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Conditional cash transfer, labor inspection and child labor in Brazil: A panel data analysis for Brazilian states

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Abstract

The main objective of this study is to investigate if the *Bolsa Família* conditional cash transfer and the Labor Inspection activities contributed in reducing the rate of child labor in Brazil. Alongside, we verify the role of other important factors such as: poverty, unemployment, urbanization and proportion of children and adolescents enrolled in school. For this purpose, we aggregate individual data from 2004–2009 and 2011–2014 PNAD to state level and estimated panel data models. Our empirical results do not permit to conclusively sustain the hypothesis that the *Bolsa Família* program and the Labor Inspection contributed in reducing child labor rate in Brazil.

Key words: *Bolsa Família*, Labor Inspection, endogeneity, time dynamics.

1. Introduction

Article 60 of the Brazilian statute for children and adolescents, recognized in Law nº 8069 of the Federal Constitution, prohibits any labor activity for minors under the age of 16, except in the condition of apprenticeship as from the age of 14. Still, in 2014, there were about 3,3 million child laborers between age 5 and 17 in Brazil (IBGE-PNAD, 2014). Specifically, about 2% of this total is between age 5 and 9, about 25% between age 10 and 14, and about 73% between age 15 and 17. Despite the remarkable reduction of child labor rate over the past decade, these figures still call for attention. Thus, the contribution of studies concerning the potential determinants of child labor continues vital.

Empirical studies concerning the causes of child labor are widespread in Brazilian literature (see Schwartzman and Schwartzman (2001); Kassouf (2007); Cacciamali and Tatei (2008); Kassouf and Justus (2010); Aquino et al. (2010), to mention few). These studies are in consensus that factors such as poverty, parent's level of education, family structure, level of urbanization, etc., are potential causes of child labor. Moreover, authors such as, for example, Kassouf (2001) has pointed that the incidence of child labor varies significantly among individuals of different skin color, gender and region of residence.

To reduce the rate of child labor and address its potential causes, the Brazilian government has adopted series of measures. Two of these are the *Bolsa Família* conditional cash transfer program (henceforth, PBF) and Labor Inspection with focus on

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child laborers. However, there are still very few studies in literature that empirically investigated the impact of these measures on child labor. Specifically, the main empirical studies that verified the effect of the PBF are Cacciamali et al. (2010); Araujo et al. (2010) and Do Nascimento et al. (2016), whereas the only empirical study which investigated the effect of inspection activities on child labor is Almeida (2015). On one hand, no empirical evidence was found concerning the effect of the participation of families in the PBF on child labor decisions. However, Do Nascimento et al. (2016) found that increase in the value of benefits reduces the probability of child labor. On the other hand, Almeida (2015) found empirical evidence that inspection activities reduce child labor.

The studies that investigated the effect of PBF on child labor used microeconometric strategies and, thus, are short-handed in addressing endogeneity issues. However, Almeida (2015) circumvented this methodological hurdle in verifying the effect of inspections on child labor by using a two-step generalized minimum least square method. This observation prompted the first motivation of this study, which is to use empirical method that addresses endogeneity in verifying the effect of the PBF on child labor.

In addition, most previous studies focus on individual decisions of child labor supply. We explicitly acknowledge that micro-level approach is crucial since child labor decisions are made at individual or family levels. Nevertheless, it is also important to verify the effect of governmental countermeasures from macro-level stance so as to guide policy makers in allocating resources among states. Therefore, different from previously mentioned studies, we do not investigate child labor decisions, but the variations of child labor rates among states. This approach permits to simultaneously investigate the effect of the PBF and Labor Inpection allocations on child labor rates of states. It is worthwhile to mention here that Ramalho and Mesquita (2013) also adopted the macro-level approach, focusing on Brazilian urban regions. However, the core of these authors was not on the effect of PBF and neither was its endogeneity addressed.

In short, the main objective here is to investigate the effect of the *Bolsa Famílía* conditional cash transfer program and Labor Inspection activities on the rate of child labor in Brazilian states. Concerning this objective, we put forward the hypothesis that both measures contributed in reducing child labor rate. On the one hand, the PBF program ease financial burden of poor families, conditioning them to enroll their children in school. On the other hand, the Labor Inspection withdraws children from work, gives them social assistance and also fines exploiters.

Besides this introductory section, Section 2 presents a detailed review of previous evidences. Section 3 presents the data, empirical strategy and procedure. Section 4 provides the empirical results. Section 5 is conclusive.

2. Previous Evidences

Being that spotlight is on macro-level factors, in this section we review empirical literature which addresses the impacts of economic performance and governmental countermeasures on child labor[3]. As to economic performance, we refer to levels of poverty, unemployment, economic growth, and urbanization.

[3]For details regarding micro-level causes, see Basu (1999), Hilowitz et al. (2004a), Kassouf (2002), Kassouf (2007) and ILO (2007).

Poverty

Poverty has been overtly concurred, in most theoretical and empirical literature, to be the major determinant of the supply of child labor both at the micro and macro level. From the micro-level stance, many empirical studies (Basu and Van, 1998; Kassouf, 2001; Edmonds and Turk, 2002; Kassouf, 2002; Basu, 2003; Hilowitz et al., 2004a) defend that families send children to work only if adult's income does not cover the basic needs of the family. Thus, families in situation of poverty or extreme poverty are more likely to send children to work, since rich families do not depend on children's income for subsistence. From the macro-level angle, studies such as Galli (2001), Edmonds (2005), Edmonds and Pavcnik (2005) and Kambhampati and Rajan (2006) concluded that macroeconomic progress reduces child labor. This is because richer societies can offer more free and quality education, better health services and also adopt poverty reduction measures, compared to poorer societies. Moreover, richer societies have a higher level of adult wage, which directly reduces micro-level poverty.

Inasmuch as poverty is widely accepted as a major cause of child labor, some studies (Barros et al., 1994; Ray, 2000; Rogers and Swinnerton, 2004; Kambhampati and Rajan, 2006; Dumas, 2007) have questioned this relationship. In short, these authors claim that the validity of the hypothesis of poverty as the major cause of child labor is doubtful. However, there is, yet, no consensus regarding the basis of such argument in literature.

