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Impact of Conditional Cash Transfer Program on Household Welfare in Southern Ethiopia: A matching estimator approach

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Abstract

Cash transfers (CTs) are now high on the agenda of most governments in low- and middle-income countries. Chronic food insecurity is one of the problems that has plagued millions of Ethiopians for centuries. This study evaluated the impact of participation in the conditional cash transfer (CCT) component of the PSNP (Public Works or PW) on household welfare in Karat Zuria District, Konso Zone, Southern Ethiopia. The cross-sectional survey data was gathered from 244 sample households, which were taken from beneficiary and control groups by using a multistage sampling procedure. Propensity score matching (PSM) was used to evaluate the program's impact on livestock holdings and total income. The result obtained from logit regression indicated that participation in a conditional cash transfer program was negatively influenced by access to credit and cultivated land size, whereas it was positively influenced by shock experience and an iron-roofed house. The econometrics model result shows that, as compared to control households, the program intervention increased the beneficiary households' livestock holding (measured in TLU) by 24.8 percent (0.53 TLU) and total income by 33 percent (1705.095 ETB), respectively. This study demonstrated how the program had a considerable impact on household livestock holdings and total income.

Keywords: Conditional Cash Transfer Program; Household; Food Security; Propensity Score Matching, logit regression, Karat Zuria District

1. Introduction

Conditional cash transfer programs (CCT) have been implemented throughout the world in different geographical areas (Handa et al., 2022). In developing countries, CCT has been put in place to reduce poverty and inequality among poor households with conditions to be adhered to (Rukiko et al., 2023; Bastagli et al., 2016). A major goal of CCT—when beneficiaries comply with the conditions, whether for their own benefits or for their environment. This ensures sustainability of the program (Alvarado et al., 2021; Rukiko et al., 2022; Zhang et al., 2022).

The rural PSNP is the Ethiopian flagship and poverty-targeted social protection programme, was launched in 2005 with the aim of building resilience to shocks and improve food security among beneficiary households and communities (Phases 1 through 4) and to reduce extreme poverty and vulnerability to extreme poverty (Phase 5) (MoA, 2020). The programme has two components: The Public Works (PW) and Permanent Direct Support (PDS). The PW component helps to mitigate food insecurity risks by providing employment opportunities in various public development works to the households with able-bodied members. It is the conditional cash transfer (CCT) component of the PSNP whereby households receive payments for their labour contributions in public work activities. In contrast, the PDS is a unconditional cash transfer (UCT) for the labour-poor households such as the elderly, people with disabilities and chronic illness, and orphaned children. The PSNP (PW and PDS combined) enrolls about 8% Ethiopia's population (AfDB, 2020).

In response to the chronic food insecurity problem, the Government of Ethiopia has introduced different food security programs (FSP). In the last fifth years. One of these programs is the Conditional cash transfer program (CCT) initiated in 2005 to reduce household vulnerability, improve community resilience to shock and stress, and break the cycle of dependence on food aid (MoARD, 2015).

According to the Karat Zuria District Office of Agricultural (KZDoA, 2022), the program has been implemented since 2005. Currently, there 4,769 CCT client's households in the district. However, despite the program operationalized for more than a decade and half in the area, there is limited empirical evidence on whether or not the program brings intended effect on the beneficiary households' livestock holding and total income, which are used in this study as indicators or outcomes of the conditional cash transfer program. Similarly, other studies addressed the impact of cash transfer in different part of the country (for instance, Tadele, 2011; Kassa, 2018; and Gizachew et al., 2017). Nevertheless, most of these studies evaluated the impact of CCT in terms of asset accumulation.

Hence, this study addresses the impact of the CCT on households' Livestock holding and income in the study area.

1.2 The objective of the Study

The general objective of the study was to evaluate the Impact of Conditional Cash Transfer Program on Household Welfare in Karat Zuria District, Konso Zone, Southern Ethiopia

Specific objectives of the study are:

1. To identify factors affecting participation in Conditional Cash Transfer Program; and
2. To evaluate the impact of the Conditional Cash Transfer Program on beneficiary households' Livestock holding and Income in the study area.

