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# Trade-offs between different early childhood interventions: Evidence from Ecuador\*

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## Abstract

Using a discontinuity in the funding scheme, we evaluate the impact of home visits and of child care centers on children and their mothers from poor families in Ecuador. The two interventions represent a trade-off between child outcomes and mother's psychic well-being on the one hand, and labor market participation and family income on the other hand. We find that home visits are beneficial for children's cognitive outcomes and health and for mothers' psychic well-being but reduce mothers' labor force participation. Child care centers, on the other hand, turn out to have no impact on children's cognitive outcomes, harm their health and the psychic well-being of their mothers but raise mothers' labor force participation and family income.

JEL-codes: J13, I28, H40, O12

Keywords: Early childhood development; child care centers; home visits; regression discontinuity design; developing country; Ecuador

## 1 Introduction

More than 200 million children under 5 years in developing countries are exposed to the risks of poverty, malnutrition, poor health and unstimulating home environments (Grantham-McGregor et al., 2007). These factors have a detrimental effect on the cognitive, motor, and social-emotional development of these children. This in turn contributes to low levels of education, low incomes and high fertility. Governments of developing countries and NGO's are aware of this vicious circle of poverty and allocate resources

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to preschool interventions with the aim to provide disadvantaged children in developing countries a better start (Engle et al., 2007).<sup>1</sup>

The empirical evidence about the beneficial effects of early childhood interventions in developing countries is, however, thin. Engle et al. (2007) review studies that evaluate the impact of various early childhood interventions on the cognitive outcomes of disadvantaged young children in developing countries. Only studies that use a randomized controlled design or matched comparison groups are included in the review. All eight center-based evaluations included in the review, report positive effects on children's cognitive development. The same is true for the three home-visiting programs that were included in the review and report the impact on cognitive outcomes. Most of this evidence comes from studies that use matched comparison groups. Only studies by Powell (2004) and Powell et al. (2004) on home-visiting are based on a randomized controlled design.

Engle et al. also draw attention to the fact that women in developing countries have high rates of stress and that many suffer from depressive symptoms. Depression and stress in mothers may have adverse effects on the development of their children. Interventions that reduce mothers' stress levels and depression may thus have a positive impact on children's outcomes through this channel. It is unlikely that child care centers achieve this as they are associated with increased labor force participation of mothers (Attanasio and Vera-Hernandez, 2004; Berlinski and Galiani, 2007; Berlinski et al., 2008).<sup>2</sup>

This paper examines the impact of child care centers and of home visits on a range of relevant outcomes of young children and their mothers in poor families in Ecuador. The largest organization that funds early childhood programs in Ecuador ranks proposals of prospective providers of such programs on the basis of a score which is a mixture of perceived quality of the providers and indicators of the social background of the families served by the program. Proposals include list with the names of the children that it will serve in case it receives funding. The organization then allocates its available budget to the programs with the highest scores. This creates a discontinuity in the probability of treatment at the score where the available budget of the funding organization is exhausted.

We exploit this feature in a regression discontinuity design in which we instrument a child's exposure to treatment with a binary indicator that equals one if the child was listed for a program that received a score at or above the cutoff score, and zero if the child

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<sup>1</sup> Also in developed countries, early childhood interventions may provide disadvantaged children with a better start (Carneiro and Heckman, 2003; Cunha et al., 2006; Currie, 2001; Currie and Thomas, 1995).

<sup>2</sup> Baker et al. (2005) and Currie (2001) summarize the evidence for child care centers in developed countries (mainly North America) as showing positive effects of prekindergarten participation on cognitive development combined with negative effects on behavioral indicators (Magnuson et al., 2007, is an example). Gomby et al. (1999) summarizes the evidence for home visit programs in the United States showing inconclusive effects of these programs on cognitive development. Almond and Currie (2010) present an updated survey, also concentrating on developed countries.

was listed for a program that received a score below the cutoff score. In the analysis we control for the underlying score. This approach provides a credible source of exogenous variation to identify the effects of the two treatments relative to their respective control groups. Because prospective providers choose themselves whether to apply for funding for a child care center or for home visits, we combine the regression discontinuity design with a difference-in-differences approach (and matching) to compare the impacts of the two treatments.

Three features of this paper stand out. First, we evaluate and compare the impacts of two different early childhood interventions using the same sampling design, the same tests and questionnaires and the same estimation method. Second, we consider a range of outcomes: children's cognitive and motor development, children's health, parenting styles, mothers' stress and depression, mothers' labor supply and income. Looking at this broad range of outcomes gives a more complete picture of the effects of early childhood interventions.<sup>3</sup> Third, in comparison to most other studies for developing countries, we collected data from a relatively large sample of over 2500 children and their mothers.

Our results show that home visits have a positive impact on children's cognitive and motor outcomes, whereas child care centers appear to have no impact or even a slightly negative impact on these outcomes. Home visits reduce the likelihood that children have anemia but at the same time come with a higher likelihood that children are below height. Child care centers appear to increase the probability that children are underweight. Furthermore, home visits reduce mothers' depression and stress and make them more responsive towards their children. Child care centers do the exact opposite: they increase mothers' depression and stress and reduce responsiveness. Finally, child care centers increase mothers' labor market participation and family income, while home visits reduce mothers' labor market participation but leave family income unaffected. The two types of interventions thus represent a clear trade-off between child outcomes and mother's psychic well-being on the one hand, and labor market participation and family income on the other hand.

Our findings regarding child care centers are in line with results recently reported by Baker et al. (2008) for Canada. Exploiting the introduction of universally accessible child care in the province of Quebec in a difference-in-differences framework, they find that child care use increases maternal labor supply but harms child outcomes in terms of aggression, motor and social skills and illness. Moreover, parenting becomes more hostile and less consistent, and parents' health worsens.

The remainder of this paper is organized as follows. The next section provides further details about the early childhood development programs in Ecuador and about the context.

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<sup>3</sup>To be clear, we report results for all outcome variables that we measured.

Section 3 discusses the empirical approach used to identify the programs' impacts and to compare these. Section 4 describes the sampling design and the scales on which various outcomes are measured. Section 5 provides descriptive statistics of the main variables used in the analysis and evidence that the groups above and below the funding threshold are not systematically different. Section 6 presents and discusses the empirical results. Section 7 summarizes and concludes.

## **2 Context and interventions**

### *Context*

Ecuador is a lower-middle income country, characterized by high poverty levels and high inequality. Of its total population of 13 million people, 1.5 million are children between 0 to 5 years old. 650,000 of these young children live in families belonging to the poorest 40 percent of the country. The 40th percentile of the wealth distribution is the government's threshold level for cash transfers to poor families. According to Grantham-McGregor et al. (2007) Ecuador is (in 2004) among the four countries in South-America where 20 to 40 percent of children under 5 years are disadvantaged; the others are Peru, Bolivia and Paraguay. In the rest of South-America the percentage of disadvantaged children below age 5 is less than 20 percent.

Education in Ecuador starts when children are between 6 and 7 years old. The enrollment rate of children in this age bracket is 0.75 for children from families around the 20th percentile of the wealth distribution, and 0.85 for children from families around the 40th percentile of the wealth distribution (see Oosterbeek et al., 2008).

Early childhood development programs are offered by both private and public providers. Private provision is small and mainly targeted towards middle and high income families. Public provision primarily serves low income families. The public provision is targeted towards children in rural and marginal urban areas. There are three main public providers, the largest of these is FODI.<sup>4</sup> FODI started in 2005 and currently serves around 300,000 children from poor families all around Ecuador.

### *Programs*

FODI supports two types of programs: child care centers and home visits. One third of the children served by FODI attends a child care center, the other two thirds are exposed to home visits. The main objective of the programs is to improve the early development

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<sup>4</sup>FODI stands for "Fondo de Desarrollo Infantil". The other two large public providers are INNFA (for "Instituto del Niño y la Familia") and ORI (for "Operación Rescate Infantil").

of young children from poor families. A program is provided at the community or neighborhood level. There is never more than one program per community/neighborhood.

child care centers provide day care, nutrition (breakfast and lunch) and educational services. Day care is provided following a curriculum designed by FODI, 52 weeks per year, 5 days per week, and 8 hours per day. A trained teacher works with groups of 8 to 10 children. An average center serves 45 children in the age range of 0 to 6 years. The annual cost amounts to US\$ 488 per child. To put this amount into perspective, the average monthly income in our sample is US\$ 300 per family or US\$ 55 per capita.<sup>5</sup> Parents do not pay a fee; FODI bears the full cost.

Through home visits, FODI attempts to stimulate children and to improve parents' attitudes, knowledge and behavior towards the development of their children. An important aim of the home visits is to teach mothers how to engage with their child in enriching activities, how to interact with their child in a non-aggressive way, how to create a responsive environment and how to prepare nutritional meals for their children. Children and their mother are treated individually when the child is younger than 3 and in groups when the child is above 3. Advisers work according to guidelines set by FODI. The annual cost of this intervention is US\$ 109 per child. Also here, FODI bears the full cost, and parents are not charged.

