

The Impact of Microcredit on Household Income: The Case of BRAC in Tanzania

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Microcredit is considered a potential tool for poverty alleviation. This study examines whether microcredit can contribute to an increase in the household income of rural households. We use two-year panel data obtained from a household-level randomized controlled trial (RCT) of microcredit service implemented in Tanzania. Our empirical results show that the provision of microcredit did not have a positive impact on household income. However, when the household income from different sources is examined, we find that microcredit had a positive impact on income from crops other than rice. Our findings are useful in designing microcredit products targeting agricultural communities in developing countries.

Key words: microcredits, impact evaluation, Tanzania

1. Introduction

Increasing access to microcredit is considered a potential means of alleviating poverty. However, there is a growing debate on whether microcredit has a positive impact on the livelihood of poor households. Previous studies based on randomized controlled trials (RCT) in general show that microcredit has positive impact on the investment by small and medium-scale enterprises but has no or little impact on their income (Attanasio *et al.* 2015; Augsburg *et al.* 2015; Banerjee *et al.* 2013).

For Sub-Saharan Africa (SSA) the largest population of the poor live in rural areas and majority of them are engaging in agricultural activities. In recent years, microfinance institutions (MFIs) have been expanding their operations to rural areas where their clients are mainly smallholder farmers. While the impact of microcredit on the investment in non-farm activities has been widely discussed, there is a limited number of randomized studies evaluating the impact of microcredit, specifically designed for agricultural households. Examples of those studies are Hossain *et al.* (2018) and Beaman *et al.* (2014) who found that microcredit increases agricultural input use and adoption of modern varieties but does not result into higher household income or higher revenues from the crop.

This paper aims to contribute to the existing body of literature by examining the impact of microcredit on the

income of rural agricultural households by using two-year panel data from the household-level randomized controlled trial conducted in Tanzania. Our empirical evidence shows that access to microcredit does not have significant impact on household income in rural households. However, when the household income from different sources are examined, we find that microcredit has an impact on income obtained from maize cultivation. We also found that microcredit did not increase medical and schooling expenditure significantly.

The rest of the paper is organized as follows; Section 2 discusses the study site, data, and the details of the microcredit program; Section 3 presents the estimation strategy; Section 4 gives the results; and Section 5 summarizes our conclusions.

2. Study Site and Data

The study reported on here uses data obtained from the BRAC-IRRI agricultural credit program (referred as the BRAC program hereafter). The program involved the household-level randomized experiment of microcredit service implemented as a collaborative research project between the International Rice Research Institute (IRRI) and BRAC, one of the largest microfinance institutions in the world. The BRAC program was implemented in Ilonga and Chanzuru villages in Kilosa District, Morogoro Region, Tanzania.

1) Study site

The villages of Ilonga and Chanzuru are located approximately 15 kilometers from Kilosa town. Each village has its own irrigation scheme, and the total

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developed area of the Ilonga irrigation scheme was 120 hectares, supporting about 600 households. The Chanzuru irrigation scheme had 400 hectares of developed area with 725 households by 2013. The irrigation infrastructure is rather simple and small, and thus, we can consider Ilonga and Chanzuru as typical irrigated rice farming villages, though rain-fed rice cultivation is more popular than irrigated rice farming in Tanzania. The Ilonga irrigation scheme has better access to water and irrigation infrastructures than does the Chanzuru irrigation scheme. The two schemes are used for rice cultivation during the main rainy season and for growing vegetables during the dry season. While farmers in the two villages also grow crops in upland plots and rain-fed lowlands, their main sources of crop income is from rice cultivation.

Sources of off-farm income include engaging in wage and business activities as well as selling livestock or livestock products. The labor market is local, characterized by poor rural household members seeking seasonal jobs. In some cases, family members from poor households find jobs in nearby large-scale sisal plantations and employment in Kilosa or other nearby towns.

2) Data

The data collection was conducted in three rounds of surveys, from 2010 to 2012. The baseline survey was conducted from September to November 2010, where 412 households were randomly selected from a roster of farmers growing in the Ilonga and Chanzuru irrigation schemes. The second survey was conducted from August to September 2011, followed by the intervention of the BRAC program from November 2011 to May 2012. During the intervention, the 412 households interviewed in the first survey were randomly assigned to one of two groups. One group consisted of 208 households who were eligible to obtain credit from the BRAC program; the other group consisted of 204 non-eligible households.

