Income Transfer Policies and Nutritional Condition of Children: An Evaluation of "Bolsa Família"

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ABSTRACT: This paper investigates the impact of the *Bolsa Familia* program, a conditional cash transfer program focused on Brazilian poor families, on children's nutritional status in a context of low monitoring of conditionalities. The analysis is carried out using data from a baseline survey conducted in 2005, the "Bolsa Família" Impact Evaluation Research. The evaluation is made using the Propensity Score Matching technique. Besides considering observational differences between beneficiaries and non-beneficiaries of Bolsa Família Program, our empirical strategy also addresses some concerns about informational issues in order to take into account potential endogeneity of the decision to participate in the Program. Our final results show a positive effect of *Bolsa Família* Program on children nutritional status only when controlling for the informational bias and for those children fulfilling educational requirements; however, this positive impact on nutritional status is restricted to BMI-for-age but does not affect height-for-age.

JEL Classification: D12; I38; J13; J18

Key words: "Bolsa Família", nutritional status, BMI-for-age, height-for-age, conditional cash transfer, Latin America, Brazil.

Introduction

The nutritional status of children under school-age has particular relevance not only due to its immediate welfare effects, but also because of its persistent impacts on physical and mental development, and on adult health status (Cravioto and Arrieta, 1986). Child's physical and mental development affects both her performance at school and her productivity after school. There are several pieces of evidence on the strong correlation between nutritional status, attendance

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and performance at school1[1], as well as between nutritional status, productivity and household income[2]. In a macroeconomic dimension there is also a relationship between malnutrition and development. According to Gillespie and Haddad (2001), malnutrition in developing countries is one of the main restrictions to human and economic development, being responsible, in part, for the high rates of morbidity and mortality by avoidable diseases, specially among women and children.

The nutritional status of children depends on several factors, among which the most important is the access to food rich in nutrients (Allen, 1994). Other relevant factors are related to inadequate eating habits (Ruel and Menon, 2002) and to diseases and infections exposure (Stephensen, 1999). Schultz (1997) also indicates child labor as a factor that can cause malnutrition since it increases child nutritional demands. All these factors are related to poverty, and suggest that malnutrition affects children in poor families more than the ones in well off families (Wagstaff e Watanabe, 2000). Recognizing the long run impacts of nutrition among children, malnutrition is seen both as cause and consequence of poverty and its intergenerational transmission.

One important innovation in public policy that takes into account both short and long run poverty dynamics is Conditional Cash Transfer programs (CCT). CCT programs combine cash transfer with demand-side strategies designed to improve mainly children's nutritional status, preventive health and education outcomes. These programs have a dual objective: immediate poverty reduction through transfers and long-term poverty reduction through investment in human capital.

The aim of this paper is to analyze the effects of "Bolsa Família" program on the nutritional status of children aged between 6 and 60 months using a baseline survey conducted in 2005. "Bolsa Família" is a CCT program aimed at poor families in Brazil being the biggest program of the world.

Despite these evidences favoring CCT programs as public policy option some authors question its efficiency (Rawlings, 2005; Schubert & Slater, 2006; Shibuya, 2008; Hall, 2008). CCT programs require a huge informational system to allow the systematic household monitoring as well as to presume that delivery of health and education services are adequate. Furthermore there is still scarce evidence focused on the relative importance of the different components of these programs. The impact of conditionality itself is not known. The only paper that tried to disentangle the components of CCT is Fernaud, Gertler & Neufeld (2008). The authors analyzed the effect of cash transfer component taking advantage of a variation in cumulative amounts of cash transfer received by households. A doubling of cumulative cash transfers was associated with an increase in height-for-age z-score and a lower prevalence of stunting as well as a lower prevalence of overweight.

1 See, for example, Jamison (1986), Moock and Leslie (1986), Glewwe and Jacoby (1995), Glewwe, Jacoby e King (2001).

2 See Boissiere, Knight and Sabot (1985), Strauss (1986), Deolalikar (1988), Behrman (1993), Strauss and Thomas (1995), Glewwe (1996), Thomas and Strauss (1997), Case and Paxson (2006), Victora et al (2008).

This paper contributes to this debate as it sheds some light on cash transfers effects on children's nutritional status. It provides evidence on a children nutritional status impact evaluation of an important program in Latin America in a context of low monitoring of conditionalities. As the enrollment in *Bolsa Familia* program is in fact an income shock, this evaluation allows to disentangle the income effect from conditionalities effect. Hence this paper is the baseline analysis of *Bolsa Familia* program regarding health and nutritional status.

Outcome variables used in this paper are the standardized z-values of height-for -age and BMI-for-age according the new WHO child growth chart (WHO, 2006). Malnutrition indicators were also used here. Our empirical analysis is carried out using *Propensity Score Matching* (PSM) method.

The main results point out a positive effect of Bolsa Família program on the nutritional status of children aged 6 to 60 months living in the poorest households. Specifically, we find significant differences between Bolsa Família beneficiaries and non-beneficiaries groups for BMI for age and acute malnutrition. This result suggests that income shocks can improve nutritional status of children living in the poorest households related to acute malnutrition. This paper contributes to empirical analysis on two key aspects: 1) it deals with the relation between cash transfer effects and conditionalities monitoring; 2) it also address some concerns about information issues, controlling by parental and children educational attainment. Most of empirical evidence concerns CCT programs that present efficient monitoring system, contrasting with *Bolsa Familia* monitoring conditions in 2005.

The remainder of this paper is organized as follows. Section 2 presents *Bolsa Familia* Program. In section 3 we provide empirical evidence of other CCT experiences on children nutritional status. Section 4 refers to the database and survey. In section 5 the methodology of evaluation is presented and the sixth section consists of the results. Lastly, in section 7, some final considerations are reported.

CCT programs and Bolsa Familia

Conditional Cash Transfer Programs (CCT) are very widespread in less developed countries, especially in Latin America. We can mention Oportunidades in Mexico (previously Progresa), Red de Protección Social in Nicaragua, Programa de Asignácion Familiar in Honduras, Familias en Acción in Columbia, Subsidio Único Familiar in Chile, and the Program of Advancement through Health and Education in Jamaica (Janvry & Sadoulet, 2006). Similar programs are also being placed in sub-Saharan Africa as well as in Bangladesh and Nepal. (Lagarde, Haines & Palmer, 2007).

Besides its direct effects on immediate poverty reduction there is evidence that CCT have positive effects on health and nutritional status. Lagarde, Haines & Palmer (2007) do a systematic review of conditional cash transfer programs conducted

in low and middle-income countries. The authors conclude that conditional cash transfer programs are effective in increasing the use of preventive services and sometime also in improving health status. Regarding anthropometric outcomes, the authors conclude that programs that monitor their impact on anthropometric measures commonly showed positive outcomes, but these are limited to some beneficiary subgroups only, which may hide smaller mean effects. The review included three programs, Oportunidades in Mexico (Gertler, 2004; Berhman & Hoddinot (2005); Rivera et al (2004); Familias en Acción (Colombia) (Attanasio and Vera-Hernández, 2004); Red de Proteccion (Nicaragua) (Maluccio and Flores, 2004).

