

How Does Early Marriage Affect the Education of Women in Brazil?

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Abstract—

The theme of early marriage, in addition to being associated with developing countries, serves as an example of human rights violations. Although the discussion about the impacts that early marriage can generate in aspects such as education and health is extensive in other countries and the Brazilian legislation itself has some contradictions in the definition of child marriage, few are the works that elucidate the current situation of the child and adolescent female population in Brazil. This study is based on the comparison of data from 2002 to 2015 of the PNAD for girls and women from 12 to 49 years of age, in addition to using PNDS of 2006 as a basis for the probability of having a stable union (formal or informal) before the age of eighteen. The propensity Score Matching (PSM) method is used to analyze the influence that early marriage potentially has on woman's educational background. These effects were negative in relation to completion of basic and higher education, by approximately 21% and 13%, respectively. The same *PSM* exercise was made for white and non-white women showing that early marriage's impact on education reaches approximately 27% among white women and 15% among non-white women for Basic Education and a 15% impact for white and 12% for nonwhite women on higher education.

Keywords—Child marriage, Early marriage, Girls and women, Education, Brazil.

Resumo—

A temática sobre casamento infantil, além de ser associada a países em desenvolvimento, serve como exemplo de violação dos direitos humanos. Embora a discussão acerca dos impactos que o casamento infantil possa gerar em aspectos como educação e saúde seja extensa em outros países e a própria legislação brasileira tenha algumas contradições na definição sobre casamento infantil, poucos são os trabalhos que elucidam a situação atual da população infantil e adolescente feminina no Brasil. Este estudo se baseia na comparação de dados de 2002 a 2015 da PNAD para meninas e mulheres de 12 a 49 anos de idade, além de utilizar a PNDS de 2006 como fundamento para a probabilidade de ter uma união estável (casamento ou informal) antes dos dezoito anos. O método de Propensity Score Matching (PSM) é utilizado para analisar a influência que o casamento infantil potencialmente tem sobre a formação educacional das mulheres. Estes efeitos foram negativos em relação à conclusão do ensino básico e superior, em aproximadamente 21% e 13%, respectivamente. O mesmo exercício de *PSM* foi feito para mulheres brancas e não brancas, mostrando que o impacto do casamento precoce na educação atinge aproximadamente 27% entre mulheres brancas e 15% entre mulheres não brancas para Educação Básica e 15% de impacto para brancas e 12% para mulheres não brancas no Ensino Superior.

Palavras-chave—Casamento Infantil, Casamento Adolescente, Meninas e Mulheres, Educação, Brasil.



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1 INTRODUCTION

Early marriage, known as a formal or an informal union entered into by an individual before reaching the age of 18¹, is a theme usually associated with developing countries and one of the main examples of human rights violations. As this strong social norm is mainly related to female children and adolescents, indicators show their relationship with the decrease in schooling rates[9], which will be the focus of this study, and reproductive control [10], in addition to increased mortality and domestic violence situations [1]. Another point of attention is the relation with the incidence of cases of early pregnancy and abandonment of children [24], since the first often serves as a pretext for marriages that until then would have been denied by law, as is the case of Brazil.

Brazilian legislation defines as legal a minimum age of eighteen for marriage, but there are exceptions in the Civil Code² that allow the marriage to happen at the age of sixteen if there is parental or legal representatives authorization. In cases of pregnancy including those related to sexual crimes, marriage can also be allowed. This type of situation evidences a law that discriminates girls from boys, since only the former can become pregnant. Upchurch et al. (2002) modeled the determinants of nonmarital fertility, focusing on the effects of other life-course events such as education and marriage, showing that the risk of nonmarital conception increases after leaving school, while the risk is lower for previously married women than for never-married women, even controlling for age.

Although the discussion about the impact that early marriage can generate in aspects such as education and health is extensive in other developing countries and the Brazilian legislation itself presents reasons to be contested, few studies clarify the current situation of the child and adolescent population in this regard. Some studies indicate that Brazil is the first country in Latin America to have married or stable women until the age of eighteen and the fourth largest in the world, with 35.6% of the female population married before the age of 18 .

Data from the 2010 Census also show fertility rates of 6.5% among women aged 15 to 19 years, with the highest concentration in the North and Northeast regions, reaching 10% and 7%, respectively, while the other regions present results close to 5.5 %. Among women aged 20-24, this pattern still persists, with rates of up to 13% for the North and 10% for the Northeast, but from the age of 25 the fertility rates between the regions are equalized, reaching a mean of 9%, maintaining a steady and similar drop over the next age brackets. The Census for this year also indicates significant figures for marriage or marriage of girls compared to boys [28]. These results mainly illustrate the issue of the gender issue associated with early marriage. In addition to these figures, some studies also denounce the lack of up-to-date data on the subject, making it difficult to conduct a deeper analysis. The question "Age of the Person when contracting the First Union", for example, did not compose the Demographic Census after 1991. On the other hand, the National Survey of Demography and Health (PNDS), whose last edition occurred in 2006, offers rich information about the population as the age of first menstruation, marriage, and use of contraceptive methods. The periodicity in which it is performed, however, ends up contributing negatively to obtaining updated and comparable results over time. Thus, much of the analysis on this topic ends up being limited to data provided by the IBGE and PNDS, as will be the case of this study, or by independent organizations from private surveys.

Considering the different impacts that early marriage may have on the lives of these girls, schooling was chosen as an object of study based on available information on the Brazilian female population. Issues posed by Taylor, Lauro, Segundo, Greene (2015) on early marriage and education involve school lag and

1. Definition available at <https://www.unicef.org/rosa/what-we-do/child-protection/child-marriage>

2. Art. 1520 of the Civil Code - Law 10406/02 - "Exceptionally, the marriage of those who have not yet reached the age of marriage (article 1517), to avoid imposition or fulfillment of criminal penalty or in case of pregnancy."

withdrawals. About one-third of girls aged 14 to 19 interviewed had not reached high school until the time of the survey.

This study is based on the comparison of data from 2002 to 2015 of the PNAD for girls aged 12 to 18 years and women over 18 years, in addition to using the 2006 PNDS to create a probability function for a girl to enter into some type of union before the age of eighteen. This function will be applied in PNAD data and the Propensity Score Matching method used to analyze the influence that early marriage potentially has on the educational background of women. Therefore, the present work will be divided into four sections: in the first one, the articles used as literature review. The methodology used will be presented in the second part, followed by the results and conclusion in the next sections.