Children who are not served by one of the programs – the control groups – are normally looked after by their mother or another family member (grandparents or older sibling) or a neighbor.

### *Selection process*

FODI does not run its own centers but subsidizes non-profit suppliers of early childhood development centers. FODI allocates its budget through a (beauty) contest. So far it organized two such contests. In 2005 it had an available budget of US\$ 30 million. 261 organizations submitted a proposal – where a proposal can cover multiple centers –, 248 of which were awarded. A second contest was organized in 2006 targeted to poor unserved neighborhoods or communities. The available budget was US\$ 12 million. 240 organizations submitted a proposal, and now 95 were awarded for a total coverage of 60,000 children. In this paper we use data from applicants (winners and losers) to the second contest. The remainder of this subsection provides further details of the rules governing this second contest.

In the 2006-contest, a proposal was only considered for funding if (i) it included a list with the names of the children it would serve if awarded, (ii) the area was not yet served by a public provider, and (iii) the proposal fulfilled certain standards regarding infrastructure

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<sup>5</sup>In 2000, Ecuador adopted the US dollar as its official currency.

and educators’ skills. Proposals meeting these requirements were given a score based on criteria that were transparent and known by the applying organizations in advance. The criteria contained the following elements (behind each element, the maximum number of points that can be earned for it): socioeconomic characteristics of the neighborhood (180); coherence of the proposal (130); share of outside funding (30); quality of personnel (150); financial aspects (110).

Adding the maximum scores per element gives an overall maximum score of 600. FODI then allocated its available budget for the second contest by funding proposals from high to low until the budget was exhausted. In practice FODI spent the last dollar of the available budget on a proposal that received an overall score of 425.<sup>6 7</sup> We will exploit this funding threshold in a regression discontinuity design. The threshold could not be anticipated by the applicants or the organizers, reducing the likelihood of manipulation.

### 3 Empirical approach

We are interested in the impact of exposure to child care centers and home visits on cognitive and physical outcomes of children, and on parenting styles, psychic well-being and labor market outcomes of their mothers. Naive OLS-regressions are likely to give biased estimates of these relationships due to (self-)selection of children and families into treatment. For instance, programs may specifically target their efforts towards children that would otherwise be severely deprived. Without intervention these children would probably have worse outcomes than other children. Or likewise, parents may for some reason prefer to enroll their smarter children into preschool programs. Without exposure to a treatment these children would probably have better outcomes than other children.

The way in which FODI allocated its budget in the second contest provides a regression discontinuity design which gives a source of exogenous variation which we will exploit to estimate the causal impacts of the two interventions. In practical terms the regression discontinuity design boils down to an instrumental variable approach in which the binary indicator ( $Z$ ) of having a score above or below the funding threshold is used as instrument for exposure to treatment. In this approach we can condition on a smooth function of the underlying score ( $s$ ) (referred to as the forcing variable) and other covariates ( $X$ ). This gives the following equation for home visits:

$$Y_i = \alpha_{HV} + \delta_{HV}HV_i + f_{HV}(s_i) + X_i\beta_{HV} + \varepsilon_{HVi} \quad (1)$$

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<sup>6</sup>Beforehand, a score of 400 was set as the minimum quality standard to be eligible for funding.

<sup>7</sup>The proposal with the lowest score that received funding was a proposal for a home visiting program, but the same cutoff score then applies to proposals for child care centers. All proposals for child care centers with a score above 425 received funding, while no proposal for child care centers with a score below 425 received funding.

where  $HV = 1$  if the child was exposed to home visits and  $HV = 0$  if the child was assigned to the comparison group for home visits. Likewise to evaluate the impact of child care centers we estimate:

$$Y_i = \alpha_{CC} + \delta_{CC}CC_i + f_{CC}(s_i) + X_i\beta_{CC} + \varepsilon_{CCi} \quad (2)$$

where  $CC = 1$  if the child was enrolled in a child care center and  $CC = 0$  for children assigned to the comparison group for child care centers.

The results that we report in the main text are based on specifications that only include a linear term of the underlying score (rank). Our graphical analysis on Section 6 suggests that the relation between (most) outcomes and rank is close to linear. In Tables A2-A4 in the appendix we present results based on other specifications: (i) a specification without control for rank; (ii) a spline specification where we allow the linear term to have different effects below and above the threshold; (iii) a specification that allows for a linear and a quadratic term in rank; and (iv) a specification that also allows for a cubic term in rank. As our results will show, controlling for rank makes a difference, but the different ways in which we do this produce very similar results.

The identifying assumption in this framework is that conditional on covariates and the forcing variable, treatment is as good as random. In the equations,  $HV_i$  and  $CC_i$  are instrumented by  $Z_i$ , where  $Z_i = 1$  if  $s_i \geq s_0$ , and  $Z_i = 0$  if  $s_i < s_0$ , and where  $s_0$  is the funding threshold of the overall score which for both programs equals 425. The parameters of interest are  $\delta_{HV}$  and  $\delta_{CC}$ . To avoid confusion, note that these parameters are estimated on different samples. The impact of home visits is estimated using a sample of children and their mothers who were on the list of a proposal for a home visit program, while the impact of child care centers is estimated using a sample of children and their mothers who were on the list of a proposal for a child care center program.<sup>8</sup>

The procedure of allocating funding allows us to compare outcomes of children and their mothers that were on the list of a proposal for a home visit center that received a score above the threshold to outcomes of children and their mothers that were on the list of a proposal for a home visit center that received a score below the threshold. It also allows us to compare outcomes of children and their mothers that were on the list of a proposal for a child care center that received a score above the threshold to outcomes of children and their mothers that were on the list of a proposal for a child care center center that received a score below the threshold. The regression discontinuity design does not allow us to compare the outcomes of children who were exposed to home visits with the outcomes of children who were exposed to child care centers. The reason is that (prospective) providers of early childhood development programs decide on the type of

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<sup>8</sup>We are thus also not using one single instrumental variable  $Z$  to estimate two parameters.



program they want to offer. We thus have no quasi-experimental design to estimate the effectiveness of home visits relative to child care centers.

To make inferences about the relative effectiveness of the two types of programs we assume that the difference in outcomes between the two comparison groups measures the no-intervention difference for the two treatment groups. We can then apply a difference-in-differences approach. The estimator for the impact of home visits relative to child care centers is then:

$$(E[Y|HV = 1] - E[Y|CC = 1]) - (E[Y|HV = 0] - E[Y|CC = 0])$$

where  $E[Y|x = 1]$  is the average outcome for children exposed to treatment  $x$ , and  $E[Y|x = 0]$  is the average outcome for children assigned to the comparison group of treatment  $x$ . In practice we implement this by estimating the following regression with instrumental variables:

$$Y_i = \beta_0 + \beta_1 LHV_i + \beta_2 T_i + \beta_3 LHV_i \cdot T_i + f(s_i) + X_i \beta_4 + LHV_i \cdot X_i \beta_5 + \varepsilon_i \quad (3)$$

where  $LHV_i = 1$  indicates that a child's name appeared on the list of a proposal submitted for funding as home visit program (whether they were treated or not),  $LHV_i = 0$  if the child's name appeared on the list of a proposal submitted for funding as child care center program.  $T_i = 1$  indicates exposure to one of the two programs,  $T_i = 0$  otherwise.  $T_i$  and  $LHV_i \cdot T_i$  are instrumented with  $Z_i$  and  $LHV_i \cdot Z_i$ . Note that the effect of control variables  $X_i$  is allowed to vary between the two interventions. Ignoring covariates ( $X_i$ ),  $\beta_1$  is now the average difference in outcomes between children listed for child care centers and children listed for home visits in the absence of treatment, whereas  $\beta_2$  is the average difference in outcomes between children in the control group and in the treatment group for child care centers.  $\beta_3$  is the average difference in outcomes between children enrolled in child care centers and children exposed to home visits.

The estimate of  $\beta_3$  can only be interpreted as the causal effect of exposure to home visits instead of placement in child care centers if the treatment effect is homogeneous. This excludes selection into programs on the basis of comparative advantage. This would for instance be the case if children exposed to home visits benefit more from home visits than children placed in child care centers. To examine the robustness of our findings, we estimate this difference-in-differences equation not only on the full sample, but also on a sample of observations with a very similar propensity to be on the list for home visits (instead of for a child care center). We implement this by first regressing the binary indicator for being on the list for home visits ( $LHV$ ) on observables ( $X$ ), then calculating for each observation its predicted probability to be on the list for home visits, and based

**Table 1.** Number of children by program, eligibility and age (number of centers in parentheses)

Program	Age	Non-eligible	Eligible	Total
Home visits	all	830 (28)	988 (33)	1818 (61)
	age >36 months	739 (27)	794 (33)	1533 (60)
	age <60 months	465 (27)	704 (33)	1169 (60)
child care centers	all	411 (12)	478 (26)	889 (38)
	age >36 months	371 (11)	421 (26)	792 (37)
	age <60 months	194 (12)	318 (26)	512 (38)

on this restrict the sample to observations with a predicted probability that is within 1.05 standard deviation of the mean predicted probability. The value of 1.05 was chosen such that in this restricted sample the groups actually on the list for home visits and actually on the list for child care centers are not significantly different on any of the background variables that we include in the analysis.