In the case of *Bolsa Familia*, the policy package is less complex than Oportunidades and Red de Proteccion. It only combines cash transfers with health and education conditionalities[3].It was conceived in 2003 as a public instrument to promote immediate poverty alleviation through direct income transfers. It also aims to break the intergenerational poverty cycle through conditionalities which reinforce the exercise of social rights in areas of health and education, and potentially allows for fighting future poverty by investing in the development of human capital.

In fact, the program consists of the integration of existing conditional cash transfer programs in Brazil, namely: *Auxilio Gás, Bolsa Alimentação, Cartão Alimentação and Bolsa Escola*. Recent studies (Rocha, 2008; Soares et al, 2006; Ferreira, Leite e Litchfield, 2006; Haddad, 2008) point out potential effects of income transfer programs on the reduction of poverty and inequality in Brazil, thereby stressing the importance of such policies. The eligibility criteria for Bolsa Família was defined in two contexts in 2005: 1) families with income *per capita* below R$ 100.00 (poverty line) with children under 15 or pregnant women; 2) families with income *per capita* below R$ 50.00 (extreme poverty), with or without children. For families in extreme poverty, the benefits begin at a basic value of R$50.00, for those without children, pregnant women, and breastfeeding mothers, and add a variable amount of R$15.00 for each child, up to three. For families in poverty, the value of the benefit corresponds only to the variable portion.

Currently, the program covers approximately 11 million households which represent almost 45 million people, or 25% of the Brazilian population. Since the creation of the program in 2003, the expansion of the enrolled population has been quite fast, although 2004 was the period when expansion was the fastest (Cedeplar & Science, 2005).

3 A previous impact evaluation was done in Brazil regarding Bolsa Alimentaçao Program (Morris et al, 2004). Bolsa Alimentaçao was a conditional cash transfer program that existed in Brazil before the integration of all cash transfer programs This impact evaluation assessed four municipalities in the Northeast of Brazil comparing 1387 children under 7 years of age from beneficiary households with 502 matched nonbeneficiaries. The authors found that each additional exposure to the program was associated with a rate of weight gain 31 g lower than control group. According to them, this result could be credited to a perception that the benefits would be cancelled if children started to grow adequately.

Bolsa Familia Program Conditionalities

Bolsa Familia program establishes conditionalities on basic children health care and attendance at school. Once a family enrolls in Bolsa Família, parents are supposed to keep their school-age children at school, in addition to comply with basic health care measures: to follow the immunization schedule – for children between 0 and 6 years of age; to supervise children growth attending a health center to check up growth and development of under-6 year children – and to keep up with pre- and post-birth agenda for pregnant women and breastfeeding mothers.

Regarding attendance to school, in 2005, these conditionalities were verified by the schools themselves. Each school was responsible for sending attendance registers of *Bolsa Familia* beneficiaries to Ministry of Social Development. Once any child in school-age in the household does not attend school, beneficiaries of this household are excluded from the program. Education conditionalities began to be monitored in 2001 when Bolsa Escola program was launched.

Health conditionalities depend on access to health services. Beneficiaries of *Bolsa Familia* program are supposed to be visited by community health agents periodically who are responsible for collecting information and sending these registers to local health authorities[4]. Health monitoring is registered in each semester and as emphasized by Lindert et al (2007) is much more complex than education. It is worth mentioning that when the program was implemented it did not create a specific an specific system of health monitoring as in other CCT programs. Health monitoring was supposed to be done using the network that was already established in the Public Health System. Besides that, health agents, who were responsible for sending health registers to local authorities, did not receive any specific training to monitor health status of *Bolsa Familia* beneficiaries. There are no penalties to beneficiaries if health conditionalities are not verified.

Official data about conditionalities monitoring evidence a strong difference between health and education monitoring. In 2005 a small percentage of households have had health status monitored: in the first semester, only 6%, and in the second semester 31%, contrasting to education monitoring that presented almost 63% of households beneficiaries monitored in 2006.

Database

The survey

The database used in this paper comes from a survey conducted by Regional Development and Planning Center – CEDEPLAR – in November 2005. The data

4 Local health agents are responsible for registering population and monitoring health status. They belong to a primary health program in Brazil implemented in 1997 and regulated through "PORTARIA Nº 1.886, DE 18 DE DEZEMBRO DE 1997". More details see: http://saudeprev.com.br/psf/.

collect and clearing were performed by a researcher team of the Brazilian Geography and Statistics Institute – IBGE in accordance with other Brazilian Households surveys. The survey was conceived as the baseline of an evaluation longitudinal study of *Bolsa Familia* Program and was contracted by Social Development Ministry jointly with the United Nations Program for Development. The questionnaire investigates household conditions, individual characteristics (education and school attendance, anthropometrics, health care utilization, immunization, work conditions and income of all family members, including child labor), family expenditures/consumption and social benefits. Even though the aim of the survey was to evaluate *Bolsa Familia* Program the sample was designed to be representative of all Brazilian social groups. This strategy was chosen in order to allow analysis of program impact on inequality and poverty. In general the questionnaire was answered by an adult who gave information about all members in the household.

Sample Design

The sample design of the Bolsa Família Research Project follows a stratified sampling procedure – in one stage for the case of larger cities (41 largest cities in Brazil in terms of population) and in two stages for small towns. In this case, the primary unit of sampling consists of clusters of municipalities (groups of contiguous municipalities with at least 50 censitary sectors), whereas the secondary sampling unit are the censitary sectors[5]. The process of data collection occurred in November 2005.

Collection and handling of information

According with the information obtained from the questionnaires, groups of households were classified in terms of eligibility, treatment and comparison. The eligibility criteria for this study was the household *per capita* income[6], and the presence of children between 0 and 14 years of age, or of a pregnant woman. According to the first criteria, the sample was restricted to the households in which *per capita* income was equal or less than R$200.00, after deducting income from cash transfer programs[7]. Eligible households, in turn, were divided in subgroups. The first one, called "Treatment", consisted of households that currently receive income from Bolsa Família. The second group, called "Comparison" is composed of households that have never received any type of income from public programs.. The remaining of the sample analyzed consists of households (i) that participate in other social programs, such as "Bolsa Escola" and "Bolsa Alimentação"; (ii) which have received income transfer from social programs in the past but no longer receive it; (iii) which have

5 For a detailed explanation on the sample stratification, see CEDEPLAR and SCIENCE (2005).

6 The definition of per capita income includes earnings from work, retirement compensation, pensions and alimony.

7 Even though the eligibility criteria of Bolsa Familia establishes R$100,00 as the upper limit income, we included households that received up to till R$200,00 in order to have 90% of Bolsa Familia beneficiaries included in our evaluation.

per capita income above R$200.00; or (iv) where there are no children or pregnant woman. The total sample has 15,240 households, including 4,435 in the "Treatment" group and 4,941 in the "Comparison" group.

