluded that cattle fattening should be facilitated by government and non-government organizations. That means development partner should focus on strengthening capacity of household through providing credit facility in the direction of asset building like livestock purchase thought revolve funding system.

It is expected that farm extension service widens household knowledge with regard to the use of the improved agricultural technology. Agricultural extension services are expected to enhance households' skills and knowledge, link households with technology and markets. Access to extension services such as information, training, field days, field visits and field tours received by households positively and significantly affected participation in cattle fattening. This implies farmers that have access to extension service may analyze cattle price information and sell their cattle at appropriate market price.

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