## 4 Data

A total of 113 submitted proposals passed the minimum quality requirement of 400 points. From these we selected all proposals with a score at most one standard deviation from the threshold:  $s \in [425 - 1SD; 425 + 1SD]$ . We subsequently selected a random sample of the centers that were included in these proposals. Recall that one proposal can include multiple centers. Within each center, we selected a random sample from the children whose names were on the list attached to the proposal. Notice that the lists with names of the children that would be served are vital for our design. Without those lists it is impossible to know which children would have received treated in the centers that did not receive funding.

The final sample consists of 2,572 children in 99 centers; 38 providing child care centers and 61 home visits. Table 1 shows the numbers of observations (children and centers) in our final sample by program (home visits and child care centers), age group (all, above 36 months, and below 60 months) and treatment eligibility.<sup>9</sup> We present a breakdown by these ages because some cognitive and motor tests are only validated for children older than 36 months while others are only validated for children younger than 60 months.

Teams of data collectors visited the homes of all children included in the final sample. They collected data from the children and their mothers and families through inter-

<sup>9</sup>As we will show in Section 5 treatment eligibility and actual exposure to treatment are very highly correlated.

views with the mothers and through tests and measurements. Data were collected between September and December of 2008. At the moment of data collection, treated children in our sample have on average been exposed to treatment during 21 months. This is the same for child care centers and home visits.

We used standard and validated test instruments to measure the cognitive, motor and social-emotional development of children. Some tests are specific for children older than 36 months. These are the Spanish versions of the Peabody Picture Vocabulary test which measures receptive vocabulary (language), the Woodcock-Johnson-Munoz test which measures long term memory, and the Pegboard test which measures fine motor skills. For all children from 0 to 60 months old, we use the Nelson-Ortiz test which measures four dimensions of child development: language skill, gross motor skill, fine motor skill and social behavior.

Test scores are standardized by age. We normalized the scores on the Peabody, Woodcock and Pegboard tests to mean zero and standard deviation one. Impact estimates are thus expressed in standard deviation units. Scores on the Nelson Ortiz tests are binary: above or below the mean of the age group.

To measure children's physical development we use height for age and weight for age. We also took blood samples to measure the hemoglobin levels of the children to detect iron deficiency anemia. For the mothers we measure the following outcomes: the Center for Epidemiological Studies Depression (CES-D) scale to measure depression and psychological stress, the Home Observation for Measurement of the Environment (HOME) scale to measure responsiveness to children, and variables related to the labor market such as participation, working hours and income. The CES-D covers the main symptoms of depression and is derived from five validated depression scales. The score on the HOME test is based on the interviewer's evaluation of the mother's attitudes and behavior towards the child during the interview. We converted respondents' scores on the CES-D test and the HOME test to mean zero and standard deviation one, so that again impact estimates are measured in standard deviation units.

## **5 First stage and identifying assumptions**

In this section we will first show that whether a proposal is above or below the funding threshold almost perfectly determines whether a child that is on the list of a proposal, is exposed to treatment. We then discuss the identifying assumption and we provide evidence in support of it.

All proposals with a score above the threshold received funding from FODI and all proposed programs were implemented at the moment of data collection. Likewise, none

**Table 2.** First stage regressions

	(1)	(2)	(3)
Home visits			
Above threshold (Z)	0.990*** (0.003)	0.988*** (0.006)	0.986*** (0.006)
<i>F</i> -test instrument	93652	27991	27812
Number of children (programs)	1818 (60)	1818 (60)	1818 (60)
child care centers			
Above threshold (Z)	0.968*** (0.020)	0.981*** (0.023)	0.972*** (0.026)
<i>F</i> -test instrument	2427	1880	1791
Number of children (programs)	889 (38)	889 (38)	889 (38)
Controls			
rank	No	Yes	Yes
<i>X</i>	No	No	Yes

*Note:* Estimates from linear probability models of actual treatment on assigned treatment. Robust standard errors that are clustered at the program-level in parentheses. \*\*\* indicates significance at the 1%-level. Background controls are the variables included in Table 4.

of the proposals with a score below the threshold received funding from FODI and none of these proposed programs have been implemented. At the proposal or program level, the allocation of FODI's budget thus represents a sharp regression discontinuity design; the score assigned to the proposal perfectly determines whether the proposal receives funding and whether the proposed program is implemented.

The sharp design at the proposal or program level translates into an almost sharp design at the level of children. Just a few children included in a proposal that received funding did not participate in the program, and also just a few children included in a proposal that did not receive funding participated in an(other) early childhood program.<sup>10</sup> The almost perfect compliance with the assigned treatment status results in first stage estimates close to one. Table 2 shows this, for both interventions and for various specifications.<sup>11</sup>

As mentioned before, proposals with a score above 425 (on a scale from 0 to 600) were eligible for funding and proposals with a lower score were not eligible. Table 3 shows average values of the scores for proposed programs above and below the threshold in our sample, separately for home visits and for child care centers. The table also shows the average scores the proposed centers received on each of the five components of the total score. The main factors determining whether proposals for home visit centers ended up below the threshold are the quality of staff and financial aspects of the proposals.

<sup>10</sup>Two children did not participate in a home visit program while they should, 9 children did not participate in a child care center program while they should, 7 children participated in a home visit program while they should not, and 5 children participated in a child care center while they should not.

<sup>11</sup>Results are virtually identical when we control for higher order terms of rank.

**Table 3.** Components of score

Variable	Home visits (HV)			child care centers (CC)			HV vs CC <i>p</i>
	<i>s</i> < 425 (1)	<i>s</i> ≥ 425 (2)	<i>p</i> (3)	<i>s</i> < 425 (4)	<i>s</i> ≥ 425 (5)	<i>p</i> (6)	
Total score	416.33 (5.96)	452.82 (13.82)	0.000	408.05 (7.25)	447.05 (12.51)	0.000	0.020
SES	173.04 (6.43)	172.58 (6.39)	0.781	177.92 (2.58)	174.23 (4.84)	0.004	0.003
Co-funding	25.91 (7.21)	25.70 (6.89)	0.910	20.67 (0.99)	23.46 (4.06)	0.002	0.749
Quality of staff	22.60 (12.55)	48.73 (10.29)	0.000	15.97 (14.51)	44.36 (18.57)	0.000	0.108
Coherence	107.45 (10.59)	110.72 (8.03)	0.194	108.10 (10.68)	114.19 (7.29)	0.078	0.251
Financial aspects	87.34 (8.87)	95.10 (11.83)	0.003	85.41 (7.25)	90.81 (9.79)	0.118	0.763
<i>N</i>	28	33		12	26		99

There is no significant difference with respect to the social economic background of the communities that are proposed to be served. Also for child care centers, the quality of the proposed staff is the main factor determining whether a proposal ends up above or below the threshold. Three other factors also show significant differences between proposal above and below the threshold, but the differences in points on these items are small. The final column of the table compares the scores of home visits versus child care center proposals. This shows that home visits are proposed for communities/neighborhoods with a higher social-economic status than the communities/neighborhoods for which child care centers are proposed. This underscores the importance to balance the children listed for the two programs when we compare the two treatments.

The identifying assumption in the regression discontinuity design is that conditional on a smooth function of the underlying score and observables included in the analysis, there are no systematic unobserved differences between observations just below the threshold and observations just above the threshold. While this assumption cannot be tested, we can test whether observations above and below the threshold are not systematically different in terms of observable characteristics.

Table 4 shows the average values for important background variables separately for observations below and above the funding threshold and separately for the two programs. It also reports the *p*-values from a *t*-test for differences in means conditional on a linear function of the forcing variable. The *p*-values in columns (3) and (6) of Table 4 indicate that the characteristics of children eligible for treatment are in most cases not significantly different from the characteristics of children not eligible for treatment. There is only

a systematic difference in age. In the samples of both programs eligible children are significantly younger than non-eligible children; the age gap is about 6 months. We have no good explanation for this difference. It makes it important, however, to control in all analyses for age. Recall also that all outcome variables are standardized by age.

The last two columns of the table report the  $p$ -values for differences in characteristics between children whose name appeared on the list of a proposal for home visits and children whose name appeared on the list of a proposal for a child care center. This information is useful for our difference-in-differences approach in which we directly compare the effects of the programs. The results show that children listed for child care centers are significantly older than children listed for home visits. There also appears to be a difference in social background between children listed for home visits and children listed for child care centers. This difference shows up in the schooling levels of the mother and of the household head, mother's language-score, household size and the wealth index. As we already saw in Table 3, home visits appear to aim at children from relatively better-off families.