The questionnaire presents two questions for the anthropometric evaluation: one is related to height and the other one to weight. The height was measured twice for each respondent, using a portable anthropometer and the weight was taken using a portable digital scale. Children under two were weighed on an adult's lap being registered in the questionnaire the total weight and afterwards the weight of the adult alone. Using the data of height and weight of children aged between 6 and 60 months, along with the information regarding their age in days and their gender, two indexes of child nutritional status were calculated – height-for-age and Body Mass Index (BMI)[8]-for-age. To built these indexes, standardized in z-values, we used the Chart of Child Growth Standards from the WHO (2006)[9] . Those two anthropometric measures are complementary since they provide different and specific information on the child's nutritional status. On the one hand, height-for-age can be seen as the nutritional stock or a long run measure. On the other, BMI-for-age provides a measure of weight or strength of the child, which is more sensitive to short-run variations.

The most relevant anthropometric indicator is height-for-age, which represents the permanent nutritional status of the child. Children with z-values of this index under -2 are considered to be "short" for their age, with low constitutional weight and chronic malnutrition, suffering of height atrophy. Children with z-values under -3 are considered to be underdeveloped, with serious nutritional nanism. The BMI-for-age indicator measures the muscular mass of the child, showing her current nutritional condition. Children with an indicator over two standard deviations below the medium of the reference population suffer from infant *marasm*, and are considered to have acute malnutrition. Children with a z-value under -3 are considered to be severely malnourished. (Badiani et al., 1997).

The choice of the age range follows what is suggested by the World Health Organization (WHO, 1995). According to the WHO, children under 60 months are the most affected by malnutrition. Children under 6 months of age, in turn, are often breastfed and, for this reason, satisfactorily well fed[10]. In 2005, the occurrence of weight deficits in children under 1 year was only 2.9%, whereas the percentage for 1 and 2 year-olds was 6.1%.[11] Due to sample size restrictions it was not possible to

8 The BMI is defined by the Quetelet indicator, in which the weight in kilograms is divided by the square of the height in meters.

9 In order to do this calculation we used the macro for STATA environment available from the WHO, called "igrowup.ado". After building z-scores related to both indexes we excluded outliers following WHO (2006) recommendations. Z-values of each index are considered biologically implausible according to the following limits: z-values of weight-for-age under -6 or over +5; z-values of height-for-age under -6 or over +6; and z-values of weight-for-height and of BMI-for-age under -5 or over +5.

10 According to data from SIAB, in 2005, 70% of children in Brazil are fed exclusively with maternal milk until four months of age. Available (Portuguese only) at http://dtr2004.saude.gov.br/nutricao/boletim_sisvan/documentos/nota_bolsa_familia.pdf.

11 Available (Portuguese only) at http://www.saude.gov/nutricao

split out our sample considering other age sub-groups.

From a sample of 6,092 children between 6 and 60 months, we had valid indexes of height-for-age and BMI-for age of 5,952 and 5,840 children, respectively, after removing the outliers. Considering only households with *per capita* income up to R$ 200.00, there were 5,682 children. From these, 5,558 had valid information for height-for-age, and 5,457 had valid values of BMI-for-age.

Empirical Approach

In the anthropometric evaluation of children benefiting from "Bolsa Família", only households included in the "Treatment" or in the "Comparison" groups were considered. As mentioned in the previous section "comparison" group includes eligible individuals that had never received any income transfer from social programs in Brazil. Following the standard evaluation method for social programs, we used the results of non-participants in order to estimate how the participating children would be had they not been enrolled in the program. The difference between the results of the "Treatment" group (participants) and the "Comparison" groups (non -participants) can be seen as the estimate of the gross impact of the program.

However, since the implementation of Bolsa Família has not taken place randomly among the eligible families, so that we could have an experimental design of the program, the results from non-participants may systematically differ from the participant results had they not enrolled in the program. This can generate a selection bias in the impact estimates (Colocar Heckman et. al). Specifically in our analysis, what type of bias can we have? Our comparison group refers to eligible households that are not enrolled in the program. We have three hypothesis to explain why an elligible household is not enrolled in *Bolsa Familia*: 1)the household may be located in a city with low level of program coverage; 2) lack of individual information about the program, 3) It was a household's decision not to enroll in *Bolsa Familia* Program. The first case would not generate a bias in our analysis under the assumption that the local of residence influences only the household probability to enroll in *Bolsa Familia*, but not directly the children nutritional status. In the second and third situations we could have a bias in our control group. In the second situation the bias occurs due to information/knowledge differences across households and in the third situation because the decision of not to enroll can be related to the fulfillment of program conditionalities. But health conditionalities are not so costly to be complied with since they can update children basic health care in few visits to the health center. Besides that, health conditionalities are only registered semesterly in *Bolsa Familia* Program, so a household can only exit the program six months later if it does not comply with the conditionalities. In the first semester of 2005 only 6% of enrolled households were health monitored. In that manner, if a household decided not to enroll in *Bolsa Familia* program, we can

infer that this decision is more related to education conditionalities than to health conditionalities. We will address both these potential biases in our empirical test.

A starting point for the evaluation of social programs whose design is not experimental is to assume that program participation is based only upon variables observed previously to the treatment, and that there is enough overlap between the distribution of these variables for the "Treatment" and "Comparison" groups (Abadie e Imbens, 2001). Under such hypotheses, similar individuals in terms of these variables are paired and the average difference between them is estimated.

Since the matching of individuals may become difficult if one considers a large number of observed characteristics (a vector with n dimensions), Rosenbaum e Rubin (1983) proposed the so-called *Propensity Score Matching* (PSM) as a way to overcome the problem of multidimensionality in the observed characteristics. In the PSM, matching is based on the probability of participation in the program, estimated from characteristics observed before the beginning of the treatment. In this manner, pairs of individuals from the "Treatment" and "Comparison" groups are formed with similar propensity scores and, subsequently, the average difference between them is estimated.

Specification of the Propensity Score

The propensity score is the probability of a family or household to receive cash transfers from the program, conditioned on a vector of characteristics X. This vector X corresponds to the focalization criteria of the program, so that the propensity score p(X) is defined by the conditional probability of treatment, D=1: $p(x)=\Pr[D=1|X]$.

