The Effect of Agricultural Extension Programs on Child-Bearing Decisions in Uganda

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Introduction

In "Agricultural extension, intra-household allocation and malaria," Pan and Singhal analyze the relationship between agricultural extension programs in Uganda and malaria prevalence. Agricultural extension programs were launched by BRAC Uganda in 2008 and operate through 60 branches nationwide, seeking to increase the productivity of low-income female farmers by encouraging the adoption of modern agricultural techniques. Since BRAC required to limit the program to villages residing within 6 km from a BRAC branch, Pan and Singhal aptly used a "sharp" regression discontinuity framework for their analysis after confirming that households on either side of the 6 km threshold were similar prior to the implementation of the BRAC programs. After a thorough robustness test of their results, they concluded that malaria prevalence was discontinuous at the threshold – program eligibility reduced the proportion of household members with malaria by 8.9 percentage points. Children under 5 years old and pregnant women benefited substantially with 11.2 and 22.5 percentage point reductions, respectively.

Since children under 5 years old and pregnant women experienced significant reductions in malaria prevalence, we question whether agricultural programs could have decreased child mortality by malaria or increased the number of successful births. Thus, we sought to study whether BRAC's programs altered child-bearing decisions in Uganda.

Numerous pieces of literature have examined how factors like child mortality, family planning programs, and old age security alter household sizes in developing countries. Banerjee and Duflo (2007) suggest that the poor need higher fertility because infant mortality rates are higher in impoverished households. According to the World Health Organization (WHO), 5.4 million children under 5 years old die every year, a majority of whom live in developing countries (World Health Organization, 2017). Therefore, households give more births to reduce the risk of having fewer children than the expected number of children (Banerjee and Duflo, 2007). Further, Bongaarts (2011) found an inverse relationship between family planning programs and reproductive preferences, but Africa's cultural bias toward large families has limited investments in family planning in Sub-Saharan Africa. Finally, poor parents may be concerned with old age security, therefore they might have more children in order to increase the likelihood of being taken care of when they grow old (Banerjee and Duflo, 2007).

Despite the plethora of literature on various factors affecting household sizes, very few studies exist to examine the relationship between agricultural extension programs – a popular form of agricultural intervention in developing countries (World Bank, 2007) – and child-bearing decisions. Since the program can simultaneously increase income, reduce poverty, and reduce malaria prevalence (Pan and Singhal, 2019), research into its other societal benefits may further emphasize its importance in developing countries.

The current paper examines the relationship between agricultural extension programs and child-bearing decisions in Uganda. Specifically, we employ a spatial regression discontinuity design to determine whether there is a relationship between program eligibility and the number of households with children under five years old. We found that the number of households with children under 5 years old was discontinuous at the 6 km threshold; households within the threshold were 9.62 percentage points less likely to have a child under the age of 5. This paper contributes to the literature by presenting novel findings regarding the relationship between agricultural programs and child-bearing decisions, a field that is largely unexplored.

Data

The data used in the study originally came from BRAC's agriculture survey that was used in Pan and Singhal's paper. The survey was conducted between July and December 2011, 3 years after the launch of the agricultural extension program. A two-stage cluster sampling approach was adopted. Firstly, 17 villages were chosen from a list of villages within a 10 km radius around a branch. Then, 25 households were picked randomly for the survey in each of the selected villages. Survey information included whether a household member suffered from malaria in the past 6 months, whether a household has a child under the age of 5, and more. Finally, data from Pan and Singhal (2019) on the distance of each household to the nearest branch were also used. Pan and Singhal (2019) collected GPS coordinates of households and calculated the distance of households and villages from the nearest BRAC branch.

As found in Pan and Singhal (2019), the sample consists of 417 villages and 7206 households. Each household has an average of 6 members. At the individual level, children aged 5 or below have the highest malaria prevalence, with 50% of them reported experiencing malaria 6 months before the survey (Pan & Singhal, 2019). Moreover, each household has an average of 0.7 children under the age of 5 and approximately 26% of households have a child under 5 years old.

