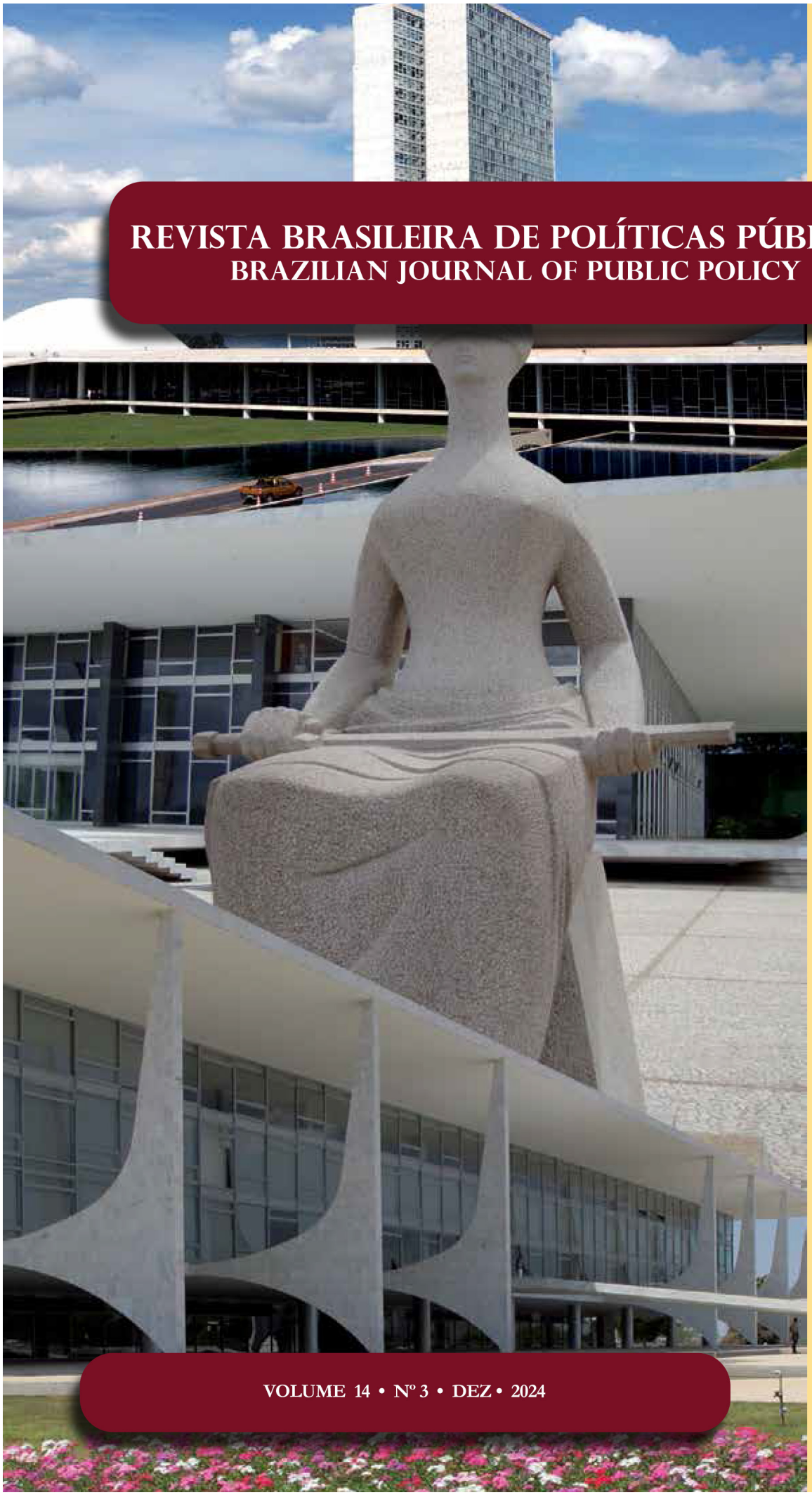

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Sumário

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A violência doméstica causa diferença salarial entre mulheres?*

Does domestic violence cause a wage gap among women?

Paulo R. A Loureiro**
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Resumo

O presente estudo tem como objetivo avaliar se a prática de violência contra as mulheres tem influência na redução dos seus salários. Utilizando dados sobre Vitimização e Justiça da Pesquisa Nacional por Amostra de Domicílios do Instituto Brasileiro de Geografia e Estatística - IBGE de 2009, construímos uma amostra contrafactual empregando o pareamento por escore de propensão para obter um contrafactual para mulheres que não sofreram violência. Este procedimento mostrou que existe de fato uma grande disparidade no salário médio entre os dois grupos, indicando que a violência contra as mulheres tem reflexo no mercado de trabalho. Para compreender os fatores que explicam a existência desta disparidade salarial, aplicámos o método de decomposição de Oaxaca e Ransom e mostramos que o diferencial salarial de 51,3% a favor das mulheres, que não sofreram violência, 34,1%, está relacionado com atributos observáveis como produtividade, enquanto 65,9% estão relacionados à discriminação estatística. Em outras palavras, o mercado de trabalho atua de forma tendenciosa contra as mulheres vítimas de violência.

Palavras-chave: violência doméstica; diferença salarial; correspondência de escores de propensão; decomposição Oaxaca-Ransom; discriminação estatística.