In 2012, all sample households were revisited in a survey designed to collect data for assessing the impact of the BRAC program. Out of the original sample of 412 households, 17 could not be interviewed, 7 were dropped for violating the program's conditions by obtaining credit without being eligible, and one household was dropped due to its extreme value. Therefore, our 2012 sample consisted of 387 households. During the baseline survey, we collected detailed information about rice cultivation

together with other household-level variables, including basic household characteristics and income related variables. We collected the data on the revenue and costs of crop cultivation on all the plots where rice and other crops were grown. During the endline survey in 2012, we asked questions similar to those in the previous survey and constructed a household-level panel data. Although, we conducted second round survey in 2011, we utilize the data collected in 2010 and 2012. This is because our analysis is mainly based on the cross-sectional variation created by RCT in 2012 and we use the data in 2010 mostly to control for the baseline characteristics.

3) Implementation of the BRAC program

The intent of the BRAC program was to support rice cultivation for farmers in the two irrigation schemes; however, there was no restriction placed on the use by farmers of the credit they obtained from BRAC. Community organizer from the Kilosa branch of BRAC Tanzania visited the eligible households and explained the conditions for borrowing from the BRAC program. Only eligible households who agreed with the conditions could obtain credit from the program. Each borrower received a loan with a value of 80,000 Tanzanian Shillings (Tsh), or approximately 50 USD at the 2012 exchange rate. Half of the credit (Tsh. 40,000) was received as cash, while the remaining Tsh. 40,000 was in the form of a voucher that can be used to pay for fertilizer at the market price. The voucher could be redeemed at the selected fertilizer dealer's store in the village.

The duration of the loan was one cultivating season, which lasted about five to six months. Farmers received the loan of Tsh. 80,000 before the cultivation season started and were supposed to repay Tsh. 100,000. Knowing that farmers receive most of their income after harvesting and selling paddy and other crops grown in the wet season, borrowers from the BRAC program were required to repay 20 percent of the total payment on a weekly basis during the cultivation period. The remaining 80 percent was to be repaid in one installment after the harvesting season.

Similar to other microcredit programs, BRAC made farmers form groups so that the members were jointly responsible for each other's loan. However, since the group size is relatively large at 15 to 20 people in each, it is questionable if this group liability was strictly followed or taken seriously by the farmers. Nonetheless, repayment

rate was as high as 73% (by a record of BRAC before the completion of harvesting season) to 92.5 % (as the self-report of the farmers during the survey). Since the program was targeting rice-growing households, BRAC offered a one-day training session on basic rice cultivation techniques and fertilizer use. BRAC conducted follow-up and monitoring activities to ensure borrowers were using their microcredit for productive purposes.

3. Estimation Strategy

Although eligibility for the program could be randomly assigned, we could not force farmers to take the credit. Thus, being an actual borrower is endogenously determined by the farmers themselves and the selection bias remains in our estimation. To circumvent this problem, we utilize our data obtained from RCT to estimate the impact of microcredit. We first estimate the intention-to-treat (ITT) effect by using randomly assigned eligibility to the program. It should be noted that ITT estimates give the partial treatment effect based on eligibility to the program regardless of whether the household actually took advantage of the credit offered. In order to examine the impact of being a borrower, we estimate the local average treatment effect (LATE) by using the instrumental variable (IV) approach.

To increase estimation power, we follow the lead of McKenzie (2012) and estimate the analysis of covariance (ANCOVA) by including the outcome variable at the baseline. Therefore, we specify the ITT-ANCOVA as

$$Y_{iE} = \alpha + \beta_1 Z_i + \beta_2 Y_{iB} + \beta_k \mathbf{X}_{ik} + \varepsilon_i \quad (1)$$

where Y_{iE} is the outcome variable of household i observed in the endline survey, Z_i is the dummy representing eligibility for the BRAC program, Y_{iB} is the pre-intervention outcome variable observed in baseline survey, and \mathbf{X}_{ik} is the vector of household characteristics. The LATE-ANCOVA is specified as

$$Y_{iE} = \alpha + \beta_1 D_i + \beta_2 Y_{iB} + \beta_k \mathbf{X}_{ik} + \varepsilon_i. \quad (2)$$

where D_i is a dummy variable having value 1 if the household borrowed from the BRAC program and 0 otherwise. We use eligibility for the BRAC program, Z_i , as the IV to estimate equation (2).

Our main dependent variable is total household income, which includes total income from crop production, income from selling livestock and livestock products, and income from wage and business activities. Total income from crop production is further divided into income from

rice and income from other crops grown by the household. We also examine the impact of credit on the total cost of crop production as well as school and medical expenditure. In each estimation model, we control for basic household characteristics, which include total land holdings, value of household assets, number of adult household members, years of schooling of household head, female household head (dummy variable), and age of household head.