2 LITERATURE REVIEW

To analyze the issue of early marriage in Brazil and its impact on educational, one point to be highlighted is the disproportionate association that the theme "early marriage" has in relation to the female sex [21]. Denying the right to choose with whom or when to marry is a serious violation of human rights, since these girls do not yet have the maturity or ability to make such choices [17]. In addition, engaging in this kind of situation often results in negative psychological and emotional consequences, hampering their development [20]. These notes denote that, above all, the problem of child and adolescent marriage is mainly a matter of gender.

To begin to think how this issue occurs in Brazil, Taylor, Lauro, Segundo, and Greene (2015) propose a literature review from subtopics, to then analyze the productions on the subject in question. This is due to the scarcity of specific publications on this topic in Brazil and the importance of understanding the variables that eventually make up a study like this.

Souzas and Alvarenga (2001) present relevant questions regarding the decision-making process of low-income women in the city of São Paulo before starting an informal marriage or marriage. According to the authors, such motives would be mainly related to a question of "excessive" family control over their choices or search for better social and economic conditions. Marriage is then seen by the woman and her family as a life-enhancing opportunity. Greene (1995), in turn, analyzes the marriage market through a case study that discusses possible explanations for the increase of marriages and informal marriages in the state of Bahia, Brazil. Informal relationships have proved to be a more comfortable alternative for men involved in relationships with underage girls. In this way, a "recycling of relations" (sic) was observed. Another favorable point for men in relation to informality is not having to provide assistance or pay pensions if there are children involved. This type of study is relevant as it denounces the legal implications that often make informal unions independent of age.

If, in one hand, the number of publications on marriage in childhood and adolescence in Brazil has been scarce, many are those who discuss related issues, such as pregnancy³, mobility limitations, exposure to different types of violence and, finally, educational delays and other challenges (Parsons et al., 2015; Loaiza and Wong, 2012; Taylor et al., 2015). The latter, in turn, involves a number of issues that must be taken into account when being used as an object of study from early marriage cases. Almeida et al. (2006) point out dropouts and school deficits as the main issues faced by these girls.

Also associated with early marriage, the sexual exploitation of minors is another factor cited in the literature [26]. Although there are no studies focused on the effect of the Brazilian legislation on fertility,

3. Pregnancy is a factor that sometimes is not a consequence, but an incentive factor for the occurrence of marriages[28]

both pregnancy and sexual exploitation are sometimes tied to the gaps left by the Civil Code, such as the possibility of marrying girls under the age of sixteen if pregnant, including cases of sexual abuse [28].

Poverty is also a factor highly associated with early marriage. In an environment lacking financial resources and low educational level, marriage is seen as an alternative to achieve a better economic situation, being the "financial weight" of caring for a child transferred to the spouse [20]. In Brazil, economic and social inequalities are evidenced by the concentration of income [6] and, therefore, end up aggravating the issue of low educational achievement [24]. According to Almeida, Aquino and De Barros (2006), 40% of the interviewed women who had children during adolescence gave up studying. Taylor, Lauro, Segundo and Greene (2015) note in their research that the practice of marriage during childhood is not necessarily more frequent among the population living in poverty than for girls who are not in this condition, but they recognize that poverty in general is a factor in the life of girls before and during marriage and that their results may be a particular case depending on the places and chosen research methods.

The authors Taylor, Lauro, Segundo, and Greene (2015) also stress the weight of the expectation that a pre-defined social role on women exerts in relation to the theme of marriage during childhood. The unequal division of tasks within households, for example, which is institutionalized at an early age by the families, causes the girls to take responsibility for the household much earlier than the boys [25].

The report also addresses a constant in this type of marriage, which is the husbands' age. Especially in informal unions, adult males make up the relationship by claiming that younger girls are more attractive, making them also feel younger. These men also report a lack of interest in performing religious ceremonies because, according to them, it would mean a big commitment. One issue addressed in some studies is the endogenous relation between pregnancy, education, and early marriage. Lloyd and Mensch (2008) point out the strong correlation between these three and the challenges in terms of estimation, since school presence is endogenous in relation to the moment of marriage, for example. Thus, it is explicit that either child or adolescent marriage, or pregnancy before adulthood may result from common factors. These factors, called by the author of "underlying cases", include socioeconomic issues, regulations, cost of marrying, parent's educational level, among others [25].

With this question in hand, the literature suggests that the possible relationship between educational frequency, age at first marriage, age at conception of the first child, and workforce are healed with the use of instrumental variables (Machio et al., 2017; Marchetta and Sahn, 2012; Herrera and Sahn, 2013; Glick et al., 2015). Schultz (1997) points out that early marriage and first gestation are two factors that affect school attendance, while higher rates of school attendance may delay pregnancy during childhood and adolescence. Thus, a variable used would be the level of knowledge that a person has about the law on child marriage, since most unions are not officialized. Tam (2017) uses this variable to estimate the long-term effect, concluding that those who had greater contact with the law⁴, had lower odds of subjecting underage girls to marriage.

Building the analysis of this issue from a social perspective in which girls marry for reasons ranging from unstable family environment to life-changing expectations, many see education as unattractive or out of reach [9]. Therefore, once married, there is a deterioration in the prospects of education and work [11]. In this case, even if they decide to abandon their marriages, this dilemma becomes more latent to them than to girls of the same age, but who are not married [28]. Moreover, among those who remain married⁵, the partner often ends

4. The Early Marriage Restriction Act of 1929 set the marriage age for girls to 14 years old and boys at 18, which was later changed to 18 for girls and 21 for boys

5. In this work we will assign the term "married" to girls who declare themselves to be spouses and therefore may be in unions of different kinds.

up assigning household and household functions raising their children to their spouse, further discouraging their quest for educational and professional training [1].

Continuing the search for contributions at the international level, Asadullah (2016) use the low educational levels and recurrent cases of early marriage in poor neighborhoods of Bangladesh in 2012 as a motivation to study the causal effect of early marriage in the educational background of these adolescents. Using information about the time of first menstruation, they try to predict the age of the first marriage, since in patriarchal societies women experience greater pressure to marry right after the first menstruation (Field and Ambrus, 2008; Asadullah, 2016).