Abstract

The present study aims to assess whether the practice of violence against women has an influence on the reduction of their wages. Using data from the Supplement on Victimization and Justice of the National Household Sample Survey of the Brazilian Institute of Geography and Statistics - IBGE from 2009, we built a counterfactual sample employing the propensity score matching to obtain a counterfactual for women who did not suffer violence. This procedure showed that there is indeed a large disparity in the average wage between the two groups, indicating that violence against women has a reflection on the labor market. To understand the factors that explain why this wage gap exists, we applied the decomposition method of Oaxaca and Ransom which showed that of the 51.3% wage differential in favor of wo-

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men who have not suffered violence, 34.1%, is related to observable attributes such as productivity, while 65.9% is related to statistical discrimination. In other words, the labor market acts in a biased way against women who are victims of violence.

Keywords: domestic violence; wage differential; propensity score matching; Oaxaca- Ransom decomposition; statistical discrimination.

JEL Classification: H30, D90, C31, C33.

1 Introduction

Violence against women has become a pervasive issue that can affect anyone. According to the Centers for Disease Control and Prevention (2020) in the US, one in four women (27%) has experienced physical or psychological assault by an intimate partner in her lifetime. Cases of domestic violence are consistently reported to the police, with an average of two women being killed each week by their current or former male partners. According to the United States National Bureau of Statistics (2020), domestic violence accounted for 21% of all violent deaths. This underscores that violence against women is no longer merely recognized as a problem; it now has significant consequences in economic and social life, warranting deeper attention. Indeed, in 1996, the Forty-ninth World Health Assembly adopted Resolution WHA49.25, declaring domestic violence an important and growing public health problem worldwide. Countries such as the US and the UK have followed the same guidance.

The issue advances as there are significant differences in the incidence of violence against women concerning income and education levels. Women with annual incomes below US$ 10,000 experience domestic violence at a rate five times higher than those with incomes above US$ 30,000, according to the Bureau of Justice Statistics (1994). In this context, about 75% of all violence against women has a higher incidence in the lowest income groups, particularly affecting impoverished women and often perpetrated by their partners[1].

The harm inflicted on victims extends beyond the severe adverse effects on physical and mental health, transcending the private sphere and incurring a significant social cost. This cost leaves detrimental traces in income generation, impacting productivity, and creates challenges in the labor market, hindering the reintegration of victims according to Lloyd[2] ; Bowlus and Seitz[3]. Violence against women is not confined to the home; in 1992 alone, 110,000 violent incidents occurred in the workplace, resulting in 750 deaths. A 1993 study by the National Safe Workplace Institute estimated the annual cost of workplace violence to be US$ 4.2 billion. Recent years have witnessed a surge in workplace violence (2018), with women constituting 85% of all victims in 2018. The annual cost of all forms of workplace violence is approximately US$ 130 billion.

Costello and Greenwald[4] underscore the importance of raising awareness about secondary traumatic brain injury (TBI) related to domestic violence. Their goal is to highlight areas for future research focusing on the diagnosis, assessment, and treatment of TBI in this population. Despite a significant increase in

[1] AIZER, Anna. The Gender Wage Gap and Domestic Violence. *The American Economic Review*, v. 100, n. 4, p. 1847-1859, Sep. 2010. Available at: http://www.jstor.org/stable/27871277.

[2] LLOYD, Susan. The Effects of Domestic Violence on Women's Employment. *Law and Policy*, v. 9, n. 2, p. 139-167, Apr. 1997. RUBIN DB1, Thomas N. Matching using estimated propensity scores: relating theory to practice. *Biometrics,* v. 52, n. 1, p. 249-64, Mar. 1996.

[3] BOWLUS, Audra J.; SEITZ, Shannon. Domestic violence, Employment, and Divorce. *International Economic Review*, v. 47, n. 4, p. 1113-1149, Nov. 2006.

[4] COSTELLO, Kellianne; GREENWALD, Brian D. "Update on domestic violence and traumatic brain injury: A narrative review." *Brain sciences,* v. 12.1, p. 122, 2022.

research on TBI due to domestic violence in recent years, the authors emphasize the necessity for further exploration in various areas, including its effects on minority populations.

Additionally, according to Medeiros[5], violence against women is pervasive across all macro-regions of the country, irrespective of family income and racial ancestry. When encouraged to share their experiences, 43% of women reported having encountered some form of violence. Among them, 33% disclosed experiencing physical violence, 27% psychological violence, and 11% sexual harassment at some point in their lives.

According to a study by the Center for Disease Prevention and Control (2003), it is estimated that in the United States in 1995, the annual economic costs of violence perpetrated against women exceeded US$ 5.8 billion. Of these costs, approximately US$ 4.1 billion (70.7%) were attributed to direct medical and mental health services, while nearly US$ 1.8 billion (30%) accounted for indirect costs associated with lost productivity. This included approximately US$ 0.9 billion in annual expenses due to the loss of work capacity and another US$ 0.9 billion in loss of life. When adjusted to 2017 dollars, domestic violence cost about US$ 8.3 billion annually: a combination of physical and mental health costs amounting to US$ 5.8 billion, along with lost productivity costs of US$ 2.5 billion (2017).

In Canada, the economic cost of violence against women is estimated to surpass CAD 1.0 billion in annual expenditures on services, encompassing the judiciary and police. A study by Bott[6], which includes Chile and Nicaragua, estimates the impact of domestic violence on the gross domestic product, indicating women's income losses at 1.6% and 2%, respectively.

In Brazil, the situation for women facing domestic violence is concerning. According to the Mortality Information System (SIM), maintained by the Ministry of Health (MS/SVS/CGIAE), the number of homicides in Brazil was calculated by summing the ICD-10 categories: X85-Y09 and Y35, corresponding to deaths caused by aggressions (110) and interventions (112) of the ICD-BR-10 cause. The average number of female homicides increased from 1555 to 4484 between the five-year periods of 1980/84 and 2015/2019, representing an almost 188.4% increase. This corresponds to an average annual growth rate of 2.68% between the two periods. According to statistics from the World Health Organization (WHO), the femicide rate in Brazil was 4.6 (4,616 women) per 100,000 women in 2019, making it the fifth highest in the world. Given these statistics, it is evident that the issue of violence against women in Brazil demands serious attention. Therefore, there is a need to conduct studies to understand the economic effects of this problem.