2. Methodology

2.1. Description of the Study Area

The administrative unit of the study area is located in the Southern Ethiopia. Karat Zuria Woreda/ District is one of the four Woredas in Konso Zone. It is located about 615 km from the capital city of Ethiopia, Addis Ababa and 215 km far from capital of Southern Ethiopia, waliyta Sodo at 5o10'–5o40' N latitude and 37o00'–37o40'E longitude. Geographically, Karat Zuria Woreda is located in South West part of the country and within the circle of rift valley. The total land area of the Woreda is 400 square km. The Woreda shares common boundary with Borena Zone of Oromia Region in the South, Alle Woreda and Weyito River in the West which separates it from the Debub Omo Zone, the Dirashe Woreda in the North, Amaro Woreda in the Northeast, and Burji Woreda in the East (Karat Zuria distric office of finance and economic development (KZDoFED, 2019).

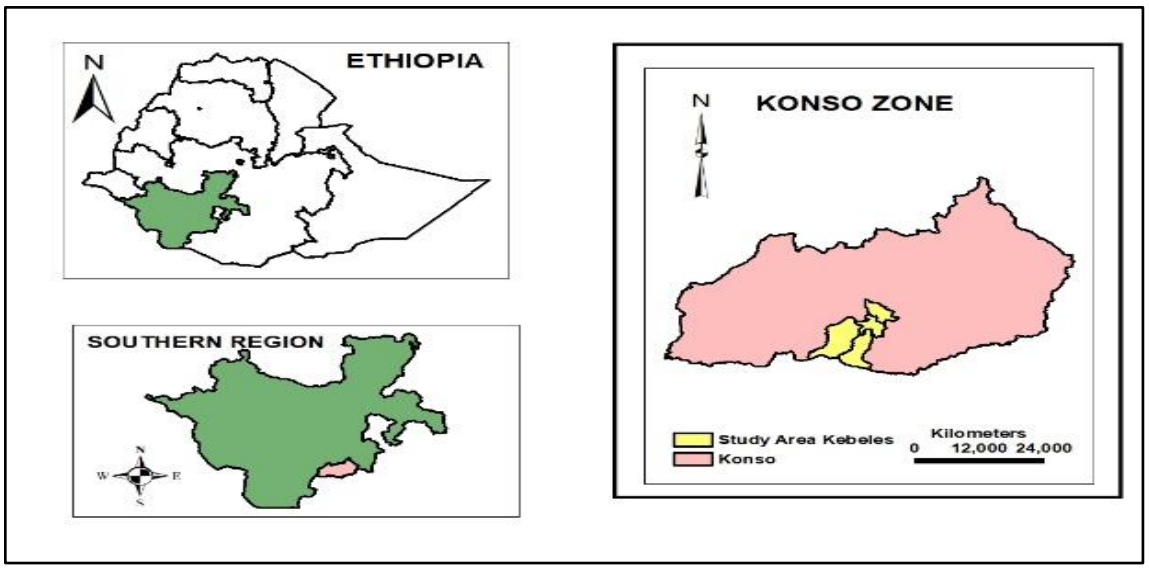


Figure 1: Map of the study area

2.2. Data Collection and Sampling Frame

Multi-stage sampling procedure was employed to collect primary data. In the first stage, out of 12 Kebeles, four

Kebeles selected randomly. In the second stage, households from each of the selected Kebeles categorized in to two strata. Stratum 1 represents households that are participating in the CCT and represents beneficiary groups. Stratum 2 refers to those households who are not selected in the program during community-based selection process and represents the controlled or non-beneficiary groups. In the last stage, based on the list of households of the four Kebeles, 244 representative sample households (120 from beneficiary and 124 non-beneficiary) selected by using simple random sampling (SRS) technique based on probability proportional to size (PPS).
To determine the sample size the formula given by Kothari (2004) was used as follows;

$$n = \frac{Z^2 pqN}{e^2(N-1) + Z^2 pq}$$

Where, Z is the 95% confidence level under the normal curve (1.96), e is the acceptable error term (0.05), but for these study error term adjusted to six percent to collect cost effective representative sample size. N is the total population (25,200 HHs) and p and q are the proportion of the population participating in CCT and non- CCT respectively with approximately 50 percent probability each.

