

# The Role of Daycare and Preschool in Shaping Couples' Time Allocation: Insights into Household and Labor Market Dynamics

Maria Victoria Garcia Rosa\*

Kênia Barreiro de Souza †

Adriana Sbicca ‡

## Abstract

Women are responsible for most of the domestic chores in the household, especially related to people care. This study explores the intricate relationship between childcare attendance and time allocation within Brazilian couples, emphasizing the roles of domestic chores and paid work. Utilizing a combination of Propensity Score Matching (PSM) reweighing and Seemingly Unrelated Regressions (SUR), it reveals that a child's attendance at childcare or preschool significantly reduces women's domestic chores while enhancing labor market engagement for both parents, especially impacting women fourfold compared to men. The findings suggest a potential improvement in gender equality. However, the reduction in time allocated in domestic chores by women is small and does not allow a commitment to a full-time job. Still, addressing childcare accessibility disparities is crucial for broader societal impact. Equitable childcare provision and supportive policies are essential to sustain these benefits, promoting shared responsibilities and advancing women's work-life balance and career opportunities.

**Key-words:** Time Allocation. Daycare. Propensity Score Matching. Seemingly Unrelated Regression.

**JEL Code:** J13; J16; J21; J23.

---

\*Ph.D. student in Economics at the Federal University of Juiz de Fora, Juiz de Fora, Minas Gerais, Brazil. Corresponding author. E-mail: victoria.ptc@hotmail.com. ORCID: 0000-0002-0306-4603

†Professor at the Department of Economics at the Federal University of Paraná, Curitiba, Paraná, Brazil. ORCID: 0000-0002-6306-2044

‡Professor at the Department of Economics at the Federal University of Paraná, Curitiba, Paraná, Brazil. ORCID: 0000-0002-6862-9070

# 1 INTRODUCTION

Time allocation within the household is still a disparity between men and women. Despite marked progress related to gender equality, women continue to bear a disproportionate burden in domestic tasks, resulting in a reduced presence in the labor market when compared to men (BROWNING; CHIAPPORI; WEISS, 2014; GREENWOOD; SESHADRI; YORUKOGLU, 2005; GOLDIN, 1989; HECKMAN, 1974; MELO; CONSIDERA; SABBATO, 2007; DEGRAFF; ANKER, 2015; MARTIN et al., 2023).

Studies have indicated that married women with children tend to work even fewer hours in the labor market than their childless counterparts, emphasizing the substantial time allocation towards domestic duties (QUEIROZ; ARAGÓN, 2015; PAZELLO; FERNANDES, 2004). A lower fertility rate is associated with higher women's participation in the labor market (PSACHAROPOULOS; TZANNATOS, 1992; LEME; WAJNMAN, 1999), which, during the reproductive period, shows a reduction in labor supply due to childcare dedication (BIRCH, 2005; RAMOS; AGUAS; FURTADO, 2011). This trend underscores the intricate relationship between childcare responsibilities and labor market engagement. This disparity pattern in domestic chores and care-giving is observed in many countries such as Brazil (SOARES, 2019; GUIGINSKI; WAJNMAN, 2019), Western European countries, the United States (BIANCHI et al., 2000; BRINES, 1994; COLTRANE, 2000; FUWA, 2004; GREENSTEIN, 2000), and Australia.

Childcare facilities, such as daycare centers and preschools, wield substantial influence on the development of young children on factors like schooling, test scores, workforce productivity, wages, and health (GARCÍA; HECKMAN; ZIFF, 2018; GARCÍA; HECKMAN, 2021; HECKMAN; PINTO; SAVELYEV, 2013; HECKMAN; KARAPAKULA, 2019a; KRAFFT, 2015; PINTO; SANTOS; GUIMARÃES, 2017). It also has a significant impact on intricate dynamics within households (HECKMAN; KARAPAKULA, 2019b; KRAFFT, 2015), affecting the decisions and time allocations (BARROS et al., 2011; COSTA, 2007; CAMPOS; SILVA, 2020).

The presence of children in the household, especially those aged up to six years, leads to a reduction in time spent on domestic chores for men and an increase in time devoted to the labor market (SOARES, 2019). Conversely, for women, an increase in time dedicated to domestic chores is observed, accompanied by a decrease in time allocated to the labor market. This effect becomes more pronounced, particularly with younger children (GUIGINSKI, 2015; GUIGINSKI; WAJNMAN, 2019; PAZELLO; FERNANDES, 2004; BIAZETTI, 2017).

Nevertheless, children's attendance in early childhood education emerges as a crucial factor in women's time reallocation. It contributes to a reduction in time spent by mothers on domestic chores compared to total working hours and leads to an increase in time dedicated to the labor market (ATTANASIO; VERA-HERNANDEZ, 2004; HALLMAN et al., 2005;

ÁNGELES et al., 2011; CAMPOS; SILVA, 2020; REYNA; SILVA, 2021).

In this context, this study explores the intricate relationship between childcare attendance and the redistribution of time among couples between household chores and paid work. Using Brazilian data from the National Household Sample Survey (PNAD) and employing the Propensity Score Matching (PSM) and Seemingly Unrelated Regression (SUR), this research aims to elucidate how childcare attendance influences the allocation of time in households with children aged zero to five years old, enrolled in childcare compared to those whose children do not attend.

This study advances the literature by examining the impact of children attending daycare and preschool on couples' time allocation, utilizing simultaneous equations. It is noteworthy that all the referenced studies focus on individuals rather than couples. However, the decision-making process regarding time allocation within a household is a joint endeavor, except in single-parent households.

The subsequent sections delve into the methodologies employed, dataset descriptions, obtained results, and concluding insights

## 2 METHODOLOGY

In non-randomized studies, propensity score (PS) weighting methods are often used to adjust for potential confounding factors when estimating treatment effects. The PS is the probability of receiving a treatment, conditional on the observed covariates. It can be used as a balancing score to compare treatment groups. Therefore, with the use of PS, it is feasible to obtain, under certain conditions, results that mimic some aspects of a randomized trial study design and allow an appropriate estimation of the causal effects. Within this study, the matching method employed for reweighting was the nearest neighbor method with replacement, allowing individuals from the control group to be matched with more than one individual from the treatment group.

To conduct this analysis, the identification of couples followed this methodology: initially, households containing a head and their spouse were selected. Subsequently, verification was performed to confirm that the spouses were in a heterosexual relationship <sup>1</sup>. Following this step, the database was filtered to include only couples with children up to five years old in the household. Finally, couples with children in this age range attending daycare or preschool were the control group, while couples whose children did not attend these institutions were considered the treatment group. After the propensity score matching procedure<sup>2</sup>, the generated weights were applied in the Seemingly Unrelated Regression (SUR), described below.

---

<sup>1</sup> Despite being able to identify homosexual couples, the sample size for these couples is too small to allow for separate analysis.