Bhattacharya, Bedi, and Chhachhi[7] discovered that women's engagement in paid work and ownership of assets are linked to substantial reductions in domestic violence in Indian villages.

Anderberg et al.[8] observed contrasting effects of unemployment on men and women concerning domestic violence. While higher unemployment among men is associated with a decrease in violence, the opposite holds true for women.

The objective of this study is to investigate whether wage discrimination exists against women who have experienced domestic violence. In other words, the study aims to assess whether violence influences women's productivity, leading to a reduction in wages. To achieve this, we employ sequential procedures. Utilizing data from a sample of battered women extracted from the Basic and Supplementary Research on Victimization and Justice of the PNAD for the year 2009, we create a counterfactual based on pairing ge-

[5] MEDEIROS, Luciene Alcinda de. Violência doméstica contra a mulher: uma expressão da desigualdade de gênero. *Desigualdade & Diversidade* – Revista de Ciências Sociais da PUC-Rio, n. 10, p. 35-58, jan./jul. 2011.

[6] BOTT, Sarah; GUEDES, Alessandra; GOODWIN, Mary; MENDOZA, Jennifer Adams. *Violence Against Women in Latin America and the Caribbean*: A comparative analysis of population-based data from 12 countries. Washington, DC: PAHO, 2012.

[7] BHATTACHARYA, M.; BEDI, A. S.; CHHACHHI, A. *Marital violence and women's employment and property status*: evidence from north indian villages. Bonn: IZA, 2009. (Discussion Paper Serie, n. 4361).

[8] ANDERBERG, D. *et al. Unemployment and domestic violence*: theory and evidence. Bonn: IZA, 2013. (Discussion Paper Serie, n. 7515).

nerated by the propensity score matching method. The goal is to form a control group with characteristics like the treated group, but comprising women who, unlike the treated group, were not victims of violence. With both the treated and untreated groups identified, we apply the decomposition methodology of Oaxaca and Ransom (1994[9], 1999[10]) to investigate wage discrimination between battered and non-battered women.

In addition to this introduction, the text is structured as follows: Section 2 provides a summary of the current state of theoretical and empirical knowledge on the causes and implications of violence against women. Within this section, we also outline the specific contributions of this article. Section 3 offers an overview of domestic violence in Brazil, while Section 4 delves into the methodology. The results of the methodology are presented and discussed in Section 5. Finally, Section 6 presents the concluding remarks.

2 Causes and Economic Implications of Violence Against Women

On a theoretical level, two competing theories aim to explain violence against women. First is the theory of exposure reduction, rooted in criminology, as proposed by Dugan, Nagin, and Rosenfeld[11]. According to this theory, an increase in the employment rate for both men and women results in a reduction of domestic violence, as it decreases the time partners spend together. Conversely, the theory of male backlash, widely applied in domestic violence studies, suggests that as women's financial independence grows, domestic violence against them tends to increase. This is attributed to the established female subjection and control by oppressive partners. This theory contrasts with the economic theory of family negotiation, proposed by Farmer and Tiefenthaler[12]. According to this theory, women's economic advancement tends to balance the power dynamic in relationships. This increased economic independence enhances female bargaining power, leading to a reduction in relationships with oppressive partners. Consequently, it ensures greater respectability and interference in family decisions (Tauchen et al.[13]; Tauchen and Witte[14]; Holvoet[15]).

Jewkes'[16] study highlights that women who are more educationally, economically, and socially empowered are the most protected against violence. However, below this high level of empowerment, the relationship between empowerment and the risk of violence becomes non-linear. If violence does not decrease, it may lead to a breakdown in the family relationship. Another theory explaining violence against women is presented by Loureiro et al.[17], who argue that in the face of professional success, women are more likely to end a relationship. The spouse might perceive the other's professional success not as a reason but as an expectation that a breakup might occur. When new professional opportunities arise for both spouses, there is an indication that there is a tendency to make the union viable. Hence, Loureiro et al. demonstrate that,

[9] OAXACA, R.; RANSOM, M. R. On discrimination e decomposition of wage differentials. *Journal of Econometrics*, v. 61, n. 1, p. 5-21, 1994.

[10] OAXACA, R.; RANSOM, M. R. Identification in the detailed wage decomposition. *The Review of Economics and Statistics*, v. 81, n. 1, p. 154-157, 1999.

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[12] FARMER, Amy; TIEFENTHALER, Jill. "Domestic Violence: The Value of Services as Signals." *American Economic Review*, v. 86, n. 2, p. 274–79, 1996.

[13] TAUCHEN, H. V.; WITTE, A. D.; LONG, S. K. Domestic violence: A Nonrandom Affair. *International Economic Review*, v. 32, n. 2, p. 491–511, 1991.

[14] TAUCHEN, H. V.; WITTE, A. D.; LONG, S. K. The dynamics of domestic violence. *The American Economic Review,* v. 85, n. 2, p. 414–418, 1995.

[15] HOLVOET N. Credit and women's group membership in south India: Testing models of intrahousehold allocative behaviour. *Feminista Economics,* v. 11, n. 3, p. 27–62, 2005.

[16] JEWKES, Rachel. Intimate partner violence causes and prevention. *The Lancet*. The Lancet (British edition), v. 359, n. 9315, p. 1423-1429, 2002.