2.3. Econometric Model Specification

This study used Propensity score matching (PSM), which is rigorous impact evaluation methods commonly used by researchers as it considers the issue of the counterfactual (What would have happened to those who had benefited from CCT had they not been benefited from the program?) and overcomes the selection bias and contamination problems (White et al., 1999). The PSM method creates the potential to identify impacts of the CCT treatment by comparing changes in an outcome of interest (say, Livestock holding (in TLU and income) between the follow-on and base years for (1) Group "a" households, which received the treatment, and (2) Group "b" matches, which are otherwise similar (based on propensity scores) but did not get the treatment.
The first step in the PSM is propensity score estimation. Any binary choice model can estimate PSM. For this study, logit model is used. Using a composite of the pre-intervention characteristics of the sample households (Rosenbaum and Robin, 1983). In estimating the model, the dependent variable is participation in CCT, which takes the value of 1 if a household participated in the PSNP and 0 otherwise.
The second step in PSM is choosing the appropriate matching estimator. For this study popularly used matching estimators such as nearest neighbor matching (NNM), caliper matching (CM), and kernel matching was employed. But the choose of the best matching algorism was made based on the criteria used by different scholars; large number of the insignificant variable after matching, large number of matched sample size, low pseudo R2 after matching, and low standard mean bias.
Third step in PSM is imposing the common support conditions, which ensures that any combination of characteristics observed in the treatment group can also observed among the control groups (Bryson et al., 2002; Cameron and Trivedi, 2005). One common support condition is fulfilled; the next step is checking the balancing test of the propensity score and covariates using different procedure by applying the selected matching algorithm. Finlay sensitivity analysis was conducted to checks the effect of unobserved variable.

3. Result and Discussions

3.1. Factors affecting participation in the Productive safety net program

The first step in the PSM is to run the logit/Probit model. For this study, binary logistic regression model was used to identify factors affecting participation in CCT.
Table 1 presents the logit estimation results on factors affecting participation in the CCT. The likelihood ratio chi-square of 43.48 with p-value of 0.000 tells us that the model as a whole is statistically significant and the logit regression coefficients give the change in the Z score or logit index for a one-unit change in the predictor.
The result further reveals that covariate variables such as access to credit service, cultivated land size, Housing type and shock experience statistically and significant affect the probability of the household's participation in the CCT. As hypothesized, credit service and cultivated land size significantly and negatively affect participation in the CCT while shock experience and iron housing type affect participation in CCT positively and significantly. The explanations for significant variables are as follows.

Table 1: Logit model result of household program participation

Covariates		Coefficients	Std. Err	ME (dy/dx)	Z- value
Sex of HH head		.0694378	.3873686	.0173443	0.18
Marital status of HH		.2518076	.2923056	.0629293	0.86
Family size		.0319084	.0589212	.0079742	0.54
Age of HH head		.0197116	.0252154	.0049261	0.78
Education status		-.1126763	.3042811	.0049261	-0.37
Non-farm income		-.0000651	.0001447	-.0000163	-0.45
Agricultural extension		.4595633	.2789701	.1143619	1.65
Credit service		-.5605811 **	.2822106	-.1392338	-1.99
Cultivated land size		-.4725766 **	.2180061	-.1181017	-2.17
Housing type		.6692604***	.2816488	.1657418	2.38
Irrigation access		-.2108094	.297124	-.0526111	-0.71
Distance to the market		-.0329071	.0429727	.0082238	-0.77
Shock experience		.5410368 **	.2786489	.1343299	1.94
Constant		-1.026768	1.18196		-0.87
Logistic regression	Sample size		= 244	Prob>chi2	= 0.0113
	LR chi2(13)		= 27.30	Pseudo R^2	= 0.0807
Log likelihood =	-155.4449				