<sup>2</sup> The variables used and the PSM results are provided in Appendix A.

## 2.1 Seemingly Unrelated Regressions

The intra-household decision of the couple's labor supply and household chores can be analyzed through the lens of the collective decision model developed by [Donni and Matteazzi \(2018\)](#), in which the family is composed of two individuals with rational and potentially different preferences. Decisions are made through interactions between the couple and produce responses that are Pareto efficient. Some exogenous factors can affect the family's decision process, called by [Bourguignon et al. \(1993\)](#) as distribution factors.

In this study, the distribution factor utilized is the age difference, as employed in studies such as [Vermeulen \(2005\)](#), [Maciel \(2008\)](#), [Fernandes and Scorzafave \(2009\)](#), and [Hendy and Sofer \(2009\)](#). The age difference serves as an indicator within the marital market ([BERGSTROM; LAM, 1991](#)). This variable amplifies with the wife's age surpassing that of her husband. Consequently, when the woman is older in comparison to her husband, her bargaining power within the household diminishes. This aligns with the dynamics of the marriage market, thereby reducing her potential for exiting the marriage ([WOOLLEY, 2003](#)).

Given the simultaneous nature of intra-family labor supply decisions, the Seemingly Unrelated Regression (SUR) estimation is employed to examine the determinants impacting labor supply and the allocation of time to domestic chores. The SUR model, pioneered by [Zellner \(1962\)](#), accounts for the interdependence between partners' decisions, acknowledging their mutual influence, even in the absence of direct measurable information regarding this interrelationship.

The SUR model can be represented as follows:

$$Y_j = X_j\beta_j + \varepsilon_j \quad j = 1, 2, \dots, k \quad (1)$$

where

$$\varepsilon_j = \begin{bmatrix} \varepsilon'_1 \\ \varepsilon'_2 \\ \dots \\ \varepsilon'_k \end{bmatrix}$$

and

$$E[\varepsilon_j] = 0$$

with  $E[\varepsilon_{jt}\varepsilon'_{ls}] = \sigma_{jl}$  if  $t = s$ , and 0, otherwise, in addition  $E[\varepsilon_j\varepsilon'_l] = \sigma_{jl}I_T$ .

It is assumed that, to estimate  $Y_j$ , a total of  $T$  observations are used, making it possible to estimate the parameters  $\beta_j$  of  $k$  equations, using the set  $X_j$  of independent variables. Each equation has  $Z_k$  regressors for a total of  $Z = \sum_{j=1}^k Z_j$ . Furthermore, the assumption is also made that the data is well-behaved<sup>3</sup> and the errors ( $\varepsilon_j$ ) are not correlated.

<sup>3</sup> For more details on well-behaved data, see [Greene \(2003\)](#).

In this study, the methodology entails the execution of four regressions ( $k = 4$ ) to gauge intra-household time allocation, adhering to the conceptual framework outlined in Equation (1): specifically, two regressions targeting the distribution of time allocated to household chores for each spouse, and an additional two focusing on the allocation of time towards labor market engagements, again for each spouse.

Some selection concerns require resolution. Hourly wages for employed individuals are derived by dividing labor earnings by hours worked. However, for non-working individuals, wage information is absent and necessitates imputation via a wage equation. To mitigate potential endogeneity, the complete sample undergoes the application of the Heckman (1979) procedure. Subsequently, wages for all individuals are predicted and substituted for missing values. This methodology aligns with the approach outlined by Donni and Matteazzi (2018).

Furthermore, the study is constrained by several limitations, including: i) endogeneity issues stemming from the concurrent nature of decisions regarding enrolling children in daycare or preschool, the duration spent in the labor market, and the interdependence between fertility (as indicated by the age of the youngest child) and participation in the labor force; and ii) the potential for bias resulting from omitted variables, such as the availability of public daycare or preschool for each household. Due to limitations inherent in the dataset, these issues could not be adequately controlled.

### 3 DATA AND SAMPLE

The methodology employed for gathering time-use data varies based on the survey's objectives. Collection methods include direct observation, self-reporting, or interviews, each possessing its strengths and weaknesses (DESA, 2004). This study utilizes data from the National Household Sample Survey (PNAD) conducted by the Brazilian Institute of Geography and Statistics (IBGE), spanning from 2001 to 2015<sup>4</sup>. Within this questionnaire format, several issues emerge. Stylized inquiries may lead to an underestimation of women's time spent caring for children, as individuals might not perceive it as work or only report it when designated as the primary activity. Additionally, respondents may encounter challenges in recollecting activities performed within the mentioned period, potentially resulting in an overestimation of socially favorable or acceptable activities (MATULEVICH; VIOLLAZ, 2019; SUH, 2016; FLORO; MILES, 2003). Another constraint within the PNAD is its reliance on a single respondent per household, allowing for the possibility of one individual completing the questionnaire on behalf of another. Consequently, this may result in an under-reporting of hours for non-respondents. Notwithstanding these limitations, the PNAD remains the singular database providing valuable insights into household chore time allocation in Brazil over an extensive period.

Beyond selecting couples based on the presence of a young child aged between zero and

---

<sup>4</sup> Except 2010, during which the demographic census replaced the survey.

five years old in the household, we also targeted couples where both partners fall within the age bracket of 20 to 60 years. This age range was chosen to mitigate potential biases; individuals at the lower end of the spectrum might still be engaged in educational pursuits, reducing their participation in the labor market. Conversely, individuals over 60 are more likely to be retired, consequently limiting their involvement in market work. Moreover, individuals were excluded from the sample if they reported not having a job but displayed a positive wage if they were employed but did not receive any wage, and if couples declared zero hours dedicated to domestic chores and the labor market. Finally, we excluded households with more than one family living together, given that the collective model is directed to only two decision-makers.

The list of variables used in the model and their descriptions are shown in Table 1.

Table 1 – Variables’ Description

Variable	Description
<b>Dependents</b>	
Hou_dc	Hours spent on domestic chores.
Hou_lm	Hours spent at the labor market.
<b>Explanatory</b>	
<b>Continuous</b>	
Age	Individual’s age.
N <sup>o</sup> of children	Number of children.
Work income_w	Income from women’s work.
Work income_m	Income from man’s work.
Work income_i <sup>2</sup>	Individual income squared.
Non-Work Income	Total household income from sources other than work (i.e. cash transfer, retirement.)
Age Dif.	Age difference between the couple.
Year	Variable ranged from 1 to 14 for each year within the sample period spanning from 2001 to 2015.
<b>Binary</b>	
Childcare	Dummy equals 1 if at least one of the children is in the childcare or preschool.
Household’s head	Dummy equals 1 if the individual is the household head.
Average Education	Dummy equals 1 if the individual completed high school or less.
High Education	Dummy equals 1 if the individual has completed an undergraduate degree.
White	Dummy equals 1 if the individual is white.
Urban	Dummy equals 1 if the individual lives in an urban area.
Teenager	Dummy equals 1 for the presence of a teenager in the household.
Teenager_f	Dummy equals 1 for the presence of a female teenager in the household.
Elderly	Dummy equals 1 for the presence of an elderly in the household.
Northeast	Dummy equals 1 for households located in the Northeast region.
Southeast	Dummy equals 1 for households located in the Southeast region.
South	Dummy equals 1 for households located in the South region.
Midwest	Dummy equals 1 for households located in the Midwest region.

