

THE EFFECTS OF THE CHILD LABOR LAW IN THE BRAZILIAN NORTHEAST REGION¹

Os efeitos da lei do trabalho infantil na região Nordeste do Brasil

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Abstract: Considered one of the most advanced acts of legislation concerning child labor in the world, Brazilian legislation on the matter is regulated in the country's 1988 Federal Constitution, in the Consolidation of Labor Laws (CLT) and in the Statute of the Child and the Adolescent (ECA). Businesses and/or individuals who hire workers under the age of 16 are subjected to penalties under those laws. Thus, this work uses a quasi-experiment generated from the Brazilian legislation in order to capture the effects of the child labor law as it is applied in the Northeast region of Brazil. Using data from the Continuous National Household Survey (*Pesquisa Nacional de Amostra por Domicílios Contínua* - PNAD) of 2017, we estimate the local average treatment effects (LATE) obtained through regressions with discontinuity. The results indicate there is not a considerable influence of the law on child labor, even though a small reduction in hours worked can be observed, in 1.7 hour, 1.3 hour and 1.7 hour, respectively, when analyzing the Northeast region of Brazil as a whole, and analyzing the Urban and Rural areas separately. It was also verified that by 2017 there are more than 103,000 children and adolescents under the age of 16 who are in the job market of the Northeast region of Brazil, violating child labor laws.

Keywords: Child labor; Regression with discontinuity; Northeast Brazil.

Resumo: Considerada uma das mais avançadas legislações do mundo sobre o trabalho infantil, a legislação brasileira é regulamentada na Constituição Federal, na Consolidação das Leis do Trabalho e no Estatuto da Criança e do Adolescente. Empresários e/ou pessoas físicas que contratam trabalhadores com idade abaixo de 16 anos estão sujeitos a punições. Assim, esse trabalho utiliza um quase experimento gerado a partir da legislação brasileira a fim de captar os efeitos da lei do trabalho infantil no Nordeste brasileiro. Utilizando de dados da PNAD Contínua de 2017, estimou-se os efeitos médios de tratamento local (LATE) obtidos em regressões com descontinuidade. Os resultados apontam pouca influência da Lei no trabalho infantil, mesmo apresentando uma pequena redução das horas trabalhadas, 1,7 horas, 1,3 horas e 1,7 horas, respectivamente no Nordeste, Urbano e Rural. Constatou-se ainda que para 2017 são mais de 103 mil jovens menores de 16 anos que estão no mercado de trabalho nordestino, violando essa lei.

Palavras-chave: Trabalho infantil; Regressão com descontinuidade; Nordeste.

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1 INTRODUCTION

Countries who have historically struggled with economic development portray numerous characteristics which can be worrisome. Income inequality, poverty, urban violence and unemployment in significant scale, to name a few. A particularly damaging occurrence in those countries is child labor. While most developed countries outlawed child labor in the nineteenth century or the early twentieth century², many underdeveloped countries, to this day, still observe children, and the youth in general, struggling in the work force to assist their families to make ends meet.

Poverty, social inequality, the scarcity of natural resources, associated with a lack of public policies, are considered as causes of child labor (CARDISIM; PORTELA SOUZA, 2004, GLEWWE; KASSOUF, 2008). However, it is not necessary for all of those factors to occur simultaneously for minors to enter the job market. Poverty alone can lead them towards those who, possibly with the justification that they are aiding the plight of people in need, exploit cheap child labor.

Works on the subject usually approach the differences between regions and/or countries, such as: Basu (2000), Kassouf (2002), Ray (2002), Basu and Tzannatos (2003), Ferreira Batista and Cacciamali (2007), Neves and Menezes (2010), all of which argue that the origin of child labor is generally linked to the poor regions of underdeveloped countries, as it is in this context that large families with low incomes are concentrated, leading young people to the job market early, to help their families financially.

In Brazil, several works have analyzed child labor with significant conclusions. Araújo et al. (2010), for instance, presents as its main result that the gender of the child and the level of family income are determinants of the insertion of children in the job market. According to Tomás (2006), who analyzed children in various age groups, the gender of the head of the family was a relevant variable in the fact that the child worked or not, and Cacciamali and Tatei (2008) concluded that if a family features mostly autonomous workers, then the likelihood of child labor occurring in that household is increased.

2 For example, the U.S. outlawed child labor through laws in 1918 and 1922, and Great Britain outlawed child labor as early as 1833 through the Factory Act.

According to the 2015 International Labor Organization (ILO) Report³, it is in the Northeast region of Brazil that one can find the greatest frequency of child labor in the country. Monte (2008), analyzing the issue using data from the 2005 National Household Sample Survey (*Pesquisa Nacional Por Amostra de Domicílios – PNAD*), shows that the involvement of children and adolescents in economic activities is quite heterogenous in the country, where the level of occupation of children and adolescents in the Brazilian Northeast is around 15.9%. In a report presented by the ILO (2006)⁴ concerning Brazil, over 60% of children between 5 and 9 years of age that are working are located in the Northeast region of the country, and that percentage was 50% in the early 1990s, indicating, thus, that for that time period, the policies implemented by the government towards preventing child labor did not lead to the expected results.

The choice of focusing on the Northeast region of Brazil for this work is justified, then, by the fact it is where most of child labor seems to occur in Brazil (IBGE, 2015). Furthermore, the region presents the lowest Human Development Index (HDI) amongst all of the five regions of Brazil, the lowest GDP per capita and the greatest level of poverty (PNAD, 2015). These factors portray how particular this region is and the importance in studying it with greater detail in terms of child labor, especially in order to provide more information towards public policies which aim to eliminate, or at least decrease, the exploitation of minors. Also, in purely economic terms, reducing child labor and focusing on more ethical practices could also allow a growing trend of more human capital being accumulated, with more productive individuals, in the long-run.

