

# **Impacts of Bolsa Família Program on multidimensional poverty**

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## **Impactos del Programa Bolsa Família en la pobreza multidimensional**

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### Abstract

«Poverty» is a multidimensional concept dealing with families deprived in more contemporaneous capability deprivations. Interlinkages between deprivations can generate a poverty status that can prevent families from escaping disadvantage. In this sense, human rights-based policies can tackle multidimensional poverty, due to the integrated structure of these programs that target different dimensions contemporaneously. In this respect, this longitudinal quasi-experimental analysis attempts to inspect the impact of a human rights-based policy, the Bolsa Família, on a multidimensional poverty index for least poor and vulnerable families. The results indicate that this policy affects poverty status for the previous two groups and influences the intensity of poverty of Brazilian families. Furthermore, this policy has a positive impact on the domains Standards of Living, and Health. Moreover, the Bolsa Família has a positive effect on almost all the dimensions within the Active and Community Life domain, but there are mixed results for the Education domain.

**Keywords:** Bolsa Família, capability, human rights, multidimensional poverty, poverty intensity, freedoms.

### Resumen

La «pobreza» es un concepto multidimensional, referido a Familias contemporáneas que sufren privaciones en capacidades. Las interrelaciones entre las privaciones pueden generar un estado de pobreza que impida que las Familias escapen de la desventaja. En este sentido, con las políticas basadas en los derechos humanos, se aborda la pobreza multidimensional, debido a la estructura integrada de estos programas, dirigidos a diferentes dimensiones. Asimismo, a raíz de este análisis longitudinal cuasi experimental, se pretende inspeccionar el impacto de una política basada en los derechos humanos, la Bolsa Família, en lo referente a un índice de pobreza multidimensional para las Familias menos pobres y vulnerables. Los resultados indican que esta política afecta al estado de pobreza para los dos grupos anteriores e influye en la intensidad de la pobreza de las Familias brasileñas. Además, esta política tiene un impacto positivo en los dominios de nivel de vida y de salud. También, la Bolsa Família posee un efecto positivo en casi todas las dimensiones dentro del dominio de la vida activa y comunitaria, pero existen resultados mixtos en cuanto al dominio de la educación.

**Palabras clave:** Bolsa Família, capacidad, derechos humanos, pobreza multidimensional, intensidad de la pobreza, libertades.

# 1 Introduction

The capability approach defines «poverty» as a multidimensional concept. Specifically, it is defined as a lack of fundamental freedoms which prevents individuals from living a dignified life (Sen 1999).

Furthermore, Sen suggests that the main role of public policy, especially of Social Security, is to bring entitlements to individuals and families (Sen 1987). In fact, individuals may face interlinked deprivations that create a joint burden of disadvantage (Sen 1994). In this respect, the role of capability-oriented policy is to target interrelated deprivations contemporaneously by providing services in a flexible and integrated way. Consequently, the structure of capability-based policy can weaken deprivation links to decrease poverty with efficacy. An example of a well-known capability-based social policy is the Bolsa Família (Drèze & Sen 2013), that integrates conditional cash transfers with a set of coordinated interventions. Therefore, this program is suitable and of interest when analysing the impact of a coordinated typology of interventions on multidimensional poverty.

In this regard, several studies have dealt with the impacts of the Bolsa Família (BF) on single capabilities. However, to the best of my knowledge, none has yet explored its impact on a multidimensional poverty index using a quasi-experimental analysis. This article fills the gap in the literature, by evaluating the impact of the BF on a Multidimensional Poverty Index (MPI), based on the Alkire-Foster methodology (Alkire & Foster 2007), for both vulnerable and least poor families. Moreover, this article attempts to fill a gap in the literature regarding the effect of this program on multidimensional poverty intensity. As for the latter dimension, this article inspects the impact of the BF on the mean number of capability deprivations of poor families over time.

Therefore, this analysis contributes to the academic debate, by showing the joint burden of multidimensional poverty of families and the role of a multi-pronged, flexible policy in tackling the overall status of disadvantage of Brazilian families. Specifically, households, and individuals do not suffer from single, different deprivations, but their lives, whether they are disadvantaged or not, are shaped by all these contemporaneous situations jointly considered.

For example, interrelations between deprivations prevent poor individuals from escaping their overall disadvantage and oblige them to live a hard life. Hence, poverty can be seen as a kind of meta-deprivation, instead of a set of separated deprivations. In this sense, an MPI can show the real situation of disadvantage of individuals and families and can incorporate interlinkages between different derivations impinging upon individual lives. In fact, the stronger the interlinkages, the steadier the situation of poverty of

individuals, and the greater the difficulty to escape poverty over time. Similarly, by using an MPI for empirical analysis, one can inspect the role of different categories of Social Security policy in weakening the persistence of disadvantage for families and individuals. Therefore, as mentioned earlier, this article contributes to the literature, by suggesting the role of a participatory, integrated, and people-centred policy in reducing and tackling poverty, by attacking different interconnected deprivations contemporaneously.

Particularly, this article assesses the impact of this policy between the year 2005, which is the baseline year, and the year 2009, which is the evaluation period of the analysis. Moreover, this empirical paper proposes an MPI like the Global MPI published by the Oxford Poverty and Human Development Initiative (OPHI) (Alkire *et al.* 2020).

In addition, this article adds dimensions relevant to the Brazilian country-specific context by using the Burchardt-Vizard approach (Burchardt & Vizard 2011). This framework includes fundamental freedoms based on human rights, some of which are relevant to the goals and the structure of the BF. As for the findings, this piece of research suggests that this policy contributes to reducing poverty in all the dimensions of the domain Standards of Living and of the domain Health.

Additionally, this policy reduces poverty in almost all the dimensions of the domain Active and Community life. Despite these positive aspects, it has a negative effect on school attendance. Finally, this program has a positive impact on multidimensional poverty status, and it is effective in tackling multidimensional poverty intensity.

## 2 The Bolsa Família Program

The BF policy was created following a period of re-democratization in Brazil fostered by movements of individuals and politicians. Specifically, from the 1980s, these groups protested against the military government, to make Brazil a democratic country again. The protests contributed to provoking social change in Brazil, which led to democracy and a new constitution in 1988. This new constitution included new rights, that were before provided as benevolence. Additionally, it granted a new and broader definition of Social Security, not only defined as social insurance that protected against unemployment or inability to work, but as a protection against low income as well (Midgley & Piachaud 2013).

Therefore, a wide range of rights started to be protected independently of social contributions paid by individuals, such as health, education, housing, and decent earning ability. This meant that the government now had the duty to provide these entitlements to the Brazilian population. Furthermore, this new expan-

sion of rights had the effect that more and more individuals and families started to be included in the Social Security provision.

Specifically, during the mid-1990s local governments began to implement conditional cash transfers to protect the rights embodied in the new constitution. From 1996, the national government noticed that these local programs were successful in fighting poverty and deprivations. Therefore, it implemented federal conditional cash transfers to fight child labour, lack of resources, and lack of nourishment, such as the Bolsa Escola, and the Bolsa Nourishment. Finally, when Lula was elected President in 2002, the Brazilian Labour party government merged the Auxílio Gás, the Bolsa Escola, the Programa de Erradicação do Trabalho Infantil (PETI), the Social Card Program, and the Bolsa Nourishment into one conditional cash transfer called the BF Program, in order to fight hunger (Da Silva e Silva *et al.* 2014, Midgley & Piachaud 2013).

Consequently, this program emerged in the context of a democratic shift in Brazil, and in the context of the birth of a new constitution which introduced new rights and started to protect existing freedoms that were previously provided through benevolence. In this sense, the main reason that this policy was launched was to fight hunger and multidimensional poverty (including income poverty), to protect and promote the rights introduced in the new constitution, and to tackle inequality.

Similarly, the BF has the goal of including more and more individuals in social protection as envisaged by the constitution. In this respect, the previous conditional cash transfers were managed by different public bodies with different administrative systems. On the other hand, the BF has only one administrative system, which allows the increase of the take-up rate of the benefits. Similarly, it provides different services, that deliver multiple freedoms in a coordinated and flexible way. Both features enhance recipients' self-selection for multiple services, and these provide inclusion in different key freedoms, as well as fostering poverty graduation and poverty alleviation.