A necessary assumption in this case is the so-called "equilibrium condition", represented as: $D \perp X \mid p(X)$.

This condition implies that if the distribution of the propensity score is the same between the treatment and the control samples, the distribution of the characteristics that determine such score is also the same in both samples. Therefore, the treatment and control samples are balanced.

Matching technique

Once we calculate the propensity scores for each household it is necessary to use some matching technique. In this study, we used the *Nearest Neighbor Matching* (NNM)[12] technique with replacement. In the NNM, for each child living in a household enrolled in Bolsa Família, another child not participating in any social programs (and with a similar propensity score) is found. That is, the matching is made as

12 Although we have reported here only the results based on NNM technique, we made some robustness check and estimate the matching using also kernel matching, radius matching and NNM based on other distance metrics.

to minimize the absolute difference between the propensity scores of the households of the treated and non-treated child. Formally, consider that p_i and p_j represent the propensity score of treated and non-treated children, respectively. The set of non-treated children matching the treated children is given by: $C(i) = \min_j \left\| p_i - p_j \right\|$, where $C(i)$ can be calculated with and without replacement. When replacement is allowed this means that the same non-treated individual can match more than one treated individual.

Once the closest neighbors of each of the children in the "treatment" and "comparison" groups are identified, it is possible to estimate three different effects: a) the average treatment effect on the treated (ATT), b) the average effect on the controls (ATC), and c) the average treatment effects (ATE). The average effect on the treatment is the average of the differences between treated children and their pairs; the average effect on the controls is the average of the differences between children in the control group and their pairs. Finally, the average treatment effects considers the average of the differences between all the children in "treatment" and "comparison" groups and their respective pairs.

Results

Descriptive statistics

In this section we describe the nutritional status of children in preschool age in the "Treatment" "Comparison" groups. Such description is made in two stages: first, we analyze the growth curves of the "Treatment" and "Comparison" groups, taking the World Health Organization growth standards as reference (WHO, 2006). In this analysis we built separate growth curves for male and female children, and then we present the average z-values and the proportion of malnutrioned children in Brazil.

Graphs 1 and 2 of Figure 1 show the height-for-age curves for children aged between 6 and 60 months, of both sexes, from the "treatment" and the "comparison" groups, in addition to the reference growth curve from the WHO. The comparison between the curves indicate that in general the average growth standard of the children from the sample was below the reference standard, specifically after the first year of living, although this difference was not over one standard deviation in most of the age groups.

Graph 3 of Figure 1 show the density functions of the height-for-age standardized values for children between 6 and 60 months of age with *per capita* household income up to R$200.00. According to this distribution, shorter children were found in the "treatment" group, with an average z-value of -0.6, as compared to an average national value of -0.3.

From the Graphs 4 and 5 of Figure 1, it can be verified that the pattern of weight for age of the children from the selected groups was above the reference medium, specially in the first few months after birth, when the difference approaches

one standard deviation. For the girls aged four and older, the growth curve closely follows the WHO medium curve for the "treatment" group, and lays slightly below it for the "comparison" group (Graph 5).

According to the BMI standardized values, in Graph 6 of Figure 1, it is suggested that children from 6 to 60 months of age in the "comparison" group are "thinner", since the tail of the distribution is thicker in the negative values below two standard deviations. Another aspect indicated in the distribution curves in Graph 6 is the high concentration of children with z-values above two standard deviations from the reference medium, considered to be overweight for their length and age.

Table 1 shows the average z-value and the standard error of the estimate for both anthropometric measures, for children in the "treatment" and "comparison" groups. The results for Brazil reinforce the previous analysis according to which only the length-for-age indicator presents negative and significant statistics, suggesting that Brazilian children have, in general, height-for-age below the average WHO standards. The average z-values of BMI-for-age are positive and significant for both groups.

Table 1. Average z-value of anthropometric indicators of children aged between 6 and 60 months, by "treatment" and "comparison" groups – Brazil – 2005

	T	C	Total
Height-for-age			
Total of children in the sample	2263	2218	5952
z-value	-0.615	-0,451	-0,305
se	0,068	0,105	0,082
Body Mass Index			
Total of children in the sample	2222	2179	5840
z-value	0,243	0,196	0,191
se	0,083	0,111	0,064

Notes: a) The "Total" column considers all the children, independently of their household per capita income.

b) All the estimates follows the research sample design, with correction of the average and standard error estimates.

c) se= standard error of the mean

Source: AIBF, 2005.

Table 2 presents the proportion of children between 6 and 60 months of age suffering from malnutrition and extreme malnutrition in Brazil, in the "Treatment" and "Comparison" groups, according to height- and BMI-for-age. The analysis of Table 2 shows that the most important problem in the anthropometric condition of Brazilian children relates to height-for-age. The rate of chronic malnutrition in Brazil is above 10%, both in the "treatment" and "comparison" groups. The rate of acute malnutrition, derived from the BMI-for-age indicator, lays between 7% and 8% for both groups in the case of Brazil.

Table 2. Proportion of children between 6 and 60 months of age suffering from malnutrition and extreme malnutrition, according to selected anthropometric indicators, by treatment and comparison groups – Brasil – 2005

	T	C	Total
Height-for-age			
Total of children in the sample	2263	2218	5952
%malnutrition	13,86	13,52	12,11
se (%)	2,00	1,70	1,05
% extreme malnutrition	5,33	7,51	6,09
se (%)	1,00	1,70	0,93
Body Mass Index			
Total of children in the sample	2222	2179	5840
%malnutrition	7,00	7,50	7,65
se (%)	1,10	1,40	0,93
% extreme malnutrition	2,60	4,10	2,88
se (%)	0,90	1,30	0,66