[17] LOUREIRO, Paulo R. A.; MENDONÇA, Mario J. C.; SACHSIDA, de A.; MOREIRA, Tito B. Do Economic Factors Determine the End of a Conjugal Relationship? *Revista Economia e Disinvolvements,* v. 7, n. 2, p. 38-60, 2009.

in terms of economic aspects, women are more influenced by these factors both when ending and entering a relationship, even though such factors are crucial in both scenarios. If the reason for the end of the relationship is a change in the structure of the attributes of one individual, such as an increase in social prestige, it suggests that the partners followed different paths, minimizing their knowledge of each other.

Empirical studies addressing violence against women trace back to the groundbreaking work of Gelles[18], who explored the connection between women's income and violence. His fundamental thesis posits a direct relationship between a woman's income and the likelihood of her leaving an abusive relationship. However, this study has some vulnerabilities, as it does not aim to investigate the potential endogeneity associated with women's income. Specifically, omitted variables related to income, such as education, may explain the observed negative relationship with violence. Consequently, reverse causality could occur, wherein the reduction in violence leads to an increase in productivity and, consequently, a woman's income.

Souza, Lopes, and Silva[19] highlight and analyze the attention given to perpetrators of domestic and family violence against women in Belém. Their focus is particularly on the experience of the "Specialized Center for Assistance to Men Perpetrators of Violence Against Women" (NEAH) from the State Public Defender's Office. According to the authors, NEAH is the only center within the Public Defender's Office specifically dedicated to perpetrators of domestic violence, representing a significant public policy initiative in the North of the country. The authors conclude that the public policies developed do not align with the guidelines established by the Maria da Penha Law (Law 11,340/2006) and other national documents, such as the General Guidelines for Aggressor Accountability and Education Services. It is noteworthy that the justice system still predominantly focuses on punishment, overlooking broader possibilities for addressing the problem.

To address the omitted variable problem, Bowlus and Seitz[20] employed a structural approach to estimate the adverse impact of female employment on abuse. Meanwhile, other researchers, such as Tauchen, Witte, and Long (1991)[21] and Farmer and Tiefenthaler[22], utilized panel data on victims of domestic violence to investigate the influence of changes in a woman's income over time on violence. The panel data approach allows for the consideration of time-invariant omitted-variable bias but does not eliminate the potential for inverse causality. Additionally, it's important to note that these results were obtained in the presence of relatively small sample sizes.

In a South African experiment, Pronyk et al.[23] conducted a randomized trial with women who received a combination of microfinance training and violence education. The intervention resulted in a notable 55% reduction in domestic violence compared to the control group.

Aizer (2010) addresses the limitations of prior studies by attempting to identify the relationships between the relative conditions of the female labor market and domestic violence. This is achieved using a large and representative sample of women in California, totaling approximately 15 million individuals over an extended period. What sets this sample apart is the utilization of administrative data (specifically, hospitalizations of women), independent of self-reports of violence.

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18 GELLES, R. J. Abused wives: why do they stay? *Journal of Marriage and the Family*, Menasha, v. 38, n. 4, p. 659-668, 1976.

19 SOUZA, Luanna Tomaz; LOPES, Ana Bratriz Alves; SILVA, Andrey Ferreira e. O NEAH e a atenção ao autor de violência doméstica e familiar contra a mulher em Belém. *Revista Brasileira de Políticas Públicas*, v. 8, n. 01, abr. 2018.

20 BOWLUS, Audra J.; SEITZ, Shannon. Domestic Violence, Employment, and Divorce. *International Economic Review*, v. 47, n. 4, p. 1113-1149, Nov. 2006.

21 TAUCHEN, H. V.; WITTE, A. D.; LONG, S. K. Domestic Violence: A Nonrandom Affair. *International Economic Review*, v. 32, n. 2, p. 491–511, 1991.

22 TAUCHEN, H. V.; WITTE, A. D.; LONG, S. K. The dynamics of domestic violence. *The American Economic Review,* v. 85, n. 2, p. 337-358, 1995.

23 PRONYK, P. M.; HARGREAVES, J. R.; KIM, J. C.; MORISON, L. A.; PHETLA, G.; WATTS, C.; BUSZA, J.; PORTER, J. D. Effect of a structural intervention for the prevention of intimate-partner violence and HIV in rural South Africa: a cluster randomised trial. *Lancet,* v. 2, p. 1973-83, Dec. 2006. doi: 10.1016/S0140-6736(06)69744-4.

Concerning omitted variable bias, Aizer[24] emphasizes that, to establish the causal relationship between women's income and domestic violence, what matters is the potential salary rather than the observed salary. The potential salary determines women's power of insertion and, consequently, the levels of violence.

The present study delves into the impact of violence against women on wages, advancing through the following key points. Firstly, our sample is highly significant, drawn from microdata sourced from the National Household Sample Survey conducted by the Brazilian Institute of Geography and Statistics (IBGE). In 2009, a Supplement on Victimization and Justice was added to this survey. The PNAD covers the entire national territory, excluding areas with special characteristics and yielding reliable results. The survey employs a probabilistic sample of households, drawn from a master sample of census tracts, ensuring the representativeness of results across various geographic levels.

Secondly, we constructed a counterfactual sample using the propensity score methodology based on various demographic and socioeconomic variables. This process aimed to obtain a counterfactual for women who did not experience violence (control group) with characteristics like the group of women who did suffer violence (treatment group). The analysis revealed a substantial disparity in the average salary between the two groups. The average salary of the control group was 50% higher than that of the treatment group, indicating a tangible impact of violence against women on their performance in the labor market.