Methodology

We used a "sharp" regression discontinuity (RD) design similar to Pan and Singhal's (2019) main analysis to assess the effect of BRAC's agricultural extension program on child-bearing decisions. Given the 6 km threshold of the program coverage, Pan and Singhal (2019) confirmed that access to the agricultural program is a discontinuous function of distance to the nearest BRAC branch (i.e., a continuous function). Our RD model is written as:

$$Y_{ij} = \alpha + \beta T_j + \phi(d_j - 6) + \epsilon_{ij} \tag{1}$$

where Y_{ij} is the outcome variable for household i in village j. Our outcome variable is a dummy variable that equals 1 if a household has a child below 5 years old and 0 otherwise. The running variable is the distance of village j in kilometers from the 6 km cutoff point: $d_j - 6$. T_j is a dummy variable that equals 1 if a household in a village is below the cutoff ($d_j - 6 \leq 0$) and 0 otherwise. A flexible control function of the running variable that can differ on either side of the threshold, $\phi(d_j - 6)$, is included. Our coefficient of interest is β which measures the intent to treat (ITT) effect – the effect of the distance to the BRAC branch on having children below the age of 5.

Since the optimal bandwidth may vary with the outcome variable and sample size, we fixed our bandwidth to 2 km, which was found to be the optimal bandwidth by Pan and Singhal (2019). Alternate bandwidths of 1.5 km and 3 km were used to check the sensitivity of our results. For each bandwidth, we ran the regression with and without controlling for the age of the household head, the head's literacy, inclusion in village councils, and other potential controls.

The validity of the RD design has been assessed by Pan and Singhal (2019). For the running variable, they found no manipulation at the discontinuity – households did not move in order to be eligible for the program. They also used data from the Uganda National Household Survey 2005–2006 (UNHS) to further demonstrate that households on both sides of the threshold were similar before the implementation of the BRAC program. Lastly, survey non-response does not bias the results, as survey non-participation rate at the village level was not found to be correlated with access to treatment within the preferred 2 km bandwidth.

Results

We employed a similar RD analysis to Pan and Singhal (2019) on our variable of interest – the presence of a child under the age of 5 within the household. This regression was conducted at 3 different bandwidths, 1.5 km, 2 km and 3 km.

In Table 1, at a bandwidth of 2 km, there was a 9.62% decrease in the number of households with a child under the age of 5 when accounting for the controls. As the bandwidth increases from 1.5 km to 3 km, the coefficient with controls decreases from 11.1% to 7.2%. At each bandwidth, we obtained statistically significant results with or without controls and covariates. As such, the regression results suggest that the implementation of the program did significantly alter the number of households with children under the age of 5 in the sample.

Table 1:

	Has A Child Under the Age of 5					
	Bandwidth = 2		Bandwidth = 1.5		Bandwidth = 3	
	(1)	(2)	(3)	(4)	(5)	(6)
Eligibility	-0.0994***	-0.0962***	-0.1165***	-0.1108***	-0.0745***	-0.0724***
	(0.0101)	(0.0113)	(0.0099)	(0.0117)	(0.0097)	(0.0106)
Covariates	No	Yes	No	Yes	No	Yes
Control means	0.2590	0.2614	0.2565	0.2598	0.2653	0.2683
Number of Households	3240	3085	2489	2363	4475	4272
Number of Villages	173	173	131	131	245	245

*Notes: This table shows the effect of being eligible for the agricultural extension program and the likelihood of a household having a child under the age of 5. For each bandwidth, we ran the regression without (columns 1, 3, 5) and with (columns 2, 4, 6) controlling for age and literacy of the household head, presence of a committee member in the household, gender of respondent, month of survey, and household distance. Standard errors are reported in parentheses. * significant to 10%, ** significant to 5%, *** significant to 1%*

Furthermore, households were found to be discontinuous along the 6 km threshold, as seen in Figure 1. These findings, coupled with Pan and Singhal's findings on better malaria health outcomes for younger children, suggests that the agricultural extension program may influence household child-bearing decisions. We hypothesize that this may be because children are experiencing better malaria outcomes and surviving past the age of five; therefore, parents might not find it necessary to have more children. However, this is just a hypothesis as our analysis has some limitations.