Particularly for Brazil, Kassouf (2001); Schwartzman and Schwartzman (2001); Emerson and Souza (2003); Aquino et al. (2010) and Cacciamali et al. (2010) found strong empirical evidence of a negative relationship between family income and the probability of child labor. However, the magnitude of the coefficient found for this proxy for poverty is low in all these studies. Therefore, family income has to increase to exorbitant levels to reduce child labor in Brazil.

Level of Urbanization

Urbanization rate is also an important determinant of child labor. This is not only because of the difference in the level of poverty but also due to peculiarities attached to child labor in rural and urban areas in terms of proportion, visibility, and sectoral distribution. There is a consensus in the national and international literature that the rate of child labor is greater in rural areas (Kassouf, 2007; ILO, 2013). However, in Brazil, despite higher rates are observed in the rural areas, the number of children and adolescents who work is higher in the urban areas due to high population density (Inaiá, 2008; Kassouf, 2015).

Other factors that increase the labor force of children and adolescents in the urban area is migration as a result of the availability of better quality education, health services, and greater economic opportunities. It is, however, important to note that inasmuch as the living conditions of urbanized areas seem better, one has to take into account the effect of inequality and wage differences between skilled and unskilled workers. According to Barros et al. (1994) and Ferreira-Batista and Cacciamali (2012), the socioeconomic condition of poor households or unskilled workers in the urban areas is harsher compared to the same group in rural areas. Some plausible reasons for this are the wage gap between skilled and unskilled labor, higher cost of living, more competitive labor markets, etc..

Sectorial Distribution

The activities in which children and adolescents are engaged vary significantly. However, there is a consensus in literature that the agricultural sector is most responsible

for the usage of this vulnerable labor force in Brazil (Kassouf, 2004). In the findings of this author, about 54.2% of the child laborers between age 5 and 15 were engaged in agricultural activities, especially in the rural areas. The agricultural sector was followed by the service and commercial sectors with 18.5% and 14.7%, respectively. In the same year, the industrial sector was responsible for the employment of about 7.2%, while the construction sector employed about 2.1%. According to Kassouf (2015), in 2011, the participation of children and adolescents in these sectors continued in the same proportional order.

According to Inaiá (2008), aside from the concentration of child labor in the agricultural sector, some of its features are quite worrisome. These features include a high incidence of recruitment of children between age 5–9, preference for boys, long working hours, work with sharp objects, exposure to toxic materials and intense solar radiation. Still, it is important to note that children and adolescents are employed by the family in numerous cases in the rural Brazilian areas. Generally, in such instance, child labor is conceived as positive to the development of a child and also as helping hand, a form of socialization and heir training by the family (Marin et al., 2012). Thus, child labor, especially in family agriculture, is backed up and perpetuated by cultural beliefs. Similar beliefs are attributed to child labor in domestic activities, mainly for female children, which is considered one of the worst forms of child labor since it is generally time exhaustive, prone to sexual exploration and invisible to political measures.

DeGraff et al. (2016) focused their study on child laborers engaged in risky occupations that cause harm to health, safety, and morals. These authors chose their definition of "risky" following specifications of the ILO and the Brazilian Ministry of Labor and Employment. Specifically, the categories of risky occupations addressed in this study are domestic workers, street workers, construction workers and farm workers engaged in the cultivation of tobacco, coffee, sugar cane and manioc. Having that the ILO regulations and Brazilian Constitution prohibit risky work for individuals below age 18, these authors considered the age group between 10 and 17. General findings from this study pointed that most child laborers in risky working conditions are engaged in domestic services and hazardous farming, followed by construction activities and street work. These authors also found that this ranking order is preserved in both rural and urban areas. However, there were relatively greater proportions in the former compared to the latter. As per gender distribution in these risky occupations, it was found that there is a greater concentration of girls in hazardous occupations. Specifically, most of these girls are involved in domestic services, while boys are mostly involved in construction activities, hazardous farming and street work.

Unemployment

Very few studies have been carried out regarding the effect of economic growth and adult unemployment on child labor in Brazil. Empirical evidence from Edmonds (2005), using Vietnamese data, points that child labor reduces with economic growth, however, highlighting that such relationship is non-linear. In contradiction, Kambhampati and Rajan (2006) found empirical evidence, using data from India, that contrarily to conventional wisdom, increase in economic growth increases child labor as an aftermath of the increase in the demand for cheaper labor by firms. These authors, however, noted that child labor is only reduced when growth is sustained sufficiently to outweigh the increase in the demand for cheaper and unregulated labor. Abu-Ghallous (2012), using Palestinians data, concluded that increase in unemployment, which is also indicative of economic performance, leads to increasing rate of child labor.

As for Brazil, Duryea et al. (2007) used Brazil's Monthly Employment Survey

(PME, in Brazilian acronym) to analyze the impact of household economic shocks, especially unemployment, on schooling and employment of youths in metropolitan Brazil. The authors estimated probit models and used data that covered about 100.000 children between age 10 and 16 from 1982 to 1999. The hypothesis alleged goes in line with that theoretically posed by Basu (1999) and Galli (2001), that adult unemployment may lead to increase in child labor. The general estimation results provided evidence which does not reject this hypothesis. Specifically, unemployment shock to male household head in metropolitan Brazil increase the likelihood of children between age 14 and 16 to enter the labor market. However, in a specific model where authors created an interaction variable between employment shocks and a dummy variable for children between age 10 and 14, evidence was found concerning a negative relationship between adult unemployment and child labor. Although counterintuitive, such idea supports the observation made by Basu and Van (1998) concerning the possible ambiguous effect of adult unemployment on child labor.

Conditional Cash Transfer Program

There are a variety of welfare programs adopted in Brazil to ease poor and extremely poor families of financial constraints. Similarly to other developing countries, one of these measures involves conditional direct cash or in-kind transfer.

The first conditional cash transfer (henceforth, CCT) programs – *Bolsa Escola* and *Renda Mínima*[4] – were created in the mid 1995s in the city of Campinas located in the state of São Paulo. These programs granted a financial subsidy to poor parents, who were obliged to enroll their children in schools. In 1996, the Program for Elimination of Child Labor (PETI, in Brazilian acronym) was created due to the high proportion and stark situation of children in the labor market. Specifically, the PETI had the objective of withdrawing children and adolescents between age 7 and 15 from hazardous work and enroll them in schools (Soares and Sátyro, 2010). Aside enrollment in schools, the PETI program required children to participate in extracurricular sport, cultural, artistic and leisure activities in order to inhibit time allocation to work. Despite greater attention was given to children and adolescents, the PETI program also created job opportunities for families who earned less than half of the minimum salary in order to prevent such families to send children back to work.