Finally, to understand the nature of this difference, we applied the decomposition methodology developed by Oaxaca and Ransom. This method identifies the factors explaining the salary difference between the two groups. Results showed that out of the 51.3% salary difference between the two groups of women, 34.1% is attributed to observable attributes, while 65.9% is associated with statistical discrimination. In other words, the labor market demonstrates bias against women who have experienced violence.

3 Overview of Violence Against Women in Brazil

In this section, we present an overview of violence against women using data from various sources, including the Mortality Information System (SIM), the Health Surveillance Secretariat (SVS), the General Coordination of Epidemiological Information and Analysis (CGIAE), and the Ministry of Health (MS).

Table 1 outlines the evolution of five-year averages, depicting the numbers and rates of homicides of women from 1980 to 2019. Considering the initial five-year period (1980-1984) and the most recent five-year period (2015-2019), the average number of deaths from homicides of women has increased from 1555 to 4484, respectively.

Examining age-specific trends, the female homicide rate among those aged 15 to 29 exhibited an upward trajectory, increasing from 3.95 per 100,000 inhabitants in the 1980/1984 period to 7.00 per 100,000 inhabitants in the 2000/2004 period. Subsequently, in the 2005/2009 period, the rate declined to 6.61 per 100,000 inhabitants, only to rise again to 6.95 per 100,000 inhabitants in the 2015/2019 five-year period. This pattern correlates with regions where the proportion of young people is higher.

In the age group of 30 to 49 years, the homicide rate displayed continuous growth during the first four five-year periods, with an average annual rate of 2.3%. Specifically, it rose from 3.83 per 100,000 inhabitants in the 1980/1984 period to 6.09 per 100,000 inhabitants in the 1995/1999 period. However, during the 2000/2004 and 2005/2009 periods, there were notable declines in the homicide rate by 5.64 and 5.40 per 100,000 inhabitants, respectively. In the last five-year period (2015-2019), it once again increased to 6.82 per 100,000 inhabitants.

[24] AIZER, Anna. The Gender Wage Gap and Domestic Violence. *The American Economic Review*, v. 100, n. 4, p. 1847-1859, Sep. 2010. Available at: http://www.jstor.org/stable/27871277.

In 2019, the reported number of femicide victims reached 3738, corresponding to a rate of 3.6 femicide victims per 100,000 inhabitants in Brazil.

Table 1 - Number, Percentage (%), and Rate of Female Homicide General and by Age Groups: five-year Mean. Brazil 1980-2019

			Homicide Rate		
Year	Numbers	(%)	General	15 to 29 Years	30 to 49 Years
1980-1984	1555	9,51	2,5	3,95	3,83
1985-1989	1974	8,56	3,0	4,62	4,17
1990-1994	2634	8,55	3,8	5,40	5,07
1995-1999	3527	8,77	4,6	6,77	6,09
2000-2004	3830	7,94	4,3	7,00	5,64
2005-2009	4260	8,12	4,7	6,61	5,40
2010-2014	4658	8,41	4,8	7,63	5,97
2015-2019	4484	7,94	5,0	6,95	6,82

Source: own elaboration based on MS/SVS/CGIAE – Information System on Mortality-SIM. *Homicide rate per 100,000 population. **Young population from 15 to 29 years old and young population from 30 to 49 years old.

It's worth noting that the home consistently emerges as the primary site for intimate partner violence (IPV) for the age group 30-49. In the initial period (1980-1984), reported homicides at home accounted for 33.0%, compared to 18.7% on public roads and 33.0% in hospitals. Even with a decline in the 2015-2019 period, the incidence of violence against women at home remained highest at 34.2%, surpassing public roads (19.1%) and hospitals (22.6%).

Table 2 - Five-Year Mean of the percentages (%) of Homicide of Women by Age Grupo and Place of occurrence. Brazil 1980-2019

Period	Domicile			Public Street			Hospital		
	Total	15 to 29	30 to 49	Total	15 to 29	30 to 49	Total	15 to 29	30 to 49
1980-1984	33,4	28,6	34,0	18,8	21,6	18,7	33,3	34,4	33,0
1985-1989	31,1	26,3	34,3	20,8	23,7	19,6	31,9	33,0	31,0
1990-1994	28,7	24,3	31,5	24,1	27,0	22,6	32,0	33,7	31,4
1995-1999	26,1	25,5	34,2	26,9	25,4	20,5	30,3	33,0	30,9
2000-2004	27,5	26,7	37,4	27,8	26,4	18,0	28,4	31,6	30,7
2005-2009	23,3	28,1	37,7	28,6	27,3	18,3	25,3	27,5	29,0
2010-2014	27,9	28,3	38,1	30,6	30,0	20,8	23,6	24,4	25,8
2015-2019	29,5	33,0	34,2	28,9	27,3	19,1	21,4	20,2	22,6

Source: own elaboration based on MS/SVS/CGIAE – Information System on Mortality-SIM. *Homicide rate per 100,000 population. **Young population from 15 to 29 years old and young population from 30 to 49 years old.

This data underscores a concerning trend of escalating homicide rates in Brazilian regions over eight five-year periods from 1980-1984 to 2015-2019 based on table 3. According to Loureiro et. al. (2017), the study suggests potential explanations for the surge in violence in the North, Northeast, and Midwest regions, including increased income, a limited capacity to combat crime, and the migration of drug traffickers—an area for future research. These findings highlight the pervasive and constant threat posed by the violent behavior of males towards females in Brazil.