Because of these differences between the groups targeted by the two interventions, we constructed a balanced sample. On the basis of a linear probability model we estimated for each observation the probability to be listed for home visits instead of a place in a child care center.<sup>12</sup> We then restricted the sample to observations for which the predicted probability to be listed for home visits differs at most 1.06 standard deviation from the mean probability to be listed for home visits. The remaining sample covers 68 percent of the observations from the original sample. The final column in the table shows  $p$ -values for differences in characteristics between children actually listed for home visits and children actually listed for a child care center in this balanced sample. This shows that these groups are not significantly different in any of the characteristics included in the analysis.<sup>13 14</sup>

## 6 Results

This section is divided into three subsections. The first subsection presents results for children's cognitive outcomes. The second subsection presents results for children's health outcomes. The final subsection presents results for mothers' outcomes. In each subsection we start with a graphical presentation of the results. We then present and discuss estimates of the impact of the two interventions on the various outcomes. For each set

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<sup>12</sup>The results are reported in Table A1 in the appendix.

<sup>13</sup>When we broaden the sample to at most 1.1 standard deviation from the mean, mother's education starts to be significantly different between the groups ( $p$ -value is 0.053).

<sup>14</sup>This restriction of the sample is similar in spirit to propensity score matching. The advantage of this procedure is that we can still use the regression discontinuity design.

**Table 4.** Differences by eligibility status

Variable	Home visits (HV)			child care centers (CC)			HV vs CC	
	$s < 425$	$s \geq 425$	$p$	$s < 425$	$s \geq 425$	$p$	All	Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Boy (dummy)	0.52 (0.50)	0.51 (0.50)	0.094	0.50 (0.50)	0.52 (0.50)	0.542	0.743	0.626
Age in months	55.8 (14.4)	49.6 (12.9)	0.000	58.3 (14.3)	52.0 (12.4)	0.000	0.055	0.631
Household size	4.87 (1.71)	4.85 (1.71)	0.232	5.70 (1.97)	5.25 (2.00)	0.075	0.026	0.721
Urban (dummy)	0.70 (0.46)	0.66 (0.48)	0.479	0.49 (0.50)	0.40 (0.49)	0.918	0.088	0.612
Cash transfer (dummy)	0.58 (0.50)	0.55 (0.50)	0.912	0.61 (0.49)	0.58 (0.49)	0.017	0.460	0.501
Wealth index	0.61 (2.33)	0.02 (3.17)	0.428	-2.16 (3.58)	-0.30 (2.74)	0.179	0.069	0.899
Mother's age (years)	30.7 (8.56)	30.5 (8.12)	0.834	31.6 (8.46)	30.6 (7.96)	0.075	0.283	0.884
Schooling mother (yrs)	7.24 (3.66)	7.61 (4.13)	0.138	5.38 (3.55)	5.96 (3.56)	0.116	0.000	0.108
Schooling head (yrs)	6.66 (3.87)	6.72 (5.36)	0.357	5.51 (3.50)	5.74 (3.37)	0.427	0.006	0.405
Language score mother	72.1 (23.9)	70.5 (26.2)	0.467	59.78 (26.0)	62.2 (25.1)	0.197	0.016	0.642
Father present	0.72 (0.45)	0.81 (0.39)	0.008	0.83 (0.38)	0.77 (0.42)	0.127	0.324	0.903
Mother present	0.95 (0.22)	0.96 (0.21)	0.688	0.95 (0.23)	0.96 (0.19)	0.981	0.734	0.968
$N$	830	988		411	478		2707	1837

*Note:* Mean values and standard deviations in parentheses.  $p$ -values are based on  $t$ -tests for equality of means conditional on a third degree polynomial in the score.

of outcomes there is also a table in the appendix which presents results from alternative specifications.

### 6.1 *Children's cognitive and motor outcomes*

Figure 1 shows for four different cognitive outcomes the relation between the rank of the proposed center and the cognitive outcome. Each hollow circle in a graph represents the mean outcome of the children that were on the list of the same proposal for home visits or a child care center. The size of each circle is proportional to the number of children that were listed on the proposal. The solid lines represent the best linear fits through the hollow circles, where we weighted by number of children. These lines are drawn separately below and above the threshold value of 425. Below each graph we report an estimate of the discontinuity at the threshold. These estimates come from regressions that allow for separate linear relations in rank at both sides of the threshold and include no other control variables.

A first thing to note from the graphs is that the relationship between rank and outcomes is not very systematic or strong. For most outcomes this relation tends to be negative, also for the proposals that received funding. Recall that the rank of a proposal is also determined by the social economic status of the community it intends to serve, where the rank increases when the community is poorer.

The graphs for the home visits intervention show increases in the cognitive scores around the discontinuity. The solid line right of the discontinuity starts at a higher level than where the solid line left of the discontinuity ended. In all cases the discontinuities at the threshold are significantly different from zero. The picture is less clear for child care centers. For all four measures the discontinuities at the thresholds indicate an increase in the score, but these increases are never significantly different from zero.

We further investigate this in Table 5, which reports various estimates of the impact of the two interventions for all cognitive and motor outcomes that were measured. The first three columns relate to tests administered for children older than 36 months and the last five columns relate to tests administered for children younger than 60 months. The top panel presents the impacts of home visits (versus no intervention) and the middle panel presents the impacts of child care centers (also versus no intervention). These results are IV-estimates based on equations (1) and (2), respectively. Results are given for two specifications; the first only includes a control for a linear term of rank, while the second controls for the linear term of rank and background characteristics.<sup>15</sup>

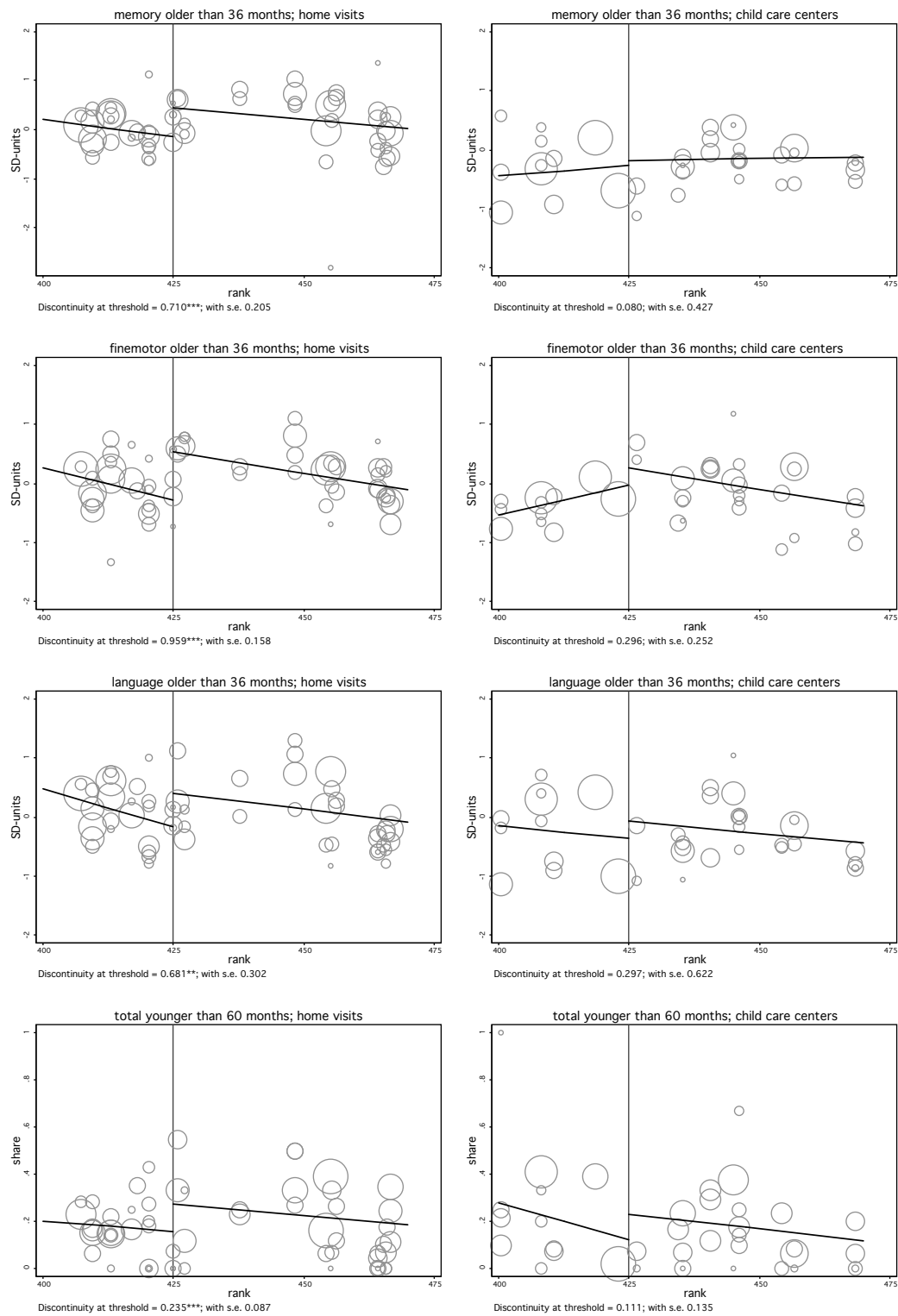
The results for home visits in the top panel reveal the same clear pattern as Figure 1.

