# Impact Evaluation Concept Note – Regression Discontinuity Design

# Action Against Hunger

## Research Questions

In this study, we ask whether cash assistance to immigrants from Venezuela and internal migrants in Colombia that live in conditions of social vulnerability help to overcome short-term financial stress (e.g., food insecurity), emotional well-being, intrahousehold violence, and long-term outcomes of economic self-sustainability (e.g., entrepreneurship).

## Identification Strategy

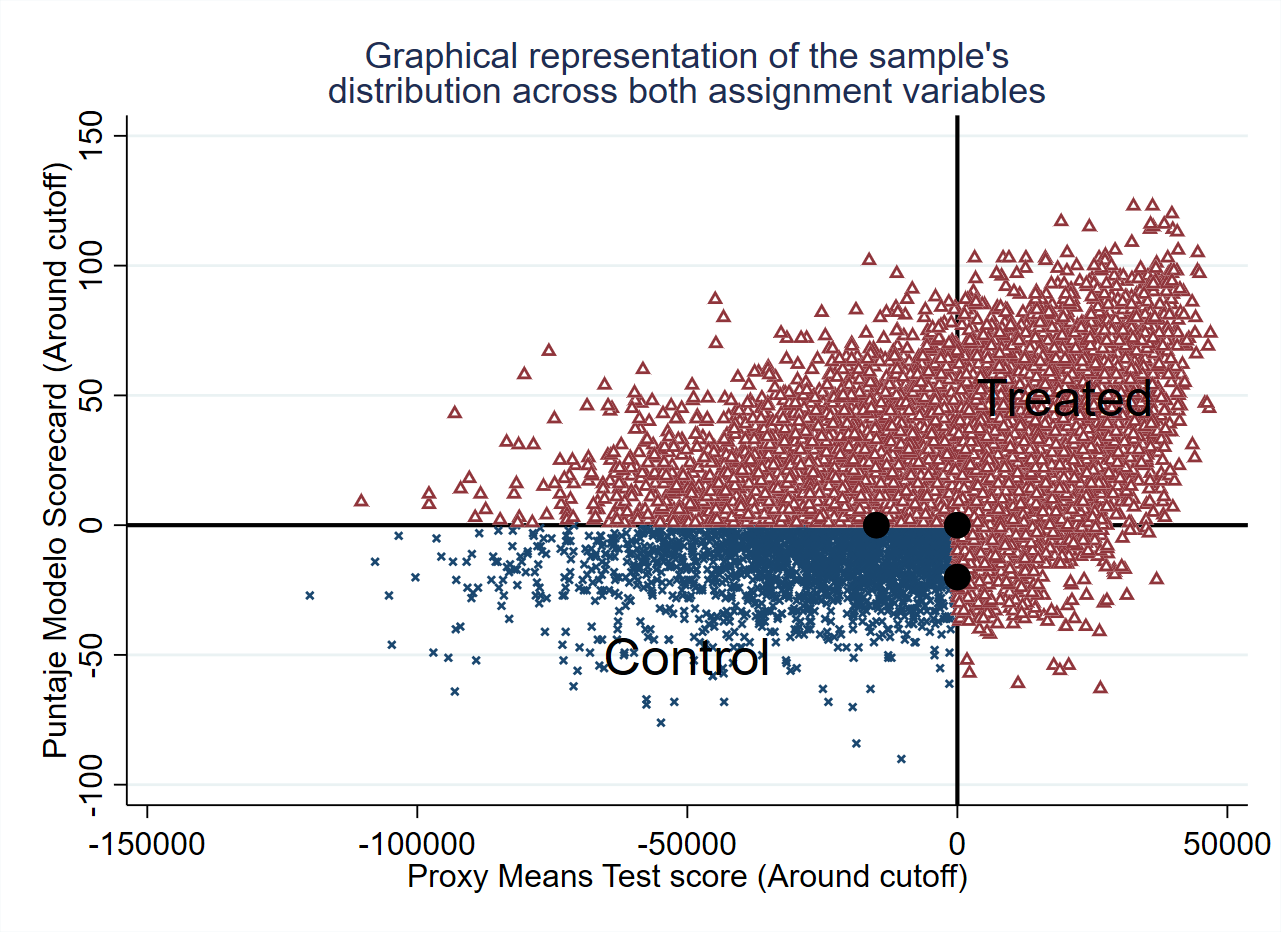
Our main identification strategy is a Regression Discontinuity Design (RDD). To obtain a causal estimate of the effect of the cash assistance, we exploit the eligibility rule of the program that assigns a set of scores to each individual based on the characteristics of the families at the moment of application. Once each family’s vulnerability is assessed through a sociodemographic and economic characteristics survey, two scores are assigned to each. This design compares outcomes of individuals who are just above and below an eligibility threshold of both scores. Families do not know how the scores are computed and so are not able to manipulate variables in order to change it. Based on budget constraints, the program gives cash assistance to every family with a vulnerability score of 90 or above for one of the scores (Scorecard Model score) and estimated household expenses below 53,168 calculated using a Proxy Means Test. We are restricting the sample of analysis to individuals who were surveyed for their eligibility assessment between November 2021 and April 2022. This is because the program delivers the first cash transfer within the first months of defining the eligibility status of each individual. Given that the program lasts approximately 6 months since the first cash transfer, this will allow us to evaluate the outcomes of a cohort of participants between 1 and 3 months of graduation from the program.