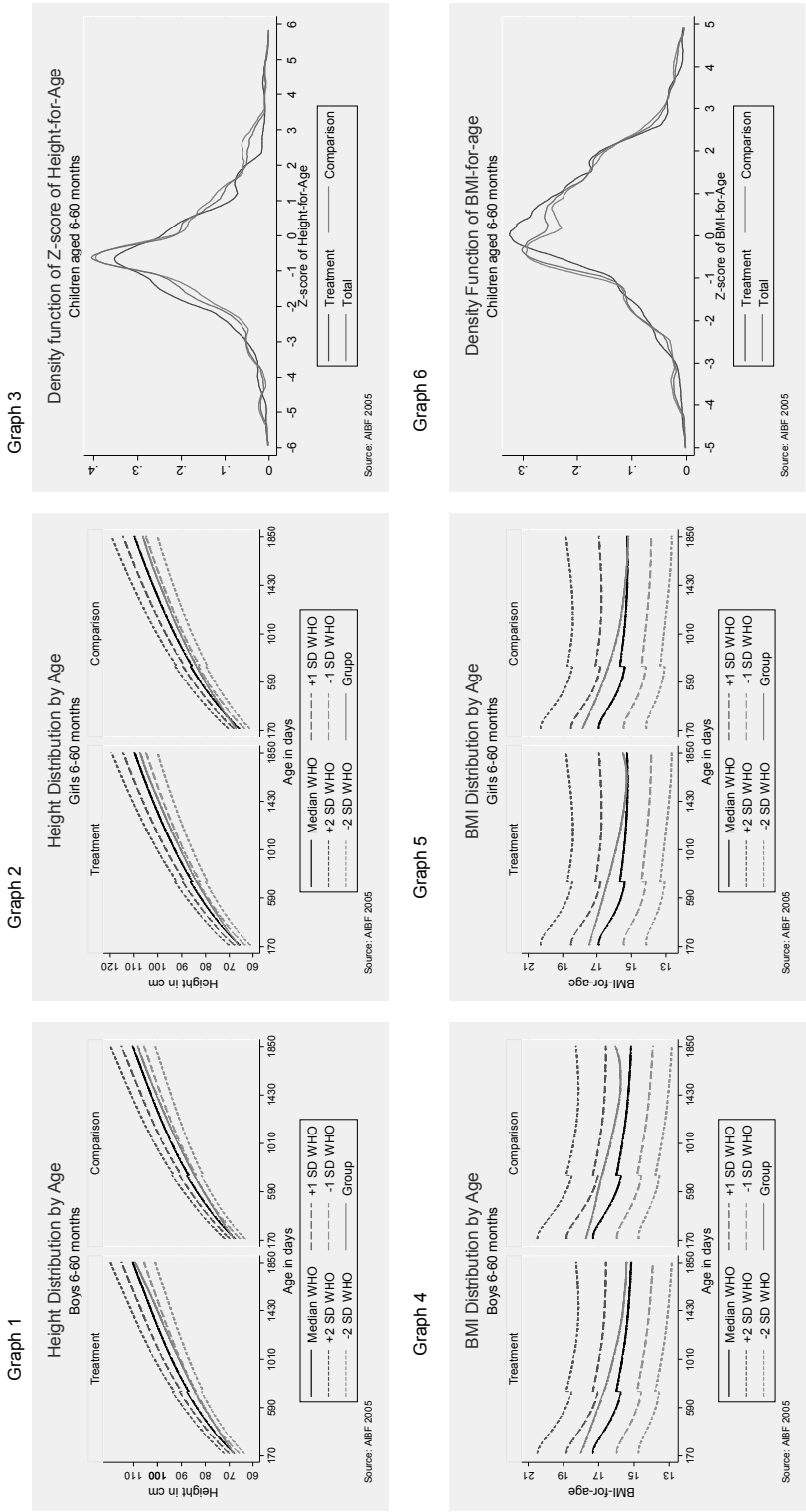
Notes: a) The "Total" column considers all the children, independently of their household per capita income.

b) All the estimates follows the research sample design, with correction of the average and standard error estimates.

c) se= standard error of the mean

Source: AIBF, 2005.

Figure 1: Graphic Analysis of the Anthropometric Indicators



Propensity Score Estimates

The propensity score of Bolsa Família was estimated using a parametric model of binary choice. In particular, a *probit* model, in which the household is the unit of analysis. The explanatory variables in the model are the characteristics which, by hypothesis, are relevant in the determination of the "treatment" and were not affected by *Bolsa Familia* program (hypothesis of ignorability of treatment). In this set of observable characteristics, we included variables both at household level and at municipal level.

The inclusion of municipal variables aims at capturing the extent of the program in previous periods as well as the degree of poverty and development of the municipality, under the hypothesis that households in municipalities where (i) the program is more wide-ranging, (ii) the levels of poverty are higher, and (iii) development is lower, will have greater probability of participating in the program. In this group of variables, we include: proportion of households with *per capita* income under R$100.00; proportion of households with *per capita* income up to R$200.00 which were supported by the Bolsa Escola program in 2001; total fertility rate; infant mortality rate (per one thousand live births); percentage of people in subnormal households; average years of education of people aged 25 and older[13].

The household variables, in turn, capture characteristics of the familiar composition, such as parent's literacy and domestic infra-structure – taken as *proxy* variables for income and welfare before the program implementation. This is done under the assumption that infra-structure conditions that are external (such as access to basic public services) and internal to the household (such as construction features of the home) are not affected in the short run by the income shock provided by the program.

Table 3 presents the results for the *probit* model. Among municipal variables, only the percentage of poor households is significant for participation in the program. The higher the proportion of households in the municipality receiving up to 100,00 reais of *per capita* income, the higher is the probability of the household to be enrolled in the program. In the case of household characteristics, at least one of the variables included in each of the subcategories seem to exert some influence on the propensity score of the household. The results suggest that uniparental families, with less educated guardians are more numerous and present a higher probability to be enrolled in the program. All these attributes are related to eligibility criteria suggesting that the program is well focalized.

13 The municipal information are from *Censo Demográfico 2000* and from *Ministério do Desenvolvimento Social*. The values of household income are calculated in constant 2005 prices.

Table 3. Estimation of the Probit Model for the household Probability of Participation in the Bolsa Família program

	Coefficients
MUNICIPAL VARIABLES	
Percentage of households under R$ 100.00 *per capita*	1.161** (0.583)
Percentage of households under R$ 200.00 *per capita* supported by Bolsa Escola in 2001	0.521 (0.449)
Total fertility rate, 2000	-0.105 (0.086)
Percentage of people living in subnormal households, 2000	0.012 (0.009)
Average years of education of people aged 25 and older, 2000	-0.078 (0.058)
HOUSEHOLD CHARACTERISTICS	
Family Composition	
Number of children between 6 and 60 months of age in the household	-0.086 (0.099)
Couple with children over 14 years of age	-0.563***(0.209)
Female household head	0.284** (0.125)
Education of the Guardians	
Male with 4 or less years of education	0.068 (0.163)
Male with 7 or less years of education	0.414** (0.178)
Female with 4 or less years of education	0.335** (0.132)
Female with 7 or less years of education	-0.005 (0.141)
Household Infrastructure	
Garbage collection	-0.181 (0.165)
Sewage disposal in septic tanks	-0.153 (0.130)
Untreated sewage disposal	-0.059 (0.185)
General water system	0.417** (0.163)
Piped water	-0.136 (0.152)
Hard wall	-0.046 (0.130)
Unfinished floor	0.08 (0.117)
Unfinished roof	-0.042 (0.188)
Density of people per bedroom	0.155*** (0.049)
Owned home	0.039 (0.145)
Other home condition	0.025 (0.164)
Constant	-0.979* (0.593)
Observations	3098