As for the legal aspects of this issue, Oliva (2006) argues that merely establishing laws is not enough, although it is an important aspect, the law is only one element in a set of factors which economic agents take into account when making their decisions. According to the author, there is also the necessity of public policies and the presence of a national network of prevention of child labor. It is worth nothing that, in Brazil, there are several ins-

3 Available, in Portuguese, at https://nacoesunidas.org/wp-content/uploads/2015/06/Trabalho-infantil_final.pdf. Visited on March 7th, 2019.

4 Available, in Portuguese, at http://www.ilo.org/brasil/publicacoes/WCMS_233639/lang-pt/index.htm. Visited on March 7th, 2019.

tutions, whether governmental or otherwise, which aim to protect children and adolescents from being forced into the job market, and to keep them in schools, as highlighted by Talavera (2006).

Thus, in order to analyze the effects of the Brazilian Child Labor Laws, namely the Consolidation of Labor Laws (*Consolidação das Leis do Trabalho – CLT*) and the Statute of the Child and Adolescent (*Estatuto da Criança e do Adolescente – ECA*), a counterfactual analysis is necessary, *i.e.*, it is important to answer what would occur if such laws did not exist. For the construction of the counterfactual scenario, the most common strategy consists of the division of two groups of individuals, those who receive treatment and those in the control group. We consider as ‘treatment’ those individuals (or ‘units’) who are in an environment where the law was implemented, and as ‘control’, those who would be in a scenario where no such law was put into place⁵.

In view of the above, this work aims to analyze the effect of the Brazilian child labor laws in the Northeast region of the country. For this purpose, it uses information from the 2017 Continuous National Household Sample Survey (Continuous PNAD) to observe the existence or not of a discontinuity near the age of 16 years. Thus, this work seeks to contribute to the literature by presenting a more robust methodology, through a quasi-experiment, to evaluate the effects of those laws, rather than the traditional methods, for the Brazilian Northeast region in the year 2017.

This work is divided into five sections, including this introduction. The second presents a brief review of the economic literature on child labor through the Route of Legality, and a brief discussion on child labor in economic terms. The third section explains the strategies for identifying and processing the data. In the fourth, the main evidence and results of this research are presented and discussed, and, lastly, the concluding remarks are featured.

2 THE CHILD LABOR LAWS IN BRAZIL

2.1 Brazil via the route of legality

According to Conde (2017), Brazilian legislation is considered to be one of the most advanced legislations in the world in terms of prohibiting

child labor, being regulated by the 1988 Brazilian Federal Constitution, in the Consolidation of the Labor Laws (*Consolidação das Leis do Trabalho – CLT*) and the Statute of the Child and the Adolescent (*Estatuto da Criança e do Adolescente – ECA*). Research performed by Aguiar (2004) and Pilotty and Rizzini (1995) suggest that the first instances of a legal resolution to the child labor problem date from 1891, when Decree n. 1,313 established the supervision, by the state, of children in all industrial manufacturers in the Federal Capital of Brazil (Rio de Janeiro, at the time), and defined the minimum age for entering the job market as 12 years old.

According to that legislation, it was allowed for children aged from 8 to 12 years old to work as an apprentice, as long as their lives were not at risk. After the International Labor Organization (ILO) was founded in 1919, Brazil has been ratifying several of the institution’s conventions, of particular relevance, the 05/1919 convention, which established a minimum age of 14 years of age for working in the industrial sector, and the 06/1919 Convention, which established the prohibition of night work for minors.

Minharro (2003) reports that, in 1927, because of international political pressure, the Code of Minors (*Código de Menores*) was created, which limited daily work to six hours, as well as prohibiting unsanitary activities for those under the age of 18. The first consolidation of labor laws (*Consolidação das Leis do Trabalho*), in 1943, redefined the minimum age for being in the job market to 14 years of age, which was reaffirmed after the promulgation of the 1988 Brazilian Federal Constitution.

The Statute of the Child and Adolescent (BRASIL, 1990) allows the minor to work only in the case of an apprenticeship, for adolescents between 14 and 16 years of age. In the year of 1998, Constitutional Amendment n. 20 of the Brazilian Constitution altered the minimum age for an adolescent to be allowed to work at 16 years of age, with the apprenticeship being permitted in the aforementioned interval. Afterwards, the ILO Conventions n. 138 and n. 182 are approved, respectively concerning the minimum age for working and the worst forms of child labor, and several government and non-government institutional programs are put into place (BRASIL, 1999, 2002).

⁵ The definitions of the treatment and control groups are further explained in the methodology section of this work.

Currently, one of the more delicate issues concerning child labor is the apprenticeship position for individuals aged between 14 and 16 years of age. The hiring of a young apprentice and the fiscal incentives for the employer to offer such positions, at times, can be more advantageous than hiring an adult worker. Thus, it is possible that Brazilian legislation, by regulating the hiring of adolescents at that age bracket, is creating an incentive for employing those individuals for simple tasks that do not require significant qualification.

In short, the Consolidation of the Labor Laws (*Consolidação das Leis do Trabalho* – CLT) states that are considered as minors those workers who are between 14 and 18 years of age, according to article 402. As for the *caput* of article 403 of the CLT, it strictly forbids, alongside the Brazilian Constitution, work for those under 16 years of age, besides when working as an apprentice from 14 years of age onwards. Lastly, also according to the Brazilian Constitution and articles 404 and 405 of the CLT, night work is prohibited for those under 18, as well as any kind of dangerous or unsanitary work.