In 2003, all the cash and in-kind transfer programs designed to reduce poverty were united to form a single conditional cash transfer program – the *Bolsa Família* (henceforth, PBF), which has nationwide coverage. The participation of families in the PBF is conditioned to the level of income. Whereas, for continuity of participation, beneficiary families have to meet additional conditions concerning health care and enrollment and attendance of children in school. Therefore, one can suppose that such conditionalities seek to increase human capital of poor families through education and health, which in turn may yield better income distribution in the long run and also break the poverty cycle.

In 2005, the PETI program was incorporated in the PBF cash transfer for the sake of better management and to exploit the synergy between both programs. Despite critics regarding the amalgamation of these welfare programs, experts have pointed that such action was imminent in order to optimize public resources, increase coverage and enhance the accessibility of grants by eligible families. Albeit the characteristics of the PETI program were maintained, the major objective of the PBF program is centered to reduce poverty.

[4]Schooling grant and Minimum Wage, respectively.

In specific, the PBF program attends families with per capita income below the poverty line, prioritizing families with pregnant women or/and children or adolescents under age 17[5]. As per financial values, a fixed amount of R$77 (Brazilian currency) is transferred to extremely poor families irrespective of family structure. In addition, a variable amount between R$35 and R$175 is transferred to poor and extremely poor families depending on family structure. Having that the PBF program only attends families below the poverty line, the PETI program was reconfigured to focus on child laborers from families above the poverty line. However, the value transferred is expressively lower than that of the PBF program – R$ 25 per child to families who reside in rural or urban areas with less than 250 thousand inhabitants and R$ 40 per child to families who reside in urban areas with more than 250 thousand inhabitants[6].

Most empirical studies that investigated the effect of CCT programs on child labor analyze its effect on the time allocation of children and adolescents. Findings from international studies such as Ravallion and Wodon (2000) and Maluccio and Flores (2005) pointed that CCT programs have a positive effect on schooling and inverse effect on child labor. Attanasio et al. (2006) empirically supported this finding by affirming that CCT programs cause a significant increase in the time allocated to studies and also increase the school enrollment of children who are prone to enter the labor market early. However, studies such as Duryea and Morrison (2004) and Glewwe and Olinto (2004) fail to find the effect of such programs on child labor.

Among the few studies that investigated the effect of CCT programs in Brazil, most are about the *Bolsa Escola*, which preceded the *Bolsa Família*.

Cardoso and Souza (2004), using 2000 census data and propensity score method, analyzed the impact of *Bolsa Escola* program on child labor and school attendance. These authors found that the program had significant positive effect on school attendance for both boys and girls. However, the program was found short-handed in reducing child labor. In fact, the authors observed that value transferred were too small to persuade families to forgo income from child labor. Instead, families preferred children to combine work and school.

Ferro and Kassouf (2005) used 2001 PNAD data to also verify if the *Bolsa Escola* had significant effect on child labor. Specifically, these authors estimated probit models to verify if the program influences the probability of a child to work or not. In addition, they used weighted least square methods to verify if the program reduces the weekly working hours of children who are already in the labor market. Ferro and Kassouf (2005) found evidence that participation in the program reduces about 3 working hours of child laborers. However, these authors highlighted that such reduction has limited effect in the sense that it covers, mostly, children who do part-time work. This is because most children who engage in full-term jobs have less incentive to participate in the program due to its modest values. Result concerning the probability to work indicated that children from families who participated in the program are more likely to work. However, these authors commented that such unexpected outcome may be due to family unobservables such as "ambition". In sum, these authors reached similar conclusions as Cardoso and Souza (2004) regarding the effect of the *Bolsa Escola* program, that children from beneficiary families are most likely to conciliate work and study and are not convinced to leave work.

In line with findings by Ferro and Kassouf (2005), Ferro et al. (2010) used 2003

[5]In 2014, the poverty and extreme poverty line are set at R$154 ($1.90 per day) and R$77 ($0.95 per day) monthly per capita income, respectively.

[6]Current values as at August/2016.

PNAD data to estimate probit models and propensity score matching models. These authors concluded that the *Bolsa Escola* program reduces the probability of children from beneficiary families to work and increases the school enrollment of the same. However, no evidence was found concerning working hours or conciliation of work and schooling. Specifically, Ferro et al. (2010) pointed that the program reduces the probability of working by 2 to 3 p.p. in the urban areas and 6 to 9 p.p. in rural areas.

Regarding the PBF program, Cacciamali et al. (2010) analyzed its impact on child labor and school attendance by using 2004 PNAD data to estimate probit models. The results from these models indicated a positive relationship between participation in the PBF program and child labor, i.e, children from beneficiary families are more likely to work. This conclusion was sustained in models for urban and rural areas, and also in models for different regions in Brazil. However, Cacciamali et al. (2010) found that the program was efficient in increasing school attendance. These authors clarified that different from the PETI program, the main objective of the PBF program is not to eliminate child labor but to reduce poverty. Moreover, they added that for effective reduction of child labor the value transferred to families has to be more generous and education quality has to be appealing so as to sway children from work to school. These authors suggested that aside enrollment, the inclusion of conditionality regarding cultural, sport or artistic extracurricular activities, alike the PETI program may contribute to better allocation of children's time.

Still, on the effect of the PBF program, Araujo et al. (2010) examined its role in child labor among beneficiaries who reside in Brazilian urban areas. The methodological strategy used to reach this objective was that of propensity score matching using 2006 PNAD data. Similarly to previous authors, Aquino et al. (2010) concluded that the PBF program was effective in increasing the school attendance and enrollment of children and adolescents. However, the program presented shortcomings regarding the reduction of child labor. These authors also buttressed the role of household unobservables in the decision of child labor supply and participation in the PBF program. Also adopting propensity score matching method for 2011 PNAD data, Do Nascimento et al. (2016) concluded that participation in the PBF program has no significant effect neither on the probability of a child to work nor working hours. However, evidence was found that the sum transferred to families contribute in reducing the probability of child labor, likewise working hours.