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<sup>15</sup>In Table A2 in the Appendix we report results for other specifications, including a spline in rank, a quadratic specification and a cubic specification. Results are very similar.



**Figure 1.** Relation between cognitive outcomes and rank by type of intervention



*Note:* Each hollow circle in a graph represents the mean value of the outcome value in a unit for home visits/childcare centers. The size of a circle is proportional to the number of children in the unit. The solid lines represent the linear best fits through the circles (weighted by circle size), separately below and above the threshold rank of 425.

**Table 5.** Cognitive and motor outcomes

Specification	Older than 36 months				Younger than 60 months				Total
	Memory	Fine motor	Language	Gross motor	Fine motor	Language	Social		
rank	0.735*** (0.217)	0.990*** (0.136)	0.642* (0.325)	0.253** (0.109)	0.091 (0.059)	0.023 (0.055)	0.113 (0.105)	0.219** (0.091)	
rank, X	0.547*** (0.102)	0.894*** (0.143)	0.285** (0.120)	0.196*** (0.073)	0.059 (0.042)	0.003 (0.040)	0.087 (0.080)	0.157*** (0.053)	
N	1510	1521	1514	1187	1192	1189	1192	1200	
			Home visits						
			Child care centers						
rank	0.094 (0.373)	0.384 (0.284)	0.296 (0.553)	0.095 (0.063)	0.091 (0.072)	0.052 (0.084)	0.268* (0.147)	0.093 (0.128)	
rank, X	-0.440** (0.202)	0.161 (0.275)	-0.368** (0.165)	-0.003 (0.074)	0.039 (0.058)	-0.076 (0.071)	0.124 (0.162)	-0.026 (0.087)	
N	770	773	767	542	540	540	543	546	
			Home visits vs. child care centers						
DD-IV	0.985*** (0.226)	0.660** (0.293)	0.633*** (0.212)	0.203** (0.102)	0.050 (0.069)	0.077 (0.082)	-0.012 (0.163)	0.199** (0.100)	
whole sample	2280	2294	2281	1729	1732	1729	1735	1746	
DD-IV	1.371*** (0.231)	0.981*** (0.373)	0.924*** (0.238)	0.057 (0.129)	0.013 (0.081)	0.112 (0.116)	0.039 (0.192)	0.166 (0.128)	
restricted sample	1559	1567	1563	1168	1174	1170	1172	1179	

*Note:* Each estimate comes from a separate IV-regression where a dummy for being at or above the funding threshold is the instrument.  $f(s)$  is a third degree polynomial in the forcing variable. Background controls are the variables included in Table 4. Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at a 10/5/1% confidence level. The restricted sample includes observations whose predicted probability to be on a list for home visits (instead of child care centers) is within 1 standard deviation of the sample's mean probability to be on such a list.

Home visits have a positive impact on most outcomes and in both specifications. Focusing on the specification with covariates all estimates for children older than 36 months as well as the overall score of the tests for children under 60 months show a significant improvement of cognitive outcomes for children exposed to home visits. The impact sizes are substantial. The first three outcomes are measured in standard deviation units, hence the impacts vary between 28 and 90 percent of a standard deviation. The last five outcomes are measured as the probability to be above the mean score of the age group, implying that the overall score goes up by almost 16 percentage points, relative to a base of 17 percent.

The middle panel confirms that results are indeed completely different for the impacts of child care centers. It turns out that including controls for background characteristics makes a difference. Without controls all point estimates are positive (as they were in Figure 1) but, with one exception, not significantly different from zero. With controls all estimates become smaller and some turn out to be negative, in two cases even significantly so. Taken together, there is no indication of a positive impact of child care centers on the cognitive and motor outcomes of young children. If anything, the results suggest that child care centers harm the cognitive development of children above 36 months.<sup>16 17</sup>

The bottom panel in Table 5 shows difference-in-differences estimates based on equation (3) to compare the impacts of home visits relative to the impacts of child care centers. The first set of results is based on the entire sample, while the second set of results is based on the balanced (68%) sample of observations that have a similar predicted probability to be listed for home visits. While results vary somewhat across the two samples, the findings point in the same direction: children's cognitive and motor development benefits more from home visits than from child care centers. The effects are quite substantial. For instance, being exposed to home visits instead of attending a child care center increases the memory score by around one standard deviation unit.

## 6.2 *Children's health outcomes*

We next look at the impact of the programs on children's health outcomes. Figure 2 shows the relationships between rank and the three health outcomes: anemia, underweight and below height. The two graphs at the top of the figure reveal a clear picture: the share of children with anemia drops sharply around the threshold value of rank for the home visits intervention and it increases slightly for the child care center intervention. The

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<sup>16</sup>The negative impact on language score for children older than 36 months disappears when a quadratic and a cubic term of rank is included; see Table A2 in the appendix.

<sup>17</sup>We also inquired whether impacts are different for boys than for girls, and for children above and below 24 months old. Neither for home visits nor for child care centers, do we find any evidence for heterogeneity of impacts across these groups.

discontinuity at the threshold is significantly different from zero for the home visits, but not for the child care centers. For underweight and below height, the graphs reveal only small discontinuities at the thresholds and these are not significantly different from zero in the specification with a spline in rank and without control variables.

Further results are presented in Table 6. According to the specification with control variables, home visits reduce the incidence of anemia by almost 22 percentage points. Relative to a base of 0.46, this implies a reduction in anemia by about one half. The impact of home visits on weight for age is small and not significantly different from zero, while the impact on being below height is positive and significant. This contrasts with the impact of child care centers on children's health. Attendance to child care centers has no impact on the incidence of anemia or being below height, but it increases the probability of being underweight by 8.8 percentage points (relative to a baseline of 0.06).<sup>18</sup> The bottom panel presents estimates from the difference-in-differences specifications to compare the two treatments. These results show that being exposed to home visits instead of a child care center reduces the probability of having anemia. For the other two health measures, differences are not statistically significant.

### 6.3 *Mothers' outcomes*

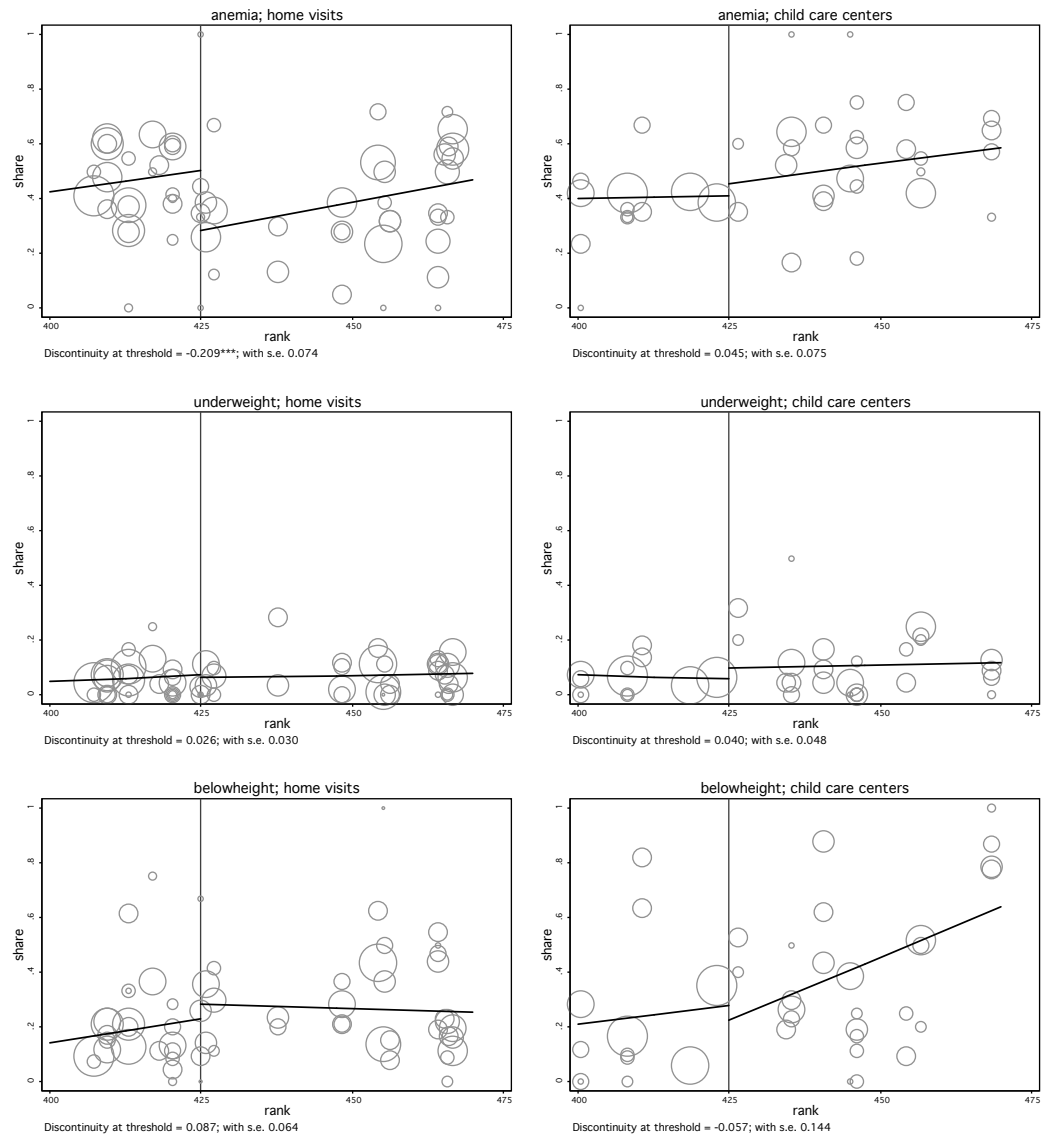
Early childhood interventions potentially also have an impact on the way mothers interact with their children and on mothers' psychic well-being and labor market outcomes. Figures 3 and 4 show for each intervention the relations between rank and mothers' outcomes. The two graphs in the top of Figure 3 indicate that home visits reduce non-responsive behavior of mothers towards their children, while child care centers seem to increase such behavior. The discontinuities at the thresholds are significant at the 1%-level in both graphs.