In that sense, Mészáros (2005) criticizes the possibility of work for children under the age 18, arguing that this is one of the reasons that prevent the hiring of the unemployed instead of children and adolescents.

2.2 A brief discussion on child labor

Recent estimates made by the International Labor Organization (ILO)⁶ indicate that there were about 168 million child workers, aged 5 to 17, worldwide in 2012, making child labor still a public concern in the 21st century. According to the ILO, almost half of the children, approximately 85 million, work long hours in dangerous conditions. Around 4 out of 10 working children were under 12 years of age (73 million). Addressing the problem of child labor makes it necessary to understand the circumstances that lead children to work in the first place.

Many economists believe that poverty is the main reason for child labor, so many children work to ensure the survival of their families and themselves. For Wahba (2015), child labor perpetuates

poverty and results in traps of intergenerational poverty. According to the author, policies that prohibit child labor, even if they can be implemented, may still be detrimental to the well-being of children and their families, rather than helping.

On the other hand, not all tasks performed by children or adolescents can be classified as child labor. According to the ILO's Statistical Information and Monitoring Programme on Child Labor (SIMPOC), child labor is a type of work that deprives children of their childhood, their potential and their dignity, and is detrimental to their physical and mental development.

According to the ILO (2013), the relative level of child labor by economic activity can vary widely from one country to another. Estimates suggest that children who were workers were involved in all three major economic activity groups (agriculture, industry and services), with more than half (60%) involved in agriculture alone, 7% employed in the industry sector, and 26% in services. Furthermore, two-thirds of child laborers were unpaid family workers, making any form of government intervention much more difficult to implement, and the participation rates of children in economic activities were, on average, two times greater in rural communities than in urban centers, as shown by data compiled by the ILO (2013).

Among the most influential precursors in studying child labor, Basu and Van (1998) point out that domestic decisions to send children to work are driven mainly by poverty. The authors conclude that if the job market is characterized by having more than one equilibrium⁷, prohibiting child labor can be benign policy. But in very poor countries (or regions), where there is only equilibrium in the job market in a situation where adult wages are low, prohibiting child labor can worsen the well-being of families. Analyzing the relationship between adult market wages and child labor in Egypt, Wahba (2006) confirms the hypothesis of Basu and Van (1998), and finds that a 10% increase in the earnings of illiterate adults reduces the likelihood of a child engaging in work in 22% for boys and 13% for girls.

Using panel data, works which follow children in the same household over time consistently found that the increase in child labor is associated

6 Available (in Portuguese) at https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---ipecc/documents/publication/wcms_221799.pdf. Accessed on March 26th, 2019.

7 Where there is one model in which adults' wages are low and children work, and there is another where adults' wages are high and children do not work. For more, see Basu and Van (1998).

with substantial declines in family income. Beegle *et al.* (2006), for example, followed children over a 3-year period in rural Tanzania, and found a trend of child labor when families experience unexpectedly poor harvests, and that children stop working when families recover from poor harvests. Durlley *et al.* (2007) found that child labor increased during periods of greater adult unemployment in urban Brazil. Corroborating with the aforementioned authors, Edmonds (2005), through a panel of Vietnamese household data from 1993 to 1997, identified that improvements in per capita spending account for 80% of the decline in child labor.

Households can also condition children to work not only to increase household income, but also as an alternative to better manage the income risk they face. In those cases, child labor can be part of a strategy to minimize the risk of disruption to a family's income stream and thus reduce the potential impact of job loss for a family member or, as discussed by Beegle *et al.* (2006), of a failed harvest.

It is also important to note that due to the imperfection of the credit market in developing countries, poor households cannot borrow capital to manage during difficult times, and in many cases need the gains generated by their children to survive, as argued, for example, in Baland and Robinson (2000) and Dehejia and Gatti (2005), who found a negative relationship between child labor and access to credit, where access to credit is represented by the extent of financial development.

Thus, there are potentially many other determinants for child labor beyond poverty. One aspect of the literature on child labor focuses, for example, on the lack of availability of good schools. The general condition of the educational system can be a powerful influence on the labor supply. In addition, traditional factors, such as cultural and social roles, further limit the educational level and increase child labor. Another aspect of the literature argues that socio-demographic characteristics and family characteristics are important determinants of child labor. For Wahba (2015), parental education plays an important role, and more educated parents are less likely to send their children to work. The author also suggests that the child's age, gender and birth order also influence the incidence of child labor. In addition, cultural factors seem to be relevant, so there is considerable va-

riation between the patterns and the incidence of child labor in different countries that derive from cultural and social norms and traditions.

3 IDENTIFICATION STRATEGIES AND METHODOLOGY

3.1 Data and Methodology

In order to capture the effects of the child labor laws for the Brazilian Northeast region, the Regression Discontinuity Design (RDD) method is applied in this work, using data from the Continuous National Household Sample Survey (*Pesquisa Nacional de Amostra Por Domicílio Contínua* - PNAD) for the year of 2017⁸, where the necessary treatment for the analysis was made, extracting a sample of 14,583⁹ individuals between the ages of 14 and 18 years old, following the methodology suggested by Calonico *et al.* (2014).

Lee and McCrary (2005) call attention to a quasi-experiment that occurs when the individual reaches the age of legal majority and the punishment for crimes abruptly changes. As individuals that are closer to the threshold age (16 years old) have similar characteristics, it is possible that there is a discontinuity in criminal recidivism. According to the authors, their methodology allows us to overcome the recurrent problems of endogeneity that occur in research that uses aggregate data for cities, since these units tend to respond to the increase of crime with greater punishments. In addition, there is an isolation of the deterrent effects of the traditional amalgam of incapacitation and deterrence. Using longitudinal data for the state of Florida, where the age of majority is attained at 18 years old, the authors estimate that there is a 2% reduction in crime, with a penalty increase of approximately 230%.