Table 3 – Evolution of the Homicide Rate by Region: Brazil 1980 – 2019

	North	North-east	South-west	South	Mid-west
1980-1984	10,85	10,25	16,34	9,92	14,80
1985-1989	15,47	12,91	21,47	10,64	18,77
1990-1994	18,53	14,96	27,24	13,59	21,61
1995-1999	17,66	17,84	34,97	14,47	26,14

	North	North-east	South-west	South	Mid-west
2000-2004	20,88	21,81	35,05	18,18	29,37
2005-2009	28,18	29,08	23,73	22,39	29,26
2010-2014	35,84	37,52	20,00	22,20	34,92
2015-2019	42,72	41,43	16,84	21,69	31,52

Source: DataSUS

As depicted in Table 4, the proportion of firearm use in homicides of women exhibited irregular behavior over time. The data suggests that firearm-related deaths increased at rates higher than other means, rising from 30.5% in the first period (1980-1984) to 53.7% in the fifth period (2000-2004). However, between the sixth period (2005-2009) and the last years (2015-2019), an inverse trend is observed, with the proportion decreasing from 51.7% to 50.8%.

A substantial deceleration in the use of cutting and/or penetrating instruments in female homicides has been observed in the last 40 years, from 24.8% in the 1980/1984 five-year period to 25.2% in the 2015/2019 period, equivalent to a slight increase in the annual rate of the relative share at 0.04%. However, this increase did not occur continuously, alternating periods of rapid decreases and increases in this instrument of death. In the time interval between 1980/1984 and 1995/1999, a loss of proportionality was recorded: from 24.8% to 17.7%, respectively. This was thanks to an annual growth rate and diversification of other means of committing murder, such as firearms (increase of 2.4% in the same period). The use of sharp and/or penetrating objects started to grow more slowly from the fourth five-year period 1995/1999, period in which reductions in the proportions of firearm use in femicide were reported.

In examining the other two means employed in femicide on a smaller scale, hanging/strangulation and blunt objects, notable trends have been observed. The participation of hanging/strangling in homicides decreased from 4.1% in the first period (1980-1984) to 3.9% in the fourth five-year period (1995-1999). Subsequently, it increased to 5.2% in the years 2000-2004 and reached approximately 6.3% in the 2015-2019 interval. On the other hand, the use of blunt objects began to be recorded in the vital statistics database from 1996 onwards. Between the five-year average of 1995-1999 and the five-year average of 2015-2019, the data in Table 6 indicates a reduction from the highest proportion recorded in the first period (10.9%) to around 7.2% in the last period.

Table 4 – Five-Year Averages of the Percentages (%) of the Means Used in Feminicides. Brazil 1980-2019

	North	North-east	South-west	South	Mid-west
1980-1984	10,85	10,25	16,34	9,92	14,80
1985-1989	15,47	12,91	21,47	10,64	18,77
1990-1994	18,53	14,96	27,24	13,59	21,61
1995-1999	17,66	17,84	34,97	14,47	26,14
2000-2004	20,88	21,81	35,05	18,18	29,37
2005-2009	28,18	29,08	23,73	22,39	29,26
2010-2014	35,84	37,52	20,00	22,20	34,92
2015-2019	42,72	41,43	16,84	21,69	31,52

Source: MS/SVS/CGIAE – Mortality Information System – SIM. *The notification started to be registered from the years of 1996.

Table 7 reports the distribution of female homicides by schooling level in percentages over the period 1980-2019. The table illustrates a shift in the decomposition of proportions of homicides by schooling, indicating a decrease in illiterate individuals from 17.6% in the period 1980-1984 to 3.7% in the last five-year period 2015-2019. The average annual homicide rate of illiterate women decreased by 2.8% over 40 years, dropping from 34.8% in the first five-year period (1980-1984) to 23.6% in the last five-year period (2015-2019).

Table 5 highlights a significant protective relationship between intimate partner violence (IPV) and women's schooling, especially for those with more than 7 years of education. Contrarily, higher rates of domestic violence were found for women with elementary and high school education, not for those without schooling.

Over the observed period from 1980 to 2019, levels of violence have increased, primarily concentrated among women with 1-2 years of education, rising from 44.3% to 44.1% in the 1980-1984 and 2015-2019 five-year periods, respectively. It's notable that as the participation of women with no schooling in homicides decreased, the percentages of violence among women with 7 to 11 years of schooling increased.

Importantly, the relationship between women's schooling and IPV, particularly with more than 7 years of studies, displayed a significant protective association that has shown a decline over the years.

Table 5 – Five-Year Percentages (%) of the Feminicides by Education levels. Brazil 1980-2019.

Period	Any Educ	1st Degree	2nd Degree	Higher	IGN
1980-1984	17,6	44,3	2,2	1,2	34,8
1985-1989	12,5	46,4	2,8	1,0	37,3
1990-1994	10,3	44,4	3,8	1,5	40,1
2000-2004	5,5	38,4	10,3	3,9	41,8
2005-2009	4,6	38,8	14,9	4,9	35,8
2010-2014	3,8	43,6	18,3	4,4	29,9
2015-2019	3,7	44,1	23,4	5,2	23,6

Source: DataSUS. Own elaboration based on MS/SVS/CGIAE – SIM.

Your statement effectively highlights the challenges in Brazil's criminal justice system, emphasizing the low effectiveness of public security and prevention mechanisms, such as policing, investigation, trial, and imprisonment. The significant rate of impunity for criminals is identified as a contributing factor to the overall growth of criminality in the country. Additionally, the mention of favoring the statute of limitations on crimes as a practice that stimulates the increase in criminal activity adds depth to the analysis of systemic issues within the legal framework. Overall, your statement provides a clear overview of key issues affecting the criminal justice landscape in Brazil.

Your analysis effectively brings attention to additional factors influencing the increase in the number of crimes in Brazil. The mention of the prisoner salary, specifically the reclusion allowance, highlights an interesting perspective regarding the financial considerations for individuals entering the world of crime. The potential financial protection for the family in the event of arrest could indeed be a significant factor in the decision-making process for individuals involved in criminal activities.