Source: Prepared by the authors (2024).

Table 2 presents the data descriptive statistics. It can be observed that there are 224,048 couples, without sample weight. Before the sample selection, the data had 370,952 couples. When considering domestic chores, while men allocate, on average, 9.82 weekly hours to it, the time allocated by women in this activity is around 19.66 hours per week. Regarding the labor market, men work around 43.41 hours a week, while women dedicate 37.73 hours to the labor market.

Table 2 – Descriptive Statistics

Variable	Men				Women				Dif.
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	
Hou_dc <sup>1</sup>	5.4839	8.1264	0	98	31.5695	18.4647	0	98	-26.0856***
Hou_lm <sup>2</sup>	42.7892	16.9835	0	160	18.3452	21.1279	0	155	24.4440***
Child Care	0.4174	0.4931	0	1	0.4174	0.4931	0	1	-
Age	36.0882	8.7936	20	60	32.5006	8.1073	20	60	3.5875***
Household's head	0.8763	0.3291	0	1	0.1237	0.3292	0	1	0.7526***
Average Education	0.2967	0.4568	0	1	0.3365	0.4725	0	1	-0.0398***
High Education	0.0921	0.2893	0	1	0.1022	0.3029	0	1	-0.0100***
White	0.4389	0.4962	0	1	0.4549	0.4979	0	1	-0.0160***
Urban	0.8931	0.3089	0	1	0.8931	0.3089	0	1	-
N <sup>o</sup> of children	2.1194	1.2272	1	14	2.1194	1.2272	1	14	-
Teenager	0.2595	0.4384	0	1	0.2595	0.4384	0	1	-
Teenager_f	0.1539	0.3609	0	1	0.1539	0.3609	0	1	-
Elderly	0.0302	0.1712	0	1	0.0302	0.1712	0	1	-
Income	12.4500	40.9738	0.0055	5.0000	8.7847	23.4859	0.0000	4405.62	3.6653***
Income <sup>2</sup>	1833.857	111780.7	0.0000	2.50e+07	628.7604	52899.93	7.31e-09	1.94e+07	1205.096***
Non-Work Income	151.8883	797.5248	0	154804.1	151.8883	797.5248	0	154804.1	-
Northeast	0.2841	0.4510	0	1	0.2841	0.4510	0	1	-
Southeast	0.2948	0.4559	0	1	0.2948	0.4559	0	1	-
South	0.1538	0.3607	0	1	0.1538	0.3607	0	1	-
Midwest	0.1197	0.3246	0	1	0.1197	0.3246	0	1	-
Years	6.7517	4.0274	1	14	6.7517	4.0274	1	14	-
Observations <sup>3</sup>	242,210								

Note: 1: Total hours dedicated to caring for people and/or household chores in the week. 2: Weekly working hours spent on all jobs. 3: Observations in number of couples without sample weight. \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%.

Source: Survey results based on PNAD data, 2001-2015 (IBGE, 2024).

## 4 RESULTS AND DISCUSSION

For the use of the SUR method to be adequate, the estimated equation errors cannot be correlated. Thus, to analyze the viability of the model, the error correlation matrix was estimated and the Breusch-Pagan test was performed, which must be significant to reject the null hypothesis that the covariance matrix is diagonal (BREUSCH; PAGAN, 1980). The test results, presented in Table 7 in Appendix B, are significant at 1%, supporting the suitability of applying the SUR method to all specified models. The PSM density function result is also presented in Appendix B.

Table 3 displays the outcomes derived from the SUR model after PSM reweighting<sup>5</sup>, where the majority of coefficients exhibited significance. The dataset comprises 163,466 couples. Analyzing the impact of child attendance in childcare or preschool on domestic chores reveals no discernible effect on the male side. Conversely, women experience a reduction of approximately 2 hours per week in this activity. In terms of the labor market, both men and women demonstrate an increase in time allocation, with women exhibiting a higher increment of about 4 hours per week. These findings imply that the availability of childcare and preschool facilities plays a crucial role in reshaping time distribution within households, potentially enhancing women's circumstances in the labor market.

<sup>5</sup> The variable used in the PSM model are: day-care, age, sex, household's head, average education, high education, number of children, income, non work income, race, urban area, and regions control.

Related to the educational level, an increase contributes to a decrease in time dedicated by women to domestic chores and to an increase in the time allocated to the labor market. For men, the higher the educational level, the higher the time dedicated to both activities. For men, being white is associated with a decrease in the time allocated to domestic chores and an increase in labor market participation. Conversely, residing in urban areas leads to an increase in time dedicated to domestic chores for both men and women. However, concerning the labor market, there is a decrease in time for men and an increase for women.

Additionally, as the number of children in the household rises, women tend to spend more time on domestic chores and less time in the labor market. In contrast, men experience a reduction in time devoted to both activities. In the context of having a teenager in the household, there is a tendency to decrease the time spent on domestic chores while increasing the time dedicated to the labor market. Notably, if the teenager is female, this impact is more pronounced, particularly for women, highlighting a tendency for women to contribute more significantly to domestic chores from an early age. Conversely, the presence of an elderly person in the household is associated with a modest decrease in time allocated to domestic chores and a more substantial reduction in labor market participation for the couple. These results may be attributed to the perception that caring for the elderly is not necessarily classified as a domestic chore.

The results indicate that the frequency of children attending daycare or preschool is associated with a slight reduction in the time spent by women on household chores, as well as an increase in the time spent in the labor market by the couple. This increase is more significant for women. These findings are consistent with previous research, such as the studies by ([ATTANASIO; VERA-HERNANDEZ, 2004](#); [HALLMAN et al., 2005](#); [ÁNGELES et al., 2011](#); [CAMPOS; SILVA, 2020](#); [REYNA; SILVA, 2021](#)). This suggests that the school attendance of children can positively impact household dynamics, aligning with existing literature on the subject ([HECKMAN; KARAPAKULA, 2019b](#); [KRAFFT, 2015](#); [BARROS et al., 2011](#); [COSTA, 2007](#); [CAMPOS; SILVA, 2020](#)).