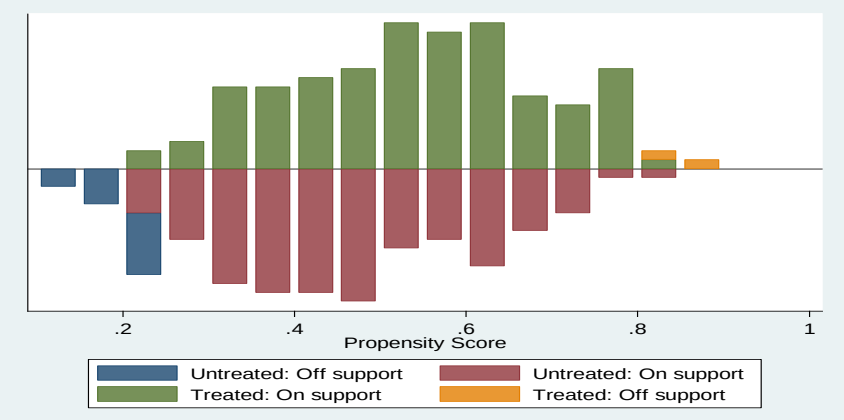
Source: Own computation results (2023)
Note: *** and ** indicate significance at the 1% and 5% probability levels.

3.2. Imposing the common support region

The common support assumptions imply that the probability of receiving treatment for each possible value of the vector X is strictly within the unit interval. Table 1 indicates the estimated propensity scores of program beneficiaries and non – beneficiaries. Accordingly, the result shows estimated propensity scores vary between .218813 and .8524438 (mean=.5453115) for intervention households and between .1375812 and .819765 (mean = .4400211) for non-intervention households. The common support would then lay between .218813 and .819765 .In other words, households whose estimated propensity scores are less than .218813 and greater than .819765 not considered for matching exercise. Because of this restriction, 15 households (13 control and 2 treated households) discarded from the analysis. Moreover, this study applied a visual analysis of the density distribution of the propensity score in the two groups (treated and control groups) to check overlap and common support before matching samples.

Table 2: Estimated propensity score distribution

Household	Observation	Mean	Std. dev	Minimum	Maximum
Total household	244	.4918033	.1637792	.1375812	.8524438
Treatment households	120	.5453115	.1503805	.218813	.8524438
Control households	124	.4400211	.1600551	.1375812	.819765



Source: own computation result (2023)
Figure 2: histogram of the propensity score estimation distribution for the treatment and control groups of CCT.

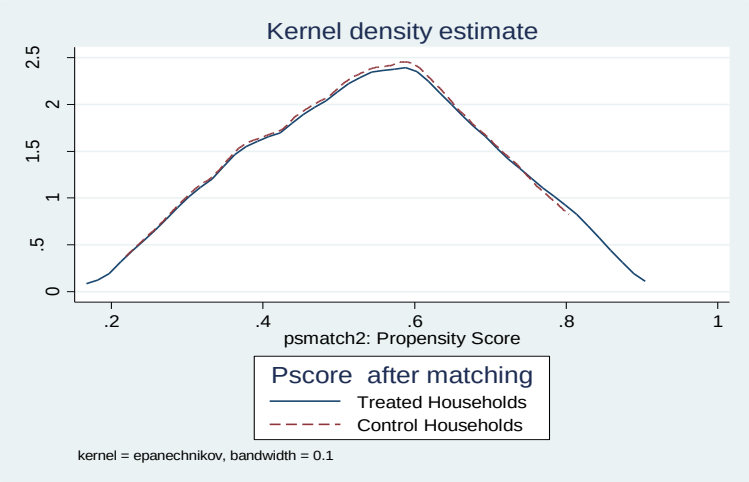


Figure 2: Show kernel density propensity score of treated households in common support after matching

3.3. Choosing a matching estimator

Despite the existence of plenty of methods, this study employed the three PSM estimators based on authors such as (Deheija and Wahba, 2002; Caliendo and Sabir, 2008). Matching estimators like nearest neighbor matching, radius matching, and kernel-based matching algorisms were used. Table 3 shows the estimated results of tests of matching quality based on the four performance criteria such as balancing test, Pseudo R2, matched sample size, Mean SB. When the result was observed, it has been found that kernel matching with a band width of 0.1 is the best estimator for the data at hand. As such, the estimation results and discussion was the direct outcomes of the kernel matching algorithm. Kernel matching associates the outcome of the treated household with the matched outcome that is given by a kernel-weighted average of all control groups improvement in household's livestock holding (in TLU) and total income. Since, the weighted average, which matches a treated groups to all control groups weighted in proportion to the closeness between the treated group and the control group are used to construct the counterfactual outcome.