Conclusively, the studies reviewed here pointed that participation in the PBF program has no conspicuous effect on the probability of children and adolescents to work. However, most studies found its effect in reducing working hours. Such unsatisfactory effect may be due to, firstly, low elasticity of child labor to changes in family income as mentioned in the first part of this section. As theoretically shown by Das and Deb (2006), modest effect of CCT may be observed if the value of benefits is too low compared to income from child labor market.

Labor Inspection

As an aftermath of the dramatic increase in the number of children and adolescents working in the 1980s, the Brazilian government recognized child labor as a problem which deserves priority. One of the adopted measures was the Labor Inspection with focus on child labor. These Labor Inspection activities are conducted by the Secretariat of Labor Inspection (SIT), which is part of the Brazilian Ministry of Labor and Employment (MTE).

Concerning the inspection process, an annual plan is drawn by the Regional Superintendencies of Labor and Employment (SRTEs) based on the guidelines of the SIT.

This plan is sketched by taking into account reports of child labor, prioritizing the worst forms. Having planned, labor inspectors are responsible for preventive actions and inspection activities. Preventive actions involve awareness-creation by publicizing the negative impacts of child labor through lectures, seminars, debates, and campaigns to children, employers and families. Months after preventive actions labor inspectors conduct inspection activities, which involve visits to businesses or workplaces in urban and rural areas throughout the country (ILO/SIT, 2010).

During visits, inspectors identify irregularities concerning child labor, take records of activities exercised by the children, withdraw children from work and issue infraction reports regarding exploiters, which may result in fines. In order to avoid the return to work, children and adolescents are included in social welfare programs. Specifically, children under the age of 14 are enrolled in cash transfer programs conditioned to school attendance and participation in social, educational and healthcare projects. Moreover, adolescents above the age of 14 are enrolled in apprenticeship programs, which offer technical training in workplaces with the intention of learning and not production. In addition, the SIT publishes data regarding the undertaken inspection activities in the Information System of Child Labor (SITI) since 2006.

The ILO/SIT (2010) reported positive results of the Labor Inspection in Brazil concerning the number of children that were withdrawn from work. However, this report suggested that the effectiveness of inspection activities should not be measured only by the number of children removed from work, but also by the awareness-creation. This is because the preventive actions undertaken by inspectors increased the visibility of child labor incidences in society, which impacted on the attitude of social media, governmental institutions, employers, and families.

The only empirical study found concerning the effect of Labor Inspection on child labor till date[7] was that of Almeida (2015). Having that most inspection decisions are taken based on complaints filed regarding child labor, the effect of Labor Inspection on child labor is subdued to underestimation and endogeneity. Therefore, this author adopted a two-step generalized minimum least squares method using data from 2000 and 2010 census and SITI database. In the first stage model, the number of labor inspectors and the distance between inspection agencies and firms were used as instruments to estimate the number of inspections. Subsequently, the estimate for Labor Inspection was used as a regressor in the second stage model, which was for child labor. It was found that 1% increase in the number of labor inspection reduces the proportion of child laborers between age 10 and 17 in 0.22% and 0.26% for the year 2000 and 2010, respectively. In absolute terms, the Labor Inspection accounted for the reduction of, approximately, 8,658 and 8,856 child laborers in the year 2000 and 2010, respectively.

Based on the empirical literature presented in this section, it is possible to create insight on the signs and challenges expected from modeling exercises. We expect an inverse relationship between poverty and child labor rate. However, the magnitude of such relationship is expected to be low. Reviewed studies also indicated that child labor is lower in urban regions, i.e, we expect a negative relationship between urbanization and child labor rates. As for sectoral distribution, one expects to find higher rates of child labor in the agricultural sector compared to the service, trade and industrial sectors. As for unemployment rate, a consensus was observed towards a positive sign, i.e, increase in unemployment rate leads to increase in the rate of child labor. As per primary interest variables, PBF and Labor Inspection, we expect a negative sign for the latter but the sign expected for the former is controversial since there is yet to be

[7] October/2016.

a consensus in literature.

3. Methodology

3.1. Data

The main source of data used to reach the objective of this study is the PNAD conducted by the IBGE. Data concerning the *Bolsa Família* Program (abbreviated, PBF) and Labor Inspection were obtained from the Ministry of Social Development (MDS in Brazilian acronym) and Ministry of Labor and Employment (MTE in Brazilian acronym), respectively.

As we focus on the effect of governmental measures and other macro-level factors on child labor rates, individual data from PNAD were aggregated to state level. Therefore, both continuous and dummy variables were transformed into means and proportions, considering weights or sample expansion factors provided by the IBGE in the data files. By aggregating data to state level and covering the period between 2004 and 2014 (without data for 2010), we create a panel data composed of 27 states over 10 years[8]. Note that data concerning the Labor Inspection only covers the period between 2006 and 2014 and had missings for some states. Thus, instead of having 210 panel observations, we ended up with the total of 207 for inspection variable. Despite few gaps, the overall panel data is strongly balanced.

Table 1 presents the description, mean and standard deviation for variables that are considered for model specification. The standard deviation is decomposed into between and within deviations. From this table, we observe that the former is greater than the latter for all variables, implying that there is expressive heterogeneity among states.

The rate of child labor among individuals between age 5 and 15 was about 6.29% during the period of 2004 to 2009 and 2011 to 2014. During the same period, an average Brazilian family is comprised of 4 members; the level of education of mothers was approximately 8 years, and; average per capita family income was, approximately, R$ 715. Moreover, about 92% of children between age 5 and 15 were enrolled in school and the adult unemployment rate was about 6%. The two variables of interest, PBF and Labor Inspection, indicate that the average per capita value transferred by the PBF was about 88 reais and that about 176 work inspections were conducted in states during the same period.

3.2. Econometric Procedures

The modeling exercises began with basic panel data models and were gradually sophisticated to best fit our objective and address endogeneity and time-dynamic issues. The model's evolution is presented in Table 2. Note that the focus here is not yet on coefficients, but on the choice of a model which best suits the study's objective.