The distribution of the scores across the full support of both assignment variables is shown in Panel A and Panel C – Figure 1. One potential problem of RD designs is that applicants may be able to alter the scores used to assign the program in their favor to become eligible for the benefits. The Figures show that at the threshold of 90 points of the Scorecard Model (SM) score, and at the threshold of 53,168 in household expenses from the Proxy Means Test (PMT) there are no evident changes in the density of the scores. A formal test of this condition is shown in Panel B and Panel D- Figure 1 where we plot the density of individuals within bandwidths of the scores, together with confidence intervals. The Figures show that there are no significant changes in the number of individuals in close vicinity at the left or right of the 90-points threshold and the 53,168 threshold for the SM score and the PMT, respectively. Taken together, these figures show that applicants have no manipulation of the scores. If there were manipulation, the strategy would fail to identify a causal effect as the internal validity of an RD design is sustained by the assumption that individuals that are just above and below the thresholds of the variables that determine their eligibility in the program are comparable in all dimensions; with the only difference being that those at the right of the threshold receive the benefit. A graphical representation of this regression discontinuity design that uses two simultaneous assignment variables is presented in Figure 1.

Our main specification for RD analysis takes the following form:

where represents an outcome (such as food insecurity post assistance) for household *i*. is a vector of control variables specific to the household, such as sex and age of the household head. is a smooth function of the vector of running variables (i.e., the scores in this case), commonly known as the control function in the RD literature. is an indicator function that takes the value 1 when the running variables are equal to or higher than their relevant threshold, that is when the household becomes eligible for the program; the error term of the regression. The coefficient of interest is , which can be interpreted as the average local effect of a household being eligible for the program.

In addition, we assess the validity of our design by comparing eligible to non-eligible individuals using data from application forms. We accessed data on the Household (HH) Consumption Index, HH per capita expenditures, HH per capita income, HH members to bedrooms ratio, number of months since arriving in Colombia, HH head age, sex, number of meals taken during the last week, number of HH members, number of HH members under 18 years old, number of HH members between 18 and 59 years old, number of HH members with primary education attained, and number of HH members without education. The results are shown in Table 1 and Table 2. We find that, before the initiation of the program, households that are just to the right of the cutoff rule of eligibility for each assignment variable, conditional on being eligible based on the threshold of the other assignment variable, are comparable in all dimensions measured to households that are just to the left of the cutoff rule and hence do not receive the program. As such, this design guarantees that causal estimates can be obtained and estimated after gathering data for these same households after the program delivers aid to eligible families.