Things occur in a similar way in Brazil in terms of employment, because there is a cut-off point provided for in the law according to the age of the individual. Any form of work for children under 14 years of age in Brazil is prohibited. For individuals from 14 years of age upwards, work is allowed under the condition of being an apprentice, and for

8 While this work was being made, the last continuous PNAD was referring to the year 2017.

9 After applying the weight of the individual in the sample, the representativeness changes to 4,208,894 individuals between 14 and 18 years of age.

those over 16 years of age, work in unhealthy activities is not permitted, only being allowed for those over 18 years old. Based on the hypothesis that there are no significant differences in the physical and intellectual capacity of individuals close to 16 years of age and that the only difference between them is the different costs that their employers and caregivers are subjected to while using their labor - it is possible to conclude that this is a quasi-experiment. Thus, the effects of the laws prohibiting child labor in Brazil can be obtained from the identification of the existence, or not, of a discontinuity in weekly hours worked for individuals whose age is around the cut-off point of 16 years old.

Table 1 shows that there are a significant number of young people working in the Brazilian Northeast region and, therefore, violating the Law that prohibits child labor. According to data from the Continuous PNAD, in 2017 there were about 387,000 (9.16%) adolescents between the ages of 14 and 17 who worked and received some form of monetary or product remuneration. This occurrence is magnified the higher the age, being even greater in urban areas. In those, the incidence rate is almost double that of rural areas in the Brazilian Northeast region.

Table 1 – Absolute and relative frequency of child labor by age and household area, Northeast, Urban and Rural, 2017

	Northeast		Urban		Rural	
	Absolute	Relative	Absolute	Relative	Absolute	Relative
14	42.684	11,07	25.591	10,14	17.093	12,83
15	61.265	15,88	35.414	14,03	25.851	19,41
16	112.383	29,14	76.841	30,43	35.541	26,68
17	169.371	43,91	114.652	45,41	54.720	41,08
Total	385.703	-	252.498	-	133.205	-

Source: Prepared by the authors based on data from the 2017 Continuous PNAD.

Table 2 presents a more intuitive view of what this work aims to analyze: the incidence rate of work is higher from the age of 16 onwards, indicating, therefore, that the law has some relevance in decreasing the hours of work offered in the Northeast region of Brazil.

Table 2 – Average hours worked per week in the urban area and rural area by age Northeast, 2017

Idade	Nordeste	Urbano	Rural
14	18.25	18.17	18.29
15	21.69	21.28	21.97
16	24.10	26.29	22.35
17	26.61	27.53	25.58

Source: Prepared by the authors based on data from the 2017 Continuous PNAD.

Note: Only individuals who worked at least one hour in the reference week were considered.

There is a marked participation of adolescents in the workforce in terms of weekly hours worked, although there appears to be more impact of the law in the urban environment from the age of 16 onwards, thus, in short, the rural environment seems to be more affected by the lack of effectiveness of policies on child labor. According to Mattos et al. (2005), younger individuals living in rural areas tend to be more likely to work compared to urban areas. Still according to those authors, this is probably due to the greater difficulty of implementing social policies in rural areas, as well as monitoring their efficiency.

Analyses made through RDD have been a fundamental tool in investigating the causal effects of treatment assignments on outcomes of interest. Empirical applications and methodological developments span across fields such as statistics, psychology, and economics (TROCHIM, 2001; IMBERNS; LEMIEUX, 2008). Among other advantages of RDD, it is worth mentioning the possibility of working with the design of programs already established, dispensing with the need for the research to be conducted at random.

In the present work, an analysis is made between weekly hours worked (variable of interest), continuous age¹⁰ (classification variable) and the ‘treatment’, in this case, Brazilian legislation that prohibits work for children under 16, except as a young apprentice¹¹.

Some basic conditions are required in order to prevent the method from providing biased estimates, thus guaranteeing the internal validity of the

10 Among the RDD implementation conditions, it is necessary that the classification variable be continuous, making it impossible to use the age variable measured in years.

11 In order to avoid inconsistency in the results, individuals who worked as a young apprentice were excluded.

analysis. First, it is necessary that the classification variable is not caused or influenced by the treatment, as well as ensuring that the cut-off point is exogenous and the attribution to the treatment is based on the score that the candidate obtains (in relation to the cutoff point). Thus, it is possible to affirm that the age of any individual is an exogenous variable, incapable of generating a self-selection bias, that is, receiving ‘treatment’, given the legal prohibition of work for minors who are 16 years old, except when being part of an apprenticeship. It is also assumed that the discontinuity at the cut-off point is due only to the change in the treatment status, and that the other variables, in the case of the covariates, should present a smooth (and continuous) behavior throughout the observations.

Following the work of Calonico et al. (2014), the units receive treatment based on the fact that the value of an observed covariant is above or below a known cut-off point, where the main feature of the design is the probability of receiving conditional treatment as this covariate jumps discontinuously at the cut-off point, inducing variation in the treatment assignment.

In a recent survey of RDD-based inference models, one can find classic empirical examples such as the work of Imbens and Lemieux (2008), Lee and Lemieux (2010), and Dinardo and Lee (2011), however, in the present work, we concentrate on approaches using local polynomial non-parametric estimators with data-oriented bandwidth selectors and bias correction techniques, aligned with works such as Imbens and Kalyanarman (2012) and Calonico et al. (2014).

Figure 1 was made using the method which emulates uniformly spaced variation using spacing

estimators, as shown in Table 3 below, composed of 1,000,000 complete observations, which is reproduced on a graph with evenly spaced boxes that mimic the underlying variability of the data.

