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Distributional effects of *Oportunidades* on early child development

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ABSTRACT

The Mexican *Oportunidades* program is designed to increase human capital through investments in education, health, and nutrition for children in extreme poverty. Although the program is not expressly designed to promote a child's cognitive and non-cognitive development, the set of actions carried out by the program could eventually facilitate improvements in these domains. Previous studies on the *Oportunidades* program have found little impact on children's cognition but have found positive effects on their non-cognitive development. However, the majority of these studies use the average outcome to measure the impact of the program and thus overlook other "non-average" effects. This paper uses stochastic dominance methods to investigate results beyond the mean by comparing cumulative distributions for both children who are and children who are not aided by the program. Four indicators of cognitive development and one indicator of non-cognitive development are analyzed using a sample of 2595 children aged two to six years. The sample was collected in rural communities in Mexico in 2003 as part of the program evaluation. Similar to previous studies, the program is found to positively influence children's non-cognitive abilities: children enrolled in the program manifest fewer behavioral problems compared with children who are not enrolled. In addition, different program effects are found for girls and boys and for indigenous and non-indigenous children. The ranges where the effect is measured cover a large part of the outcome's distribution, and these ranges include a large proportion of the children in the sample. With regard to cognitive development, only one indicator (short-term memory) shows positive effects. Nevertheless, the results for this indicator demonstrate that children with low values of cognitive development benefit from the program, whereas children with high values do not. Overall, the program has positive effects on child development, especially for the most vulnerable, who are at the bottom of the distribution.

1. Introduction

Insufficient investments in human capital that are typically found among the poor seriously compromise children's present and future well-being. Children with poor health, nutrition, and education are less likely to develop the necessary skills for functioning in the economic and social realms in adulthood. Unhealthy conditions early in life, for example, have detrimental effects on the immunological system and development of the brain, and as a consequence, lead to poor cognition, problems with conduct, and difficulties in developing social relations at school (Walker et al., 2007; Walker et al., 2005; Chang et al., 2002). Additionally, these conditions lead to low educational attainment and wage earnings (Duc, 2011; Case and Paxson, 2010; Schick and Steckel, 2010). The Mexican *Oportunidades* program aims to improve early life conditions by providing monetary transfers to disadvantaged families conditioned on regular investments in health, nutrition, and education. The program also provides scholarships to school-aged children (Fernald et al., 2008; Levy, 2006; Skoufias, 2005). Altogether, these investments are expected to break the intergenerational cycle of poverty.

Previous evaluations of *Oportunidades* and of similar interventions in other countries, generally show positive effects on the participants (Parker et al., 2008; Ranganathan and Lagarde, 2012; Lagarde et al., 2009; Lagarde et al., 2007). For example, *Oportunidades* has been associated with greater height-for-age (Gertler, 2004; Behrman and Hoddinott, 2005; Farfán et al., 2011), lower prevalence of anemia, and fewer episodes of illness (Gertler, 2004; Rivera et al., 2004). Additionally, positive effects on school enrollment and performance have been documented, both for primary and junior high school (Schultz, 2004; Behrman et al., 2005). However, recent studies have drawn attention to the heterogeneity in these effects among participants: Todd and Winters

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(2011), who found that the program increases the probability of on-time school enrollment, report greater impacts for children with literate mothers, whereas Behrman et al. (2005) show better progression rates for girls throughout primary school. Heterogeneous effects of the program on health care utilization have also been detected between indigenous and non-indigenous participants (Sosa-Rubí et al., 2011), and evidence provided in Lamadrid-Figueroa et al. (2010) points to greater impacts on the poorest in regard to the use of contraceptive methods.

Bearing in mind such heterogeneity, I investigate the effect of *Oportunidades* on children's cognitive and non-cognitive development using stochastic dominance methods which entail the analysis of cumulative distributions. The procedure has the advantage of showing how the effects are distributed across children; thus, it addresses the possibility of disregarding important information for the analysis of the program. Most studies in the impact evaluation literature rely on some sort of average measure to assess the effect of an intervention. In fact, the analysis of the mean has become the standard rule in most impact evaluation studies. The mean effect, however, leads to skewed results when the program affects individuals in different ways. For example, a positive mean effect could be the result of few participants obtaining very large benefits, whereas many are hurt, as suggested by Deaton (2009). Looking at how effects are distributed could also address concerns about efficiency if the program brings fewer benefits to subgroups in greater need (Gakidou et al., 2007; de Janvry and Sadoulet, 2006). Few impact evaluation studies have employed distributions to assess the effect of interventions similar to *Oportunidades*, one study by Djebbari and Smith (2008) evaluates consumption patterns among *Oportunidades*' participants, finding evidence of systematic variation by subgroups. This suggests the varying effects could also exist in other domains where the program expects results. To my knowledge, this is the first paper that evaluates developmental outcomes for children in *Oportunidades* using non-average methods. Moreover, only few studies have used stochastic dominance criteria in the context of impact evaluation – Some examples are Verme (2010), Naschold and Barrett (2010), and more recently, Van de gaer et al., 2013. This latter study concentrates on health outcomes for children in *Oportunidades* and detects greater effects for the most deprived subgroups.