The second pair of graphs in Figure 3 indicate that mothers are more likely to read with their children when they have been exposed to home visits or when their children have been enrolled in child care centers. Here the discontinuities at the thresholds are not significantly different from zero in the specification without control variables. The next pair of graphs suggests that the home visit intervention increases the likelihood that there are learning materials in the home while this likelihood decreases when the children are enrolled in child care centers. But here again the discontinuities at the thresholds are not significant in the specification without control variables. The final pair of graphs in the figure indicates that home visits reduce mothers' stress and depression while child care centers lead to an increase of these symptoms. The discontinuity at the threshold is

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<sup>18</sup>Results for other specifications are presented in Table A3 in the appendix. This shows that the negative impact of home visits on children's height is not a very robust finding.

**Figure 2.** Relation between health outcomes and rank by type of intervention



*Note:* See the note of Figure 1.

**Table 6.** Health outcomes

Specification	Anemia	Under weight	Below height
Home visits			
rank	-0.244*** (0.067)	0.022 (0.030)	0.117** (0.057)
rank, X	-0.215*** (0.060)	0.028 (0.031)	0.114** (0.050)
<i>N</i>	1658	1787	1769
Child care centers			
rank	0.038 (0.082)	0.038 (0.051)	-0.075 (0.142)
rank, X	-0.026 (0.101)	0.088** (0.037)	-0.021 (0.095)
<i>N</i>	763	872	870
Home visits vs. child care centers			
DD-IV (whole sample)	-0.188 (0.116)	-0.073 (0.045)	0.115 (0.102)
<i>N</i>	2421	2659	2639
DD-IV (restricted sample)	-0.255** (0.118)	-0.010 (0.072)	0.102 (0.130)
<i>N</i>	1654	1810	1799

*Note:* See the note of Table 5.

significantly different from zero in the graph for home visits.

The estimation results presented in columns (1) to (4) of Table 7 confirm the results from the graphs.<sup>19</sup> Focusing on the results from the specification with controls for background characteristics, we find that home visits make mothers' more responsive to their children, while child care centers reduce responsiveness. The dependent variable here is measured in standard deviation units, so home visits reduce non-responsiveness by almost one standard deviation unit, while child care centers increase it by about 80 percent of a standard deviation unit. Being exposed to home visits has positive impacts on mothers reading to their children and the children having learning materials (books, clay, toys) at home. Attending a child care center has no significant impact on mothers reading to their children but it reduces the probability of having learning materials at home. The fourth column shows that home visits reduce stress and depression in mothers whereas child care centers have the opposite impact. Effects are again in standard deviation units, implying that home visits reduce stress and depression by 34 percent of a standard deviation while child care centers increase it by 41 percent of a standard deviation. These impacts are quite substantial.

The results in the bottom panel of the table show that these findings also hold when we compare the two treatments directly: when the child is exposed to home visits instead of a child care center, mothers are more responsive, it is more likely that there are learning materials in the home and the psychic well-being of the mothers improves considerably.

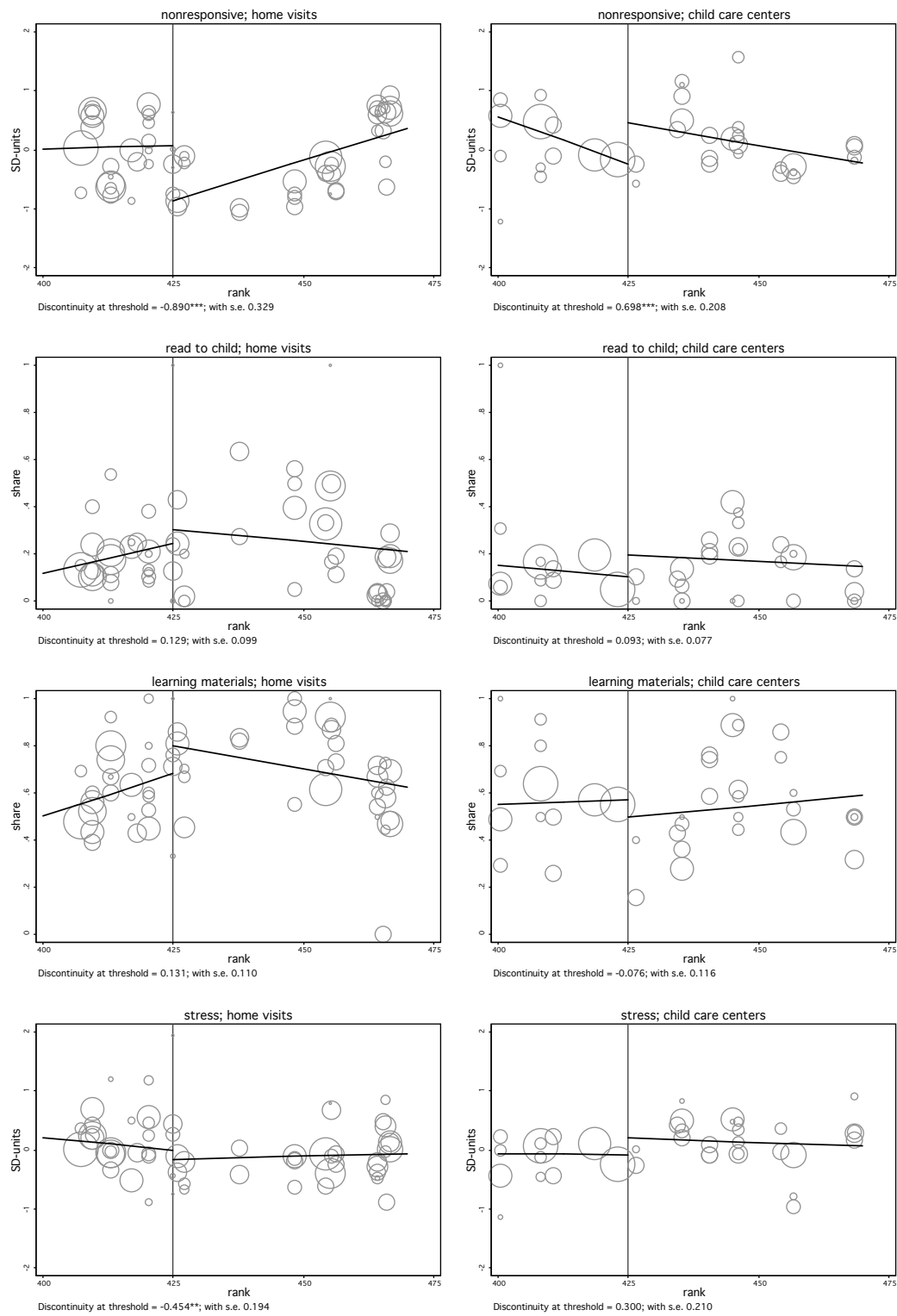
Figure 4 shows for both interventions the relations between rank and labor market outcomes. The two graphs at the top of this figure clearly suggest that home visits reduce the incidence of mothers working, while child care centers increase this. The discontinuities at the thresholds are significantly different from zero. A similar pattern is observed in the second pair of graphs for the number of hours that the mother works. Again the discontinuities at the thresholds are significantly different from zero. The pair of graphs for the income of mothers is consistent with this. Mothers' income goes down in case of home visits while it increases when the child is enrolled in a child care center. Here only the discontinuity at the threshold of the graph for child care centers is significant. The final pair of graphs in the figure demonstrate the relationship with the income generated by the head of the household. If mothers are working less (or more), this can be compensated by household heads working more (less). For both interventions, we see a tendency for household heads to earn more when their child is exposed to an early childhood program, but the discontinuity is only significant at the threshold for child care centers.