Table 3: Comparison of the four matching estimators by performance criteria

	Performance criteria			
Matching estimators	balancing test*	Pseudo R^2	matched sample size	Mean SB
Nearest neighbor matching				
With replacement	11	0.042	229	9.2
Without replacement	11	0.051	229	15.7
Caliper matching				
0.1	11	0.042	229	9.2
0.25	11	0.042	229	9.2
0.5	11	0.042	229	9.2
0.8	11	0.042	229	9.2
Kernel matching				
Bandwidth 0.1	**13**	**0.006**	**229**	**3.1**
Bandwidth 0.25	13	0.013	229	5.8
Bandwidth 0.5	13	0.032	229	11.5
Bandwidth 0.8	11	0.042	229	13.3

Source: own computation result (2023)

3.4. Balance test for propensity score and covariates

Accordingly, the output of the (Table 4) shows two rows for each covariate variables unmatched represented by "U" and matched represented by "M", that is before matching and after matching mean for covariate, "% bias", % reduction in bias, and t-test for treatment and control group. The fifth and sixth columns of (Table 4) shows the mean standardized bias before and after matching and total bias reduction obtained by the matching procedures, respectively. The standardized difference in covariates before matching is in the range of 2.7 percent and 36.4 percent in absolute value. After matching, the remaining standardized difference of covariate for all covariates lies between 0.1 percent and 9.4 percent, which by far below critical level of 20 percent suggested by Rosenbaum and Rubin (1985). In all cases, it evident that sample differences in the unmatched data significantly exceed those of matched cases. Therefore, the process of matching thus creates a high degree of covariate balance between the treatment and control samples that are ready to use in the estimation procedure.

Moreover, t-value obtained in (Table 4) shows that before matching four covariates from the thirteen-exhibited statistically significant difference, whereas all of the covariates balanced after matching.

Table 4: Results of the Balancing Test of Covariates and Pscore Using the Kernel Matching Estimator

		Mean		Standardized bias		T-value	
Covariates	Sample	Treated	Control	%bias	%Reduction	T	P>|t|
Propensity	U	.54531	.44002	67.8		5.29	0.000
Score	M	.54022	.53342	4.4	93.5	0.36	0.716
HH head Sex	U	.74167	.76613	-5.7		-0.44	0.659
	M	.74576	.78558	-9.2	-62.8	-0.72	0.472
HH Marital status	U	1.225	1.1694	9.9		0.77	0.440
	M	1.2203	1.221	-0.1	98.8	-0.01	0.993
Family size	U	7.7833	7.7177	2.7		0.21	0.835
	M	7.8305	7.8986	-2.8	-3.9	-0.22	0.830
Age of HH head	U	39.125	38.403	12.3		0.96	0.339
	M	39.102	39.117	-0.3	97.9	-0.02	0.984
Education status	U	.55833	.62903	-14.4		-1.12	0.263
	M	.55085	.55369	-0.6	96.0	-0.04	0.965
Non-farm -	U	949.23	1091.1	-14.6		-1.14	0.256
Income	M	957.02	977.2	-2.1	85.8	-0.17	0.866
Agricultural-	U	.51667	.45161	13.0		1.01	0.311
Extension	M	.50847	.50694	0.3	97.6	0.02	0.981
Credit service	U	.48333	.62903	-29.5		-2.31	0.022
	M	.49153	.53791	-9.4	68.2	-0.71	0.478
Cultivated land	U	.84583	1.0565	-30.1		-2.34	0.020
Size	M	.86017	.83462	3.6	87.9	0.32	0.748
OIRONCHOME	U	.575	.39516	36.4		2.85	0.005
	M	.5678	.55985	1.6	95.6	0.12	0.903
Irrigation access	U	.36667	.45161	-17.3		-1.35	0.179
	M	.37288	.38675	-2.8	83.7	-0.22	0.827
Distance to the-	U	6.85	7.121	-8.2		-0.64	0.521
Market	M	6.8814	6.9429	-1.9	77.3	-0.14	0.888
Shock-	U	.6	.47581	25.0		1.95	0.052
Experience	M	.59322	.57314	4.0	83.8	0.31	0.756

Source: own computation result (2023)

Note: ***, ** and* means significant at 1%, 5% and 10% probability level, respectively; U-Unmatched, M-Matched, HH, TLU, stand for Household Head And tropical livestock unit.