Robust standard errors in parenthesis

* significant at 10%; ** significant at 5%; *** significant at 1%

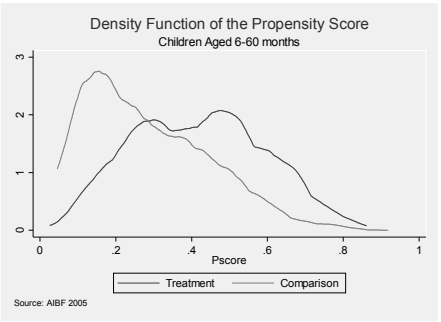
Note: the estimates of coefficients and standard errors include the sample weight

Source: Authors' calculation using data from the research AIBF, 2005, from Demographic Census, 2000 and from "Ministério do Desenvolvimento Social" – 2006

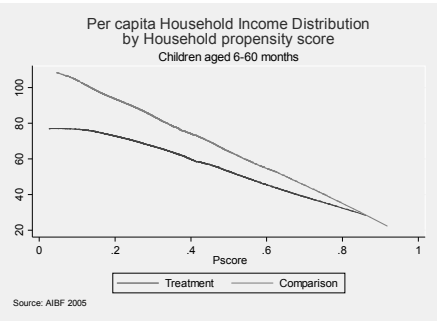
In order to examine the estimates of the propensity score, Figure 2 presents a graphical analysis of the distribution of predetermined characteristics of the "Treatment" and "Comparison" groups.

Figure 2. Graphical Analysis of the "Treatment" and "Comparison" Groups

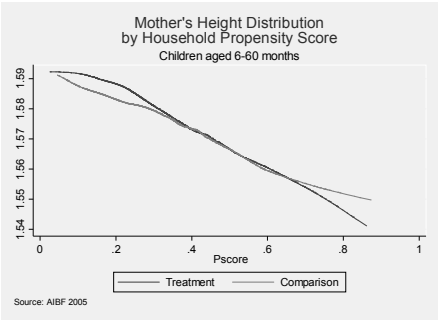
Graph 1



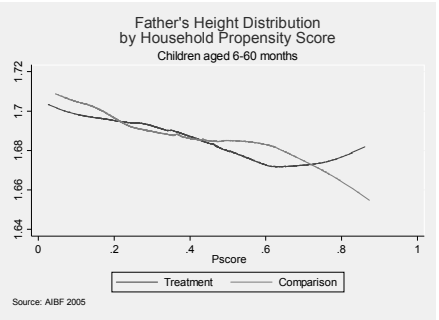
Graph 2



Graph 3



Graph 4



Graph 1 in Figure 2 presents the density of propensity scores of treated and control units, in order to check for the existence of enough juxtaposition between such distributions. Graph 1 indicates that for propensity scores above 0.4 there is a reduction in the number of children in the "Comparison" group, which makes the matching less efficient. This means that the closest neighbor may not be as similar as expected, and also that the use of the same control as a pair for different units in the treatment group is more frequent.

Graphs 2 to 4 in Figure 2 analyze the quality of the estimated probability of participation. In this case, we examine how close the propensity score distributions of predetermined characteristics are for the "treatment" and the "comparison" groups. Since we do not have information about the children before the implementation of Bolsa Família, we use the *per capita* income net of transfers and the mother's and father's heights as a picture of the situation before the program. Particularly the latter indicators present the advantage of not suffering any influence from the program, being in fact totally predetermined. The distributions of *per capita* household income per propensity score for treated and non-treated children present the expected behavior and are very similar, although the "Com-

parison" group presents a better situation. Higher income *per capita* is associated to lower probability of being treated. Regarding the distributions of the mother's height per propensity score, we observe for the case of Brazil a wide interval of intersection or proximity between the curves of the "Treatment" and "Comparison" groups. Finally, the results regarding the father's height distribution for treated and non-treated children by probability of participation suggests a similar pattern for both groups, with the greatest differences occurring for higher values of the propensity score. Overall, the propensity score estimated at household level seems to be associated with similar predetermined characteristics for individuals in the "Treatment" and "Comparison" groups.

Matching Results

Once we have analyzed the quality of the estimated probability of participation in the Bolsa Família program, the next step is to check on the quality of the matching that was based on this propensity score. In this case, we compare the averages between the observed characteristics for the "Treatment" and "Comparison" groups which were included in the estimation of the propensity score before and after matching.

Table 4 provides the comparison of such averages before and after the treated children were matched. Before matching, the average of the "Comparison" group include all the children incorporated in this group. After matching, we consider only the children that were used as pairs for the children in the "Treatment" group, i.e. only the closest neighbors of the treated children, in terms of propensity scores.

Since the matching aims at reducing the selection bias in the estimation of the program's impact – assuming that systematic differences between children in the "Treatment" and "Comparison" groups are derived from observed characteristics – we expect the differences in the average characteristics of the children in both groups to be reduced after matching.

Table 4. Differences between the Covariate Means for the "Treatment" and Comparison" groups before and after matching

	Coef.	SE	z	P>|z|	Confidence interval 95%	
HEIGHT-FOR-AGE						
Malnutrition						
ATT	-0.039	0.033	-1.20	0.231	-0.103	0.025
ATC	-0.002	0.033	-0.05	0.956	-0.066	0.063
ATE	-0.014	0.026	-0.54	0.591	-0.065	0.037
Extreme Malnutrition						
ATT	-0.012	0.020	-0.57	0.568	-0.052	0.028
ATC	-0.019	0.022	-0.87	0.385	-0.062	0.024
ATE	-0.017	0.017	-0.99	0.324	-0.050	0.016
Z-Value						
ATT	-0.017	0.137	-0.13	0.899	-0.286	0.251
ATC	-0.126	0.163	-0.77	0.441	-0.446	0.194
ATE	-0.090	0.122	-0.74	0.457	-0.329	0.148
BMI-FOR-AGE						
Malnutrition						
ATT	-0.010	0.022	-0.44	0.661	-0.053	0.033
ATC	-0.014	0.022	-0.61	0.542	-0.058	0.030
ATE	-0.012	0.018	-0.70	0.482	-0.047	0.022
Extreme Malnutrition						
ATT	-0.010	0.013	-0.77	0.444	-0.036	0.016
ATC	-0.016	0.015	-1.03	0.303	-0.046	0.014
ATE	-0.014	0.012	-1.21	0.226	-0.036	0.009
Z-Value						
ATT	0.135	0.136	0.99	0.322	-0.132	0.402
ATC	-0.074	0.144	-0.51	0.608	-0.355	0.208
ATE	-0.006	0.112	-0.05	0.960	-0.224	0.213

Note: C = Comparison T = Treatment Dif = Treatment – Comparison

Source: Authors' calculation using data from the research AIBF, 2005, from Censo Demográfico, 2000 and from Ministério do Desenvolvimento Social, 2006.