Table 3 – Couple’s time allocation

Variables	Men		Women	
	Chores	Market	Chores	Market
Daycare	-0.0490 (0.0406)	0.986*** (0.0819)	-2.225*** (0.0894)	4.353*** (0.100)
Age	-0.0138*** (0.00290)	-0.214*** (0.00585)	-0.00721 (0.00641)	0.0799*** (0.00719)
Household’s head	0.551*** (0.0631)	0.961*** (0.127)	-1.812*** (0.139)	3.210*** (0.156)
Average Education	0.725*** (0.0471)	1.775*** (0.0964)	-0.977*** (0.103)	4.322*** (0.115)
High Education	0.343*** (0.0703)	4.228*** (0.144)	-8.521*** (0.155)	14.57*** (0.173)
White	-0.418*** (0.0441)	1.329*** (0.0903)	-0.140 (0.0985)	0.214* (0.110)
Urban	0.937*** (0.0769)	-1.271*** (0.155)	0.661*** (0.169)	0.814*** (0.190)
N <sup>o</sup> of children	-0.0938*** (0.0193)	-0.144*** (0.0390)	1.698*** (0.0429)	-1.625*** (0.0481)
Teenager	-0.372*** (0.0733)	0.704*** (0.148)	-1.204*** (0.162)	2.746*** (0.181)
Teenager_f	-0.605*** (0.0840)	0.132 (0.170)	-2.604*** (0.185)	2.122*** (0.208)
Elderly	-0.541*** (0.118)	-1.533*** (0.239)	-0.538** (0.261)	-0.827*** (0.292)
Work income_m	-0.00617*** (0.000762)	-0.0789*** (0.00155)	-0.00495*** (0.000975)	-0.00194* (0.00109)
Work income_w	0.00267*** (0.000775)	0.0106*** (0.00157)	-0.0269*** (0.00286)	-0.0750*** (0.00320)
Work income <sup>2</sup>	1.76e-06*** (2.64e-07)	1.83e-05*** (5.41e-07)	1.09e-05*** (1.24e-06)	2.35e-05*** (1.38e-06)
Non Work Income	0.000278*** (2.24e-05)	-0.00208*** (4.51e-05)	0.000173*** (4.92e-05)	-0.000849*** (5.52e-05)
Age Dif.	-0.00424 (0.00380)	-0.132*** (0.00766)	-0.0431*** (0.00765)	0.131*** (0.00858)
Northeast	0.0190 (0.0677)	-0.890*** (0.137)	4.746*** (0.149)	0.231 (0.168)
Southeast	0.682*** (0.0689)	0.768*** (0.139)	4.362*** (0.152)	1.704*** (0.171)
South	2.051*** (0.0818)	1.099*** (0.165)	2.165*** (0.181)	5.161*** (0.203)
Midwest	-0.00208 (0.0866)	1.577*** (0.175)	1.280*** (0.191)	2.403*** (0.214)
Years	0.0293*** (0.00530)	-0.309*** (0.0107)	-0.277*** (0.0117)	-0.137*** (0.0132)
Constant	4.354*** (0.157)	51.49*** (0.316)	29.61*** (0.315)	12.95*** (0.353)
Observations	163,466	163,466	163,466	163,466
R <sup>2</sup>	0.016	0.061	0.065	0.088

Note: \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%. Observations represented in number of couples, with sample expansion.

Source: Survey results based on PNAD data, 2001-2015 (IBGE, 2024).

## 4.1 Robustness

Given that children up to three years old require more intensive care, a robustness test was conducted on the database of couples with children in this age group. Overall, the results

are similar to those obtained in the general model. For men, the frequency of these children attending daycare increases the time spent on household chores and work, with the latter effect being smaller than in the general model. Despite the results being significant, the change is not even one hour per week. On the other hand, women reduce the time spent on household chores by about 2 hours per week and increase the time spent on work by close to 5 hours per week. The reduction in time spent on household tasks and the increase in time spent on work are more pronounced in this sample than in the general model.

Related to education levels, an increase is associated with a decrease in the time women spend on domestic chores and an increase in time devoted to the labor market. However, these changes in time allocation are smaller for both activities compared to the general model, except for the results of high education levels and labor market participation. For men, a higher educational level is linked to more time spent on both activities, with both results higher than those in the general model. Being white is linked to less time spent on domestic chores and more participation in the labor market for the couple. On the other hand, living in urban areas is associated with an increase in time spent on domestic chores for both men and women. However, concerning the labor market, there is a decrease in time for men, and the result is not significant for women.

Moreover, as the number of children in the household increases, women tend to spend more time on domestic chores and less time in the labor market. This effect is more pronounced when considering couples with children up to three years old. In contrast, men experience a reduction in time devoted to both activities. Regarding households with teenagers, only women tend to decrease the time spent on domestic chores, while it increases the time dedicated to the labor market for the couple. If the teenager is female, this impact is more pronounced in terms of the time spent on domestic chores, particularly for women. Conversely, the presence of an elderly person in the household is associated only with a reduction in the time men allocate to the labor market.

The results from the model focusing on couples with children up to three years old reinforce those of the general model, highlighting the increased burden of caring for children of this age group. This higher burden can be inferred by the fact that the frequency on child care has a higher contribution to women's time allocation.

Table 4 – Couple’s time allocation with Children Up to 3 Years Old

Variables	Men		Women	
	Chores	Market	Chores	Market
Daycare	0.184*** (0.0591)	0.814*** (0.117)	-2.241*** (0.131)	4.889*** (0.141)
Age	-0.0215*** (0.00433)	-0.171*** (0.00859)	-0.0487*** (0.00967)	0.153*** (0.0104)
Household’s head	0.578*** (0.0896)	0.973*** (0.178)	-1.779*** (0.199)	2.849*** (0.214)
Average Education	0.750*** (0.0692)	2.016*** (0.139)	-0.817*** (0.155)	4.454*** (0.166)
High Education	0.621*** (0.0994)	4.386*** (0.200)	-7.843*** (0.225)	14.83*** (0.241)
White	-0.469*** (0.0643)	1.349*** (0.129)	-0.322** (0.145)	0.318** (0.156)
Urban	0.886*** (0.113)	-1.139*** (0.225)	0.947*** (0.252)	0.181 (0.271)
N <sup>o</sup> of children	-0.108*** (0.0262)	-0.0982* (0.0520)	1.902*** (0.0591)	-1.930*** (0.0635)
Teenager	-0.0899 (0.119)	0.603** (0.236)	-2.169*** (0.265)	3.696*** (0.284)
Teenager_f	-0.948*** (0.137)	0.00882 (0.271)	-3.080*** (0.304)	1.962*** (0.327)
Elderly	-0.267 (0.175)	-2.623*** (0.346)	-0.0745 (0.388)	-0.376 (0.417)
Work income_m	-0.00539*** (0.00108)	-0.0797*** (0.00216)	-0.00330** (0.00143)	-0.00310** (0.00154)
Work income_w	0.00671*** (0.00122)	0.0169*** (0.00242)	-0.0353*** (0.00467)	-0.0816*** (0.00500)
Work income <sup>2</sup>	1.26e-06*** (3.19e-07)	1.63e-05*** (6.42e-07)	1.82e-05*** (2.44e-06)	3.25e-05*** (2.62e-06)
Non Work Income	0.000158*** (2.96e-05)	-0.00137*** (5.86e-05)	8.36e-05 (6.56e-05)	-0.000639*** (7.05e-05)
Age Dif.	-0.00779 (0.00560)	-0.114*** (0.0111)	-0.0557*** (0.0111)	0.141*** (0.0120)
Northeast	0.117 (0.0982)	-0.830*** (0.195)	4.947*** (0.218)	0.383 (0.235)
Southeast	0.928*** (0.100)	0.934*** (0.199)	4.853*** (0.223)	1.892*** (0.240)
South	2.415*** (0.117)	1.181*** (0.233)	3.055*** (0.262)	5.363*** (0.281)
Midwest	0.136 (0.126)	1.466*** (0.250)	1.605*** (0.280)	2.454*** (0.301)
Years	0.0210*** (0.00764)	-0.327*** (0.0152)	-0.247*** (0.0171)	-0.151*** (0.0184)
Constant	4.538*** (0.229)	49.70*** (0.455)	30.21*** (0.467)	11.02*** (0.502)
Observations	79,172	79,172	79,172	79,172
R <sup>2</sup>	0.019	0.053	0.070	0.112