Table 5: Chi-square test for the joint significance test of covariates

Sample	Pseudo R^2	Mean Bias	LR chi^2	P>chi^2
Unmatched	0.089	20.5	30.17	0.007
Matched	0.006	3.1	2.12	1.000

Source: own computation result (2023)

3.5. Estimating treatment effect on treated

The estimation result presented in (Table 6) provides the supportive evidence of statistically significant effect of the

program on the livestock holding (in TLU) and total income of the beneficiary households. After controlling for pre-intervention difference in the characteristics of the CCT beneficiary (treatment) and non-CCT beneficiary (control) households, it was found that, participation in CCT has increased the beneficiary households' livestock holding (measured in TLU) by 24.8 percent (0.53 TLU) and total income by 33 percent (1705.095 ETB), respectively. The results were consistent with the studies of (Bhalla et al., 2017; Kileo, 2019; Kronebusch and Damon, 2019; Resosudarmo et al., 2020) who concluded that conditional cash transfer improves food security in beneficiary households as the cash provided helps them to buy food for their households. In contrast, Tadele (2011) and Habtamu (2011) reported that PSNP which include both direct and public work had negative impact on the calorie intake of the beneficiary households.

Table 6: The result of average treatment effect on treated (ATT)

Outcome variables	Treated	Control	Difference	Std.err	T-value
Livestock holding (in TLU)	2.645110	2.120021	.5250888	.2769814	1.90*
Total Household income (in birr)	6852.385	5147.289	1705.095	672.3130	2.54***

Note: ***and* means significant at 1% and 10% probability level. Source: Own computation result (2023)

3.6. Sensitivity analysis

Table 7 and 8 below; provide the result of the sensitivity analysis of the significant outcome variable Livestock holding (in TLU) and total household income the result showed that the CCT estimators ATT are insensitive to the unobserved election bias and the pure effect of the Program participation on the outcomes variables.

Table 7: Sensitivity analysis of outcome variable (Livestock holding (in TLU)) after matching by Rosenbaum bound (rbound)

P-critical (the upper bound of wilcoxon significant level (Sig^+) at different critical value of Gamma(e^y)									
Outcome	ey=1	ey=1.25	Ey=1.5	Ey=1.75	Ey=2	Ey=2.25	Ey=2.5	Ey=2.75	Ey=3
Kcal/AE	P<0.00	0	0	0	0	0	0	2.2e-	16

Table 8: Sensitivity analysis of outcome variable (Total household income) after matching by Rosenbaum bound (rbound)

P-critical (the upper bound of wilcoxon significant level(Sig^+) at different critical value of Gamma(e^y)									
Outcome	ey=1	ey=1.25	Ey=1.5	Ey=1.75	Ey=2	Ey=2.25	Ey=2.5	Ey=2.75	Ey=3
Kcal/AE	P<0.00	0	0	0	0	0	0	2.2e-	16

4. Conclusion and Recommendations

In this study, the impact of a conditional cash transfer on livestock holding (in TLU) and total Household income (in birr) was studied using cross-sectional data from the Karat Zuria District of the Konso Zone. The result obtained from logit regression indicated that participation in a conditional cash transfer program was negatively influenced by access to credit and cultivated land size, whereas it was positively influenced by shock experience and an iron-roofed house.

Based on the criteria for selecting the matching algorithm, the ATT is calculated. The result confirms that participation in the conditional cash transfer has a positive impact on livestock holdings (in TLU) and the annual total income of beneficiary households. Therefore, the development intervention should emphasize the improvement of the benefit to the program beneficiary. Moreover, the CC transfers a large amount of resources and covers a large area of the country. It is not reliable to conclude the program's impact at the country level based on this study. Hence, further research using a large sample size at different locations should be conducted to gain credible findings on the impact of the program on the welfare of the beneficiary. This is another research gap that should be addressed in the future.

Conflict of Interest

The authors declare that they have no conflicting interests.

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Data availability statement

The data used to support the findings of this study are available from the corresponding author upon request.

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