In terms of model specification, the response variable is the rate of child labor. Specifically, *child laborer is any individual between the age of 5 and 15 involved in any labor activity deemed formal or informal, domestic or non-domestic, temporary or permanent, paid or unpaid labor activities, except in the condition of apprenticeship.* This variable is denoted as `childlabor`.

The group of regressors is composed of the: proportion of children and adolescents between age 5 and 15 enrolled in school (`childeduc`); average family income per capita (`famincome`); average years of mothers' schooling (`mothereduc`); average number

[8]We did not consider data for previous years because the PBF program was created in 2003 and data its data was only available as from 2004.

Table 1: Summary statistics for panel data used for estimation

Variable	Description		Mean	Std. Dev.	Min	Max
`childlabor`	Percentage rate of child labor	overall	6.29	3.20	0.61	17.11
		between		2.48	1.12	11.68
		within		2.07	1.19	12.67
`childeduc`	Percentage of children and adolescents between age 5 and 15 enrolled in school	overall	92.24	3.26	80.97	97.60
		between		2.39	87.03	95.54
		within		2.25	85.69	98.84
`famincome`	Average family income per capita	overall	714.87	294.80	276.79	1,962.02
		between		273.90	408.05	1,624.42
		within		119.98	291.30	1,052.47
`mothereduc`	Average years of mothers' schooling	overall	7.68	1.15	4.85	10.59
		between		0.97	5.77	9.79
		within		0.64	6.01	9.02
`familysize`	Number of family members	overall	3.88	0.35	3.21	5.16
		between		0.32	3.41	4.56
		within		0.17	3.40	4.48
`PBF`	Per capita value transferred by the PBF to states in reais (Brazilian currency)	overall	88.25	68.43	5.41	317.43
		between		42.94	22.70	159.63
		within		53.86	−26.72	246.05
`inspect`	Number of Labor Inspections with focus on child labor	overall	176	250	1	1,510
		between		136	20	603
		within		−210	413	1083
`unemp`	Unemployment rate among economically active population	overall	5.89	2.36	1.69	15.06
		between		2.20	2.65	12.24
		within		0.99	1.19	8.71
`urban`	Urbanization rate in percentage	overall	80.23	9.32	58.25	98.21
		between		9.087	63.89	96.78
		within		2.63	72.46	85.85

Source: Prepared using data from PNAD.
Note: Number of observations is 270, except for the `inspect` variable which has 207 observations.

of family members (`familysize`); per capita value transferred by the PBF program to states (`PBF`); number of Labor Inspections with focus on child labor (`inspect`)[9]; unemployment rate among economically active population (`unemp`); urbanization rate (`urban`): group dummy for years to control for time shocks (`years`), and lastly; control for long-run tendency of a time series effect of child labor (`trend`).

The starting point of the modeling exercise was the pooled regression

$$\texttt{childlabor}_{it} = \alpha + \mathbf{x}'_{it}\beta + u_{it} \quad \text{where} \quad u_{it} = \alpha_i - \alpha - \varepsilon_{it} \tag{1}$$

estimated by OLS method. $\texttt{childlabor}_{it}$ is a column vector of response variable, $\mathbf{x}'_{it}$ is a matrix of $N \times K$ regressors which vary over time, t, and across state, i, and u_{it} is the idiosyncratic error term which consists of time-invariant factors (α_i) and time-variant omitted factors (ε_{it}). Similarly to the conventional linear model, the Pooled model also assumes exogeneity of regressors, $E(u_{it}|\mathbf{x}_{it}) = 0$, conditional homoskedasticity, $E(u_{it}^2|\mathbf{x}_{it}) = \sigma^2$, and conditionally uncorrelated observations, $E(u_{it}\, u_{jt}|\mathbf{x}_{it}\, \mathbf{x}_{jt}) = 0$, where $i \neq j$. The violation of the exogeneity assumption leads to inconsistency of β estimates, whereas the violation or relax of the last two assumptions makes the Pooled model no longer fully efficient.

The results from this initial model are provided in column Pooled of Table 2. All unobservable and omitted factors are incorporated with the error term, u_{it}, and are

[9]Due to unavailability of this focused inspection for years prior to 2006, little adjustments were made while modeling equations with this variable so as to avoid observation loss for other regressors

assumed uncorrelated with the regressors. However, in light of the heterogeneity among states, it is important to control for states' fixed effects. The reason for this is that factors such as cultural, ideological and social beliefs may sprout innate differences among states (Basu, 1999). Such control is not possible in the OLS models, so we resort to Fixed and Random Effect models (FE and RE, respectively). These models admit the presence of a time-invariant component in the error, thus permitting control of state time-invariant unobservables.

Table 2: Models from estimation procedures

Response variable: `childlabor`

	OLS	RE	FE	GMM-I
`constant`	19.80^{***}	18.97^{***}	6.577	17.57^{***}
	(2.055)	(2.959)	(4.096)	(2.691)
$\texttt{childlabor}_{t-1}$				0.154^{**}
				(0.071)
`famincome`	-1.032^{***}	-0.783^{**}	0.559	−0.448
	(0.183)	(0.334)	(0.670)	(0.376)
`childeduc`	-2.689^{***}	−2.068	−0.801	−0.924
	(1.011)	(1.299)	(1.382)	(1.353)
`familysize`	-0.817^{*}	−0.827	−0.0693	-1.503^{*}
	(0.480)	(0.821)	(0.795)	(0.823)
`urban`	-1.596^{***}	-1.701^{***}	−0.615	-1.563^{**}
	(0.386)	(0.444)	(0.707)	(0.747)
`unemp`	-0.692^{***}	-0.500^{***}	−0.0485	-0.329^{**}
	(0.078)	(0.108)	(0.144)	(0.140)
`mothereduc`	-0.674^{*}	−0.983	−2.198	-1.548^{***}
	(0.391)	(0.607)	(1.460)	(0.526)
`inspect`	-0.0594^{***}	-0.0579^{***}	-0.0452^{**}	-0.0478^{*}
	(0.016)	(0.020)	(0.022)	(0.025)
`PBF`	-0.161^{***}	-0.159^{**}	−0.254	-0.125^{**}
	(0.054)	(0.065)	(0.159)	(0.060)
N	207	207	207	207
R^2	0.783		0.536	

Note: Robust errors in parentheses; ***, ** and * denote signifiance at 1%, 5% and 10%, respectively; All variables, both the response variable and its regressors, are logarithmized; N is the number of observations.