Note: \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%. Observations represented in number of couples, with sample expansion.

Source: Survey results based on PNAD data, 2001-2015 (IBGE, 2024).

## 4.2 Singles

As a heterogeneity check, the model was separately estimated for single men and women, assuming that time dedicated to home production and the labor market is correlated only for

the same individual. The outcomes presented in Table 5 indicate that daycare is a significant factor in altering the time distribution between domestic chores and the labor market for both single men and women. Notably, the disparities are more pronounced among single men when juxtaposed with the outcomes derived from the general model. Specifically, the decline in time dedicated to domestic chores for single men is significant and the increase in labor market engagement is greater. Conversely, for women, the reduction in domestic chores and the increment in labor market participation are comparatively modest.

In terms of the number of children, the outcomes for men are statistically insignificant, whereas women tend to augment the time devoted to domestic chores and curtail the time allocated to the labor market. Conversely, having a female teenager in the household yields comparable effects on domestic chores for both single men and women. Moreover, if a single man has an elderly person in the household, there is a reduction in his time dedicated to domestic chores, while for women, there is an increase in domestic chores. This outcome suggests that single fathers may receive more support than single mothers.

Table 5 – Single’s time allocation

Variables	Men		Women	
	Chores	Market	Chores	Market
Daycare	-0.929** (0.455)	3.055*** (0.689)	-1.424*** (0.187)	3.949*** (0.233)
Age	-0.0356 (0.0242)	-0.180*** (0.0367)	0.107*** (0.00931)	-0.235*** (0.0116)
Average Education	-0.0526 (0.564)	2.522*** (0.855)	-0.887*** (0.227)	5.358*** (0.283)
High Education	-1.512 (1.068)	11.70*** (1.619)	-6.269*** (0.372)	13.34*** (0.462)
White	0.0838 (0.510)	2.137*** (0.772)	0.243 (0.206)	0.120 (0.256)
Urban	1.247 (0.813)	-4.253*** (1.231)	0.699 (0.435)	-1.396*** (0.540)
N <sup>o</sup> of children	0.219 (0.196)	0.149 (0.297)	1.360*** (0.0810)	-1.152*** (0.101)
Teenager	0.0227 (0.733)	1.764 (1.111)	0.102 (0.293)	1.870*** (0.364)
Teenager_f	-3.433*** (0.828)	-0.139 (1.255)	-3.629*** (0.313)	1.942*** (0.390)
Elderly	-1.900** (0.943)	-2.506* (1.428)	1.001** (0.392)	-3.417*** (0.487)
Work income_w	-0.0406 (0.0299)	-0.334*** (0.0454)	-0.0423*** (0.00786)	-0.184*** (0.00978)
Work income <sup>2</sup>	1.48e-05 (0.000151)	0.000992*** (0.000228)	2.27e-05*** (6.59e-06)	9.80e-05*** (8.20e-06)
Non Work Income	0.00130*** (0.000297)	-0.00541*** (0.000450)	0.000137*** (3.59e-05)	-0.000667*** (4.46e-05)
Northeast	1.060 (0.660)	-1.728* (1.000)	4.645*** (0.298)	-1.730*** (0.371)
Southeast	2.458*** (0.683)	-0.710 (1.035)	3.781*** (0.310)	0.370 (0.385)
South	1.309 (0.816)	2.131* (1.236)	2.129*** (0.382)	1.680*** (0.476)
Midwest	1.530* (0.865)	4.408*** (1.310)	1.265*** (0.392)	1.329*** (0.487)
Years	0.440*** (0.0606)	-0.313*** (0.0919)	-0.0416* (0.0235)	-0.402*** (0.0292)
Constant	7.524*** (1.426)	53.25*** (2.160)	17.58*** (0.674)	37.59*** (0.838)
Observations	2,710	2,710	33,608	33,608
R <sup>2</sup>	0.047	0.142	0.046	0.084

Note: \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%. Observations re-presented in number of couples, with sample expansion.

Source: Survey results based on PNAD data, 2001-2015 (IBGE, 2024)

## 5 FINAL CONSIDERATIONS

This study aimed to investigate the interplay between childcare attendance and the reallocation of time within couples, particularly in the context of sharing responsibilities between household chores and paid work. The results, derived from the Propensity Score Matching (PSM) reweighing used in a Seemingly Unrelated Regression (SUR), underscore the significance of a child’s attendance at childcare or preschool in shaping the time allocation dynamics within

couples. Specifically, the findings indicate that such attendance plays a pivotal role in reducing the time women dedicate to domestic chores. Additionally, noteworthy is the observed increase in time allocation to the labor market for both parents, with a notable fourfold higher impact on women.

In delving deeper into the implications of childcare attendance, the results suggest that the increased time dedicated by both parents to paid work signifies a potential shift in societal norms, challenging traditional gender roles and fostering greater gender equality in the workforce. Furthermore, the disproportionately higher impact on women's labor market engagement underscores the instrumental role that childcare facilities can play in enhancing female empowerment and economic participation.

Despite this, it is observed that the reduction in time spent on household chores by women due to the frequency of children attending daycare and preschool is quite modest, around 2 hours per week for the couples models and 1 hour per week for the single women model. This reduction is not sufficient to promote a significant entry into the labor market, especially in full-time occupations, which typically require an average of 40 hours per week. Therefore, the observed increase in time spent in the labor market is likely more related to part-time jobs. According to [Goldin \(2021\)](#), when the couple has a child someone needs to be available for the demands, which means being inserted in a more flexible job and, usually, this paper delves into women, which these results can also infer.