Additionally, the discussion of the privileged forum or forum by function prerogative sheds light on a systemic issue that may contribute to illegality. The idea that crimes can be committed by individuals protected by legislation they themselves have created raises concerns about the principle of equality before the law. Your statement provides valuable insights into the multifaceted nature of factors contributing to the complex landscape of criminality in Brazil.

Your insight into the protection of individuals under 18 years of age as a potential incentive for entering the world of crime adds another layer to the complex dynamics influencing criminal behavior. The questioning of such protection mechanisms underscores the need for a nuanced examination of policies and practices related to juvenile justice. This consideration, along with other highlighted factors, contributes to the formation of a cultural context where social subjects may emerge, and their stories become entwined within the world of criminality or on the peripheries of socially accepted norms.

Your observation emphasizes the importance of understanding the cultural and systemic aspects that shape individuals' choices and the development of their histories within the broader context of crime and

societal standards. This recognition of the multifaceted nature of influences on criminal behavior enriches the analysis of the factors contributing to the complexities of the criminal landscape in Brazil.

The inclusion of data from the PNAD Victimization and Justice survey (2009) provides valuable insights into the underreporting of domestic violence cases among women in Brazil. The fact that only 56.4% of battered women reported the crimes indicates a significant gap in the disclosure of such incidents. The primary reasons for not reporting intimate partner violence (IPV) are crucial aspects highlighted in your statement. The data revealing that distrust in the police is the main cause for not reporting (30.7% of battered women) emphasizes the importance of building trust in law enforcement agencies to encourage victims to come forward. Additionally, the fear of retaliation by the partner, affecting around 16.8% of victims, underscores the complex dynamics that can prevent individuals from seeking help. The statement effectively sheds light on the challenges and barriers that contribute to the underreporting of domestic violence, offering a comprehensive view of the factors that impact victims' decisions to disclose or withhold information about their experiences.

4 Methodology: Propensity score matching and Oaxaca e Ransom decomposition

4.1 Propensity score matching

The use of the propensity scores matching technique to identify a counterfactual group of women who did not experience the treatment, specifically in the context of domestic violence. The mention of this technique being widely used in the literature indicates its established utility in various research contexts. The reference to Rosenbaum and Rubin[25] further solidifies the credibility and historical significance of the propensity score matching method.

This explanation provides a clear distinction between the propensity score matching technique and pure matching, offering valuable insights into the methodological evolution involved. The comparison to pure matching, where each unit in the treated group is matched with untreated units, highlights the limitations of relying solely on observed characteristics.

However, finding a good match for each element treated requires matching as closely as possible the determinants of an individual's decision to enroll in the program. If the number of relevant characteristics observed is very large, it may be difficult to identify a match for each of the units in the treatment group. However, if the pairing is done with a small number of variables, it is very likely that a good match will not be found for those enrolled in the program. Therefore, we have a difficult choice when making use of pure matching.

In the propensity score matching methodology, it is not necessary to compare each treated unit with its untreated pair. Instead, for each unit in the treatment and control group, the probability of experiencing violence is calculated, based on observable characteristics, known as the propensity score. This score, inserted in the interval (0.1), summarizes all the observed characteristics of the units, since they influence the probability of enrolling in the program. Having calculated the propensity score for all units, the units in the treatment group can be combined with those belonging to the untreated group that have the closest propensity score. The "closest units" become the comparison group and are used to produce an estimate of the counterfactual.

[25] ROSENBAUM, P. R.; RUBIN, D. B. The central role of the propensity score in observational studies for causal effects. *Biometrika*, v. 70, n. 1, p. 41-55, 1983.

More specifically, to estimate β_{ATT} it is necessary to find individuals belonging to the treated and control groups that can be compared, after adjusting for the characteristics observed for each individual i associated with a vector $X_i = [X_{i1}, \ldots, X_N]$, where X_{ij} is the characteristic j of the individual j. The conditional independence hypothesis is also considered.

$$Y(1), Y(0) \perp S \mid X, \text{ for } \forall X \quad (1)$$

This hypothesis implies that selection is based solely on observable characteristics and that all variables that simultaneously influence treatment assignment and potential outcomes are observed, which of course is a very strong hypothesis. It should also be considered that matching becomes more and more problematic as the dimensionality of X increases[26]. Rosenbaum and Rubin suggest so-called balance scores. According to the authors, if the potential outcomes are treatment-independent, conditional on X, then they are also treatment-independent, conditional on a balance $b(X)$.

The propensity score, $p(S=1 \mid X) = P(X)$, is the probability of the individual participating in the treatment (in this case, the woman suffers physical violence) given the observed factors X, so that the conditional independence hypothesis must be rewritten as

$$Y(1), Y(0) \perp S \mid P(X), \text{ for } \forall X \quad (2)$$

Thus, it is possible to find the treatment effect for each value of X_i through the difference of the means of $Y(1)$ and $Y(0)$ (Rosenbaum and Rubin, 1985). In this way, equation (2) can be rewritten as:

$$\beta_{ATT} = E\{E[Y_i \mid p(X_i), S_i = 1] - E[Y_i \mid p(X_i), S_i = 0]\} \quad (3)$$