Using the introductory notation, we see that the number of bins for control and treatment units is $\hat{J}_{-,n}=7665$ and $\hat{J}_{+,n}=5074$, respectively, implying lengths of binaries of 0.057 and 0.063 percentage points, respectively. The polynomial is constructed using a polynomial of the 4th degree, *i.e.*, [$p = 4$ para $\hat{\mu}_{-,p,1}(x)$ e $\hat{\mu}_{+,p,1}(x)$]. The output table also tells the IMSE (ideal number of bins) and the multiplicative factor [scale] associated with the number of selected bins (taking the optimal IMSE value as a reference). Lastly, the weights of the IMSE which correspond to the number of selected bins are presented¹².

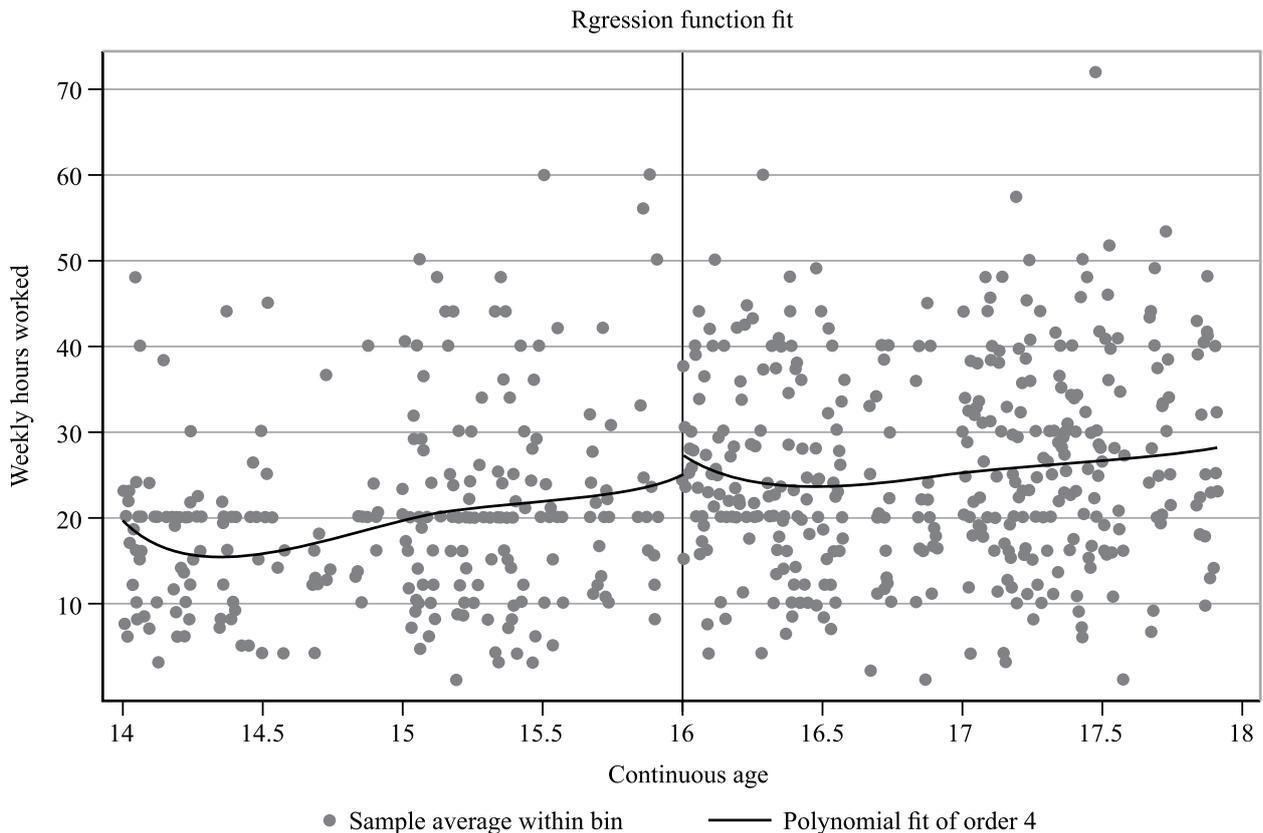
Table 3 – Number of positions for the RDD estimations

Cut-off $c=16$	To the left of c	To the right of c
Number of observations	484.769	515.231
Polynomial order	4	4
Chosen scale	2.000	1.913
Selected bins	19	17
Bin length	7665	5074
IMSE-optimal bins	19	17
Mimicking variance bins	7665	5074
Relative to IMSE-optimal:		
Implied scale	403.421	298.471
WIMSE variance weight	0.000	0.000
WIMSE bias weight	1.000	1.000

Source: Prepared by the authors using the 2017 Continuous PNAD.

12 For more details, see: Calonico, Cattaneo e Titiunik (2014).

Figure 1 – RDD plot



Source: Prepared by the authors using data from the 2017 Continuous PNAD

3.2 Regression with Discontinuity: Non-Parametric Approach

Given that in a non-parametric regression, the estimator is constructed according to the information obtained through the data, not taking a predetermined form, the functional form itself is estimated. Considering the existing procedures, the use of a local linear regression is advisable, which can be equated to a linear estimation in two intervals adjacent to the cut-off point, thus estimating the impact on a sub-sample within a given bandwidth at left and right of the cut-off point.

According to the findings in Cattanea et al. (2014), the non-parametric method makes it possible to construct robust parameters using a local polynomial regression, which is adequate to the data structure and its proposed thresholds, smoothing dispersions and modeling functions.