Although our results suggest that matching is not efficient for all the variables, the balancing property was test and hold in the individuals' blocks according to the propensity score. It means that within the block children in "Treatment" and "Comparison" groups have the same observed characteristics on average[14]

Besides, it is worth mentioning that the matching reduces the average difference between treated and non-treated children for most of the variables. The largest differences are found in municipal level for percentage of households under R$100.00 *per capita* and population average years of education. Regarding household attributes the main difference refers to guardians' education. In general, the indicators for "treatment" group are always worse than the ones for the comparison group, which reflects the program's target. In other words, the analysis of these averages suggest that participant children live in less developed municipalities and under less educated guardians. It is worth mentioning that there are no differences between both groups related to sewage treatment system and garbage collection. In this manner, even though treated children live in poorer municipalities than non-treated children, it does not result in worse sanitation conditions. Even though the matching does not allow us to reduce all differences between beneficiaries and non-beneficiaries, it can be a useful instrument to understand the bias direction. As already shown *Bolsa Familia* beneficiaries live in worse conditions therefore our analysis of the program effect can present a downward bias. In this context our estimates of treatment effects should be interpreted as a lower bound of these effects.

Average Treatment Effect

Table 5 presents the results regarding the average treatment effect for the children in the treatment group (ATT), in the comparison group (ATC) and for the entire sample (ATE). In all the cases, the sample weight of the children were included in the estimation of the average differences between the pairs of children. The results did not indicate any effect of the Bolsa Família program on the nutritional status of the children aged between 6 and 60 months, taking into consideration the height-for-age and BMI-for-age indicators in 2005. We did not find any significant difference both when we analyzed the continuous z-value and when we considered the probability of malnutrition and extreme malnutrition.

Differently from other conditional cash transfer programs focused on children, such as Oportunidades in Mexico, Bolsa Família does not associate the conditional cash transfer to any kind of alimentary supplementation. For this reason, participation in the program does not necessarily mean an improvement in the diet of children aged 6 to 60 months. Besides that, Bolsa Família conditionalities related to

14 Note that it is not sufficient in the sense that the balancing may not hold for higher order moments of the distribution of characteristics. So, to be precise, the program we have used to estimate the matching does not test the Balancing Hypothesis, but only one of its implications.

supervision of birth and growth/development of children up to 7 years of age have had, in practice, very limited monitoring in 2005 in a way that these results concern only the cash transfer effect.

Table 5. Average Effect of the Bolsa Família program, Brazil

	Coef.	SE	z	P>|z|	Confidence interval 95%	
HEIGHT-FOR-AGE						
Malnutrition						
ATT	-0.039	0.033	-1.20	0.231	-0.103	0.025
ATC	-0.002	0.033	-0.05	0.956	-0.066	0.063
ATE	-0.014	0.026	-0.54	0.591	-0.065	0.037
Extreme Malnutrition						
ATT	-0.012	0.020	-0.57	0.568	-0.052	0.028
ATC	-0.019	0.022	-0.87	0.385	-0.062	0.024
ATE	-0.017	0.017	-0.99	0.324	-0.050	0.016
Z-Value						
ATT	-0.017	0.137	-0.13	0.899	-0.286	0.251
ATC	-0.126	0.163	-0.77	0.441	-0.446	0.194
ATE	-0.090	0.122	-0.74	0.457	-0.329	0.148
BMI-FOR-AGE						
Malnutrition						
ATT	-0.010	0.022	-0.44	0.661	-0.053	0.033
ATC	-0.014	0.022	-0.61	0.542	-0.058	0.030
ATE	-0.012	0.018	-0.70	0.482	-0.047	0.022
Extreme Malnutrition						
ATT	-0.010	0.013	-0.77	0.444	-0.036	0.016
ATC	-0.016	0.015	-1.03	0.303	-0.046	0.014
ATE	-0.014	0.012	-1.21	0.226	-0.036	0.009
Z-Value						
ATT	0.135	0.136	0.99	0.322	-0.132	0.402
ATC	-0.074	0.144	-0.51	0.608	-0.355	0.208
ATE	-0.006	0.112	-0.05	0.960	-0.224	0.213

Note: ATT = Average Effect on the Treated; ATC = Average Effect on the Comparison Group; ATE= Total Average Effect. SE = Standard Error

Source: Authors' calculation using data from the research AIBF, 2005.

As already noted in this work we observe differences between the beneficiaries and the non-beneficiaries profile. The matching analysis points out that these differences favor non-beneficiaries households that present male guardians with high level of schooling. Considering the downward biases, one possible interpretation of these results is that we are underestimating program effects. Taking into account that *Bolsa Familia* beneficiaries are in worse conditions we expect that, in the absence of the program, children nutritional status would be lower for that group.

In order to address potential bias in our comparison group we add two empirical exercises. In the first exercise we re-estimated our models restricting our sample to households in which both male and female guardians have no more than 4 years of schooling. We performed this estimative model to control the information bias as both beneficiaries and non-beneficiaries live in households with the same level of information. In the second test we re-estimated our model considering the restricted sample, but we additionally included only children that were fulfilling education requirements. Our intention with this empirical exercise is to control for the household decision of not enrolling in *Bolsa Familia* program due to education conditionalities.

Tables 6 and 7 present these estimations. Table 6 refers to the estimation when we considered all children aged 0 to 6 living in households in which male and female guardians have till 4 years of schooling. In accordance with our previous result we do not observe any statistically difference between beneficiaries and non-beneficiaries. Table 7 presents the estimated effects when we controlled the information bias and included only children that were fulfilling education requirements. Considering this restricted sample we found differences statistically significant between both groups for BMI indicators, but not for height. The result differences observed in tables 6 and 7 are probably related to education conditionalities. We did not find any effect in table 6 because in this situation households can receive an additional income provided by children labour. In table 7 we restrict our sample in order to consider only households in which children are attending school and not working. In this case our control group does not have the opportunity to obtain additional income from child labour that could compensate the program income shock. The effect´s magnitude is quite high, around 18 pp. It means that on average the treated group presents a lower level of acute malnutrition, less 18 pp than the comparison group. Besides that we also observe a difference of 1 z-score between both groups for BMI for age.

Our results are in line with other evidence for CCT programs. First, as emphasized by Lagarde, Hainer & Palmer (2007), CCT effects on anthropometrics are restricted to some sub-groups in the population. Second, it provides one more evidence on pure cash transfer effect. As health monitoring was quite low in 2005 we can interpret our effects as a result of an income shock. Fernaud et al (2008) also found similar results.