Despite the FE and RE models account for unobservables, the treatment given by both differ. As to the FE model, the unobserved effects, α_i, are eliminated by mean-differencing, since they are assumed to be time-invariant. Thus Eq. 1 is transformed in

$$(\texttt{childlabor}_{it} - \overline{\texttt{childlabor}}_i) = (\mathbf{x}_{it} - \bar{\mathbf{x}}_i)'\beta + (\varepsilon_{it} - \bar{\varepsilon}_{it}). \quad (2)$$

Compared to the Pooled model, the estimation of β in the FE model requires a weaker assumption that $E(\varepsilon_{it}|\alpha_i, \mathbf{x}_{it}) = 0$. In other words, the time-invariant component, α_i, of the composite error, u_{it} is permitted to correlate with regressors.

An extended version of the FE model was provided in the Stata software, where Eq. 2 is written as follows

$$(\texttt{childlabor}_{it} - \overline{\texttt{childlabor}}_i + \overline{\overline{\texttt{childlabor}}}) = (\mathbf{x}_{it} - \bar{\mathbf{x}}_i + \bar{\bar{\mathbf{x}}})'\beta + (\varepsilon_{it} - \bar{\varepsilon}_{it} + \bar{\bar{\varepsilon}}) \quad (3)$$

whereby $\bar{\bar{\mathbf{y}}}$, $\bar{\bar{\mathbf{x}}}$ and $\bar{\bar{\varepsilon}}$ are grand mean of $\mathbf{y}_{it}$, $\mathbf{x}_{it}$ and ε_{it}, respectively. The advantage of this extension is that an intercept estimate and its respective level of significance are provided, which is the average of unobservables, α_i.

The Random Effect model (RE) is quite similar to the Fixed effect model (FE) in the sense that it admits and controls α_i. However, in the RE model α_i is assumed to be purely random and not permitted to correlate with regressors, i.e, $E(\varepsilon_{it}|\alpha_i\,\mathbf{x}_{it}) = E(\varepsilon_{it}|\mathbf{x}_{it}) = 0$. The results for both models are presented in columns FE-I and RE-I, respectively. Note that the Breush-Pagan test confirmed heteroskedasticity for all models. Thus, robust standard errors were calculated for all models.

To statistically back up the abandon of the Pooled model, the F-test and the Breusch and Pagan Lagrange-multiplier test were carried out. The former tests between FE model and pooled OLS model, whilst the later tests between the RE model and pooled OLS model. With a F-test value of 5.62, we reject the null hypothesis of the nonexistence of unobservable state time-invariant effects, α_i. Likewise, having a value of $\bar{\chi}^2 = 30.11$ for the Breusch and Pagan Lagrange-multiplier test, we reject the hypothesis that $\text{var}(\alpha_i) \neq 0$. This confirms that it is, indeed, important to control for time-invariant unobserved factors.

To choose between the FE and RE models, the Hausmann test was performed. With a test value of 36.52, we reject the null hypothesis of no correlation between regressors and state unobservables. Therefore, the RE model was abandoned in favor of the FE model.

Ramalho and Mesquita (2013), using 2001–2009 PNAD data to estimate dynamic panel data models, affirmed the existence of temporal dynamics of child labor rate in Brazil. However, the models estimated till now do not permit the inclusion of lagged dependent variable as a regressor. Following the steps of these authors, as per the control for temporal dynamic, we used the System Dynamic Panel-Data Estimator (henceforth, GMM). Thus, our dynamic model of order 1 in $\texttt{childlabor}_{it}$ is represented as

$$\texttt{childlabor}_{it} = \gamma_1 \texttt{childlabor}_{i,t-1} + \mathbf{x}'_{it}\beta + \alpha_i + \varepsilon_{it}, \quad t = 1, ..., T \text{ and } |\gamma| < 1 \quad (4)$$

Apart from providing consistent estimates for γ_1 and β, the Arellano-Bond estimator accounts for endogenous regressors. In Eq. 4, $\mathbf{x}_{it}$ can be treated as either exogenous or endogenous. Exogenous regressors are those which are uncorrelated with ε_{it}, they require no special treatment and are used as instrument for themselves. As to endogenous regressors, $E(\mathbf{x}_{it}\,\varepsilon_{is}) \neq 0$ for $s \leq t$ and $E(\mathbf{x}_{it}\,\varepsilon_{is}) = 0$ for $s > t$. However, such variables can be instrumented using their lagged values. Moreover, due the moment condition that $E(\Delta\mathbf{y}_{1,\,t-1}\,\varepsilon_{it}) = 0$, the GMM also permits to use $\Delta\texttt{childlabor}_{1,\,t-1}$ as instrument (Arellano and Bover, 1995; Blundell and Bond, 1998). In this study, we use all possible lags of endogenous variables as instruments, but we limited lags of response variable to the maximum of two. The reason for this is that, according to Cameron and Trivedi (2010), the use of too many instruments for GMM estimator may cause poor performance of asymptotic results.

The results obtained from the initial dynamic model are presented in column GMM-I from Table 2. The variables considered exogenous in this model are `unemp`, `familysize`, `mothereduc` and `urban`. The reason for this is that the decision of a child to work does not determine neither of these variables at state level. On the contrary, the variables which we consider as endogenous are `famincome`, `gini`, `childeduc`, `PBF` and `inspect`.

The `famincome` variable is suspected to be endogenous based on the observation made by Psacharopoulos (1997) and Basu (1999) that children tend to be sole contributors to households income in extremely poor families. In this sense, the endogeneity

of average per capita family income tends to be high if child's income has significant weight in the family income. Despite debate concerning the conciliation of work and schooling by children and adolescents, the simultaneous relationship between child labor and child education is in consensus in literature (Basu, 1999; Dessy and Pallage, 2001; Ranjan, 2001; Das and Deb, 2006). Therefore, the proportion of enrolled children is potentially endogenous. However, such endogeneity is reduced if most children conciliate schooling and work as observed by Kassouf (2002) and Kassouf (2015).