In this sense, the BF is a conditional cash transfer included in a big network of collateral interventions that provides in-kind transfers as well. The program seeks to protect and stimulate improvements in child education, in child health, and in the living standards of families, because these dimensions are important human rights (Hellman 2015). According to the designers, the BF aims to target income poor families and extremely poor households with pregnant women or with children under eighteen years old. In order to obtain transfers, recipients have to fulfil education and health conditions (Hellman 2015). Extremely poor families receive a basic payment, that is unconditional and independent of having children.

Further, variable transfers are provided to all poor families with specific features (Soares 2012); for example, in 2009, the pover-

ty threshold for extremely poor families was 70R\$ of monthly per capita income. Moreover, the eligibility threshold for poor families was 140R\$ of monthly per capita income (see Table A in the Annex). Further, the basic BF benefit was 68R\$, and the variable BF benefit ranged between 22R\$ and 33R\$ (Soares 2012). In addition, not all eligible families are enrolled in the BF.

In fact, the government defines quotas of households that are to be enrolled in the BF on a monthly basis by applying some prioritisation criteria during the selection process (Parsons 2014).

As for the median wage of a family in Brazil in the year 2009, it was about 1,285 R\$, like the average monthly wage, whereas mean expenditures were 1,066 R\$. Households with this amount of money could afford basic items, such as necessary food; for example, rice, beans, milk, basic, coffee, bread, and beef. Furthermore, they could afford clothes and accommodation, such as modest rented flats. Similarly, families could pay for utilities, although they cost a high portion of the wage. However, regarding leisure time expenditures, households earning the median wage could only afford to eat in inexpensive restaurants and could save little money for unpredictable events.

As for the structure of the BF, the policy is managed both at the federal and at the decentralized level. According to the program, municipalities are responsible for the registration of all potential beneficiaries in the Cadastro Único, for monitoring the compliance of conditions, and for reporting the results to the federal government. In turn, the government can suspend and cancel transfers to families that do not abide by the conditions. Moreover, the federal government has the duty to send transfers directly to recipients monthly.

According to the law, the activities of local governments related to the BF are paid by the federal government through administrative transfers delivered to municipalities. Moreover, the BF is included in a network of complementary programs focusing on a wide set of capability deprivations (Quinhoes & Fava 2010).

The program seeks to coordinate this network of complementary programs to the BF, to make these interventions flexible to the needs, values, and life circumstances of families. The designers of the BF aim to use this network of services to empower households, and to achieve a permanent escape from multidimensional poverty by attempting to reinforce the impact of BF transfers on poverty through these complementary programs (Quinhoes & Fava 2010). In fact, the interlinked nature of the BF can contribute to reducing the strength of interconnections between deprivations and can contribute to tackling multidimensional poverty. As well as this, the conditions can highlight barriers for families in satisfying human rights. Hence, according to the law, the

conditions should act as an obligation of the Brazilian government to intervene in and tackle these barriers.

Regarding the participatory structure of this program, at local level, there is an important body called Centro de Referencia de Asistencia Social (CRAS), which includes a wide range of actors, such as municipal representatives and civil society representatives. In this respect, the program seeks to support the local management of the BF through this body, particularly about meeting beneficiaries' needs. Within this council, the actors can discuss the coordination of complementary services and of local policies with the BF. Moreover, the CRAS deals with designing and delivering the BF at local level. Moreover, the CRAS has a duty to help with the compliance of conditions.

Therefore, the designers of the BF aim to increase the participatory structure of this program (Trubek *et al.* 2013), by allowing individuals to have a voice regarding the planning, the accountability and the budgeting of the program.

Consequently, the structure of this program can directly affect many capabilities, by tackling a considerable range of deprivations contemporaneously. Finally, the participatory and interlinked nature of this program can increase its efficacy in reducing multidimensional poverty.

### 3 Literature review

This section describes the main findings regarding the effect of the BF on education, health, employment, child labour, living standards, and active and community life.

As for education, academic articles suggest positive outcomes of the BF for both participation and enrolment (De Brauw *et al.* 2015, Barrientos *et al.* 2016).

However, Nilsson and Sjöberg (2013) show a significant, negative impact on school enrolment. Additionally, De Oliveira (2005) shows a positive outcome on the dimension allocating, further time to study. On the other hand, the report points out a negative effect on school attendance. Finally, Cireno *et al.* (2014), and Simoes and Sabates (2014), suggest mixed results on educational achievements.

As for health, Bohn *et al.* (2014), and Shei *et al.* (2014), indicate positive effects on healthcare service access. De Brauw *et al.* (2012), and Mourao *et al.* (2012), suggest positive impacts on the share of children receiving on-time vaccinations. On the other hand, Andrade *et al.* (2012) indicate no effect on the immunization status of children.

Further, positive outcomes are shown on weight/age, birth weight and body-mass-index-for-age (Paes-Sousa *et al.* 2011, De

Brau et al. 2015). Moreover, Kamakura and Mazzon (2014), and Mourao et al. (2012), highlight positive findings on food insecurity, number of daily meals, necessary consumption and material wellbeing. However, De Cassia et al. (2015) suggest that this programme fails to solve the problem of food deprivation. Andrade et al. (2012) suggest positive effects on nourishment only for children fulfilling educational requirements. Soares (2012) indicates mixed results on food security. Moreover, this article shows not significant effects on child labour. Furthermore, Ribas and Soares (2011) suggest an enhancement in the participation of additional workers in rural areas. On the other hand, the BF has negative impacts on the urban formal employment sector. Moreover, De Oliveira et al. (2013) signal that the program does not negatively affect labour market participation and reduces child labour. Similarly, Nazareno (2016) indicates that the BF reduces informal jobs. However, Do Monte and Filho (2013) demonstrate that the BF decreases the probability of participating in the labour market.

Da Silva e Silva and De Almada Lima (2014) indicate that the BF is associated with a shift from worked hours in formal jobs to informal employment.

As for standards of living, Kamakura and Mazzon (2014), and De Oliveira (2005), show a positive impact of the BF on housing expenditures, home maintenance, and on home furnishings. Finally, Soares (2012) indicates positive effects on isolation and small social networks which reduce the poor's welfare and keep them in poverty.

The literature review indicates a gap in the estimation of the impact of the BF on a MPI, and on multidimensional poverty intensity.

Consequently, this article contributes to the academic debate, by inspecting the role of the BF in reducing the burden of deprivations that push the lives of families into a situation of entrenched and stable disadvantage. It fills this gap by inspecting the effect of this policy on an MPI based on the Alkire-Foster methodology.

Specifically, this paper aims to analyse two main issues:

1. How is the impact of the BF on multidimensional poverty?
2. How does the BF affect intensity of multidimensional poverty?

## 4 Dataset

This analysis uses the longitudinal Avaliação do Impacto do Bolsa Família (AIBF) dataset, which was released by the Fundação de Desenvolvimento da Pesquisa, and by the Centro de Desenvolvimento e Planejamento Regional (CEDEPLAR) of the Federal University of Minas Gerais, in collaboration with the Ministry of the Social Development and Fight Against Hunger (Secretaria de Avaliação e Gestão da Informação, Ministério do Desenvolvimento Social e Combate à

Fome 2012). This dataset includes 15,426 households in the year 2005. In 2009 a follow-up of this dataset was carried out, in which 11,433 households from the first wave of the AIBF were re-interviewed. This dataset contains information on demographics, income, consumption, health, education, and participation in social policies. Households included in the AIBF were selected in a non-random way.

The main reason deals with the fact that this dataset was constructed to inspect the effect of the BF on poverty and hunger, and so therefore it mainly focuses on poor families and on BF recipients. Specifically, this dataset was created through a stratified sampling procedure (Ministério do Desenvolvimento Social e Combate à Fome 2012). The sample is divided into three strata. The first was set up for recipient families, which is the treatment group. This set of families received the benefits of the BF. The second stratum includes households in the Cadastro Único. This set of families contains households enrolled in social policies. Therefore, in this group, called «control group one», there are also households eligible but not enrolled in the BF, due to eligibility quotas (see Section 2). In fact, the law requires some levels of prioritisation during the selection process. Specifically, the benefits are given first to families with the lowest household income; then, to families with the largest number of children from 0-17 years old (Parsons 2014). Consequently, the families eligible for the BF in control group one are excluded from the cash transfers of this policy. The third stratum is made up of non-recipient households, which are not inside the Cadastro Único, because they do not meet the BF eligibility criteria. This set of families belongs to control group two. Moreover, the sample is representative of the biggest areas of Brazil, the North-East, the South-East and South and North, and the Centre and West. Further, sample weights were constructed to make the sample representative at national level. However, the main issue regarding this dataset is the attrition rate in 2009.