Thus, the authors show that those who are mothers and married before the age of eighteen have significantly lower schooling rates than those who married latter. In addition, their results indicate that children of mothers who marry too early also have lower educational outcomes. Explanations involve parental decisions, especially of mothers, who pressure their daughters to marry early. These mothers also end up investing less in their training, and this same control had no effect on boys. Asadullah (2016) also show that mothers who marry early appear to be less empowered within marriage and therefore have less influence on the educational background of their children.

This study aims to provide results on a topic that has not been explored in Brazil, empirically verifying whether the cases of child and adolescent marriage in Brazil impact in some way the educational development of girls and women. Use several years and different data sources will serve as a way to enrich the analysis by tracing a profile of Brazilian girls and adolescents and measure their relationship with educational outcomes applying econometric methods such as the *Propensity Score Matching* (PSM).

3 METHODOLOGY

To measure the possible association and impact between early marriage cases and educational outcomes of Brazilian girls and women, two sources will be used. The first will be the PNDS (National Survey of Demography and Health) for the year of 2006, and the second will be the PNAD (National Household Sample Survey) from 2002 to 2015. The first will be applied to girls and women who married before the age of eighteen, allowing to estimate the likelihood of joining a marital union before the age of eighteen that later will be applied to the PNAD data. Considering that the PNDS is the only source in Brazil that presents a question about the girls or woman's age at the time of the first union, it will be possible to calculate such probability using different controls such as geographic region, housing whether or not belonging to the urban area, income, among others. With this probability function that will be estimated from the coefficients generated by the *probit* of the first stage, it will be possible to use the same controls found in the PNAD to create a *proxy* variable for union before the age of eighteen and then obtain results using the method of *Propensity Score Matching* and its impact on education. PNAD data will be used considering the periodicity of this research being greater than the PNDS, being the first annual, compared to the decennial period of the second.

3.1 Sample and Data

3.1.1 National Demography and Health Survey (PNDS)

The PNDS of 2006 is the last edition available from the Ministry of Health, and although it does not present recent data, it has relevant elements to outline the profile of Brazilian girls analyzed here. These elements include information about the occurrence of first menstruation, performing abortions, receiving fellowships and governmental aid, use of contraceptive methods and, especially, the age at which she began

to live in some kind of union. This last issue is not addressed by the PNAD and will be essential for the analysis as a whole, since it will allow the creation of a probability function that will later be used in PNAD data as *proxy* variable for early marriage. In addition to more specific variables such as those mentioned above, the PNDS also covers issues addressed by PNAD, such as age, sex, demographic region, among others. Finding variables that are associated with the question that will be analyzed here and which are also present in both databases is one of the primary factors of this analysis, since the use of the same variables will allow to obtain the coefficients that 'connects' both data bases. These common variables will be discussed later.

3.1.2 National Household Sample Survey (PNAD)

In addition to the PNDS, the PNAD, carried out by the Brazilian Institute of Geography and Statistics (IBGE), presents annual information⁶ on population in demographic and socioeconomic terms. Therefore, it was decided to use the available annual data from 2002 to 2015, allowing to try to extend the size of the results obtained from the probability model that will be generated using the PNDS data.

In spite of being an extensive database and widely used by the academy, in this case the PNAD does not offer variables as specific as those offered by PNDS. Another point of attention is the methodological capacity applied by IBGE in terms of sampling. In this case, it is necessary to consider the possibility that the PNAD does not fully capture in its sample methodological nuances of the Brazilian reality, which are generally not easily recorded, such as data captured in marginalized areas, for example⁷.

However, there are other features that support the use of this database, such as the frequency with which it occurs, its length and the number of observations. The existence of variables in common with the PNDS will also allow to extract information from the estimates that will be explained later.

3.2 Variables

3.2.1 Dependent Variable

Having in mind that this study aims to analyze the possible impact that early marriage has on educational outcomes, four variables of interest will be used in two different moments of this research. The first part involves a variable of interest using the PNDS database "Age when starting to live with the first partner" for Brazilian girls and women from 10 to 49 years old (Table 1). This variable and the probabilistic model created from it will be discussed later in the section 3.3.1. The second part involves two variables of interest based on the PNAD data: Whether or not basic education was concluded and whether or not higher education was completed⁸.

Therefore:

$$y_{1i} = \begin{cases} 1, & \text{completed basic education or more} \\ 0, & \text{or else} \end{cases} \quad (1)$$

$$y_{2i} = \begin{cases} 1, & \text{completed higher education.} \\ 0, & \text{or else} \end{cases} \quad (2)$$

Being i = female subjects between 25 and 60 years of age.

6. By the year 2015 the IBGE conducted annual surveys, having its frequency changed to quarterly results from 2016.

7. Further versions of this study will aim to introduce Census data in order to provide wider information and other comparison possibilities. The latest data is from 2010, being the next one expected to be available in 2021/2022.

8. Tests were carried out using completion of primary, secondary and higher education as variable responses, but not significantly different results were obtained between the first two, leading to the replacement of the first two with one that encompasses those who have completed elementary education.

3.2.2 Control Variables

The literature on early marriage, both international and national, is practically unanimous in pointing out which variables to consider for this type of analysis (Ainsworth et al., 1996; Asadullah, 2016; Parsons et al., 2015). These variables include (Brazilian) region of residence, whether urban or not, religion (catholic, evangelical or other), number of children born alive up to the date of the interview and age of the children, besides educational information about parents and spouses, age of the spouse, if she has a living mother, if she has already received or receives "Bolsa Familia"⁹, and finally the monthly per capita household income.

For this study, it was necessary to determine variables that possibly were associated with the issue of early marriage and which were also available in both databases. It is important that the variables be the same so that, after estimating the probability function of a girl to marry before the age of eighteen with the PNDS data, the coefficients of the variables used are used to create the new variable using the PNAD.

In the next step, to estimate the probability function and later the Propensity Score Matching, we will use variables such as: domicile located in urban or rural area, Brazilian region, labor income¹⁰, receiving school scholarships and "Bolsa Familia", if she ever had a child born alive and ethnicity (Table 1). The estimation of the latent variable that expresses the probability of a girl starting an union before the age of 18 in this case is nothing more than the application of the coefficients obtained in the first stage of the probit of the PNDS to the annual data of the PNAD using a normalized probability function. Using the same variables in this case not only ceases to be a problem, as corroborates for a more robust analysis, since they are two databases with completely different individuals, but that are analyzed from the same characteristics. Thus, the PSM will indicate what impact each of the characteristics (variables) considered exerts on education, having the woman or girl in question married or not before the age of eighteen.