Regardless of the progress these findings indicate, it is crucial to acknowledge the existing challenges and disparities in childcare accessibility. A more widespread and equitable provision of affordable and high-quality childcare services is essential to extend the benefits observed in this study. Additionally, fostering a supportive environment that encourages shared responsibilities within households, coupled with targeted policy interventions, can further amplify the positive impact of childcare attendance on women's work-life balance and career advancement.

## Bibliography

ÁNGELES, G. et al. Evaluación de impacto del programa estancias infantiles para apoyar a madres trabajadoras. *Informe Final de la Evaluación de Impacto. Instituto Nacional de Salud Pública, México, 2011.*

ATTANASIO, O.; VERA-HERNANDEZ, M. Medium-and long run effects of nutrition and child care: evaluation of a community nursery programme in rural colombia. Institute for Fiscal Studies. Working Paper EWP04/06, 2004.

BARROS, R. et al. The impact of access to free childcare on women's labor market outcomes: evidence from a randomized trial in low-income neighborhoods of rio de janeiro. In: CITESEER. *World Bank Economists' Forum.* [S.l.], 2011.

- BERGSTROM, T. C.; LAM, D. The two-sex problem and the marriage squeeze in an equilibrium model of marriage markets. 1991.
- BIANCHI, S. M. et al. Is anyone doing the housework? trends in the gender division of household labor. *Social forces*, Oxford University Press, v. 79, n. 1, p. 191–228, 2000.
- BIAZETTI, M. B. L. Efeito da presença de filhos na oferta de trabalho e nos salários das mulheres brasileiras. 2017.
- BIRCH, E.-R. Studies of the labour supply of australian women: What have we learned? *Economic Record*, Wiley Online Library, v. 81, n. 252, p. 65–84, 2005.
- BOURGUIGNON, F. et al. Intra household allocation of consumption: A model and some evidence from French data. *Annales d'Economie et de Statistique*, JSTOR, p. 137–156, 1993.
- BREUSCH, T. S.; PAGAN, A. R. The Lagrange multiplier test and its applications to model specification in econometrics. *The review of economic studies*, Wiley-Blackwell, v. 47, n. 1, p. 239–253, 1980.
- BRINES, J. Economic dependency, gender, and the division of labor at home. *American Journal of sociology*, University of Chicago Press, v. 100, n. 3, p. 652–688, 1994.
- BROWNING, M.; CHIAPPORI, P.-A.; WEISS, Y. *Economics of the Family*. [S.l.]: Cambridge University Press, 2014.
- CAMPOS, A. L. M. de; SILVA, M. M. d. C. Access to early childhood education and time allocation of mothers. 2020.
- COLTRANE, S. Research on household labor: Modeling and measuring the social embeddedness of routine family work. *Journal of Marriage and family*, Wiley Online Library, v. 62, n. 4, p. 1208–1233, 2000.
- COSTA, J. S. o. d. M. Determinantes da participação feminina no mercado de trabalho brasileiro. 2007.
- DEGRAFF, D. S.; ANKER, R. Gênero, mercados de trabalho e o trabalho das mulheres. *Séries Demográficas*, v. 2, p. 163–197, 2015.
- DESA, U. World economic and social survey 2004: International migration. *United Nations Department of Economic and Social Affairs (UN DESA)*, New York, UN, 2004.
- DONNI, O.; MATTEAZZI, E. Collective decisions, household production, and labor force participation. *Journal of Applied Econometrics*, Wiley Online Library, v. 33, n. 7, p. 1064–1080, 2018.
- FERNANDES, M. M.; SCORZAFAVE, L. G. Estimação da oferta de trabalho com modelos de racionalidade coletiva: uma aplicação para o brasil. *Pesquisa e Planejamento Econômico*, v. 39, n. 2, 2009.
- FLORO, M. S.; MILES, M. Time use, work and overlapping activities: evidence from Australia. *Cambridge Journal of Economics*, Oxford University Press, v. 27, n. 6, p. 881–904, 2003.
- FUWA, M. Macro-level gender inequality and the division of household labor in 22 countries. *American sociological review*, Sage Publications Sage CA: Los Angeles, CA, v. 69, n. 6, p. 751–767, 2004.

- GARCÍA, J. L.; HECKMAN, J. J. Early childhood education and life-cycle health. *Health Economics*, Wiley Online Library, v. 30, p. 119–141, 2021.
- GARCÍA, J. L.; HECKMAN, J. J.; ZIFF, A. L. Gender differences in the benefits of an influential early childhood program. *European economic review*, Elsevier, v. 109, p. 9–22, 2018.
- GOLDIN, C. Life-cycle labor-force participation of married women: Historical evidence and implications. *Journal of Labor Economics*, University of Chicago Press, v. 7, n. 1, p. 20–47, 1989.
- GOLDIN, C. *Career and family: Women's century-long journey toward equity*. [S.l.]: Princeton University Press, 2021.
- GREENE, W. H. *Econometric analysis*. [S.l.]: Pearson Education India, 2003.
- GREENSTEIN, T. N. Economic dependence, gender, and the division of labor in the home: A replication and extension. *Journal of Marriage and Family*, Wiley Online Library, v. 62, n. 2, p. 322–335, 2000.
- GREENWOOD, J.; SESHADRI, A.; YORUKOGLU, M. Engines of liberation. *The Review of Economic Studies*, Wiley-Blackwell, v. 72, n. 1, p. 109–133, 2005.
- GUIGINSKI, J.; WAJNMAN, S. A penalidade pela maternidade: participação e qualidade da inserção no mercado de trabalho das mulheres com filhos. *Revista Brasileira de Estudos de População*, SciELO Brasil, v. 36, 2019.
- GUIGINSKI, J. T. Mercado de trabalho e relações de gênero: associação entre a presença de filhos e as condições de acesso ao trabalho das mulheres. Universidade Federal de Minas Gerais, 2015.
- HALLMAN, K. et al. Mothers' work and child care: findings from the urban slums of guatemala city. *Economic development and cultural change*, The University of Chicago Press, v. 53, n. 4, p. 855–885, 2005.
- HECKMAN, J.; PINTO, R.; SAVELYEV, P. Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *American Economic Review*, American Economic Association, v. 103, n. 6, p. 2052–2086, 2013.
- HECKMAN, J. J. Effects of child-care programs on women's work effort. *Journal of Political Economy*, The University of Chicago Press, v. 82, n. 2, Part 2, p. S136–S163, 1974.
- HECKMAN, J. J. Sample selection bias as a specification error. *Econometrica: Journal of the econometric society*, JSTOR, p. 153–161, 1979.
- HECKMAN, J. J.; KARAPAKULA, G. *Intergenerational and intragenerational externalities of the Perry Preschool Project*. [S.l.], 2019.
- HECKMAN, J. J.; KARAPAKULA, G. *The Perry Preschoolers at late midlife: A study in design-specific inference*. [S.l.], 2019.
- HENDY, R.; SOFER, C. *Within Resource Allocation in Egyptian Couples: Do Distribution Factors Matter*. [S.l.], 2009.
- KRAFFT, C. Increasing educational attainment in egypt: The impact of early childhood care and education. *Economics of Education Review*, Elsevier, v. 46, p. 127–143, 2015.