4. Results

1) Descriptive results

Table 1 shows a descriptive analysis of the household income variables. Among eligible households, there are farmers who took a loan from the program and those who did not. We call those who took a loan “borrower” to distinguish them from eligible households. We conduct t -test comparisons between eligible and non-eligible households and between borrowers and non-eligible households. We also conduct sub-sample analysis for the Ilonga and Chanzuru irrigation schemes. The reason for this is that, as we discussed earlier, farmers in Ilonga enjoy under more favorable conditions in terms of availability of irrigation water as compared to farmers in Chanzuru, and thus the impact of credit may differ between the farmers in the two schemes. We present results using four panels. Panel A consists of total household income from different sources, Panel B shows the total cost of crop cultivation, Panel C shows the sub-components of total crop income, and Panel D shows school and medical expenditure.

The descriptive results for the total sample (columns 1 to 3) show that eligible households and borrowers increased total income from crops other than rice (mainly maize). The average income from crops other than rice for eligible households is 60.6 USD, while for borrowers it is 60.68 USD; non-eligible households, it is 21.3 USD. The increase in income from these crops, however, was not large enough to result in an increase in total income from crop cultivation or in total household income.

We expected that increased fertilizer use would produce an increase in total income from rice. Contrary to our expectation, however, we do not observe a significant difference in income from rice either between eligible and non-eligible farmers or between borrowers and non-eligible farmers. There is no significant difference for the variables such as total household income, crop revenue and crop production costs.

Table 1. Descriptive analysis of household income, cost structure of crop cultivation and school and medical expenditure (2012)

VARIABLES	Total Sample			Ilonga			Chanzuru		
	Eligible	Borrower	Non-eligible	Eligible	Borrower	Non-eligible	Eligible	Borrower	Non-eligible
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A: Total household income</i>									
Total household income (USD)	837.31	888.22	888.72	965.46	783.08	790.90	712.85	993.35	990.93
Livestock income (USD)	24.24	29.54	34.79	16.78	18.07	37.68	31.49	41.02	31.77
Business and wage labor income (USD)	263.21	217.03	306.99	357.74	160.67	146.58	171.41*	273.40	474.61
Total crop income (USD)	549.85	641.64	546.94	590.94	604.35	606.64	509.95	678.94*	484.56
<i>Panel B: Costs of crop cultivation</i>									
Total crop revenue (USD)	815.37	948.25	822.70	865.84	901.71	938.41	766.35	994.80**	701.79
Paid out costs for machinery and animal use (USD)	47.80	62.12	46.54	43.17	53.84	54.65	52.29	70.40	38.07
Paid out costs for hired labor (USD)	175.37	192.34	187.90	175.47	182.73	218.73	175.27	201.95	155.67
Paid out costs for current input use (USD)	49.87	61.90	48.54	70.22	73.48	73.21	30.10	50.33***	22.77
<i>Panel C: Sub-components of crop income</i>									
Total income from rice (USD)	489.25	580.96	525.64	565.59	593.86	593.79	415.11	568.07	454.44
Total income from other crops (USD)	60.60***	60.68***	21.30	25.34	10.48	12.86	94.84***	110.87***	30.12
<i>Panel D: School and medical expenditure</i>									
School Expenditure (USD)	139.29	167.52	137.27	125.12	161.07	116.48	153.05	173.98	158.99
Medical Expenditure (USD)	61.94	113.07	72.49	86.05	156.50*	63.79	38.53	69.63	81.58
Observation (Households)	205	80	182	101	40	93	104	40	89

Source: Authors (2019).

Notes: *** denotes significant at 1%, ** significant at 5%, and * significant at 10% in *t*-test comparison between eligible and non-eligible or borrower and non-eligible.

Panel B shows the revenue and paid out costs for total crop production, not only rice.

Looking at the sub-sample analysis (columns 4 to 6 for Ilonga, and columns 7 to 9 for Chanzuru), results show that for Ilonga there are no significant differences among the three groups except that medical expenditure for borrower households is higher than for non-eligible households. In Chanzuru, eligible households have significantly higher income from business and wage activities as well as income from crops other than rice. Furthermore, borrower households in Chanzuru have significantly higher total crop income and income from

crops other than rice. They also have higher crop revenue and expenditure in current input use, which includes the cost of using fertilizer and other agrochemicals.

2) Econometric results

Table 2 shows the estimation results regarding the impact of microcredit on household income and other dependent variables, following a similar structure as that in Table 1. Although not reported here, the coefficient of eligibility for the program on being a borrower is highly statistically significant in the first stage regression,

Table 2. ANCOVA estimates for the impact of microcredit on household income, cost structure of crop cultivation and school and medical expenditure