3.3 Econometric Model

3.3.1 Estimating the latent variable that expresses the probability for union before age eighteen.

Again, one point of attention associated with this type of study lies in the endogeneity between the decision to marry during childhood or adolescence and to give up studies - or to leave them in the background [22]. Thus, it would be necessary to define instrumental variables that explain the decision to marry and, at the same time, do not explain the results on education conditioned to the decision to marry.

An alternative, therefore, would be to use the relevant information that exists in a not-so-updated database (PNDS) to connect to another database which, in addition to being more recent, has a longer period available for analysis so that the time effect is measured; to PNAD. Thus, the issue of endogeneity would be remedied, since different individuals will be compared, but with similar characteristics.

To use this information and create a new early marriage variable, called here "Marriage during Childhood"¹¹, from the variable "Age when you start living with the first companion" of the PNDS. Thus, using variables that are present in both the PNDS and the PNAD, the coefficients generated through the PNDS can be used to create the variable "Marriage in Childhood" using the PNAD. Therefore, the first step will be to obtain the coefficients by means of a probit using the PNDS, where:

$$Y_i^* = \beta_1 + \sum_{j=2}^k \beta_j X_{ji} + \epsilon_i \quad (3)$$

9. Social welfare program of the Government of Brazil, part of the Fome Zero network of federal assistance programs.

10. Labor income is the only income variable that is contemplated in both databases.

11. Under age 18 in this article, are considered still in childhood.

being:

Y_i^* = Latent variable for early marriage available only in PNDS "Age when starting to live with first mate".

For this, this variable will be transformed into Y_i , a dummy in which:

$$Y_i = \begin{cases} 1, & \text{if } Y_i^* > 0 \\ 0, & \text{otherwise} \end{cases} \quad (4)$$

X = Vector of Y-influenced regressors common to both PNDS and PNAD.

The latent variable presented in (3) will be used later to estimate the propensity of a girl or woman to have entered into some kind of union before the age of eighteen through PNAD data.

In this case, therefore, girls and women who have not married before the age of eighteen will be defined as counter-factual, that is, a comparison group closer to the expected one if some factor did not make them choose to marry.

Thus:

$$P_i = P(Y_i = 1) = P(y_i^* > 0) \quad (5)$$

$$P(Y_i = 1) = P\left(\beta_1 + \sum_{j=2}^k \beta_j X_{ji} + \epsilon_i > 0\right) \quad (6)$$

$$P_i(Y_i = 1) = F\left(\beta_1 + \sum_{j=2}^k \beta_j X_{ji}\right) \quad (7)$$

$$P_i(Y_i = 1) = \Phi(X_j \beta) \quad (8)$$

being:

$Y_i(1)$, if girl i has entered into any type of union before the age of eighteen;

$Y_i(0)$, otherwise (counterfactual situation).

Given that F is the cumulative distribution function of ϵ and Φ represents the cumulative distribution of the function with normal distribution, the vector of regressors, X , includes the following variables: dummies for region (south, southeast and northeast), urban area, white race, monthly income, whether or not to receive study/daycare aid and "Bolsa Familia".

Thus, by generating the probability function from the equation (8), this new variable of interest will be constructed based on the coefficients generated by the PNDS *probit* applied to the PNAD data by means of a standardized probability function, allowing not to need to find instrumental variables that were not available in PNAD.

The Figure 2 presents two histograms generated from the creation of two variables using PNDS. The first contains the prediction generated from the results obtained by the *probit* in (3), while the second one presents the series generated based on the probability function of equation (8) constructed using the coefficients presented by the *probit* (Table 2). It is possible to notice the similarity between the distributions, corroborating to the existence of robustness between the two methods. The Figure 3, shows the distribution obtained by applying the second method to the PNAD data based on the coefficients obtained by the PNDS *probit*.

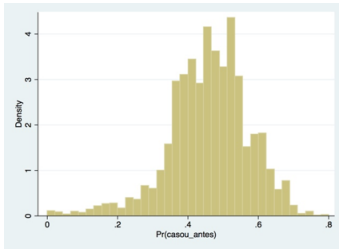


Figure 1: Variable "Marriage during Childhood" generated from the results obtained by *probit*.

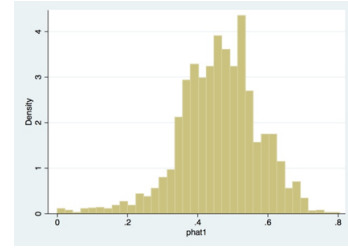


Figure 2: Series generated based on the coefficients of the probability function

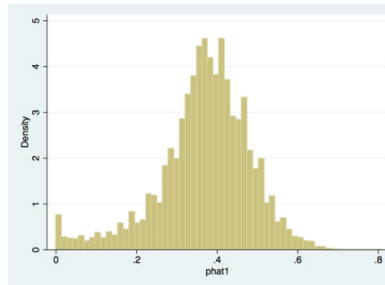


Figure 3: Histogram generated from the probability function using PNDS coefficients applied to PNAD data. Source: PNAD (2002-2015). Self elaboration.

3.3.2 Defining treatment and control groups

It is worth bearing in mind that the variable created from the latent variable applied to the PNAD, "Marriage in Childhood", represents the probability of a woman having started some kind of union before the age of eighteen, the treatment and control groups will be defined, therefore, based on those who married during adolescence and those who did not marry, respectively.

Thus, from the distributions shown in figures 2 and 3, these groups will be divided and analyzed under the 85% percentile¹² of the calculated probability distribution with respect to PNAD data, of which:

$$P(Y_i = 1) = Pr(y_i^* \geq 0.85) \quad (9)$$

$$P(Y_i = 0) = Pr(y_i^* < 0.85) \quad (10)$$

3.3.3 Propensity Score Matching (PSM)

The probability function that will measure the early marriage effect in the PNAD sample and explain the variable that will act as control and treatment, the *Propensity Score Matching* (Delprato et al., 2015; Koski, 2016; King et al., 2007) will be used to test the two groups from the probabilities estimated by the previous function. This way it will be possible to try to find pairs of participants in the treatment and control groups who are comparable. *Propensity Score Matching* can therefore be defined as:

12. There was no significant variation for tests performed with other percentages above 75%

$$P(\underline{X}) = P(T = 1|\underline{X}) \quad (11)$$

Being \underline{X} a vector composed of variables that provoke imbalance between treatment and control groups, being girls and women between 12 and 49 years of age married and not married during adolescence, respectively. These variables that belong to vector \underline{X} will be those that affect only the selection bias discussed in section 3.2.2.