- LEME, M. C.; WAJNMAN, S. Efeitos de período, coorte e ciclo de vida na participação feminina no mercado de trabalho brasileiro. *Mercado de trabalho: uma análise a partir das pesquisas domiciliares no Brasil*, 1999.
- MACIEL, M. C. A divisão do trabalho doméstico e a oferta de trabalho dos casais no Brasil. Universidade Federal de Pernambuco, 2008.
- MARTIN, E. et al. How new mothers' and fathers' allocation of tasks relate to their coparenting relationship. *Journal of Family Issues*, SAGE Publications Sage CA: Los Angeles, CA, p. 0192513X231211460, 2023.
- MATULEVICH, E. C. R.; VIOLLAZ, M. Gender differences in time use: Allocating time between the market and the household. *World Bank Policy Research Working Paper*, n. 8981, 2019.
- MELO, H. P. d.; CONSIDERA, C. M.; SABBATO, A. D. Os afazeres domésticos contam. *Economia e sociedade*, SciELO Brasil, v. 16, n. 3, p. 435–454, 2007.
- PAZELLO, E. T.; FERNANDES, R. A maternidade e a mulher no mercado de trabalho: diferença de comportamento entre mulheres que têm e mulheres que não têm filhos. *ENCONTRO DA ASSOCIAÇÃO NACIONAL DE PÓS-GRADUAÇÃO EM ECONOMIA*, v. 31, 2004.
- PINTO, C. C. d. X.; SANTOS, D.; GUIMARÃES, C. The impact of daycare attendance on math test scores for a cohort of fourth graders in Brazil. *The Journal of Development Studies*, Taylor & Francis, v. 53, n. 9, p. 1335–1357, 2017.
- PSACHAROPOULOS, G.; TZANNATOS, Z. *Case studies on women's employment and pay in Latin America*. [S.l.]: World Bank, 1992.
- QUEIROZ, V. d. S.; ARAGÓN, J. A. O. Alocação de tempo em trabalho pelas mulheres brasileiras. *Estudos Econômicos (São Paulo)*, SciELO Brasil, v. 45, n. 4, p. 787–819, 2015.
- RAMOS, L.; AGUAS, M. F. F.; FURTADO, L. M. d. S. Participação feminina na força de trabalho metropolitana: o papel do status socioeconômico das famílias. *Economia Aplicada*, SciELO Brasil, v. 15, n. 4, p. 595–611, 2011.
- REYNA, E. F.; SILVA, M. M. da C. Preschool attendance and intra-household time allocation: Evidence from Brazil. *Brazilian Review of Econometrics*, v. 41, n. 2, 2021.
- SOARES, C. A distribuição do tempo dedicado aos afazeres domésticos entre homens e mulheres no âmbito da família. *Anais do XVI Encontro Nacional de Estudos Populacionais, ABEP*, p. 1–19, 2019.
- SUH, J. Measuring the “sandwich”: Care for children and adults in the American time use survey 2003–2012. *Journal of family and economic issues*, Springer, v. 37, p. 197–211, 2016.
- VERMEULEN, F. And the winner is... an empirical evaluation of unitary and collective labour supply models. *Empirical Economics*, Springer, v. 30, n. 3, p. 711–734, 2005.
- WOOLLEY, F. Control over money in marriage. *Marriage and the economy: theory and evidence from advanced industrial societies*, Cambridge Univ Pr, v. 105, p. 128, 2003.
- ZELLNER, A. An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American statistical Association*, Taylor & Francis, v. 57, n. 298, p. 348–368, 1962.

# Appendix A

## Constructing the wages

As it is not possible to observe the wages of individuals who are not employed, the Heckman (1979) correction is used to correct the sample selection bias. The procedure is done in two stages. First, with a probit model, the labor force participation is estimated.

The dependent variable assumes a value equal to one if the individual participates in the labor force and zero if not and is then regressed from:

$$y_i^* = \beta_i X_i + \mu_i \quad (2)$$

where  $X_i$  is a vector of explanatory variables, being age, sex, if the individual is the household head, educational level, number of children, race, region, and the year of interview. The latent probability of the individual being in the labor force  $y_i$  is not observed. What is observed is the binary dependent variable  $y$ , such that:

$$y_i = 1 \text{ if } y_i^* > 0 \text{ and,} \quad (3)$$

$$y_i = 0 \text{ if } y_i^* \leq 0 \quad (4)$$

By estimating the parameters  $\beta_i$  and  $\mu_i$ , it is possible to construct  $\lambda$ , which is called the inverse of Mills ratio, through:

$$\lambda = \frac{\phi\left(\frac{\beta X_i}{\sigma_\mu}\right)}{\Phi\left(\frac{\beta X_i}{\sigma_\mu}\right)} \quad (5)$$

where  $\phi$  is the probability density function and  $\Phi$  is the cumulative distribution function for the normal distribution. The inverse of the Mills ratio,  $\lambda$ , is included in the wage equation.

The wage equation is then calculated using:

$$w_i = \delta \lambda Z_i + \varepsilon_i \quad (6)$$

where  $w_i$  represents the wage,  $Z_i$  represents the vector of explanatory variables, given by age, sex, educational level, number of children, race, region, and the year of interview.  $\delta_i$  corresponds to the parameter set, and  $\varepsilon_i$  is the error vector.

## Results

### Heckman procedure and Wage equation

Table 6 – Heckman procedure and Wage equation results

Variables	Heckman	Wage equation
	LFP	LFP
Age	-0.00995*** (0.000255)	0.137*** (0.00736)
Women	-1.425*** (0.00608)	-11.16*** (0.685)
Household Head	0.422*** (0.00522)	1.779*** (0.298)
Average Education	0.489*** (0.00538)	5.125*** (0.215)
High Education	1.055*** (0.0106)	28.41*** (0.699)
N <sup>o</sup> of children	-0.00295* (0.00178)	-0.434*** (0.0420)
Black	0.0402*** (0.00484)	-2.629*** (0.118)
Urban	0.0544*** (0.00615)	2.936*** (0.0867)
Northeast	-0.00412 (0.00647)	-2.319*** (0.166)
Southeast	0.103*** (0.00678)	1.114*** (0.204)
South	0.232*** (0.00827)	0.148 (0.237)
Midwest	0.0897*** (0.00802)	2.412*** (0.285)
Year	-0.0305*** (0.000558)	0.217*** (0.0215)
Mills	-	13.88*** (1.168)
Constant	1.626*** (0.0133)	-1.399*** (0.464)
Observations	627,924	423,908
R <sup>2</sup>	0.2583	0.054