The estimation results presented in columns (5) to (8) of Table 7 are consistent with

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<sup>19</sup>See also Table A4 in the appendix for results from alternative specifications. Almost all results we report in Table 7 are robust to changes in the specification. When this is not the case, we mention that in the main text.

**Figure 3.** Relation between mothers' outcomes and rank by type of intervention



*Note:* See the note of Figure 1.

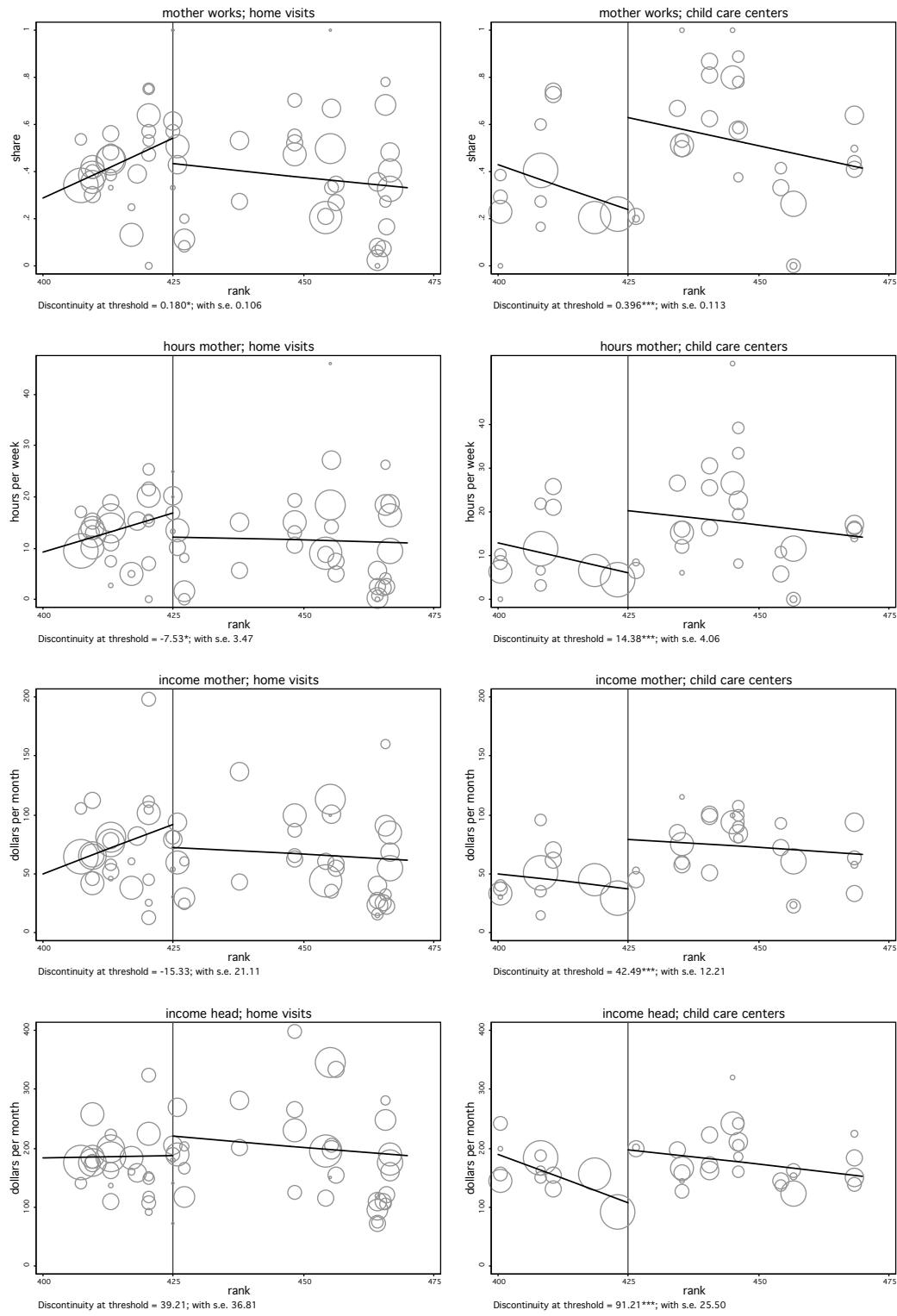


**Table 7.** Parenting and labor market outcomes

Specification	Non- responsiveness (1)	Read (2)	Learning material (3)	Stress/ depression (4)	Labor mother (5)	Hours mother (6)	Income mother (7)	Income head (8)
rank	-1.186*** (0.285)	0.174 (0.107)	0.221** (0.109)	-0.489*** (0.144)	-0.091 (0.111)	-5.203 (3.442)	-4.973 (18.556)	48.357 (37.955)
rank, X	-0.916*** (0.160)	0.073** (0.034)	0.141** (0.062)	-0.337*** (0.117)	-0.089 (0.080)	-4.757* (2.498)	-13.354 (12.521)	12.118 (15.396)
N	1798	1818	1818	1817	1818	1816	1818	1817
			Home visits					
rank	0.655** (0.246)	0.090 (0.076)	-0.080 (0.126)	0.307 (0.200)	0.389*** (0.125)	14.040*** (4.562)	41.982*** (12.995)	85.116*** (30.648)
rank, X	0.798*** (0.243)	-0.056 (0.045)	-0.237** (0.105)	0.406** (0.181)	0.223** (0.107)	7.305* (4.119)	17.348 (12.769)	45.017** (19.050)
N	870	889	889	889	889	888	889	887
			Child care centers					
DD-IV (whole sample)	-1.723*** (0.289)	0.153*** (0.056)	0.406*** (0.124)	-0.689*** (0.206)	-0.299** (0.130)	-11.781** (4.582)	-29.300* (17.222)	-23.541 (22.583)
N	2668	2707	2707	2706	2707	2704	2707	2704
DD-IV (restricted sample)	-1.576*** (0.401)	0.059 (0.075)	0.395** (0.184)	-0.753*** (0.273)	-0.471** (0.194)	-17.386** (6.969)	-42.663** (19.896)	-48.444* (27.036)
N	1710	1735	1735	1734	1735	1732	1735	1733
			Home visits vs. child care centers					

Note: See the note of Table 5.

**Figure 4.** Relation between labor market outcomes and rank by type of intervention



*Note:* See the note of Figure 1.

the picture that arises from the graphs. We find a significantly positive effect of child care centers on the probability that the mother works. The effect is large; 22 percentage points in the specification with controls for background characteristics. The impact of home visits on mothers working is not significantly different from zero, the point estimate has, however, a negative sign. For working hours we find that these go up by around 7 hours per week when the child is enrolled in a child care center, while these go down by around 4 hours per week in case of home visits. For income of the mother and the household head, we find insignificant effects of home visits. The effect of child care centers on income of the mother is positive but not significant in the specification that includes controls for background characteristics, and significantly positive for the income of the household head. It may seem strange that while women work more not they but their husbands earn more. This is, however, not so strange in the context of a developed country with a large informal sector and where many families work in a small household enterprise. Household income increases with around 60 USD per month. The bottom rows of the table show that the effects obtained from the regression discontinuity designs carry over to the direct comparison of home visits and child care centers.

## **7 Conclusions**

The evidence on the effects of early childhood interventions in the context of developing countries is thin. In this paper we provide evidence on the impact of child care centers and home visits on a range of outcomes: children's cognitive and motor development, children's health, parenting styles, mothers' labor supply and income and mothers' psychic well-being. Home visits and child care centers are both evaluated against no intervention through a regression discontinuity design, and are compared by combining the regression discontinuity design with a difference-in-differences approach.

Our results show that home visits have a positive impact on children's cognitive and motor outcomes, whereas child care centers appear to have no impact or possibly a small negative effect on these outcomes. Home visits have a positive impact on children's health in the sense that it reduces anemia, but also seem to increase the probability of being below height. This latter finding is, however, not robust and disappears when we include higher order terms of rank in the specifications (see Table A3 in the appendix). Child care centers appear to result in children being underweight more often. Furthermore, home visits reduce mothers' stress and depression symptoms and make them more responsive towards their children. Child care centers do the exact opposite: they harm mothers' psychic well-being and reduce responsiveness. Finally, child care centers increase mothers' labor market participation and family income, while home visits reduce mothers' labor market

participation but leave family income unaffected. The two types of interventions thus represent a clear trade-off between child outcomes and mother's psychic well-being on the one hand, and labor market participation and family income on the other hand.