The government variables `PBF` and `inspect` are naturally endogenous. Specifically, the number of Labor Inspections conducted in a specific region depends on the number of complaints filed about the use of child labor in the region. Similarly, the amount of money transferred by the `PBF` to a certain region depends on the level of poverty of the region which, in turn, determines the number of children working.

Arellano and Bover (1995) instructed that ε_{it} must be serially uncorrelated in order to obtain consistent estimation of parameters. Formally, $\Delta\varepsilon_{it}$ are correlated with $\Delta\varepsilon_{i,t-1}$, since $Cov(\varepsilon_{it},\ \varepsilon_{i,t-1} = Cov(\varepsilon_{it} - \varepsilon_{i,t-1},\ \varepsilon_{i,t-1} - \varepsilon_{i,t-2}) = -Cov(\varepsilon_{i,t-1},\ \varepsilon_{i,t-1}) \neq 0$, however, $\Delta\varepsilon_{it}$ will not correlate with $\Delta\varepsilon_{i,t-k}$ for $k \geq 2$. Loosely speaking, the first-differenced errors, $\Delta\varepsilon_{it}$, are correlated in the AR(1) but not in subsequent orders. The statistic test that verifies this assumption is the Arellano-Bond test. The null hypothesis of this test is that there is no autocorrelation in the first-differenced errors. Another test used to verify if the dynamic panel model is misspecified is the Sargan test of overidentifying restrictions. It is important to note that this test assumes that errors are independent and identically distributed (i.i.d), thus the Sargan test can not be performed on heteroskedastic-robust errors.

The Sagan test of overidentifying restrictions was performed on the GMM-I model to verify if instruments are valid. The model is considered overidentified because 189 instruments were used to estimate 10 parameters, summing 179 overidentifying restrictions. Having that Sargan test assumes strict homogeneity of error, we apply this test on the regular standard errors of the model. The value of this test was 209.87 with a p-value of 0.057, implying that we do not reject the null hypothesis that overidentifying restrictions are valid at a level of 10%. Note that Arellano and Bond (1991) pointed that Sargan test over rejects in the presence of heteroskedasticity. This might be the reason for relatively low p-value since there is clear evidence of heteroskedasticity as observed in previous models.

Subsequently, Arellano-Bond test for zero autocorrelation in first-differenced errors was performed since the GMM estimator requires that ε_{it} to be serially uncorrelated. Therefore, we expect to reject the null hypothesis of no correlation at the first order but not at higher orders. The test value observed was $z = -3.57$ and p-value 0.004 at first order and $z = 0.92$ and p-value 0.3557 at second order. Hence, the null hypothesis that $Cov(\Delta\varepsilon_{it},\ \Delta\varepsilon_{i,t-k}) = 0$ is rejected at a level of 1%, i.e, error ε_{it} is serially uncorrelated.

At this point, we conclude that the GMM estimator best fits the objective of this study. In short, it permits to account for time dynamics, unobservable and omitted time-invariant factors and also to control potential endogeneity caused by the loop of causality between the child labor rate and, especially, governmental countermeasures.

Henceforth, the model GMM-I will be regarded as our benchmark model and all empirical results will be based on this model and its variations.

4. Analysis of Empirical Results

The main hypothesis we test is that *Bolsa Família* cash transfer program and Labor Inspection activities contribute in reducing child labor rate in Brazil. To reach this

objective, as detailed in the previous section, we opted for dynamic panel models which permitted to control the endogeneity of both governmental countermeasures.

In Table 3, we present the benchmark model (GMM-I) from Section 3.2 and two variations of itself. In model GMM-II, we included lagged values of the main variables of interest, `PBF`, and `insect`, to verify if the effect of both governmental countermeasures transcends from previous years. In the GMM-III model, we control for time shocks by including dummies for years (`years`) so as to isolate the effect of regressors from the fixed effect of time.

We statistically verified the importance of time-shock control by performing the Wald test for a composite linear hypothesis. Having a test value of 44.25, we reject the null hypothesis that all time coefficients are jointly equal to zero, therefore control for time fixed effects is necessary. Analogously, we tested the need to control for the long-run tendency of time series (`trend`). The test value was 10.73, thus, such control is also statistically important. Subsequently, we proceed with empirical analysis by comparing results from this model with those from the benchmark model so as to emphasize the importance of time-shock controls.

In the benchmark model, which addressed endogeneity but has no control for time shocks and lagged values of `PBF` and `inspect`, we found empirical evidence which points that both governmental countermeasures contributed in reducing child labor. However, with these additional controls in model GMM-III, the effect found for `PBF` and `inspect` turned not to be statistically significant. Similar observation were made for the controls for `familysize` and `mothereduc`. Thus, we conclude that in light of temporal shocks and the long-run tendency of time series there is no clear-cut empirical evidence concerning the effect of neither the *Bolsa Família* conditional cash transfer program nor the Labor Inspection activities, even though when endogeneity is addressed.

Similar results have been found in literature concerning the effect of conditional cash transfers in Brazil. For example, Cardoso and Souza (2004) and Ferro and Kassouf (2005) found no empirical effect of the *Bolsa Escola* program in reducing child labor, but found evidence concerning its effect on school attendance. Similarly, Aquino et al. (2010) and Do Nascimento et al. (2016) found no effect of the participation in the PBF program on the probability of children to work or not. However, the latter authors found that the sum transferred to families reduced the child labor, likewise working hours. Using the same estimation method as that which we used in this study, although not controlling endogeneity, Ramalho and Mesquita (2013) also found no significant effect of the PBF program.

It is important to recall that the main objective of the program is poverty and not child labor and, also, that the program has limitations concerning the coverage of child laborers since it only focuses on families with per capita income below the poverty line.

As per Labor Inspection, we acknowledge that Almeida (2015) provided the first empirical evidence concerning the effect of inspection activities in reducing child labor. However, our results do not provide sufficient empirical evidence to support this hypothesis after controlling for time-specific shocks.

Nevertheless, as suggested by ILO/SIT (2010), we do not limit our definition of efficiency to the direct outcomes of the Labor Inspection activities, but also recognize its unobservable impacts on child labor. Specifically, the Labor Inspection aims to reduce child labor through four channels: a) awareness creation, which prevents child labor; b) inspection, which directly reduces child labor; c) render of social assistance to withdrawn children, which prevent them to return to work and; d) fining of exploiters, which serves as penal measure to caught firms and warning to others.