**Figure 1:** Graphical representation of the Regression Discontinuity Design with two assignment variables for the sample in the evaluation

**Figure 2:** Graphical representation of non-manipulation of the vulnerability score that assigns program benefits for the sample

|  |  |
| --- | --- |
| Panel A: Scorecard Model score - Distribution | Panel B: Scorecard Model score - Manipulation Test using Applicant’s Data |
|  |  |
| Panel C: Proxy Means Test score - Distribution | Panel D: Proxy Means Test score - Manipulation Test using Applicant’s Data |
|  |  |

**Table 1**: RD estimates of differences between eligible and non-eligible applicants with Proxy Means Test scores around the cutoff (restricted to participants with Scorecard Model scores below the threshold)



**Table 2**: RD estimates of differences between eligible and non-eligible applicants with Scorecard Model scores around the cutoff (restricted to participants with Proxy Means Test scores below the threshold)



**Figure 3:** Graphical representation of the RD estimates of differences between eligible and non-eligible applicants with scores of their Proxy Means Test and Scorecard Model around their respective cutoffs on selected variables

|  |  |
| --- | --- |
| Panel A: HH Consumption Index around the Proxy Means Test threshold | Panel B: HH Consumption Index around the Scorecard Model threshold |
|  |  |
| Panel C: HH per capita expenditure around the Proxy Means Test threshold | Panel D: HH per capita expenditure around the Scorecard Model threshold |
|  |  |
| Panel E: Months since arriving in Colombia around the Proxy Means Test threshold | Panel F: Months since arriving in Colombia around the Scorecard Model threshold |
|  |  |
| Panel G: Age of HH head around the Proxy Means Test threshold | Panel H: Age of HH head around the Scorecard Model threshold |
|  |  |
| Panel I: Number of HH members around the Proxy Means Test threshold | Panel J: Number of HH members around the Scorecard Model threshold |
|  |  |

1. **Survey and Sample Design**

The results from the power analysis show that the optimal bandwidths are approximately [-12; 7] points around the eligibility threshold for the Scorecard Model and [-3785; 3300] points around the threshold of the Proxy Mean Test score. In the data, we have 2,318 non-eligible applicants and 10,084 eligible applicants in this vicinity. We propose a sample size that will be able to detect at least a 0.3 SD difference in household consumption index, household per capital expenses, and household per capita income. With this assumption, we would need to gather a random sample, in this vicinity, of 2,060 non-eligible applicants and 1,393 eligible applicants. The computations were done using the command *rdsampsi* in Stata® provided by Cattaneo, Titiunik & Vazquez-Bare (2019).[[1]](#footnote-2) As noted below, this is a feasible sample size given the possible contact rates in the field. However, a greater sample of 5,228 participants is recommended for further sensitivity analysis.

All households will initially be contacted for a telephone survey, and a representative sample of households not reached by telephone will be followed up for a face-to-face survey. Assuming differential phone-survey re-contact rates of 60% and 40% in the treatment and control groups, respectively, and 69% re-contact rates in the face-to-face survey, the final target analytic sample is between approximately 1,300 and 1,600 households per intervention group, or 2,600 to 3,200 households total. The analytic sample will be powered to detect an effect size of approximately 0.32 standard deviations at least on household consumption index, household per capital expenses, and household per capita income (power=80% and significance=5%).

**Table 1. Sample Sizes**



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Phone Survey Sample**  **(N Households)** | **Face-to-Face Survey**  **(N Households )\*** | **Effective Analysis Sample**  **(N Households Pessimistic scenario)** | **Effective Analysis Sample**  **(N Households Optimistic scenario)** |
| Sample - Treatment Group | 1879 | 282 | 1297 | 1654 |
| Sample – Control Group | 1467 | 587 | 2,055 | 1,712 |

\*The number of face-to-face surveys will be up to 1221 households not reached through the phone survey, though the distribution across treatment and control may vary.

1. See Cattaneo, M. D., Titiunik, R., & Vazquez-Bare, G. (2019). Power calculations for regression-discontinuity designs. *The Stata Journal*, *19*(1), 210-245. [↑](#footnote-ref-2)