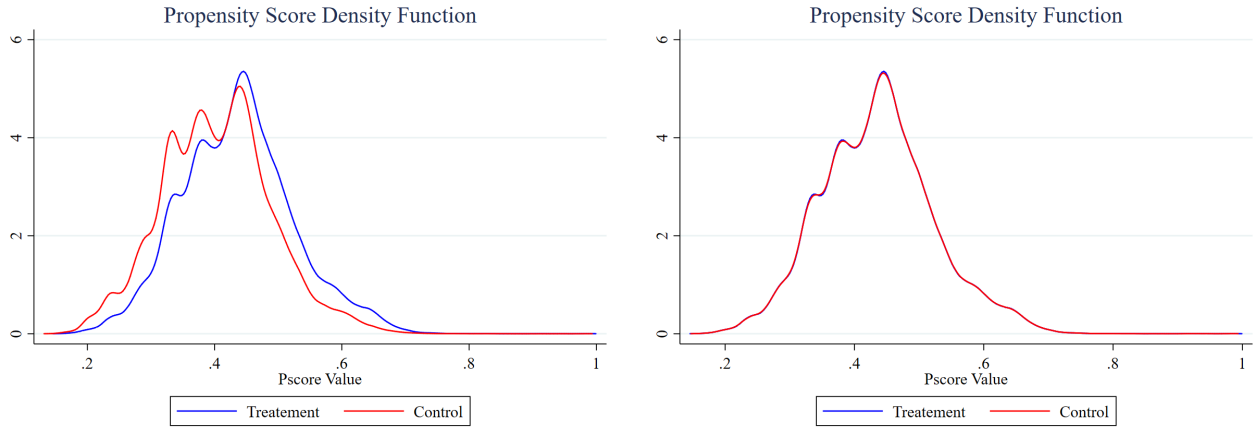
Note: \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%. Observations represented with sample expansion.

Source: Survey results based on PNAD data, (2001-2015 IBGE, 2024)

# Propensity Score Matching

## General Model

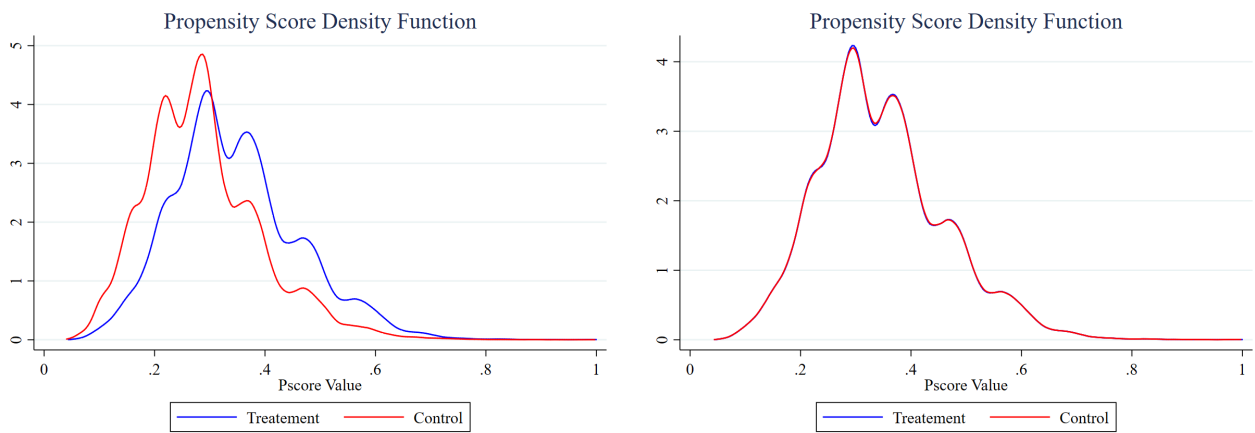
Figure 1 – Propensity Score Matching - General Model



Source: Survey results based on PNAD data, 2001-2015 (IBGE, 2023)

## Until 3 years old

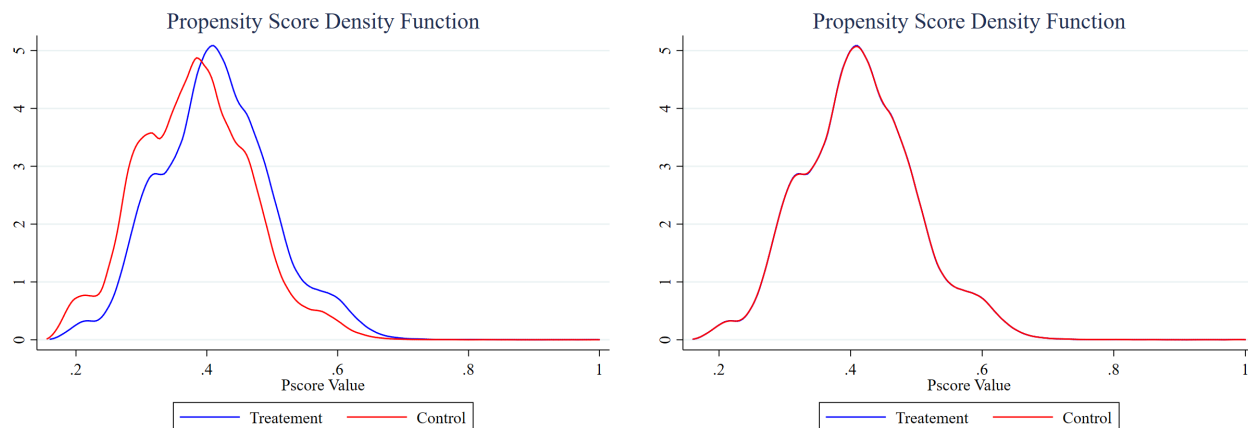
Figure 2 – Propensity Score Matching - General Model



Source: Survey results based on PNAD data, 2001-2015 (IBGE, 2023)

## Singles

Figure 3 – Propensity Score Matching - Singles Model



Source: Survey results based on PNAD data, 2001-2015 (IBGE, 2023)

## Appendix B - Breusch-Pagan test results

Table 7 – Breusch-Pagan LM Diagonal Covariance Matrix Test (SUR)

Model	Lagrange Multiplier Test	Degrees of freedom	P-Value >Chi2(6)
General Model	3.981e+04	6	0.000
Untill 3 years old	1.881e+04	6	0.000
Single Men	312.66904	1	0.000
Single Women	6163.39997	1	0.000

Note:  $H_0$ : Run OLS;  $H_1$ : Run SUR.

Source: Research results based on PNAD data, 2001-2015.