In this work, it is understood that the potential impact of the law that prohibits work to children under 16 years old in the Northeast acts as a treatment, which should be evaluated. The treatment group is composed of individuals under 16 years

of age¹³, while the counterfactual will be composed of adolescents who have already reached 16 years of age. We then separate those in treatment and control using a deterministic function of the classification variable, the (continuous) age of the individuals.

Consider $[\{Y_i(0), Y_i(1), X_i\}:i=1,2,\dots,n]$ as being a random sample of $\{Y(0), Y(1) \text{ and } X\}$, in which $Y(1)$ and $Y(0)$ denote the potential results of those individuals without treatment. In this particular case, $Y(1)$ is the number of weekly hours worked by individuals under the age of 16, and $Y(0)$ denotes the weekly hours worked by individuals from 16 years of age onwards. Treatment will be determined by the following rule: unit i will be allocated in the treatment group if $X_i < \bar{x}$, for $\bar{x} = 16$, for . Thus, the observed result will be

$$Y_i = \begin{cases} Y(1) & \text{if } X_i < \bar{x} \\ Y(0) & \text{if } X_i \geq \bar{x} \end{cases} \quad (1)$$

¹³ Due to the Continuous PNAD only featuring individuals from 14 years of age onwards in the job market, our minimum point is, thus, that age.

While the observable random sample will be $\{(Y_i, X_i): i=1, 2, \dots, n\}$. The average treatment effect at the threshold of a sharp design is given by:

$$\tau = E\{Y_i(1) - Y_i(0) | X_i = \bar{x}\} \quad (2)$$

This estimate is identifiable non-parametrically under certain conditions and continuity. Specifically,

with

$$\hat{\beta}_{+,p}(h_n) = \arg \min_{\beta \in R^{p+1}} \sum_{i=1}^n I(X_i \geq \bar{x}) \{Y_i - r_p(X_i - \bar{x})'\beta\}^2 K_{h_n}(X_i - \bar{x}) \quad (5)$$

$$\hat{\beta}_{-,p}(h_n) = \arg \min_{\beta \in R^{p+1}} \sum_{i=1}^n I(X_i < \bar{x}) \{Y_i - r_p(X_i - \bar{x})'\beta\}^2 K_{h_n}(X_i - \bar{x}) \quad (6)$$

where $r_p(x) = (1, x, \dots, x^p)'$, $e'_0(1, 0, \dots, 0) \in R^{p+1}$

is the first unit vector, $K_h(u) = \frac{K\left(\frac{u}{h}\right)}{h}$ with $K(\cdot)$ a Kernel function, h_n is a positive bandwidth sequence and $I(\cdot)$ denotes the indicator function.

Under simple regularity conditions, local polynomial estimators are known to satisfy:

$$\beta_{+,p}(h_n) \rightarrow_p \beta_{+,p} \text{ and } \beta_{-,p}(h_n) \rightarrow_p \beta_{-,p} \quad (7)$$

$$\beta_{+,p} = \left(\mu_+, \mu_+^{(1)}, \frac{\mu_+^2}{2}, \dots, \frac{\mu_+^{(p)}}{p!} \right) \quad (8)$$

$$\beta_{-,p} = \left(\mu_-, \mu_-^{(1)}, \frac{\mu_-^2}{2}, \dots, \frac{\mu_-^{(p)}}{p!} \right) \quad (9)$$

$$\mu_+^s = \lim_{x \downarrow \bar{x}} \frac{\partial^s}{\partial x^s} \mu_+(x) \quad (10)$$

$$\mu_+(x) = E\{Y(1) | X_i = x\} \quad (11)$$

$$\mu_-^s = \lim_{x \uparrow \bar{x}} \frac{\partial^s}{\partial x^s} \mu_-(x) \quad (12)$$

$$\mu_-(x) = E\{Y(0) | X_i = x\} \quad (13)$$

In which $s = 1, 2, \dots, p$. With that, it presents a set of consistent estimators of τ . For that reason, the linear local estimator of $\hat{\tau}_1 = \hat{h}_n$ is possibly the

$$\tau = E\{Y_i(1) - Y_i(0) | X_i = \bar{x}\} \quad (3)$$

We then use a estimator based on the Kernel method with local polynomials on both sides of the cut-off point. The polynomial regression of weighted order p for treated units and control units, respectively, is presented as follows:

$$\hat{\tau}_p(h_n) e'_0 \hat{\beta}_{+,p}(h_n) - e'_0 \hat{\beta}_{-,p}(h_n) \quad (4)$$

most common choice for the implementation of a regression with discontinuity.

4 RESULTS

Despite the attractiveness of using discontinuity in this work, it is quite challenging, since it is necessary to carefully evaluate the robustness of its estimates. In order to guarantee the robustness, a sub-sample of reasonable size with 1,000,000 observations was used, as previously mentioned. The flexibility provided by the non-parametric model chosen allowed us to estimate four different functional forms in order to adjust the data to a polynomial up to the fourth order, besides the estimates being conducted on different neighborhoods¹⁴, considering symmetrical age intervals of 3, 6 and 9 months.

To obtain the bandwidth¹⁵ alternative methodologies were used, given the greater challenge of implementing a model with a non-parametric approach. Thus, the estimation was carried out by a data-driven process, that is, from the data itself (input), operating through an algorithm, we arrive at the result (output), without any interference based on any form of “empirical intuition”. In this work, three different methods were used to achieve bandwidth selection, which are: the Ludwig and Miller (2007) method, the Imbens and Kalyanaraman

¹⁴ Referring to the bandwidth. For more information, see Li (1987)

¹⁵ Neighborhood in which the observations will be considered to estimate the functional form. For more, see Cattaneo, Calonico and Titiunik (2014).