According to studies such as Kassouf (2002), Hilowitz et al. (2004b), Inaiá (2008),

Table 3: Results from benchmark models

Response variable: `childlabor`

	GMM-I	GMM-II	GMM-III
`constant`	17.57***	14.65***	7.281
	(2.691)	(3.094)	(4.435)
$\texttt{childlabor}_{t-1}$	0.154**	0.222**	0.231**
	(0.071)	(0.090)	(0.094)
`famincome`	−0.448	−0.409	0.526
	(0.376)	(0.378)	(0.568)
`childeduc`	−0.924	−1.920	−1.784
	(1.353)	(1.572)	(2.934)
`familysize`	−1.503*	−1.200*	−1.224
	(0.823)	(0.664)	(0.775)
`urban`	−1.563**	−1.224*	−1.223*
	(0.747)	(0.654)	(0.669)
`unemp`	−0.329**	−0.288*	−0.357**
	(0.140)	(0.162)	(0.157)
`mothereduc`	−1.548***	−1.378*	−1.360
	(0.526)	(0.750)	(0.836)
`inspect`	−0.0478*	−0.0371	−0.0254
	(0.025)	(0.026)	(0.027)
$\texttt{inspect}_{t-1}$		−0.0290	−0.000444
		(0.030)	(0.030)
`PBF`	−0.125**	−0.627*	0.229
	(0.060)	(0.343)	(0.398)
$\texttt{PBF}_{t-1}$		0.578*	0.236
		(0.322)	(0.359)
`year2007`			−0.0754
			(0.071)
`year2008`			−0.133
			(0.070)
`year2009`			−0.102
			(0.112)
`year2011`			−0.188*
			(0.098)
`year2012`			−0.332***
			(0.073)
`year2013`			−0.335***
			(0.076)
`trend`			−0.149***
			(0.046)
Number of observations	207	178	178

Note: Robust errors in parentheses; ***, ** and * denote significance at 1%, 5% and 10%, respectively; All variables, both the response variable and its regressors, are logarithmized; The constant term is the average effect of state unobservables

Aquino et al. (2010), Kassouf and Justus (2010) and ILO (2013), among many others, the level of urbanization plays a very important role in the determination of the rate of child labor. Specifically, these authors found that most child laborers are found in the rural area, especially in the agricultural sector. The incidence of child labor is higher in rural areas mainly because of fewer inspections, high incidence of family agriculture and a higher level of poverty compared to urban areas. The importance of this variable is reflected in the magnitude of its coefficient, which is the highest. In specific, the rate of child labor reduces in, approximately, 1.2% for every increase of 1% urbanization rate.

According to Inaiá (2008) and DeGraff et al. (2016), child labor in the rural area tends to be more hazardous because they involve the most invisible forms of child labor and are less passive of reduction through inspection, especially in family agriculture and domestic services. Marin et al. (2012) also affirmed that child labor is higher in many Brazilian rural regions because it is not considered exploit, but as assistance, means of socialization and heir training. Note that, in such cases, child labor is not necessarily motivated by poverty, but by a category of a social norm which was referred to as *filial interactions* by López-Calva et al. (2002).

The estimate found for `unemp` indicates a negative relationship between the rate of child labor and adult unemployment. This relationship is contradictory compared to that pointed by Galli (2001). However, Basu and Van (1998) cautioned that the relationship between adult employment and child labor may be ambiguous in a competitive labor market. Nevertheless, this result goes in line with the evidence from Duryea et al. (2007) for children between the age 10 and 14. A possible explanation for this is that the `unemp` variable captured the effect of economic performance. Therefore, one can interpret that the reduction of economic progress led to both adult and child unemployment. Nevertheless, we suggest further investigation of the effect of adult unemployment on child labor.

Finally, our results corroborate that found by Ramalho and Mesquita (2013) regarding the existence of temporal dependence of the rate of child labor. Specifically, we observed a positive value of about 0.23. Similarly, these authors observed a positive value of about 0.29. In other words, despite the divergence of our model specification from that of these authors, we both conclude that the rate of child labor is dependent on itself over time. Specifically, about 23% of the previous rate of child labor is disseminated to current rates. Therefore government policies to combat child labor may have time lagged effect on the rate of child labor.

5. Concluding Remarks

In this study, we investigated the determinants of child labor rate, however, paying special attention to the role of two governmental welfare programs – PBF conditional cash transfer and Labor Inspection with focus on child labor. The hypotheses alleged was that both programs contribute in reducing child labor rate in Brazil. On the one hand, we alleged this hypothesis concerning the *Bolsa Família* program because it relieves poor and extremely poor families of financial burdens, under the condition of enrollment of their children in school. On the other hand, the Labor Inspection is alleged to have a mitigating effect on child labor rate because it directly withdraws children from work so as to enroll them in school and provide them social assistance. Moreover, it fines exploiters of child labor and creates awareness in the society concerning magnitude and consequences of early work of children and adolescents.

This hypothesis was tested using dynamic panel models, which were estimated using 2004–2009 and 2011–2014 PNAD data aggregated by state. In light of time

fixed effect, we did not find conclusive empirical evidence which permits to sustain the hypothesis that the PBF and Labor Inspection reduced child labor rate in Brazil. Particularly, we found that by simply methodologically addressing the endogeneity of these governmental countermeasures, tricky desired results are observed, which are, eventually, results of time-specific shocks and trends.

Among all factors controlled in the empirical model, only that for urbanization rate showed an elastic relationship with child labor rate. This indicates that effective regional policies that promote urbanization may provoke high mitigating effect on child labor rate. Moreover, urbanization sprouts other social benefits such as access to better health, education and infrastructural facilities, which in turn bolster overall economic growth. Despite these enticing benefits, it is important that urbanization policies take into account the possible adverse effects such as an increase in crime, inequality, migration, poor living conditions, etc. Inclusively, such conditions may end up diverting child labor to invisible and worst forms such as prostitution, drug trafficking, street trading, and services, etc..

Lastly, we found empirical evidence which corroborates previous literature concerning the intertemporal dependence of child labor rate in Brazil. Therefore, the effect of governmental countermeasures against child labor in a period may be disseminated to subsequent periods.

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