Also, being \underline{X} a vector containing variables that will allow to determine the probability of being treated from the function $P(\underline{X})$, score of propensity, previously estimated by the *probit* model. Yet $T = 1$ represents whether she was 85% or more likely to have married during adolescence. In addition, it was assumed that the decision to marry does not depend on factors related to \underline{X} . Thus:

$$E[y_i|X, T = 1] = E[y_i|X, T = 0] \quad (12)$$

After estimating the models, balancing tests, sensitivity analysis and impact calculations will be performed. There are different types of pairing, being the choice of which method to use related to the set of factors that compose \underline{X} [4]. One limitation regarding this method lies in the fact that individuals contain not only a vector of observable characteristics, but also many other unobserved features. If these are correlated with the decision to marry and with the potential outcome, the method may contain selection bias.

4 RESULTS AND DISCUSSION

4.1 Descriptive Analysis and Expected Results

Based on the literature presented and the methodology to be used, it is expected that women who started some kind of union before the age of eighteen - or, in the case to be estimated, have characteristics that imply a high probability of having married in childhood or adolescence - present lower rates of completion of the analyzed educational cycles. In order to understand the results obtained and the possible aspects associated with them, the data available will be analyzed from different perspectives. Table 1 presents summary statistics of girls and women according to three age groups (10 to 14 years, 15 to 17 and 18 or more) for the beginning of the first union, according to the PNDS, while the Table 3 presents demographic information from PNAD from 2002 to 2015.

Starting the analysis of the place of residence, it can be seen that women who married before the age of 15 live in urban areas in a lower proportion compared to the other groups (65% against 71% and 78%, respectively)¹³. This data points to other studies output that women living in rural areas are twice as likely to marry earlier during adolescence [8].

From the racial point of view¹⁴, a similar relationship exists between the participation of white girls and women according to age, with 27% of them entering the first union between 10 and 14 years of age and 43% among those who entered union after eighteen years of age. Comparing this result with the values presented for other black and brown women and girls, it is possible to notice a different result pattern, with the average number of girls starting the first union before 15 years older than the following age groups.

13. According to the PNDS, in 2006 urban areas were occupied by approximately 65% e 66% of all respondents, men and women, who were 10 to 14 and 15 to 17 years old at the time of the interview, respectively. Among those who were 18 years of age or older, they represent an average of 72% of urban dwellers.

14. Values presented for self-reported white, black and brown women, only.

In addition, observing the results for those who declared themselves to be black or brown, there is a movement contrary to that presented by whites, corroborating the idea that the theme of early marriage may be essentially related to a racial issue [28]. Bearing in mind that the context that leads to child marriage in Brazil is commonly associated with situations of poverty inherently related to race [21], it is expected to observe a negative racial effect on education among those who have declared themselves to be non-white and marry during adolescence. This factor will serve as a justification for assessing whether there are also significant impacts of child marriage on schooling from a racial perspective.

Again, both the age at first intercourse and the age at first pregnancy increase according to the age range, both of which are around the age of fourteen for girls whose first union occurred before 15 years¹⁵. One point of attention is the 9.32 standard deviation presented on the age of the 1st relation, evidencing a possible relation with the problematic about cases of child sexual exploitation [26].

Differently from the previous variables, the average age of the spouse did not present great differences between the age ranges, remaining around 38 years. Using as a basis for interpretation that the women who answered the questionnaire remained with the same man with whom they entered the first union, one could assume a difference of age of 5 to 8 years between the spouses according to the age range decay.

In terms of geographic distribution, it was observed that unions before the age of 15 occur mainly in the north and northeast, similar information presented by Taylor et al. (2015), in which only between the years 2003 and 2011 there were a generalized drop in marriage numbers in Brazil, but the same movement did not occur for the states of the North and Northeast. Among those who started the first union between 15 and 17 years, one can notice a greater prevalence in the South and Midwest regions, while those that belong to the third age range belong mostly to the Southeast and South regions.

Considering that more than 80% of the sample was working when the survey was conducted in spite of the age range the girl got into her first union, once again it is possible to notice the increasing income discrepancy between women. These values almost triplicate between those that joined a union before the others, starting from R\$ 286.70 and reaching R\$ 674.20. Observing the household income corresponding to each range, it is also possible to note that women who started union before age 15 belonged, on average, to families with lower incomes, reaching less than 2 minimum wages¹⁶, while those families whose women belong to the other two age groups receive on average a little less than three minimum wages (R\$ 859.60) and four minimum wages (R\$ 1,383.8).

Still according to PNDS data and following the same division for age range of the first union, Table 4 presents the summary measures for variables related to schooling, thus allowing us to trace the profile of these women and then to assume possible expected results for the *Propensity Score Matching* which will be estimated below. Observing the results, it is possible to note the possible effects associated with the early union in the educational formation of Brazilian girls and women.

Those who started unions before age 15 were, on average, the majority of those who did not have any type of schooling (despite being a low number), 1.5% compared to 0.76% among those who started union between 15 and 17 years of age and 0.25% among women whose union occurred after seventeen years of age. The same pattern in a similar proportion occurs between those who attended only Elementary School or Technical Course, while none of the women in the sample who belong to the age group at the time of the first union have a postgraduate degree, being also a minority in the Higher Education courses.

Looking now at the annual results presented by Table 5 for PNAD, it is possible to see a slight decrease

15. T tests performed to verify and ensure difference in values between age groups.

16. Values of R\$ 350.00 for the minimum wage in 2006 - approximately US \$163.00 with commercial dollar quoted at 2.15.

in the average number of married adolescents before the age of eighteen over the years¹⁷. This number, which in 2002 represented approximately 10% of the sample, was reduced to 7% by 2015. A similar drop could be observed among married women aged 18 or 19 years, but the same does not occur among respondents above age of 19 years. For the latter group, there have been no significant changes over the years, indicating that women continue to initiate marriages, despite the increase in numbers related to divorce and female heads of household, surpassing 40% in 2015 [5].