Its main source derives from the fact that the field team could not find recorded addresses of some interviewed families.

Hence, as the attrition is not random and the weights cannot make the sample representative, results of a quasi-experimental analysis focusing on the effect of the BF can be biased. For this reason, attrition-adjusted weights were constructed. Moreover, another issue is about a different labelling of the same variables between years. This problem makes it difficult to merge both datasets; therefore, the variables with the same questions were renamed but with different labelling before the merge. In addition, the two waves of this dataset do not allow researchers to match family members across years. Consequently, this empirical analysis was conducted using household level data (De Brauw *et al.* 2015). The final dataset is made up of the matched sample of families; that is, this dataset has a longitudinal structure.

The baseline period of this quasi-experimental analysis is the year 2005, and the year 2009 is the follow-up period. In this analysis, the treatment group did not receive the BF transfers in 2005 and obtained the benefits in 2009. The control group represents individuals who received benefits neither in 2005 nor in 2009. Specifically, the control group used in this empirical analysis belongs equally to the control group one and to the control group two.

The treatment group is made up of 4,398 units and the control group amounts to 3,945 units. The units who received the benefits in both years, and the units who received benefits in 2005 but not in 2009, are excluded from the analysis.

As for the data, I cannot share the AIBF dataset, because I received the data and agreed not to disclose it to other individuals. The dataset is however available upon request.

## 5 Methodology

### 5.1. Construction of the multidimensional poverty index

The novel goal of this article is to analyse the effect of the BF on the multidimensional poverty status of Brazilian families using a longitudinal quasi-experimental model. Specifically, this article assesses the impact of this policy between the year 2005 and the year 2009. The poverty status is estimated by constructing an MPI based on the Alkire-Foster methodology. The choice of this measure of poverty is suggested because of its capacity to identify multidimensional poor families through the set-up of a poverty cut-off (Alkire & Foster 2007). Similarly, this MPI is interesting, because it can estimate the effect of policies on the intensity of disadvantage. In particular, the Alkire-Foster methodology uses two distinct cut-offs: deprivation cut-offs and poverty cut-offs. Deprivation thresholds define a minimum level of achievement in each dimension below which a person is deprived in these dimensions. A poverty line indicates the minimum share of capability deprivations required to be identified as poor.

Moreover, the AF methodology assigns weights to each dimension (Alkire *et al.* 2020). In this regard, the first step of this methodology identifies the number of deprivations of every household using deprivation cut-offs. Then, weights are applied to each unit of analysis and weighted deprivations are computed, generating a deprivation score. Next, poor units are identified by comparing the deprivation score with a chosen poverty threshold. This step creates a censored matrix of the MPI. The elements of this matrix take the value 0 for non-poor families and take the value 1 for poor families. Finally, an index of intensity of poverty is computed as the

mean number of capability deprivations of all poor families (Alkire & Foster 2007).

## 5.2. Basic structure of the empirical analysis

This quasi-experimental analysis evaluates the impact of the BF on the average multidimensional poverty status of Brazilian families using the censored matrix of the MPI. Moreover, this article estimates the effect of this policy on multidimensional poverty intensity. Finally, it analyses the efficacy of this policy on each single capability deprivation included in the MPI (see Table 1). Specifically, this empirical analysis estimates the impact of the BF by combining the propensity score matching (PSM) technique with the difference-in-difference (DID) technique (Mu & Van de Walle 2011). In this regard, the PSM technique compares important observable characteristics of the treatment group with the same observable features of the control group. Consequently, this technique constructs control groups that are like treatment groups in those relevant observable features (see Section B in the Annex).

Hence, an advantage of the PSM is the exploitation of observable time variant characteristics to construct a balanced control group, and to avoid distortions in the DID analysis (Guo & Fraser 2015). This procedure allows the DID to estimate the effect of the BF, by comparing treatment and control groups that are similar in important, observable features except for being enrolled in the BF and for receiving the BF cash transfers (see Sections B and C in the Annex). Specifically, the DID methodology estimates the difference in the value of the MPI of each treated family between the year 2009 and 2005 and computes the mean level of this difference for the treatment group. The same difference is computed for the control group. Next, the DID calculates the difference of the previous two differences. The same procedure is applied to estimate the effect on multidimensional poverty intensity.

In particular, the DID technique applied in this analysis is called Average Treatment Effect on the Treated, because it focuses on the BF recipients (see Section B and C in the Annex). Therefore, the DID is useful because it considers time-invariant unobservable characteristics, which might bias causal links, such as the effects of other policies on multidimensional poverty (see Table C in the Annex).

## 5.3. Difference-in-difference regression analysis and poverty estimation procedure for different dimensions and for the multidimensional index of poverty

As for the DID regression that estimates the effect of the BF after conducting the PSM analysis, the equation is:

$$Y = \beta_0 + \beta_1 Time + \beta_2 Treated + \beta_3 (Time * Treated) + \beta_4 X + \varepsilon,$$

in which  $Y$  represents the outcome of interest,  $Time$  is a dummy representing the period and  $Treated$  represents the treatment group. Moreover,  $Time * Treated$  is an interaction term capturing the effect of the treatment, and  $\beta_3$  is the coefficient of the effect of the BF; that is the D coefficient. Finally,  $X$  represents the control variables used in regressions, which are dichotomic except for household income (see Table D in the Annex). Particularly, this paper runs a regression for each outcome deprivation (see Table 1), and for the effects on the MPI at different poverty thresholds (see Tables 2 and 3), without employing clustered errors. Furthermore, it estimates the effect of the BF on the MPI according to two main poverty thresholds.

First, to identify poor families, this piece of research uses a threshold, set at  $k = 25\%$ , which considers a household deprived in a quarter of the four domains as poor, that is in one domain. This group of families includes households with a moderate level of multidimensional poverty. Moreover, this article employs a second cut-off, that is  $k = 40\%$ . This threshold considers each family deprived in one domain and in the 66% of a second domain as poor, such as one domain plus one dimension of health (see Table 1). The latter threshold is higher than 1 domain and 50% of a second domain, so it can identify vulnerable families. Hence, this group includes households with a greater level of disadvantage. In addition, this empirical analysis estimates the impact of the BF on the MPI across a range of cut-offs estimated through the AF methodology; specifically, between  $k = 25\%$  to  $k = 56.3\%$ .

The rationale of this analysis deals with assessing the dynamics of the effects of the BF, which cannot be inspected by using only two poverty thresholds. This analysis can be important for policy purposes; for example, it can highlight in which part of the distribution the impact of this policy is increasing and in which part the BF loses its power of tackling multidimensional poverty. As for the structure of the MPI, it includes all the dimensions of the four domains, which are health, education, standards of living, and active and community life (see Table 1). Further, the MPI takes values 0 and 1, according to different poverty thresholds; for example, if the latter threshold is set equal to 25%, individuals deprived in one domain will be assigned the value of one. As for the construction of weights, following the AF methodology, the domains are weighted equally, and the dimensions within each domain are weighted equally as well (Alkire & Robles 2017).

As for the selection of dimensions, the variables are based on the reports of the Global MPIs (Alkire *et al.* 2020) and on an article by Burchardt and Vizard (2011). This paper analyses the main international treaties on human rights and provides a list of valuable domains and dimensions taken from human rights. The choice of the levels of each deprivation follows the methodology of constructing the cut-offs of indicators in the reports of the OPHI (Alkire & Robles 2017).

## 5.4. Sensitivity analysis

Finally, this article conducts robustness analysis. First, it uses a regression analysis including the estimated propensity score, to check the sensitivity of the DID results of the main empirical analysis. In addition, as the main analysis does not employ weights, results are biased. Consequently, this paper conducts a second robustness analysis applying attrition-adjusted weights to the main DID analysis, to check the difference in the findings.