Our findings are consistent with a production technology in which children's outcomes are determined by three inputs: the quantity of time spend with them, the quality of time spend with them, and parental income. The home visiting intervention is likely to come with increases in the quality and quantity of mothers' time input, while parental income is not affected. The quality of mothers' time input is likely to increase because the program explicitly aims (and manages) to improve mothers' parenting styles. The quantity of mothers' time input is likely to increase because the program reduces mothers' labor supply. Home visits thus change the relevant inputs such that children's outcomes will improve, which is what we observe. In contrast, the child care center intervention has ambiguous effects on the quality and quantity of time inputs, while parental income increases. The quantity of time input increases with the hours during which the child attends the child care center but mothers' presence is reduced. What happens with the quality of the time input depends on the quality of the child care center, and whether this quality is sufficiently high to compensate for the reduced quality of mothers' time inputs. The quality of mothers' time input is lower if stressed or depressed mothers have worse parenting styles, which is what we find. Apparently, the negative changes in inputs exceed the positive changes, which explains why children's outcomes deteriorate.

This discussion makes explicit that our findings are conditional on the quality of the early childhood interventions included in our design. In that respect it is important to emphasize that we look at the effects of programs that were well above the minimum quality standards required to receive funding. Moreover, the home visit programs and child care centers that we evaluate are of the same quality level (measured by the scores that the proposals received in the contest). At the same time, lower quality of child care centers in Ecuador than those operated elsewhere might explain why we find negative effects of child care centers on children's development while studies for Norway and Germany report positive effects of child care centers on these outcomes (Havnes and Mogstad, 2011; Felfe and Lalive, 2010).

The trade-off which we identified poses a difficult choice to policy makers and funding agencies. Children and women in poor families in developing countries are both vulnerable groups. Home visits benefit children, whereas child care centers make women less happy but are also likely to empower them by increasing their labor market participation. We trust that information about these conflicting interests are helpful in formulating and implementing efficient policies.

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## Appendix

Table A1: Linear probability model for being listed for home visits vs child care centers

	coefficient		s.e.
Boy	0.008		(0.017)
Age	-0.003	***	(0.001)
Household size	-0.024	**	(0.012)
Urban	0.126	***	(0.021)
Cash transfer	0.049	***	(0.019)
Wealth index	0.011	***	(0.004)
Mother's age	0.001		(0.001)
Schooling mother	0.012	***	(0.003)
Schooling head/10	-0.002		(0.024)
Language score mother/10	0.002		(0.005)
Father present	-0.016		(0.026)
Mother present	-0.029		(0.050)
Indigenous	-0.052	***	(0.019)
Number of adolescents in household	-0.019	**	(0.008)
Number of adults in household	0.010		(0.018)
Number of old people in the household	-0.018		(0.041)
Mother is illiterate	0.023		(0.031)
$R^2$	0.09		
$N$	2707		

Note: Robust standard errors in parentheses. \*\*\*/\*\* indicates significance at the 1%/5%-level.

Table A2: Additional specifications cognitive outcomes

Specification	Older than 36 months			Younger than 60 months			Total	
	Memory	Fine motor	Language	Gross motor	Fine motor	Language		Social
No controls	0.193* (0.103)	0.189* (0.108)	-0.009 (0.140)	0.076 (0.055)	0.010 (0.020)	0.019 (0.027)	0.079 (0.051)	0.064* (0.035)
Spline rank, X	0.566*** (0.109)	0.891*** (0.153)	0.384*** (0.125)	0.149* (0.087)	0.067 (0.046)	0.020 (0.045)	0.137 (0.086)	0.183*** (0.061)
Quadratic rank, X	0.553*** (0.109)	0.852*** (0.156)	0.390*** (0.135)	0.186** (0.089)	0.085* (0.050)	0.031 (0.043)	0.178* (0.096)	0.210*** (0.062)
Cubic rank, X	0.546*** (0.116)	0.814*** (0.143)	0.364*** (0.131)	0.225** (0.086)	0.092* (0.048)	0.027 (0.043)	0.194* (0.104)	0.220*** (0.060)
N	1510	1521	1514	1187	1192	1189	1192	1200
			Home visits					
			Child care centers					
No controls	0.204 (0.192)	0.230 (0.142)	0.009 (0.324)	0.018 (0.039)	-0.025 (0.061)	-0.006 (0.062)	0.013 (0.086)	-0.031 (0.081)
Spline rank, X	-0.478** (0.206)	0.004 (0.205)	-0.392** (0.187)	0.004 (0.078)	0.054 (0.060)	-0.037 (0.066)	0.136 (0.153)	-0.013 (0.090)
Quadratic rank, X	-0.558** (0.229)	-0.152 (0.207)	-0.433* (0.219)	-0.007 (0.086)	0.070 (0.065)	-0.006 (0.071)	0.124 (0.162)	-0.014 (0.098)
Cubic rank, X	-0.575** (0.281)	-0.090 (0.308)	-0.227 (0.247)	-0.079 (0.093)	0.168** (0.066)	0.058 (0.074)	0.076 (0.208)	0.017 (0.122)
N	770	773	767	542	540	540	543	546

Note: Each estimate comes from a separate IV-regression where a dummy for being at or above the funding threshold is the instrument. Background controls (X) are the variables included in Table 4. Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at a 10/5/1% confidence level.



Table A3: Additional specifications health outcomes

Specification	Anemia	Under weight	Below height
Home visits			
No controls	-0.068 (0.046)	0.016 (0.015)	0.082** (0.039)
Spline rank, X	-0.188*** (0.066)	0.029 (0.029)	0.090 (0.054)
Quadratic rank, X	-0.163** (0.067)	0.023 (0.029)	0.036 (0.060)
Cubic rank, X	-0.154** (0.069)	0.026 (0.031)	0.005 (0.066)
<i>N</i>	1658	1787	1769
Child care centers			
No controls	0.115*** (0.035)	0.043* (0.025)	0.189** (0.082)
Spline rank, X	-0.021 (0.100)	0.091** (0.034)	0.005 (0.077)
Quadratic rank, X	-0.017 (0.103)	0.097*** (0.034)	0.040 (0.077)
Cubic rank, X	0.031 (0.117)	0.095 (0.065)	0.183 (0.118)
<i>N</i>	763	872	870

Note: See the note of Table A2.

Table A4: Additional specifications parental outcomes

Specification	Non-responsiveness (1)	Read (2)	Learning material (3)	Stress/depression (4)	Labor mother (5)	Hours mother (6)	Income mother (7)	Income head (8)
No controls	-0.143 (0.174)	0.073* (0.040)	0.094* (0.054)	-0.250*** (0.093)	-0.070 (0.047)	-2.392 (1.679)	-6.269 (8.799)	15.257 (18.726)
Spline rank, X	-0.679*** (0.242)	0.043 (0.038)	0.067 (0.067)	-0.314** (0.155)	-0.178** (0.074)	-7.020*** (2.459)	-24.927 (14.965)	15.995 (19.245)
Quadratic rank, X	-0.544** (0.244)	0.016 (0.034)	0.031 (0.074)	-0.293* (0.157)	-0.171* (0.093)	-7.171** (2.930)	-22.129 (15.608)	16.741 (18.677)
Cubic rank, X	-0.530** (0.225)	0.009 (0.033)	0.032 (0.075)	-0.316** (0.158)	-0.142 (0.087)	-6.792** (2.903)	-16.023 (13.175)	16.101 (18.049)
N	1798	1818	1818	1817	1818	1816	1818	1817
			Home visits					
No controls	-0.038 (0.166)	0.047 (0.041)	-0.018 (0.063)	0.219* (0.112)	0.198** (0.076)	8.150*** (2.580)	30.140*** (6.590)	28.124 (19.505)
Spline rank, X	0.881*** (0.196)	-0.054 (0.042)	-0.223** (0.095)	0.398** (0.178)	0.229** (0.097)	7.695** (3.738)	17.714 (11.430)	53.686*** (14.698)
Quadratic rank, X	0.976*** (0.197)	-0.065 (0.044)	-0.243** (0.104)	0.417** (0.191)	0.215** (0.106)	7.583* (4.015)	16.531 (11.457)	65.056*** (12.981)
Cubic rank, X	1.117*** (0.322)	-0.135** (0.057)	-0.417*** (0.113)	0.724*** (0.234)	0.295 (0.186)	9.939 (6.607)	20.167 (17.538)	82.724*** (19.126)
N	870	889	889	889	889	888	889	887
			Child care centers					

Note: See the note of Table A2.