4.2 Regression Results

Before evaluating the effects of early marriage on each educational cycle obtained when executing the *PSM* (Section 3.3.3), it is necessary to observe the impacts that each variable mentioned above generates on the propensity of a girl or woman who have observable characteristics similar to the ones that married before or after the age of eighteen.

Table 6 contains the *probit* coefficients generated in Section 3 as the basis for the Propensity score Matching of each educational cycle. Each cycle, therefore, was used as a dependent variable based on the treatment dummy created as a proxy for early marriage.

Regarding basic education, the results indicate that there was no racial significance for white girls in relation to marriage before the age of eighteen, while for higher education, this relationship was positive. This result goes against the intuition initially expected that white girls are less likely to marry before the age of eighteen and not the other way around, as observed in Table 1. No information or similar results have been identified in the literature to explain this relationship, leading us to believe that a justification could be associated with income, a variable that was not included at this stage, although in this case having better financial conditions does not serve as a guarantee that child marriage can not occur in this context [28].

Still on the results presented in Table 6, it is possible to see that for both types of education, girls living in urban areas are less likely to join an union before the age of eighteen. This is because, in addition to having greater access to school and transportation, there is a better chance of occurrence of enrollment, attendance, and knowledge about the Statute of the Child and Adolescent [25]. In addition, informal relationships may end up happening to a greater extent in rural areas because they are considered part of a "cultural tradition" [28]. Like those living in the South and Southeast regions, the opposite occurs, however, for those residing in the northeast region, meaning a greater propensity to marry before reaching the age of majority.

Observing the other results related to white and nonwhite women (Table 7), it is possible to see that all those residing in urban areas are less likely to enter into marriage before reaching the age of majority. Again, the explanation for this phenomenon remains independent of ethnicity. Among the regions analyzed, there was consensus among the results for all regions, meaning that regardless of schooling, those residing in the Northeast region are more likely to join in before the age of eighteen. This same pattern could be observed for the South and Southeast regions, but now indicating a lower propensity on the part of the girls and women of this sample.

When it comes to the effects of early marriage on each educational cycle obtained when executing the *PSM*, the initial results were negative for the difference between the values generated for treatment (married during adolescence) and control (other women who married after the age of eighteen) in both educational levels (Table 8). This result shows that those who started a union before the age of eighteen presented a lower chance of finishing a given educational period when compared to their peers with similar characteristics, but who, in the second case, started their first union after the eighteen years.

17. A statistically significant mean difference was observed for marriage data between the analyzed years.

< Table 8 >

The effect of marriage before the age of eighteen on the completion of basic education mainly shows how early marriage serves as a disincentive to study, and each additional year of basic education may be associated with lower risks of marriage during adolescence and pregnancy [30]. In addition, this disincentive factor is linked to the fact that for a marriage to occur before the age of eighteen, it would be necessary that the responsible ones allowed the emancipation of the daughter¹⁸. Thus, once emancipation is granted based on the marriage relationship, the compulsory school enrollment and attendance imposed by the Brazilian Statute of the Child and Adolescent, would be no longer applied. This breach in the system may open precedents so that girls in union during adolescence may fail to study.

Wodon (2018) also supports the idea that, although the social norm associated with child marriage is explicit and involves largely family members seeking some kind of protection for their daughter, access to quality educational settings would be the best way to combat early marriage, regardless of country.

In the higher education scenario, the difference was lower, 13% against the 21% related to basic education. This would be because, in theory, those who reach higher levels of education, continued their studies because of different other incentives, which could be from a characteristic related to their own - or even the husband's - income, since the married teenager in a context with more financial resources would not have to take on a larger share of tasks and could rely on the help of third parties to ensure the rearing of any children while studying [23].

Now targeting outcomes among white and non-white women, we again found negative results regarding differences between treatment and control groups (Table 9).

< Table 9 >

Among those who finished primary education, white women who joined a marital union before the age of eighteen are less likely to complete this educational cycle when compared to those who came into union after reaching the age of majority (Table 6). Viewed from the perspective of the universe of nonwhite women, there is also a lower propensity to complete the educational cycle when the union happens before the age of eighteen, but to a lesser extent when compared to white women. A possible explanation could be associated with the idea that, when compared to the others, the proportion of non-white women between 18 and 24 years of age who had not finished high school and were not attending school by themselves is already higher than of white women¹⁹.

Upchurch et al. (2002) show in their study that in cases of women who first married, interrupted their studies and had no children, 2.9% were black compared to 6.8% of white and Hispanic women evaluated²⁰, justifying that one of the reasons may be associated with the fact that black women tend to either drop out of school or have children and then carry out the remaining steps.

In addition, when the proportion of people by level of education is assessed among white and non-white women, it is necessary to consider factors that lead to proportions that initially appeared similar between both races for results on complete Elementary and Incomplete Secondary Education (14.3% and 14.5% for white

18. According to the Civil Code 2002, in the 5th term, single paragraph, II, the law does not require a minimum age for emancipation through marriage. Still in the Civil Code 2002, article 1,520, the marriage of minors of 16 years can occur, exceptionally, without case of pregnancy.

19. This proportion reaches 25% for white women compared to 37% for black women and births (IBGE, Demographic Census 2010).

20. It is necessary to emphasize that in this study the authors did not apply the same methodology used in the present study and neither have the same objective, since they focus on examining the determinants that lead to the fertility of North American women outside marriage and their effects on events such as education - taking into account the issue of endogeneity. See table 2, p. 317, of their study for more information on the different scenarios analyzed.

and non-white, respectively), but differing in the following educational levels, reaching a proportion of 17.7% of white women with complete Higher Education compared to 6.7% for non-white women (Figure 4).

5 CONCLUSION AND FURTHER WORK

This study aims to contribute under different aspects to the issue of early marriage in Brazil. In the foreground is the lack of up-to-date data and a deep analysis of its true situation in Brazil. This subject has been explored more assiduously in recent years as a result of initiatives to combat this and other gender issues that have structural sexism as its common denominator.