At last, to control for potential effects on causal inference of unobservable variables, which can lead to a hidden bias that may make matching estimators not robust, the bounding approach implemented by Rosenbaum (2002) is applied. This test calculates the potential influence of a hypothetical unobserved variable on the results of a DID analysis at different bounds called Gamma. In particular, the *bound Gamma = 1* is the base scenario of no hidden bias, «but with increasing Gamma, the bounds move apart reflecting uncertainty about the test-statistics in the presence of unobserved selection bias» (Becker & Caliendo 2007, p. 4).

This situation can lead to an overestimation of the treatment effect. An overestimation of the effect for a low level of Gamma does not mean that a policy is not effective on deprivations. However, it entails that the results are not robust to the introduction of a potentially unobserved variable that can simultaneously affect assignment into treatment and the outcome variable. Hence, «the results are quite sensitive to possible deviations from the identifying unconfoundedness assumption and hence, some caution when interpreting the results is advisable» (Becker & Caliendo 2007, pp. 11-12).

Finally, a parallel trend test cannot be conducted, because this analysis employs just one pre-treatment period. Moreover, the parallel trend assumption is substantially untestable, because it is based on an unobservable counterfactual that deals with what would have occurred to the treatment group if it had not been exposed to a policy. Therefore, even a visual inspection of the parallel trend assumption that suggests parallel trends between treated and control groups over time would not grant that the assumption holds. In this regard, this article applies the propensity score matching technique that, by constructing a control group which is as similar as possible to the treatment group based on observable features, can enhance the likelihood that the parallel trend assumption is not violated. One of the reasons is that, by constructing a balanced control group based on observable characteristics, this methodology can correct the selection bias.

This means that it can assume that the observed trends between the treatment group and the control group would have continued to be parallel in the absence of the exposure to a policy more credible.

Domains and related dimensions	Definition	Weights
<b>Health</b>		
Undernutrition	Household has a child 0-4 years old undernourished in terms of z-scores of weight-for-age	8.33 %
Vaccination	Household has a child 0-6 years old without a vaccination card	8.33 %
Access to health insurance	Household has no access to public health agents and to private health insurance	8.33 %
<b>Education</b>		
Ability to read and write	Household has a child less than 17 years old who cannot properly read and write	12.5 %
School attendance	Any child 6-17 years old out of school	12.5 %
<b>Standards of living</b>		
Cooking fuel	Household uses wood or charcoal	4.16 %
Improved sanitation	No bathroom or toilet; access to poor bathroom or toilet	4.16 %
Safe drinking water	Water source is not in general network or in property	4.16 %
Electricity	No access to electric network	4.16 %
Flooring	No wood or cement	4.16 %
Assets	No access to car, motorbike, truck, or bicycle	4.16 %
<b>Active and community life</b>		
Unemployment	At least one household member is not working	6.25 %
Child labour	Any child less than 18 years old is working	6.25 %
Informal jobs	At least one household member is working and not paying any contribution	6.25 %
Social connectedness	At least one household member does not participate in any civil society organization	6.25 %

**Table 1**  
Definition of domains and of dimensions

## 6 Results

The effects of the BF on single capability deprivations show a positive and significant impact on the use of inadequate cooking fuel, on having no assets, on child labour, and on low social connection (see Table 2). Specifically, this policy provides important capabilities: the ability to move, and the ability to eat cooked food. Moreover, it diminishes child labour, which is a fundamental human right for the dignity of children's lives. Furthermore, it plays a role in enhancing family's power to influence policymakers' decisions, and to spur social change (Drèze & Sen 2013).

The results agree with the literature regarding the impact of this program (see Section 3), except for the findings regarding having no assets, which, as far as I know, is a novel empirical analysis.

Further, the BF has a positive but not significant effect on vaccination, undernutrition, improved sanitation, safe drinking water, electricity, and flooring. Similarly, the BF has a positive impact on the ability to read and write, although this finding is not significant. This is a novel result that adds to the literature and may show a role of the BF in educational inclusion. However, this policy has a negative and significant effect on unemployment. As well as this, it has a negative but not significant effect on health insurance inclusion, school attendance, and informal jobs. These findings follow some part of the literature on the effects of the BF.

Dimensions	DID results <sup>1</sup> (percentage points)	Number of observations	Standard errors
Undernutrition	-0.014	7,935	0.0043
Cooking fuel	-3.97***	8,258	0.008
Assets	-3.36***	8,285	0.0094
Child labour	-1.22**	7,850	0.0053
Social connectedness	-7.75***	8,246	0.0147
Vaccination	-0.84	8,024	0.0065
Access to health insurance	0.06	7,992	0.0068
School attendance	1.45	7,908	0.0098
Read and write	-0.36	8,220	0.0099
Improved sanitation	-1.23	8,268	0.0094
Safe drinking water	-0.6	8,252	0.0089
Electricity	-0.16	8,233	0.0047
Flooring	-0.84	8,285	0.0056
Unemployment	3.15**	8,206	0.012
Informal labour	0.47	8,253	0.0151

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

**Table 2**

Results of ATT analysis by single dimensions using matched treatment and control groups without attrition-adjusted weights

As for multidimensional poverty, the literature points out the effects of the BF on single deprivations and on income poverty, including extreme poverty (Drèze & Sen 2013). Therefore, the analysis regarding multidimensional poverty can contribute to the academic debate, by inspecting the impact of the BF on families that suffer from different, interlinked deprivations which keep them in an entrenched, steady vulnerable situation. This impedes their amelioration of wellbeing and their graduation from poverty. This section analyses the impact on multidimensional poverty status for less poor

1 This is an Average Treatment Effect on Treated (ATT) analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Section D of the Annex.

families and for vulnerable households. Finally, this article analyses the impact on multidimensional poverty intensity.

The findings show a positive, low and not significant impact on moderate poor households. On the other hand, the effect on vulnerable families indicates a reduction of multidimensional poverty status by a level higher than 2 percentage points (see Table 3). To gain more detailed information regarding the impact on multidimensional poverty, the effects across different poverty thresholds are inspected. The results suggest a reduction of the level of poverty, with an increase across the first three poverty thresholds (see Table 4). Moreover, the BF has higher and significant positive effects from the 35.4 % to the 41.7 % cut-offs. Specifically, the results decrease slightly between the 35.4 % and 39.6 % thresholds: from a poverty reduction of 2 percentage points to a reduction of 1.78 percentage points. At the 41.7 % cut-off, there is an increasing impact of about 2.07 percentage points, which is the highest effect of the BF. In addition, the impact of this policy reaches vulnerable households up to a threshold of 47.9 %, whose level of poverty reduction is 1.05 percentage points. Further, the effect of the BF contribution becomes negligible from the 50 % poverty line (see Picture 1, blue line).

The outcomes indicate that the integrated structure of the BF effects families between the 29.25 to 31.3 % thresholds. However, the policy has the highest impact between the 35.4 % to the 41.7 % poverty lines, in which it substantially reduces the magnitude of disadvantage. Therefore, the BF has positive effects on families deprived in one domain and 40 % of a second domain up to families deprived in one domain and 66 % of a second domain (see the Table 4). In this sense, the integrated, flexible, and participatory structure of the BF and its wide network of service provision suggest that this policy has an inclusive design (Quinhoes & Fava 2010). In fact, the BF spurs social change, by delivering substantial freedoms. Further, the BF fosters agency across the distribution of poor families. Hence, it contributes to breaking linkages between capability deprivations for these households (Quinhoes & Fava 2010).

On the other hand, the effectiveness of this policy steadily decreases for vulnerable families. This outcome can be caused by a higher burden of poverty, that diminishes self-selection for the service system. Moreover, a lower flexibility in the access to public support, and missing services are important issues. In fact, a lack of human and financial resources, and a low participation in the CRAS, are experienced in poorer areas of Brazil. Particularly, a lack of infrastructures such as health facilities, a lack of business-related services, insufficient policy coordination, and low quality of services reduce the BF's power in poorer areas (Da Silva e Silva & De Almada Lima 2014). For similar reasons, the BF does not affect more vulnerable families, which range between

the 50 % poverty cut-off and the 56.3 % threshold and are poor in two or more domains.