Table 6. Average Effect of the Bolsa Família program – Male and Female Guardians with 4 or less years of Education, Brazil

	Coef.	SE	z	P>|z|	Confidence interval 95%	
HEIGHT-FOR-AGE						
Malnutrition						
ATT	0.032	0.056	0.560	0.573	-0.079	0.143
ATC	-0.017	0.057	-0.290	0.769	-0.129	0.095
ATE	0.009	0.043	0.200	0.842	-0.076	0.093
Extreme Malnutrition						
ATT	0.005	0.040	0.110	0.910	-0.073	0.082
ATC	-0.008	0.039	-0.200	0.844	-0.085	0.070
ATE	-0.001	0.030	-0.050	0.964	-0.060	0.058
Z-Value						
ATT	-0.179	0.255	-0.700	0.484	-0.679	0.322
ATC	0.389	0.267	1.450	0.146	-0.136	0.913
ATE	0.093	0.200	0.460	0.643	-0.299	0.484
BMI-FOR-AGE						
Malnutrition						
ATT	-0.040	0.045	-0.870	0.383	-0.128	0.049
ATC	-0.098*	0.054	-1.820	0.069	-0.204	0.008
ATE	-0.068*	0.037	-1.800	0.071	-0.141	0.006
Extreme Malnutrition						
ATT	-0.038	0.030	-1.240	0.215	-0.097	0.022
ATC	-0.072	0.046	-1.570	0.116	-0.161	0.018
ATE	-0.054*	0.029	-1.890	0.059	-0.110	0.002
Z-Value						
ATT	0.314	0.279	1.130	0.260	-0.232	0.860
ATC	0.032	0.285	0.110	0.911	-0.527	0.591
ATE	0.179	0.214	0.840	0.403	-0.241	0.599

Note: ATT = Average Effect on the Treated; ATC = Average Effect on the Comparison Group; ATE= Total Average Effect. SE = Standard Error
Source: Authors' calculation using data from the research AIBF, 2005.

Table 7. Average Effect of the Bolsa Família program – Male and Female Guardians with 4 or less years of Education and all Children at school, Brazil

	Coef.	SE	z	P>|z|	Confidence interval 95%	
HEIGHT-FOR-AGE						
Malnutrition						
ATT	-0.035	0.071	-0.500	0.620	-0.175	0.104
ATC	0.033	0.083	0.390	0.695	-0.130	0.195
ATE	-0.004	0.057	-0.070	0.943	-0.116	0.108
Extreme Malnutrition						
ATT	-0.034	0.052	-0.660	0.507	-0.136	0.067
ATC	0.048	0.069	0.700	0.486	-0.088	0.184
ATE	0.004	0.045	0.080	0.935	-0.084	0.091
Z-Value						
ATT	-0.649*	0.369	-1.760	0.079	-1.373	0.075
ATC	-0.162	0.359	-0.450	0.652	-0.866	0.542
ATE	-0.425	0.272	-1.560	0.119	-0.959	0.109
BMI-FOR-AGE						
Malnutrition						
ATT	-0.183***	0.067	-2.740	0.006	-0.313	-0.052
ATC	-0.150***	0.057	-2.630	0.009	-0.261	-0.038
ATE	-0.168***	0.047	-3.600	0.000	-0.259	-0.076
Extreme Malnutrition						
ATT	-0.155***	0.052	-3.000	0.003	-0.257	-0.054
ATC	-0.106**	0.049	-2.170	0.030	-0.201	-0.010
ATE	-0.133***	0.038	-3.520	0.000	-0.206	-0.059
Z-Value						
ATT	1.026***	0.366	2.800	0.005	0.308	1.744
ATC	0.683	0.447	1.530	0.127	-0.194	1.560
ATE	0.868***	0.300	2.890	0.004	0.280	1.457

Final Considerations

The examination of the anthropometric condition of children between 6 and 60 months of age in Brazil shows that the country presents malnutrition levels above 10% considering the height-for-age indicator in all the analyzed regions and groups.

On the other hand, when the BMI-for-age indicator is evaluated, the malnutrition levels are quite low, and the average z-value is positive for all the analyzed samples, suggesting a weight-for-length and -age above the standard WHO growth curves. Since the BMI indicator considers the weight of the child, it is necessary to do a more careful analysis of the low malnutrition indexes which can be associated with the diet habits of the children.

This paper provides a description of the nutritional status of children in Brazil, and also evaluates the effect of the Bolsa Família on such nutritional status. Besides being a cash transfer program that relaxes the budget constraint of poor families and increases their ability to feed adequately their children in preschool age, the *Bolsa Familia* includes conditionalities which can improve their nutritional condition. In order to measure the differences in the nutritional condition of treated children in comparison to the others, at a point in time, we used the *Propensity Score Matching* (PSM) technique.

The results of the evaluation of the effect of *Bolsa Familia* on the nutritional condition of children aged 6 to 60 months, according to the anthropometric indicators height- and BMI-for-age, do not point to significant differences in favor of the children supported by *Bolsa Familia* when we consider the whole population. The absence of effects of *Bolsa Familia* can be explained by the supervision limitations of the program conditionalities. On the other hand, when we restricted our analysis to the poorest in the population we found great differences in children nutritional status favoring *Bolsa Familia* beneficiaries related to acute malnutrition. In this restricted sample we controlled for potential bias between treatment and comparison group. Performing our estimates in this restricted sample allowed us to guarantee homogeneity between both groups.

In terms of policy implications our results point out short-run effects but not long-run effects on children nutritional status. Short-run effects can be reached with income shoks while long-run effects are probably related to fullfilling of conditionalities as already evidenced in the literature.

We are aware of the strength of some assumptions that we made on our empirical analysis, most of them due to Program design that was not experimental. Consequently, we adopted a quasi-experimental approach in which the central assumption was the selection on observables. Despite these limitations this paper sheds some light not only on the relation between cash transfer and children's nutritional effects but also on the role of conditionalities. We take advantage of a context when health monitoring practically does not occur making it possible to disentangle program income effects from conditionalities effects. Furthermore, we also address some concerns about informational issues. Not surprisingly we only find significant short-run effects of *Bolsa Familia* when we control for informational bias.

Finally, it is worth mentioning that conditional cash transfer program is a widespread policy over underdeveloped countries and *Bolsa Familia* is one of the biggest conditional cash transfer programs in the world since it has about 40 million beneficiaries. Thus, our evidence in favor of such kind of Program, even when the conditionalities are not active, is an important result for policy analysis.

Acknowledgements

This research was supported by Ministério do Desenvolvimento Social e Combate à Fome/Secretaria de Avaliação e Gestão da Informação (MDS/SAGI) – Social Development Ministry - through the Agreement of International Technical Cooperation with United Nations Program for Development (UNPD) – BRA04-046. We are thankful to CNPQ for financial support.

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Recebido para publicação em outubro de 2013.
Aprovado para publicação em outubro em março de 2014.