Thus, this study contributes to the measure that offers a new strategy to deal with the lack of data faced by those who study the problem of early marriage in Brazil. The variable created as a *proxy* for early marriage, which was generated from a probability function based on the coefficients obtained by the PNDS, could then be transformed into a new treatment variable. This process in itself would already allow the analysis of the impacts of early marriage under different aspects beyond the educational issue discussed here.

In addition to the contribution in terms of strategy for data analysis, this paper also offers results on the impacts of early marriage on the educational background of Brazilian girls and women over the last years. In addition to the descriptive analysis presented, the *Matching* performed between the variable generated for treatment and control allowed to obtain the effects of early marriage on education. These effects, therefore, were negative in relation to completion of basic and higher education, by approximately 21% and 13%, respectively. This information is supported by the preliminary results presented both in Table 8, and in Figure 4 where it is possible to observe the inverse relationship between the highest attended series versus the age of the first union based on PNDS data.

After repeating the *PSM* exercise by segmenting the sample among white and non-white women, the difference in the impact of early marriage on education reaches approximately 27% among white women and 15% among non-white women for completion of Basic Education 15% for white and 12% for nonwhite impact on higher education. Thus, women who have observable characteristics similar to the ones that married before the age of eighteen tend to conclude less frequently both types of education compared to those who marry after reaching adulthood regardless of their color.

Bearing in mind that access to education and encouragement of parents to it serve as primary factors for the decrease in the occurrence of early marriage in Brazil [25] and that pregnancy during adolescence also serves as a point of attention linked to both cases of early marriage studies such as this become relevant as they provide an estimate of this issue based on data from recent years.

Thus, it is suggested that for future studies the technique used here is improved so that the probability function becomes increasingly capable of capturing the nuances that characterize the profile of those who initiate a union before reaching the age of majority. It is also expected that new data will be made available and some already existing variables, reviewed, so that they can be better utilized in the analysis.

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6 TABLES

Table 1: Summary statistics - PNDS (2006)

Variables	All	First Union (age)		
	(15 to 49 years)	10 to 14	15 to 17	18 or more
Age	35.13 (7,806)	32.02 (8,663)	33.17 (8,136)	36.25 (7,320)
Urban Area	0.754 (0.431)	0.647 (0.479)	0.708 (0.455)	0.784 (0.411)
White	0.401 (0.490)	0.269 (0.444)	0.354 (0.478)	0.434 (0.496)
Black	0.0964 (0.295)	0.116 (0.321)	0.101 (0.302)	0.0919 (0.289)
Brown	0.457 (0.498)	0.542 (0.499)	0.495 (0.500)	0.434 (0.496)
Age - 1st Intercourse	18.46 (8,123)	14.22 (9,318)	15.94 (5,374)	19.86 (8,359)
Age - 1st Pregnancy	20.51 (6,064)	14.97 (2,301)	17.18 (3,128)	22.43 (6,332)
Husband's Age	38.80 (9,556)	38.10 (10.14)	38.05 (10.10)	39.17 (9,235)
Region				
North	0.166 (0.369)	0.305 (0.458)	0.190 (0.390)	0.144 (0.350)
Northeast	0.184 (0.387)	0.225 (0.418)	0.185 (0.389)	0.181 (0.385)
Southeast	0.211 (0.408)	0.116 (0.321)	0.196 (0.397)	0.225 (0.418)
South	0.240 (0.427)	0.161 (0.368)	0.221 (0.415)	0.255 (0.436)
Midwest	0.199 (0.399)	0.193 (0.395)	0.207 (0.405)	0.196 (0.397)
Monthly income	579.5 (933.0)	286.7 (303.8)	420.7 (746.1)	674.2 (1026.2)
Household Income	1241.6 (1843.4)	620.9 (717.2)	859.6 (1125)	1383.8 (2054.7)
Receives School / Daycare Aid	0.0282 (0.166)	0.0522 (0.223)	0.0359 (0.186)	0.0230 (0.150)
Receives Housing Assistance	0.204 (0.403)	0.293 (0.456)	0.258 (0.438)	0.173 (0.378)
Living Son	0.983 (0.131)	- -	0.990 (0.0986)	0.978 (0.148)
Works	0.897 (0.304)	0.867 (0.340)	0.894 (0.308)	0.900 (0.300)

Table 1 continued from previous page

Observations	4,916	272	1,331	3,284
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Source: Author's computations using data from PNDS, 2006.

Table 2: Coefficients obtained after probit (PNDS 2006).

Variables	Married before age 18	
	(1)	(2)
Urban	-0.203 *** (0.05)	-0.224 *** (0.0487)
White	-0.109 * (0.05)	-0.119 ** (0.0464)
Region		
Northeast	-0.170 ** (0.06)	-0.140 ** (0.0577)
Southeast	-0.243 *** (0.06)	-0.253 *** (0.0578)
South	-0.240 *** (0.06)	-0.251 *** (0.0578)
Monthly Income	-0.000 *** (0.00)	-0.000322 *** (8.5x10-5)
School aid	0.275 * (0.12)	
Housing assistance	0.159 ** (0.06)	
Constant	-0.363 *** (0.06)	-0.291 *** (0.0538)
Observations	4,878	4,880

Standard errors in parentheses
*** p <0.01, ** p <0.05, * p <0.1

Source: Author's computations using data from PNDS, 2006.

Table 3: Summary statistics PNAD (2002-2015)

Variable	Mean	Standard Deviation	Minimum	Maximum
Woman	0.513	0.499	0	1
Age	31.18	9.680	16	49
Husband's age	41.71	11.46	16	65
Income	2,014	7,500	0	925,000
Household Income	780.3	2,251	0	100,000
Married	0.440	0.496	0	1
Mother is alive	0.763	0.424	0	1
Ethnicity				
White	0.449	0.497	0	1
Black	0.075	0.263	0	1
Brown	0.467	0.498	0	1
Geographic Region				
Midwest	0.107	0.309	0	1
South	0.151	0.358	0	1
North	0.140	0.347	0	1
Northeast	0.309	0.462	0	1
Southeast	0.291	0.454	0	1
Urban Area	0.811	0.390	0	1
Education				
Elementary (ES)	0.181	0.385	0	1
Attended ES	0.331	0.470	0	1
ES Completed	0.074	0.261	0	1
Attended High School	0.284	0.450	0	1

Table 3 continued from previous page

Higher education	0.085	0.280	0	1
Postgraduate studies	0.008	0.092	0	1
No education	0.218	0.413	0	1
Observations	4,982,683			

Source: Author's computations using data from PNAD, 2002-2015.