In fact, these households experience a higher multidimensional poverty level, and this excludes them from the benefits of the BF. Finally, there are positive effects on the mean intensity of multidimensional poverty, but this result is not significant (see the Table 2).

Dimensions	DID results <sup>2</sup> (percentage points)	Number of observations	Standard errors
Poverty status; threshold below 25 %	-0.51	6,849	0.0151
Poverty status; threshold below 40 %	-2.07**	6,849	0.0086
Average poverty intensity	-0.55	8,285	0.0035

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

**Table 3**

Results of ATT analysis regarding poverty status and intensity of poverty using matched treatment and control groups without attrition-adjusted weights

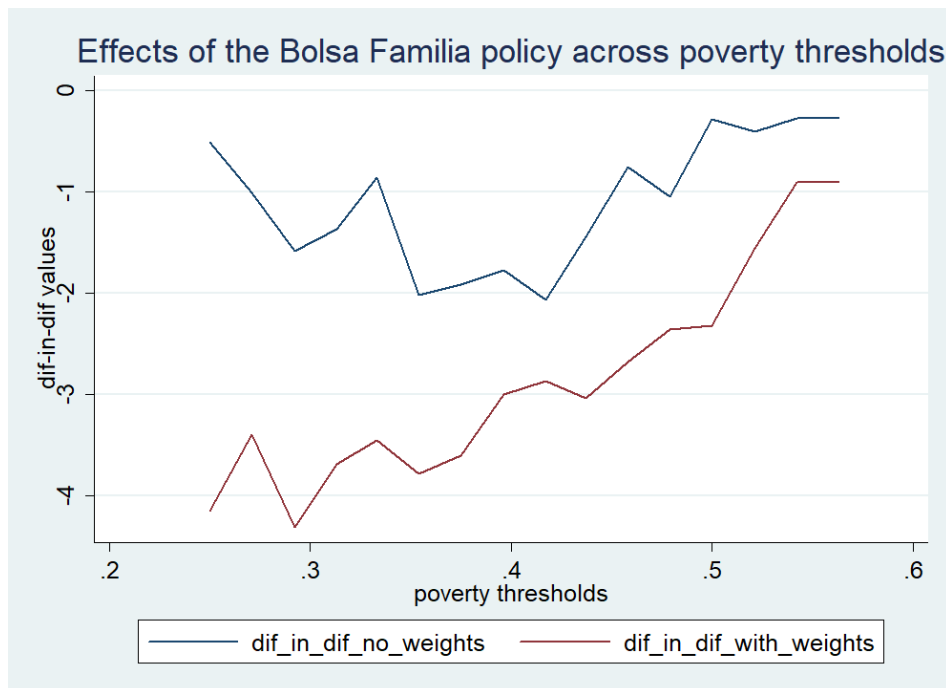
Poverty thresholds	DID results <sup>3</sup> (percentage points)	Number of observations	Standard errors
25 %	-0.51	6,849	0.0151
27.1 %	-1.01	6,849	0.0147
29.2 %	-1.59	6,849	0.0136
31.3 %	-1.37	6,849	0.0134
33.3 %	-0.86	6,849	0.0129
35.4 %	-2.02*	6,849	0.0110
37.5 %	-1.92*	6,849	0.0107
39.6 %	-1.78*	6,849	0.0097
41.7 %	-2.07**	6,849	0.0086
43.7 %	-1.45*	6,849	0.0078
45.8 %	-0.76	6,849	0.0073
47.9 %	-1.05*	6,849	0.0062
50 %	-0.29	6,849	0.0056
52.1 %	-0.41	6,849	0.0044
54.2 %	-0.28	6,849	0.0032
56.3 %	-0.28	6,849	0.0032

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

**Table 4**

Results of ATT analysis across multidimensional poverty thresholds using matched treatment and control groups without attrition-adjusted weights

- 2 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Section D of the Annex.
- 3 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Table D of the Annex.



**Picture 1**  
Effect of the BF on poverty status across the thresholds

## 7 Robustness checks

As the estimates of the impact of the BF might be sensitive to the choice of parameters of the measure, such as weights, this article undertakes a robustness check of the previous results. Specifically, each outcome variable is regressed on controls for baseline features, that are not considered in the main analysis; that is, the propensity score and the dummy variable representing the treatment and control groups. Subsequently, this empirical analysis compares the findings with the previous outcomes. This regression analysis can be safely used because, in the considered period, there are no external events, conditions, or additional confounders that can blur the causal outcome.

The results suggest similar findings regarding some dimensions, compared to the previous analysis. However, some results are different from the findings of the main analysis. Specifically, the effect on undernutrition becomes negative. This is an important issue in the literature. In fact, among other causes, these findings can be influenced by the tendency of poor families to use BF benefits to purchase energy-rich food, instead of buying healthy food. Moreover, the insufficient level of benefits with respect to the needs of families can make families decide to buy cheaper, but less nutritious food (Lignani *et al.* 2010). Furthermore, the effect on access to electricity becomes negative, whereas the impact on informal jobs, on access to health insurance, and on school attendance be-

comes positive. In addition, the effects on the dimensions having no assets and unemployment become lower (see Table 5). Further, there is a lower and not significant impact on multidimensional poverty for vulnerable families in the robustness analysis (see Table 6). In addition, the result of the robustness analysis across multiple cut-offs shows a lower effect for each threshold except for the 25 % and 29.2 % lines. Finally, the impact on multidimensional poverty for the 50 % line is lower and becomes negative (see Table 7).

As for the robustness analysis by dimension using attrition weights, this paper does not estimate the statistical significance, because the weighted effect is calculated only on the treated (see Tables F, G, and H in the Annex). Specifically, the effect of the BF is higher for all dimensions, except for child labour and flooring. Moreover, the impacts become negative for the dimension social connectedness and school attendance. On the other hand, the effect of the BF becomes positive for the dimensions of undernutrition, electricity, unemployment, and access to health insurance (see Table H).

As for the robustness analysis using attrition-adjusted weights for moderate poor, vulnerable families, and for multidimensional poverty intensity, the results show a higher level of the effect of the BF for the two main poverty cut-offs, and for poverty intensity. The same findings are obtained for the effects across thresholds, but the results suggest a decreasing trend from the first threshold to the last, with impacts below one percentage point from the 54.2 % poverty line (see Tables F and G). In fact, as Picture 1 indicates, there is an increasing trend in the impact up to the 41.7 % threshold; then, there is a decreasing trend using data without attrition-adjusted weights. On the other hand, the data with attrition-adjusted weights suggest a higher level of effect for each poverty line, but a decreasing trend from the first to the last poverty line.

Finally, the sensitivity analysis using Rosenbaum's bounding approach points out a sensitivity to a potentially unobserved variable for the dimensions of vaccination, ability to read and write, sanitation, safe drinking water, electricity, flooring, having no assets, informal jobs, and undernutrition. On the other hand, the results suggest some robustness to an unobserved variable of unemployment, access to health insurance, child labour, social connectedness, cooking fuel, and school attendance. As for the sensitivity analysis across thresholds, the results are not robust up to the 35.4 % line; subsequently, the findings for the other cut-offs become robust to a potentially unobserved variable. On the other hand, the effect on multidimensional intensity of poverty is sensitive to unobserved variables. As mentioned in the methodology section, these results do not mean that there is unobserved heterogeneity, and that the BF has no effect on some dimensions and thresholds, but that one needs to be careful in interpreting the results.