To illustrate the convenience of the analysis of distributions, I take as a point of departure the results of the three studies so far that have investigated the impact of *Oportunidades* on child development. The first two studies, by Gertler and Fernald (2004) and by Fernald et al. (2009), show a positive average effect on behavioral but not cognitive development after 3–6 and 10 years of exposure, respectively. The third study, by Ozner et al. (2009), concentrates on behavioral problems and shows how children exposed to the program for 3.5–5 years experience a reduction in aggressive/oppositional symptoms (but not anxiety/depressive symptoms). The results presented here suggest that some effects of the program on early child development have indeed been overlooked. In particular, cognitive effects not previously detected for boys and for children with non-indigenous background are now found. Overall, the results indicate that children with lower values of cognitive development benefit from the program, whereas those with higher values do not. Additionally, the majority of the children in the sample are consistently better off in terms of non-cognitive abilities.

2. Methods

I use stochastic dominance criteria to assess the effect of the program on five indicators of early child development. The procedure consists of comparing the cumulative distributions of each indicator for children in both a control group and a treatment group. A positive effect of the program occurs whenever the distribution of treated children dominates that of the control. Given the difference in composition between the treatment and control samples, I carry out a Propensity Score Matching procedure (PSM) to address the possible bias. The analysis is performed for the entire sample and for the sample split in two on the bases of gender and indigenous background of the children.

2.1. Data and sample

The data were collected in 2003 by the *Oportunidades* staff in rural communities in Mexico as part of the external evaluation of the program. A subsample of children aged two to six years was selected for the purpose of assessing their cognitive and non-cognitive development. The sample contains information for two groups: children from families incorporated into the program in 2000 (treatment), and those from households not incorporated into the program (INSP, 2005).

The selection of the treatment sample proceeded as follows. In the first stage in 1997, highly deprived communities were identified and randomly assigned for program participation by *Oportunidaes*' authorities. As a result, 186 localities with at least 500 inhabitants, and at most 2500, were selected during this stage. In the second stage, socioeconomic and demographic conditions were assessed to identify which households within the selected localities were eligible for the program. A marginality index based on income, demographic composition, and dwelling conditions of the household indicated whether a family was eligible for the program or not (Todd, 2004). Finally, a sample of children from eligible families was selected. Given that eligibility does not necessarily imply that these families agreed to participate, I only take into account those children for whom administrative records indicate their families received at some point monetary transfers from the program.

The selection of the control group, on the other hand, was conducted by a PSM procedure. This PSM is independent of the procedure followed in this article and it was conducted by the *Oportunidades*' authorities with the objective of selecting localities and not children, as in our case. Deprived localities where the program did not operate in 2003 were matched to treatment localities with similar observable characteristics (Todd, 2004). However, as explained by Van de gaer et al. (2013), this exercise has two problems. First, information on the set of characteristics used to categorize deprived localities in 2003 comes from the National Census in 2000, when the treatment group had already entered the program. Second, localities instead of individuals were matched during this phase. Therefore, differences in terms of pre-program characteristics between treated and non-treated children might still exist.

To check if the comparability of the sample was compromised, I performed a logistic regression using as a dependent variable participation in the program (one indicating a child being enrolled in the program, zero otherwise) and as covariates a set of observable characteristics as shown in Table A1 in the Appendix. As observed in the table, the head of the household in the treatment group was more likely to be older, male, and from an indigenous background, but less likely to be educated and to have a job in comparison with the control group. Additionally, differences in terms of the demographic composition, dwelling conditions, and the type and quality of the assets available in the household were detected. These results indicate that children in the control and treatment samples were not similar; thus, differences in child development might be due in part to environmental or socioeconomic conditions and not the result of *Oportunidades*. For instance, one could erroneously infer a positive effect if the treated children