Table 4: Summary statistics for Schooling - PNDS (2006)

	All	First Union (age)		
	15 a 49 years	10 a 14	15 a 17	18 ou mais
None	0.00454 (0.0673)	0.0156 (0.124)	0.00763 (0.0870)	0.00245 (0.0495)
Basic Literacy	0.00702 (0.0835)	0.0234 (0.152)	0.0114 (0.106)	0.00399 (0.0630)
Youth and Adult Education Programme	0.00207 (0.0454)	- -	0.00305 (0.0552)	0.00184 (0.0429)
Elementary School	0.476 (0.499)	0.773 (0.419)	0.627 (0.484)	0.392 (0.488)
High school	0.344 (0.475)	0.145 (0.352)	0.282 (0.450)	0.384 (0.486)
Certificate Programs	0.00847 (0.0916)	0.00391 (0.0625)	0.00153 (0.0390)	0.0117 (0.107)
Higher education	0.111 (0.314)	0.0117 (0.108)	0.0374 (0.190)	0.148 (0.355)
Postgraduate studies	0.0277 (0.164)	- -	0.00839 (0.0912)	0.0377 (0.191)
Observations	4,853	256	1,311	3,259

Source: Author's computations using data from PNDS, 2006.

Table 5: Summary statistics – Female spouses. PNAD (2002-2015)

Year	Sample size	Female spouses (age)			
		Total (15 to 49)	15 to 17	18 or 19	20 to 49
2002	7,555	0.642 [0.479]	0.101 [0.302]	0.210 [0.407]	0.464 [0.498]
2003	7,436	0.643 [0.479]	0.100 [0.301]	0.219 [0.413]	0.469 [0.499]
2004	7,602	0.642 [0.479]	0.099 [0.299]	0.214 [0.410]	0.469 [0.499]
2005	7,671	0.638 [0.480]	0.109 [0.312]	0.217 [0.412]	0.469 [0.499]
2006	7,260	0.638 [0.480]	0.108 [0.310]	0.217 [0.412]	0.472 [0.499]
2007	6,721	0.622 [0.484]	0.095 [0.293]	0.201 [0.400]	0.464 [0.498]
2008	6,693	0.612	0.089	0.193	0.462

Table 5 continued from previous page

		[0.487]	[0.285]	[0.394]	[0.470]
2009	6,881	0.616	0.094	0.189	0.469
		[0.486]	[0.291]	[0.391]	[0.499]
2011	6,131	0.603	0.084	0.181	0.465
		[0.489]	[0.278]	[0.385]	[0.498]
2012	6,084	0.598	0.083	0.186	0.466
		[0.490]	[0.276]	[0.389]	[0.498]
2013	6,106	0.592	0.083	0.173	0.469
		[0.491]	[0.277]	[0.378]	[0.499]
2014	5,937	0.591	0.087	0.188	0.470
		[0.491]	[0.282]	[0.391]	[0.499]
2015	5,866	0.580	0.077	0.158	0.471
		[0.493]	[0.266]	[0.364]	[0.499]

Source: Author's computations using data from PNAD, 2002-2015.

Table 6: Propensity Score Matching Results (85% Cut)

	Concluded Basic Education	Concluded Higher Education
Ethnicity: White	-0.0004 [0.002]	0.060*** [0.003]
Urban Area	-0.600*** [0.003]	-0.585*** [0.002]
Region: Northeast	0.115*** [0.003]	0.115*** [0.003]
Region: Southeast	-0.084*** [0.003]	-0.093*** [0.003]
Region: South	-0.150*** [0.003]	-0.165*** [0.003]
Constant	0.897*** [0.006]	0.939*** [0.006]
Year Control	Yes	Yes
Observations	1,342,085	1,278,431

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Propensity Score Matching Results (85% Cut) – White and Non White Women

	Concluded Basic Education		Concluded Higher Education	
	White	Non White	White	Non White
Urban Area	-0.601*** [0.005]	-0.596*** [0.005]	-0.579*** [0.006]	-0.586*** [0.005]
Region: Northeast	0.126*** [0.005]	0.108*** [0.004]	0.127*** [0.005]	0.107*** [0.004]
Region: Southeast	-0.018*** [0.005]	-0.137*** [0.004]	-0.028*** [0.005]	-0.143*** [0.004]
Region: South	-0.097*** [0.004]	-0.216*** [0.007]	-0.115*** [0.005]	-0.224*** [0.006]
Constant	0.873*** [0.008]	0.894*** [0.007]	0.943*** [0.009]	0.926*** [0.008]
Year Control	Yes	Yes	Yes	Yes
Observations	634,906	707,179	591,722	686,709

Table 7 continued from previous page

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 8: Results - Average treatment on the treaty

ATT	Concluded Basic Education	Concluded Higher Education
Difference	-0.208**	-0.134**
S.E.	0.046	0.032
T-stat	-4.66	-4.09
Common support only	Yes	Yes

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 9: Average treaty treatment for white and non-white women

ATT	Concluded Basic Education		Concluded Higher Education	
	White	Non White	White	Non White
Difference	-0.277*	-0.148*	-0.148**	-0.123**
S.E.	0.062	0.065	0.048	0.043
T-stat	-4.47	-2.29	-3.05	-2.83
Common support only	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

7 FIGURES

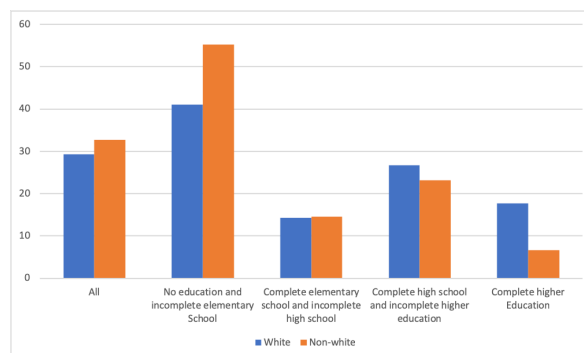


Figure 4: Proportion of people by level of education (%).
 Source: IBGE, Demographic Census 2010.