Dimensions	DID results <sup>4</sup> (percentage points)	Number of observations	Standard errors
Undernutrition	0.05	7,935	0.0042
Cooking fuel	-3.64***	8,258	0.0079
Assets	-2.62***	8,285	0.0092
Child labour	-1.12**	7,849	0.0054
Social connectedness	-7.45***	8,246	0.0141
Vaccination	-0.88	8,024	0.0064
Access to health insurance	-0.21	7,992	0.0062
School attendance	2.05**	7,907	0.0097
Read and write	-0.55	8,216	0.0096
Improved sanitation	-1.31	8,268	0.0092
Safe drinking water	-0.43	8,252	0.0088
Electricity	0.09	8,233	0.0046
Flooring	-0.54	8,285	0.0055
Unemployment	2.79***	8,206	0.0116
Informal labour	-0.1	8,253	0.0145

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

**Table 5**

Robustness analysis: results of ATT analysis for single dimensions using matched treatment and control groups by conducting regression analysis without attrition-adjusted weights

Dimensions	DID results <sup>5</sup> (percentage points)	Number of observations	Standard errors
Poverty status; threshold 25 %	-0.3	6,849	0.0145
Poverty status; threshold 40 %	-1.37	6,849	0.0087
Average poverty intensity	-0.31	8,285	0.0034

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

**Table 6**

Robustness analysis: results of ATT analysis regarding poverty status and intensity of poverty using matched treatment and control groups and regression analysis without attrition-adjusted weights

Poverty thresholds	DID results <sup>6</sup> (percentage points)	Number of observations	Standard errors
25 %	-0.3	6,849	0.0145
27.1 %	-0.81	6,849	0.0142
29.2 %	-0.99	6,849	0.0133
31.3 %	-0.51	6,849	0.013
33.3 %	-0.26	6,849	0.0119
35.4 %	-1.3	6,859	0.0109
37.5 %	-1.19	6,859	0.0105

4 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Section D of the Annex.

5 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Table D of the Annex.

6 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions, the control variables used in each analysis are shown in the Section D of the Annex.

Poverty thresholds	DID results <sup>6</sup> (percentage points)	Number of observations	Standard errors
39.6 %	-0.99	6,849	0.0096
41.7 %	-1.37	6,849	0.0087
43.7 %	-0.92	6,849	0.0078
45.8 %	-0.30	6,849	0.0074
47.9 %	-0.65	6,849	0.0062
50 %	0.05	6,849	0.0056
52.1 %	-0.06	6,849	0.0045
54.2 %	-0.11	6,849	0.0034
56.3 %	-0.11	6,849	0.003

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

**Table 7**

Robustness analysis: results of ATT analysis across multidimensional poverty thresholds using matched treatment and control groups by conducting regression analysis without attrition-adjusted weights

## 8 Conclusions

This article analyses the effects of the BF on an MPI based on the Alkire-Foster methodology. It inspects the impact on the single capability deprivations included in this MPI as well. This piece of research fills a gap in the literature regarding the efficacy of this policy on multidimensional poverty indexes by inspecting the effectiveness of the BF in reducing multidimensional poverty for poor and vulnerable families. Hence, this paper contributes to the academic debate, by assessing the effectiveness of this human rights-based policy in tackling multiple deprivations of Brazilian families contemporaneously to ease escape from entrenched poverty over time.

The findings of this longitudinal quasi-experimental analysis without attrition-based weights suggest that the BF protects social connectedness, which represents a crucial form of democracy that can spur social and economic change. Moreover, this policy improves the ability to move and the ability to eat hot meals. As well as this, it protects children from labour, which is a fundamental entitlement to child life quality. Furthermore, the policy has a positive effect on vaccination, the ability to read and write, on sanitation, safe drinking water, electricity, and flooring.

However, the BF has a negative impact on unemployment, which may undermine the reduction of disadvantage for the current generation of Brazilian households. Similarly, it has a negative influence on access to health insurance, school attendance, and informal labour (see Table 2).

Further, this policy reduces multidimensional poverty both for poor and vulnerable households (see Tables 3 and 4). This outcome suggests that a policy based on human rights and freedoms can increase efficacy in fighting multidimensional poverty, compared to other Social Security policies, such as workfare policy. In fact, it grants access to a wide, valued range of services and transfers, and it provides flexible and coordinated delivery (Quinhoes & Fava 2010). Consequently, this category of policy can tackle different capability deprivations simultaneously, and it can weaken the burden of multidimensional poverty. These features allow individuals to escape a situation of entrenched joint burden of deprivations towards lower levels of disadvantage. Particularly, these factors allow the BF to have a disproportionate effect on multidimensional poverty escape.

In addition, the results using the attrition-based weights, that correct for the bias due to missing observations in the AIBF for the year 2009, point out similar results regarding single dimensions, except for social connectedness, which shows a negative impact of the BF. Moreover, the findings indicate a positive effect on unemployment, access to health insurance, and on informal labour. Further, the results suggest a positive influence on multidimensional poverty and multidimensional poverty intensity. Therefore, it seems that the correction of the attrition bias leads to different findings with regards to three dimensions of the active and community life.

Specifically, the BF is effective in tackling unemployment and informal labour, but it has a negative influence on social connectedness. Similarly, the findings using weighted data indicate a positive impact on access to health insurance. Finally, this policy has a positive impact on multidimensional poverty, and on the intensity of multidimensional poverty as well.

Finally, the Rosenbaum test suggests sensitivity to potential unobserved factors for almost all dimensions of standard of living; for the ability to read and write, vaccination, undernutrition, and informal jobs. Therefore, there may be an overestimation of the effect of the BF on these dimensions, due to hidden bias.

The positive findings can probably be explained by inspecting peculiar features of the BF, compared to important policies in Latin America. Specifically, the BF, Chile Solidario, and Progres/Oportunidades are conditional cash transfers with similar structures. In fact, among common features, all these policies share the focus on families, share transfers of cash and in-kind benefits, feature the implementation of programs at local level, have complementary programs, and have conditions on receiving benefits, and sanctions. However, there are differences that can make the BF more inclusive, and more effective in fighting multidimensional poverty; for example, as for the exit process, if recipients of Chile Solidario

do not meet minimum requirements in a given period, they become ineligible for the policy. In this sense, the policy can exclude more vulnerable families from the policy, because the level of their deprivations does not allow them to overcome disadvantage during the period established by the policy. On the other hand, the BF allows recipients to be enrolled in the policy, until they fulfil the exit rules (Cecchini & Madariaga 2011).

As for complementary programs, joint action protocols between ministries are not established in the policy Chile Solidario. Therefore, although some mechanisms are in place to make these programs and services flexible to the issues of recipients, in many instances, they fail to ease access to these interventions (Cecchini & Madariaga 2011, Shulte 2007). Moreover, Progres/Oportunidades includes main interventions and services, but it does not contain schemes complementary to the established interventions (Cecchini & Madariaga 2011). On the other hand, the BF includes these formal joint protocols, that allow social workers to provide integrated services and interventions to increase self-selection of recipients (Trubek *et al.* 2013). Finally, although Chile Solidario delivers services and programs in a decentralized way, it is not participatory. Specifically, recipients do not have a voice regarding issues of access to programs at local level.

On the other hand, family counsellors, and specific organizations without representatives of recipients, have the role of coordinating interventions, and identifying and filling the gap in existing services and programs (Shulte 2007). Further, as for Progres/Oportunidades, the implementation and coordination of this policy is mainly left to the federal government, without allowing the participation of civil society in the policy at local level (Niño-Zarazúa 2020, Cecchini & Madariaga 2011). On the other hand, the BF set up social councils, such as the CRAS, which allow them to participate in the design, and the accountability of the BF at local level. Similarly, the CRAS and public officials gather data on issues of recipients and solutions to ease the access to the BF (Lindert 2007). The comparison suggests that the Brazilian policy is more inclusive, compared to Chile Solidario, and Progres/Oportunidades. This contributes to its effectiveness in tackling multidimensional poverty for less disadvantaged and vulnerable families.

However, using both unweighted and weighted data, the results show that the BF has a small and not significant effect on poverty for more vulnerable families. In this regard, the territorial heterogeneity of Brazil is a factor that can explain the previous result. Specifically, the BF is more effective in richer regions, due to greater resources, more infrastructures, better equipped managers, and higher empowerment of civil society. Similarly, lower service quality, and missing interventions in poor areas can be important features that impinge upon the small effect on more disadvantaged households (Da Silva e Silva *et al.* 2008). In addition, the

decentralized governance can influence a lack of efficacy on more vulnerable families. In fact, municipalities can be inefficient in the implementation of the BF. Moreover, local governments and civil society can be captured by the discretionary influence of local elites (Hall 2008). Furthermore, the amounts of the BF cash transfers should be increased. Similarly, the role of social workers and the CRAS should be enhanced to better tailor services and interventions inside the BF for these families (Parsons 2014).