(2012) method, and, lastly, the Cattaneo et al. (2014) method, the latter being adopted as presenting more robustness when compared to the other two.

Table 4 presents the results of the β coefficients which represent the “jump” that occurs in the average hours worked per week when the young person reaches the age of 16, considering the observations at different intervals of individuals at a certain age (the windows).

It should be emphasized that the interpretation of the results is concentrated in the window of ± 3 months, considering individuals whose ages are between 15 years and 9 months of age and 16 years and 3 months of age, since, although there is a loss of observations, a sufficiently large sample (365,626 individuals) is still available to guarantee unbiased results, and are close enough to the 16 years of age cut-off point, thus allowing for the control of possible differences in the characteristics of individuals.

Table 4 – *LATE* in weekly hours worked – Northeast region of Brazil

		± 9 months	± 6 months	± 3 months
Polynomial	n	366657	259323	153238
1	β	0,04039*** (0,00317)	0,09511*** (0,00523)	-0,2213*** (0,01873)
2	β	0,08309*** (0,00618)	0,01099*** (0,01434)	-0,28341*** (0,09867)
3	β	0,10306*** (0,01307)	-0,3088*** (0,03022)	-1,8772*** (0,37863)
4	β	-0,16879*** (0,02814)	-1,2453*** (0,08315)	-2,8686*** (1,2228)

Source: Prepared by the authors using data from the 2017 Continuous PNAD

Note: Local Average Treatment Effects (*LATE*) obtained through the methodology proposed by Cattaneo, Calonico and Titiunik (2014). The periods indicated at the top of the columns refer to the age ranges below and above 16 years included in the regressions. The first column is composed by the indication of the orders of the polynomials used in the specification of the estimated model. Second row represents the number of “n” individuals that were included in the sample. Standard errors are presented in parentheses, representing results for the Northeast region. *** $p < 0.01$.

The results show that the Federal Laws prohibiting work for minors under 16 years of age has no considerable influence on the weekly hours worked by children and adolescents in the Northeast region of Brazil, with an average of 1.3 hour of work per week. Thus, it can be said that the law does not fulfill its objective of discouraging children and adolescents of looking for work, or companies employing

them. This result corroborates with Machado and Oliveira (2016), who analyzed the prohibition of any form of work for children under 14 years of age in Brazil, and as a result found that the law reduces, on average, 3.5 weekly hours of work per week.

In order to seek more robust results, the coefficients were estimated for individuals residing in urban and rural areas separately, again using the narrower neighborhood. As a result, there is an average local treatment effect of 1.7 hour of work a week, for workers under 16 years of age. Similar results are found when applying other methods for bandwidth selection, as shown in table A1 in the appendix.

Although it seems small, the impact of the law is about 8 times greater for individuals who are in the window of ± 9 months, that is, when the neighborhood is broadened, the effect of the law increases. It should also be noted that the number of hours worked in urban areas is lower than the average of the entire population, which causes a greater impact when the urban area is analyzed separately. Following the results found in academic literature, the result in this work concludes that, since in urban environments government supervision tends to be more severe, there is an increase in the probability of punishment for economic agents, be they individuals or companies, which employ minors to work, thus decreasing the incentives for that practice.

Table 5 – *LATE* in weekly hours worked – Urban areas of the Northeast region of Brazil

		± 9 months	± 6 months	± 3 months
Polynomial	n	265335	188403	113554
1	β	0.05633 *** (0.00325)	0.1016 *** (0.00537)	-0.19465 *** (0.01982)
2	β	0.07542 *** (0.00637)	-0.02331 *** (0.01516)	-0.66527 *** (0.1005)
3	β	0.10000 *** (0.01336)	-0.28709 *** (0.03224)	-4.0129 *** (0.34741)
4	β	-0.16247 *** (0.03019)	-1.0214 *** (0.0862)	-2.6938 *** (1.2322)

Source: Prepared by the authors using data from the 2017 Continuous PNAD.

Note: Local Average Treatment Effects obtained from the methodology proposed by Cattaneo, Calonico and Titiunik (2014). The periods indicated at the top of the columns refer to the age ranges below and above 16 years included in the regressions. The first column is composed by the indication of the orders of the polynomials used in the specification of the estimated model. Second row represents the number of “n” individuals that were included in the sample. Standard errors are presented in parentheses, representing the results for the Northeast region of Brazil. *** $p < 0.01$.

Regarding the rural area, the results presented in table 6 show a positive relationship with the Child Labor Laws. In the narrower neighborhood, there is a local average treatment effect of more than 1.7 working hour per week, thus indicating that the dissuasive effect of the Law does not positively impact the reduction of the number of hours worked per week for children and adolescents in the rural areas.

Table 6 – *LATE* in weekly worked hours – Rural Northeast – 2017

		± 9 months	± 6 months	± 3 months
Polynomial	n	101322	70920	39684
1	β	-0.0283 *** (0.00687)	0.0555 *** (0.01149)	-0.58821 *** (0.4144)
2	β	0.08277 *** (0.01345)	0.11655 *** (0.02907)	0.65994*** (0,16412)
3	β	0.1177 *** (0.0285)	-0.56389 *** (0.05353)	3.6640 *** (0.9776)
4	β	-0.33482 *** (0.05093)	-3.0575 *** (0.1636)	-2.042 *** (3.0073)

Source: Prepared by the authors using data from the 2017 Continuous PNAD.

Note: Local Average Treatment Effects obtained from the methodology proposed by Cattaneo, Calonico and Titiunik (2014). The periods indicated at the top of the columns refer to the age ranges below and above 16 years included in the regressions. The first column is composed by the indication of the orders of the polynomials used in the specification of the estimated model. Second row represents the number of “n” individuals that were included in the sample. Standard errors are presented in parentheses, representing the results for the Northeast region of Brazil. *** $p < 0.01$.