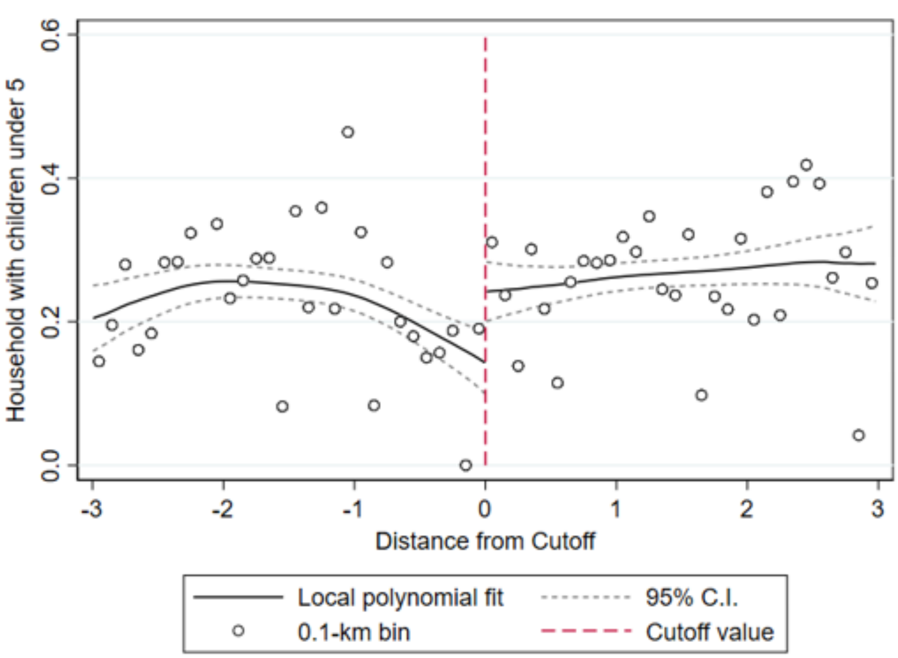

Figure 1

Discussion and Limitations

Our results demonstrate that participating in the program reduced the likelihood of having a child less than 5 years old by approximately 9.9 percentage points. A possible mechanism for this finding is an increase in income due to these programs, which improves access to health care and investments in health products (Pan and Singhal, 2019). Such factors may result in lower morbidity, reduced infant mortality rate, and increase in successful births. As examined by Banerjee and Duflo (2007), the poor population needs higher fertility because infant mortality rates are higher in impoverished households. Therefore, increased income - because of these agricultural programs - could have reduced the infant mortality rate and eliminated the need for these households to have more children. Although we did not test this mechanism, exploring the relationship between increased income and child-bearing decisions serves as potential for future research.

Our analysis experienced some limitations. First, we lack pre-intervention data regarding the number of households with children less than 5 years old, a detail that was missing in the Uganda National Household Survey 2005–2006 (UNHS) used by Pan and Singhal as pre-intervention data. Consequently, we could not determine if the number of households that have a child below 5 years old was continuous before the treatment. Therefore, we cannot definitively conclude that the agricultural programs altered child-bearing decisions; if a discontinuity existed before the treatment, then our interpretation of the results might be invalid. The second limitation occurs from a 3-year gap between the intervention of the program and data collection. The 3-year difference directly affects our results because children between 2 to 4 years old when the program was launched were no longer considered "children under 5 years old" when the data was collected and were not included in the analysis. Furthermore, an event could have occurred within these 3 years that altered child-bearing decisions. Without knowledge of this event, we might have falsely attributed the event's effect to the programs instead.

Despite the limitations, our findings may have two policy implications. First, agricultural extension programs may address overpopulation in Uganda. According to Worldometer (n.d.), Uganda's population almost doubled from 2000 to 2020 and it is forecasted to double again in thirty years. Uganda's population growth of 3.32% is amongst the fastest in the world, but agricultural extension programs could slow down growth by reducing the number of children within households. Second, these programs may become a more popular solution in developing countries to simultaneously address multiple societal concerns like poverty eradication, women empowerment, and mortality reduction**.**

This paper contributes to the literature not only by providing novel research on the relationship between agricultural extension programs and child-bearing decisions, but also by calling into question Pan and Singhal's (2019) findings. Given our finding that the number of children below the age of 5 was discontinuous at the 6 km threshold, Pan and Singhal (2019) may consider controlling this variable in their original analysis to assess whether the number of children in households is correlated with household malaria prevalence. Furthermore, we did not directly test whether agricultural programs altered malaria mortality or the number of successful births. This would be interesting to explore in future research.

Conclusion

Our results demonstrate that participating in the program reduced the likelihood of having a child less than 5 years old. A possible mechanism to explain this reduction is an increase in income due to these programs, but more research is required. Income generating programs such as the BRAC agricultural extension program show to have important health implications for individuals of various demographics. As better access to BRAC centers could improve malaria outcomes and reduce the number of children in households, our results and those of Pan and Singhal imply that the agricultural extension programs could have long-term economic and health benefits for households in low-income countries. While our results are specific to a particular area of study, they do indicate a possible relationship between agriculture and family planning decisions. Further research into household child-bearing decisions could enhance our understanding and inform policies aimed at alleviating the consequences of overpopulation and other societal issues.

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