	Total Sample		Ilonga		Chanzuru	
	ITT	LATE	ITT	LATE	ITT	LATE
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Household income</i>						
Total household income (USD)	-7.36 (131.110)	-18.94 (333.139)	131.58 (178.556)	332.44 (444.451)	-200.86 (187.592)	-513.20 (478.769)
Livestock income (USD)	-8.10 (8.606)	-20.70 (21.838)	-19.23 (14.898)	-48.14 (36.792)	-0.70 (11.573)	-1.78 (28.756)
Business and wage labor income (USD)	24.42 (114.455)	62.64 (289.917)	196.63 (157.127)	494.28 (393.042)	-185.04 (164.166)	-471.60 (414.842)
Total crop income (USD)	-34.19 (48.625)	-88.45 (124.861)	-54.05 (73.941)	-137.50 (183.677)	-35.98 (61.203)	-92.81 (156.734)
<i>Panel B: Costs of crop cultivation</i>						
Total crop revenue (USD)	-52.85 (57.036)	-136.14 (146.367)	-88.72 (87.883)	-222.78 (215.228)	-34.36 (70.673)	-88.59 (180.653)
Paid out costs for machinery and animal use (USD)	0.54 (5.716)	1.38 (14.420)	-6.97 (7.795)	-16.91 (18.575)	5.74 (8.070)	14.83 (20.278)
Paid out costs for hired labor (USD)	-15.58 (16.737)	-39.93 (42.694)	-30.64 (25.256)	-77.21 (62.718)	2.33 (22.285)	5.94 (55.341)
Paid out costs for current input use (USD)	2.30 (5.330)	5.88 (13.430)	2.07 (9.332)	5.18 (22.795)	4.25 (4.799)	10.88 (11.754)
<i>Panel C: Sub-components of crop income</i>						
Total income from rice (USD)	-44.72 (50.555)	-114.70 (129.034)	-46.90 (78.744)	-118.02 (193.736)	-62.29 (63.022)	-158.87 (161.612)
Total income from other crops (USD)	21.84** (10.091)	55.76** (25.722)	4.49 (9.835)	11.20 (24.049)	39.43** (18.560)	102.01** (47.140)
<i>Panel D: School and medical expenditure</i>						
School Expenditure (USD)	21.25 (27.800)	54.45 (70.406)	28.17 (31.317)	70.78 (76.721)	6.32 (43.932)	16.11 (109.554)
Medical Expenditure (USD)	-9.16 (24.153)	-23.47 (61.453)	36.59 (34.120)	91.95 (82.087)	-33.49 (36.224)	-85.32 (92.291)

Source: Authors (2019).

Notes: *** denotes significant at 1%, ** significant at 5%, and * significant at 10%.

Robust standard errors in parentheses. In each estimation model, we control for household characteristics at baseline (i.e., total land holdings (ha), value of household assets (USD), number of adult household members, years of schooling of household head, female household head dummy, and age of household head) and the baseline dependent variable.

suggesting that eligibility is a suitable IV for being borrower in our LATE-ANCOVA estimation.

Columns (1) and (2) show the ITT-ANCOVA and LATE-ANCOVA estimates for the total sample, while columns (3) to (6) show those for the Ilonga and Chanzuru sub-sample, respectively. On contrary to our expectation, we do not find any significant impact of credit on income from rice. In fact, in our complementary study, we observed significant increase in chemical fertilizer use. However, credit use did not result in higher paddy yield, presumably because low or moderate return to fertilizer in these areas (Nakano and Magezi 2019).

These observations are consistent with our finding that there is no increase in total income from rice. The overall results presented in columns (1) and (2) show that microcredit had a significant impact on income from crops other than rice. The use of microcredit led to an increase in income from other crops of approximately by 21.84 to 55.8 USD. However, the increase in income from these crops was too small to have a significant influence on total income from crop cultivation or on total household income. We also observe that this increase of income from other crops arises mainly in Chanzuru. Since farmers in Chanzuru work under less favorable conditions for rice cultivation compared to farmers in Ilonga, it is possible that they used part of the credit for maize production, where they would expect higher returns. Other subcomponents of household income, crop revenue and production costs appear to be unaffected by either credit eligibility or credit use.

5. Conclusion

This paper examined the impact of microcredit on the income of agricultural households using a randomized control trial. We provided microcredit in the form of cash and a fertilizer voucher to randomly selected rice growing farmers in two irrigation schemes in Tanzania. Our results show that even though the microcredit did not have an impact on total household income, it significantly increased income from crop cultivation other than rice. This is especially true in a village where the availability of water for rice cultivation is relatively poor, possibly because these farmers allocate their resources to cultivating crops other than rice.

Our findings are consistent with previous studies, which report little or no impact of microcredit on the household income of small and medium-scale enterprises in urban and rural settings in developing countries. Our results suggest that it is important to understand the characteristics of clients and their socioeconomic environment when MFIs design their loan products targeting clients in agricultural communities. Additionally, our findings suggest that credit access may not be the only constraint on agricultural households. Accordingly, future development policies must seek to simultaneously address other factors that can enhance the role of credit in improving the livelihood of farmers.

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