As for the limitations, this article does not account for heterogeneity analysis. Future papers should inspect the effect of the BF on different groups and areas, such as by geographical area, state, and race, using the AF MPI. In fact, although the data is at household level, it provides information regarding the racial composition of families, as well as regarding the states and areas in which families live.

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## Appendix

### A. Main features of the Bolsa Família

The BF policy is a conditional cash transfer included in a big network of collateral interventions. The program seeks to protect health, education, and income security rights. Its structure is derived from the merge of separate programs: the Auxílio Gás, which provides cooking fuel; the Bolsa Escola, that reduces costs of school attendance; the PETI, which tackles child labor; the Social Card Program, that delivers food and basic necessities, and the Bolsa Nourishment, which provides cash transfers to families with children between 0 and 6 years old (Da Silva e Silva *et al.* 2013). Specifically, in 2009, the eligibility poverty line for extreme poor families is 70R\$ of monthly per capita income. The second eligibility threshold is 140R\$ of monthly per capita income. The basic benefit is 68R\$; moreover, the variable benefit ranges between 22R\$ and 33R\$ (Soares 2012).

The BF transfers cash to poor families. Eligible families are those with pregnant women and those with children less than eighteen years old. In order to obtain transfers, recipients have to fulfil

some condition (Hellman 2015). Families have to grant at least 85 % of monthly school attendance for children between six and fifteen years old. Households have to guarantee monthly attendance of 75 % for individuals between sixteen and seventeen years old. Pregnant or breastfeeding women have to make periodical health visits. Furthermore, they must follow educational health and nutrition meetings. Finally, families have to give vaccinations to children younger than seven years old and have to take them to healthcare centres (Mourao & De Jesus 2011).

An important role regarding the BF management is played by the CRAS. This body is made up of a team of social workers, of municipal representatives, of members of social welfare, health, education and food security, as well as of civil society representatives. According to the designers, the main goal of this body is to understand families' issues, and to adapt the provision of local services and of the complementary programs to individual necessities. Specifically, the CRAS seeks to design and implement local services, and services of complementary policies in an integrated and flexible way. Its goal is to ease the self-selection of claimants for all these programs (Quinhoes & Fava 2010). The main reason is to spur fulfilment of conditions and to foster graduation from poverty. In addition, it seeks to include all eligible poor families in the registry; for example, the CRAS actively searches for eligible households through home visits. Finally, municipalities have the duty to allow recipients to satisfy conditions by aiming to establish services, infrastructures, and policies. In this respect, according to the law, the CRAS can help claimants to make local governments accountable, if recipients cannot fulfil the conditions. As for recipients' enrolment, families self-select for the Cadastro Único (CU), that is the database of poor families, and for the BF by self-declaring their income.

Different transfers are provided to poor families, first a basic payment that is unconditional and independent of having children. This income is transferred only to extreme poor families. Further, a variable transfer is provided to families with at least one child up to fifteen years old. Similarly, a variable transfer is delivered to families with adolescents between sixteen and seventeen years old who attend school. Moreover, a variable amount of money is provided to families with children up to six years old.

This transfer is delivered, until households are below a specific per-capita monthly income (Trubek *et al* 2013). The BF can be integrated with existing state and municipal social programs. As well as this, the BF is included in a set of complementary programs, via the information inside the Cadastro Único (Hellmann 2015). Supplemental transfers, provided because of the enrolment in local and complementary programs, are received jointly with the BF transfers through a new social card delivered by the federal government (Hellmann 2015). The complementary programs seek

to tackle different issues, first employment and economic inclusion. Examples are the Next Step program, microcredit programs and interventions, that give the possibility to open savings accounts (Hellman 2015). Further, some education programs are included in the complementary interventions, such as the Brazil Alphabetization and the Brasil Carinhoso (Da Silva e Silva *et al.* 2013). Finally, there are programs regarding light accessibility and housing ownership as well (Da Silva e Silva & De Almada Lima 2014). However, when families do not abide by the regulations, four warnings are sent before transfers are permanently suspended. Only variable transfers can be blocked (Soares 2012). As for the registration process in the Cadastro Único, according to the designers of the BF families can visit and register at fixed and mobile posts, at schools, health centres, social assistance centres, neighbourhood organizations, churches and at the central municipal office. There are different means through which information regarding the BF structure and its eligibility rules is spread; for example, the use of toll-free hotlines, emails to the MDS, and the means «Speak with the MDS» promote transparency, accountability, and awareness of the BF (Hellmann 2015).

Finally, after the Ministry of Social Development defines the number of households that are to be enrolled in the BF on monthly basis, some levels of prioritisation during the selection process are applied. Specifically, the benefits are given, first, to families with the lowest household income; then, to families with the largest number of children from 0-17 years old (Parsons 2014).

## B. Propensity score matching technique

The PSM procedure estimates a propensity score regarding the likelihood of being a BF recipient for treatment and control groups in 2005, using a logit model which includes some baseline characteristics. Subsequently, these matching characteristics are used, and a Kernel-matching estimator forms a control group that matches the main features of the treatment group. This process generates a control group similar to a treatment group in relevant observed characteristics. Particularly, this matching estimator constructs a counterfactual for each treatment unit considering each control unit. It weights each of the latter units proportionally to their distance from the treatment units. The closer is the control unit the higher is its weight. Specifically, this article applies the Epanechnikov algorithm metric. This matching estimator assigns a higher weight to control units with propensity scores, like the propensity scores of treatment units. The general Kernel weighting equation is:

$$W_{i,j} = G(p_j - p_i / a_n) / \sum_j G(p_j - p_i / a_n)$$

in which  $G(\cdot)$  is the Kernel function, « $an$  is a bandwidth parameter which scales the difference in the estimated propensity scores, and  $p$  is the estimated propensity score» (Morgan & Winship 2015, p. 162).  $i$  and  $j$  refer to unit  $i$  and unit  $j$ , for which the distance is computed (Morgan & Winship 2015). The main advantage of this non-parametric technique is that it uses more information, compared to other matching estimators. The main disadvantage is that it does not discard poor matches (Caliendo & Kopeinig 2005). To avoid biased results, the estimates of the causal effects have to be performed only in the common support area.

This area is the range in which control and treatment units overlap (Caliendo & Kopeinig 2005). Specifically, this article checks that treatment and control units have a common support area in terms of propensity score values. This process makes sure that there is a «sufficient overlap in the distribution of the observed covariates» (Guo & Fraser 2015, p. 257). After the matching procedure, it is checked that this process generates a balanced treatment and control group, by testing the equality of the mean value of relevant variables for both groups. This empirical analysis employs other indicators to control the quality of the matching procedure as well (Rosenbaum & Rubin 1985).

## **C. The difference-in-difference estimation strategy**

After estimating the propensity score for treatment and control units, as well as the weights of the control units, this empirical analysis estimates a DID on the outcome variables. The most important outcome variable of this analysis is multidimensional poverty status of Brazilian households, which is computed using the Alkire and Foster methodology (Alkire & Foster 2007). Poverty status is a dichotomic variable that ranges from 0, when a household is not poor, to 1, when a household is poor in a specified number of capabilities. As the equations 1 and 2 show, this paper evaluates a DID that is called ATT in two steps: first, the average level of the difference of the multidimensional poverty status of each household in the treatment group over time is estimated, using a given poverty line in 2005 (Morgan & Winship 2015); therefore, the difference for each Brazilian household belonging to the treatment group over time is estimated; for example, if one treated family is poor in 2005 and not poor in 2009 the difference is  $-1$ . If in 2005 that family is not poor and remains out of poverty in 2009, the difference is 0. After computed all these differences, the average value of these differences is calculated. Similarly, the average value of the difference in the level of poverty status for each household in the matched control group over time is computed. Next, the difference between the two previous differences is estimated. If the sign of the difference in the differences is negative, the results show a reduction in the

level of poverty within a chosen poverty threshold. Moreover, this article applies the ATT to estimate the effect of the this policy on multidimensional poverty intensity, and on the single dimensions of the MPI. The formula of the ATT is:

$$ATT = \delta_0 - \delta_1$$

in which:

$$\delta_0 = E[Y_{t1} - Y_{t0}], \delta_0 \in [-1; +1], t \in [0, 1]$$

and:

$$E[Y_{t1} - Y_{t0}] = 1 / M[\sum_j M(Y_{tj1} - Y_{tj0})], j = 1 \dots M, t \in [0, 1]$$

$$\delta_1 = E[Y_{c1} - Y_{c0}], \delta_1 \in [-1; +1], t \in [0, 1]$$

And:

$$E[Y_{c1} - Y_{c0}] = 1 / N[\sum_i N(Y_{ci1} - Y_{ci0})], i = 1 \dots N, t \in [0, 1]$$

In which  $\delta_0$  is the mean value of the difference of the level of the poverty status for each treated household over time. Similarly,  $\delta_1$  is the mean value of the difference of the level of the poverty status for each matched control group household over time. The ATT is the difference of the two previous differences.  $Y_{tj1}$  and  $Y_{tj0}$  are the values of poverty status for each treated household over time.  $Y_{ci1}$  and  $Y_{ci0}$  are the values of poverty status for each control group family over time. Moreover,  $t$  is the time-period: 0, period before policy introduction, and 1, period of policy implementation. Further,  $j$  and  $i$  are the set of households inside the matched treated and control groups.