Among the possible reasons for the law not being enforced in rural areas is the difficulty of inspection often generated by the distance between the urban center and the rural environment, resulting in a significant increase in monitoring costs. It is worth noting that often the work performed by minors which is inappropriate is mostly in family farming or subsistence activities. In addition, one cannot ignore economic factors and the deterministic characteristics of these agents, as well as social and cultural reasons that end up reinforcing the inefficiency of the law in rural areas, rather than in urban centers.

5 CONCLUDING REMARKS

The main objective of this work was to investigate if the CLT, Consolidation of the Labor Laws in Brazil, as well as the ECA, Statute of the Child

and Adolescent, as to what these laws pertain to prohibiting child and adolescent labor, aside from the possibility of the youth being an apprentice, have generated an effect of dissuading these economic agents of not entering the workforce, having, thus, a positive effect as to decreasing the presence of individuals under 16 years of age in the Brazilian job market in the Northeast region of the country. Also, this work analyzed the effects in the urban and rural areas of the region separately.

For that purpose, a *quasi*-experiment was performed through a regression discontinuity design, since it allows for the estimation of the average effects of local treatment without the recurring concern of violating the strict exogeneity hypothesis which is common to other methods. Thus, we estimated the local average treatment effect comparing only the individuals around a cut-off point.

The results aim to contribute to the empirical analysis of the effects of legislation, as well as assist in the formulation of public policies which seek to reduce child labor in the Brazilian Northeast. Those results show that the laws which prohibit child labor appear to be ineffective in the sample analyzed, even though a small decrease in hours worked is observed, in 1.7 weekly hour worked, 1.3 hour weekly hour worked and 1.7 weekly hour worked, respectively, for the Northeast region as a whole, for the urban area of the region, and the rural area. It was also observed that over 103,000 individuals under the age of 16 are in the Brazilian Northeast job market, which is a clear violation of the law.

It can be argued that the law is only a small part of the equation, being frequently overlooked by economic agents when making their decisions. The attempt to eradicate child labor probably needs far more elements than legislation to be effective, such as the accompanying work of non-governmental agencies, public policies geared towards financial assistance and/or educational policies which create incentives for children and adolescents to remain in school, rather than seeking work to aid their families.

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APPENDIX A – LOCAL AVERAGE TREATMENT EFFECT USING ALTERNATIVE METHODS

Table A.1 – Local Average Treatment Effect using the Imbens and Kalyanaraman (IK) method

Polynomial		± 9 months			± 6 months			± 3 months		
		Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
	n	366657	265335	101322	259323	188403	70920	153238	113554	39684
1	β	0.01294 *** (0.00195)	0.02125 *** (0.00202)	-0.01535 *** (0.00421)	0.02084 *** (0.00239)	0.0298 *** (0.00246)	-0.01777 *** (0.00521)	0.07653 *** (0.00356)	0.0919 *** (0.00598)	0.03107 *** (0.0198)
		0.04039 *** (0.00317)	0.05633 *** (0.00325)	-0.0283 *** (0.00687)	0.09511 *** (0.00523)	0.1016 *** (0.00537)	0.0555 *** (0.01149)	-0.22013 *** (0.01873)	-0.19465 *** (0.01982)	-0.58821 *** (0.04144)
3	β	0.08309 *** (0.00618)	0.07542 *** (0.00637)	0.08277 *** (0.01345)	0.01099 *** (0.01434)	-0.2331 *** (0.01516)	0.11655 *** (0.02970)	-0.28341 *** (0.09867)	-0.66527 *** (0.1005)	0.65994 *** (0.14632)
		-0.10306 *** (0.01307)	0.1000 *** (0.01336)	0.1177 *** (0.0285)	-0.3088 *** (0.08315)	-0.28709 *** (0.03224)	-0.56389 *** (0.05353)	-1.8772 *** (0.37863)	-4.0129 *** (0.34741)	3.664 *** (0.9776)

Note: *** p<0.01.

Table A.2 – Local Average Treatment Effect using the Ludwig and Miller (CV) method

Polynomial		± 9 months			± 6 months			± 3 months		
		Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
	n	366657	265335	101322	259323	188403	70920	153238	113554	39684
1	β	0.04039 *** (0.00195)	0.05633 *** (0.00223)	-0.0283 *** (0.00614)	0.09511 *** (0.00239)	0.1301 *** (0.00246)	0.0554 *** (0.00532)	-0.22013 *** (0.00603)	-0.19465 *** (0.0975)	-0.58321 *** (0.0187)
		0.08309 *** (0.00317)	0.07542 *** (0.00265)	0.08279 *** (0.00298)	0.01099 ** (0.00523)	-0.02313 *** (0.00384)	0.11655 *** (0.01345)	-0.28341 *** (0.01786)	-0.66417 *** (0.01927)	0.65994 *** (0.06412)
3	β	0.10306 *** (0.00618)	0.1000 *** (0.00367)	0.1177 *** (0.01345)	-0.3088 *** (0.01434)	-0.28709 *** (0.01561)	-0.56389 *** (0.02907)	-1.8772 *** (0.09867)	-4.0129 *** (0.1054)	3.6641 *** (0.16412)
		-0.16879 *** (0.01307)	-0.16247 *** (0.03019)	-0.33482 *** (0.02595)	-1.2453 *** (0.03022)	-1.0214 *** (0.03224)	-3.0575 *** (0.05364)	-2.2866 *** (0.37863)	-2.6983 *** (0.37414)	-2.6041 *** (0.9967)

Note: *** p<0.01.