Regarding the whole methodology process, this empirical analysis uses a single estimation framework based on information from both treatment and control groups contemporaneously. The propensity score for each treatment and control group is estimated by applying a logit regression analysis which accounts for confounders.

Then, the matching between treatment and control units using a kernel matching estimator is computed, which attaches higher weights to control units that have bigger propensity scores. This procedure identifies control units more similar to treatment units. Furthermore, this procedure checks for the common support area, to avoid bias in the final outcome. Finally, the process estimates the DID between treatment and control groups contemporaneously using an ATT specification. Considering the process of propensity score matching and the ATT procedure as a joint estimation approach, the formula is:

$$DID\_PSM = 1 / M[\sum_j M(Y_{tj1} - Y_{tj0}) - \sum_i N W(j, i)(Y_{ci1} - Y_{ci0})]$$

in which  $W(j, i)$  are the kernel-based weights for each control group unit. This formula implies that every treated unit is compared to all control units inside the common support area. Therefore, as treat-

ment and control units are similar in important observable characteristics, the difference in outcome dimensions between these two groups are reasonably caused by the fact that the treatment group is affected by the BF.

## D. Main baseline control variables

The main control variables are: family living in a *favela*, being a family sharing the same house, having at least a pregnant woman in family, having at least a child between the age of six to seventeen in family, having at least a child under six in family, having a child under eighteen in family, having at least a family member over sixty-four in family, region in which family lives, having at least an unemployed household member, ethnicity of family, age of family head, family lives in rural areas, family lives in urban areas, family has durable goods (fridge, television, radio, electric shower, washing machine, and computer), family has no assets (bike, motorbike, truck, or car), family size, sex of family head, family owns a house, family income, family has at least an undernourished child, family has at a child without vaccination, family has no access to health-care insurance, family uses wood or charcoal, family has no toilet or has access to poor bathroom or toilet, family has poor water source, family has no access to electric network, flooring is neither wood nor cement, child in family has low ability to read and write, child in family is out of school, family has at least a child under eighteen years old working, family has at least a member working and not paying contributions, and family has at least one member who does not participate in any civil society organization.

## E. Demographic characteristics using unmatched treatment and control groups

Dimensions	Unmatched treatment	Unmatched control
Mean family size	4.7	3.9
Mean family income	449.76	679.48
Mean female age	42.7	45.1
Mean male age	39.8	46.3
Percentage of females	35.6 %	37.4 %
Percentage of males	64.3 %	62.5 %
Number of pregnant women	3.8 %	3 %
Percentage of females, age 0-15	70.8 %	64 %
Percentage of children, age 6-17	82.2 %	63.1 %
Percentage of children, age 6	46.8 %	31.3 %

Dimensions	Unmatched treatment	Unmatched control
Percentage of children, age 4	34.4 %	23.5 %
Percentage of children, under 6	40.8 %	27.6 %
Percentage of adults over 64	10 %	19.8 %
Percentage of families in rural areas	23 %	15.8 %
Percentage of families in urban areas	76.9 %	84.1 %
Percentage of families living in favelas	6.7 %	5.1 %
Percentage of families with children without a vaccination card	6.5 %	5 %
Percentage of families with undernourished children	2.9 %	1.9 %
Percentage of families without access to public and private health systems	97.5 %	91.8 %
Percentage of families with children who cannot properly read and write	35.1 %	28.2 %
Percentage of families with children out of school	9.8 %	6.6 %
Percentage of families using wood or charcoal to cook food	22.7 %	12.7 %
Percentage of families with poor or no access to bathroom or toilet	21 %	14.3 %
Percentage of families with water source not in property or in general network	19 %	12.2 %
Percentage of families with no access to electric network	4 %	3.2 %
Percentage of families with floors without wood or cement	4.9 %	3.4 %
Percentage of families without cars, trucks, bicycles, or motorbikes	16.6 %	11.7 %
Percentage of families in which at least one member is not working	17.9 %	17.4 %
Percentage of families in which underage children are working	5 %	2.1 %
Percentage of families in which at least one member is working but not paying any contribution	67.3 %	57.1 %
Percentage of families in which at least one member is not participating in any civil society organization	64.8 %	62.5 %

## F. Sensitivity analysis: results of ATT analysis regarding poverty status and intensity of poverty using matched treatment and control groups with attrition-adjusted weights

Dimensions	DID results <sup>7</sup> (percentage points)	Number of observations	Standard deviation
Poverty status; threshold 25 %	-4.15	3,625	0.0358
Poverty status; threshold 40 %	-2.87	3,625	0.0147
Average poverty intensity	-5.68	4,341	0.0123

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

7 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Section D of the Annex.

## G. Sensitivity analysis: results of ATT analysis across multidimensional poverty thresholds using matched treatment and control groups and attrition-adjusted weights

Poverty thresholds	DID results <sup>8</sup> (percentage points)	Number of observations	Standard deviation
25 %	-4.15	3,625	0.0358
27.1 %	-3.4	3,625	0.0291
29.2 %	-4.31	3,625	0.0253
31.3 %	-3.69	3,625	0.0299
33.3 %	-3.45	3,625	0.0232
35.4 %	-3.78	3,625	0.0217
37.5 %	-3.6	3,625	0.0208
39.6 %	-3	3,625	0.0182
41.7 %	-2.87	3,625	0.0147
43.7 %	-3.04	3,625	0.0154
45.8 %	-2.68	3,625	0.0143
47.9 %	-2.36	3,625	0.0110
50 %	-2.32	3,625	0.0096
52.1 %	-1.56	3,625	0.0064
54.2 %	-0.91	3,625	0.0056
56.3 %	-0.91	3,625	0.0056

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %

## H. Sensitivity analysis: results of ATT analysis by dimension using matched treatment and control groups and attrition-adjusted weights

Dimensions	DID results <sup>9</sup> (percentage points)	Number of observations	Standard errors
Undernutrition	-1.16	4,133	0.0075
Cooking fuel	-4.26	4,324	0.0093
Assets	-3.72	4,341	0.0196
Child labour	-1.11	4,155	0.0069
Social connectedness	13.3	4,324	0.0231
Vaccination	-2.17	4,194	0.013
Access to health insurance	-0.42	4,211	0.0103

8 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Section D of the Annex.

9 This is an ATT analysis, hence the coefficient of the effect of the BF refers to BF recipients. Each result is estimated using different regressions; the control variables used in each analysis are shown in the Section D of the Annex.

<b>Dimensions</b>	<b>DID results<sup>9</sup> (percentage points)</b>	<b>Number of observations</b>	<b>Standard errors</b>
School attendance	3,65	4,187	0.0161
Read and write	-3.23	4,318	0.013
Improved sanitation	-6.09	4,335	0.0184
Safe drinking water	-1.53	4,327	0.0215
Electricity	-1.54	4,312	0.0044
Flooring	-0.65	4,341	0.006
Unemployment	-3.6	4,316	0.0139
Informal labour	-12.3	4,337	0.0217

\*\*\* significant at 1 % | \*\* significant at 5 % | \* significant at 10 %