p(Xi) is estimated using the probit model. To match the treated group (women who suffer violence) and the untreated group (women who do not suffer violence), three algorithms are used: 1 nearest neighbor, 5 nearest neighbors, and kernel matching (a treated person compared with a weight of the people in control). To assess the quality of matching, the tests proposed by Dehejia and Wahba[27] are used. Pseudo-R^2 values close to zero indicate that the model has less power to explain the treatment condition, evidencing a good quality of matching. Additional evidence is the joint non-significance of the regressors in the Likelihood Ratio (LR) test. The quality of matching can also be observed by the reduction of bias after matching, given by the difference in mean and median between the observable characteristics of the control and treatment groups. Additionally, the difference in the means of the covariates before and after the matching is analyzed. For the propensity score matching to be applied, in addition to the conditional independence hypothesis, some additional conditions are necessary. First, it is necessary that all treated units correspond to some untreated unit. However, it may happen that there are treated units that do not find any units in the untreated group with similar propensity scores. In other words, there may be a "lack of common support" or little overlap between the propensity scores of the treatment group and those of the untreated group. Second, it must be ensured that there are no systematic differences in the characteristics of treatment and control units, in addition to requiring an extensive set of data. Hainmueller[28] (2012) also points out that, when estimating propensity scores, it is often difficult to jointly balance all the covariates, being necessary to use iteration until a satisfactory balancing solution is reached.

[26] Which is known as the conditionality curse.

[27] DEHEJIA, R.; WAHBA, S. Propensity Score Matching Methods for Nonexperimental Causal Studies. National Bureau of Economics Research Working Paper No. 6829, forthcoming Review of Economics and Statistics. 2002.

[28] HAINMUELLER, Jens. Entropy Balancing: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies". *Political Analysis,* v. 20, n. 1, p. 25-46, 2012. Winner of the 2013 Warren Miller Prize for the best work appearing in Political Analysis the preceding year.

4.2 Decomposition of Oaxaca and Ransom

Wage discrimination is generally defined as unequal treatment of equally productive individuals with respect to pay. One of the purposes of this study is to observe not only labor market conditions, but also the external circumstances (non-market factors), in which their effects are implemented through the utility function of the agents involved. To investigate wage discrimination between battered and non-abused women, the decomposition methodology of Oaxaca and Ransom[29],[30] will be used. The gross wage differential between the two groups of women is defined by:

$$B_{(NA,A)} = (\frac{S_{NA}}{S_A}) - 1 \qquad (4)$$

where **S**NA is the salary of non-aggressed women, and **S**A is the salary of battered women. In a non--discriminatory wage structure in the labor market, the wage differential between the two groups of women only expresses the difference in productivity, since

$$P_{(NA,A)} = (\frac{S_{NA}}{S_A})^0 - 1 \qquad (5)$$

SNA/SA is the observed wage rate between the two groups of women. $(SNA/SA)^0$ is the salary rate in the case of absence of discrimination. 0 denotes no discrimination. From the two equations (4) and (5) it is possible to obtain the discrimination coefficient (DNA,A), defined by the proportion variation between (PN A,A + 1) and (BN A,A + 1), such that

$$D_{NA,A} = \frac{S_{NA}/S_A - (S_{NA}/S_A)^0}{(S_{NA}/S_A)^0} \qquad (6)$$

In the absence of wage discrimination, both groups receive competitive wages and thus earn according to their marginal productivities. We have that (SNA/SA)0 = PMgNA/PMgA, where PMgNA and PMgA are the marginal products of non-aggressed and battered women, respectively. Since (SNA/SA)0 is unknown, estimating DNA,A is equivalent to estimating (SNA/SA)0. In terms of natural logarithm, we have:

$$\begin{aligned} ln(D_{NA,A} + 1) &= ln(S_{NA}/S_A) - ln(S_{NA}/S_A)^0 \\ &= ln(S_{NA}/S^0_{NA}) + ln(S^0_A/S_A) \\ &= ln(\theta^0_{NA} + 1) + ln(\theta^0_A + 1) \end{aligned} \qquad (7)$$

where $\theta^0_{NA} = (S_{NA}/(S^0_{NA})) - 1$ represents the difference between the wages of non-aggressed women and the wages they would receive in the absence of discrimination, and θA0 = (SA0 /SA) − represents the difference between the wages of battered women and the wages they would receive in the absence of discrimination. We must:

$$ln(\overline{S}_{NA} = \widehat{\beta}_{NA}\overline{X}_{NA} + e_{NA}) \qquad (8)$$

$$ln(\overline{S}_A = \widehat{\beta}_A\overline{X}_A + e_A) \qquad (9)$$

[29] OAXACA, R.; RANSOM, M. R. On discrimination e decomposition of wage differentials. *Journal of Econometrics*, v. 61, n. 1, p. 5-21, 1994.

[30] OAXACA, R.; RANSOM, M. R. Identification in the detailed wage decomposition. *The Review of Economics and Statistics*, v. 81, n. 1, p. 154-157, 1999.

where lnSNA is the logarithm of the wages of women who have not been battered (equation 8) and ln(SA) is the logarithm of wages of the battered women (equation 7), Xi is the vector of individual characteristics, βi is the parameter to be estimated, and finally, ei is the random error, which are assumed to be independent and identically distributed (iid).

Equation (10) describes the decomposition of the difference in the logarithm of the average salary between non-battered and battered women.

$$\overline{lnS_{NA}} - \overline{lnS_A} = \beta^*(\overline{X}_{NA} - \overline{X}_A)' + \overline{X}'_{NA}(\widehat{\beta}_{NA} - \beta^*) + \overline{X}'_A(\beta^* - \widehat{\beta}_A) \quad (10)$$

where lnSN A − lnSA is the difference between the logarithms of the average wages of non-battered and battered women, respectively. The parameter β* is the vector constructed from the coefficients that determine wages in the absence of discrimination, as proposed by Cotton (1988). β* is calculated using the equation β* = pNAβNA − pA.βA, where pNA and pA are the proportions of non-aggressed and battered female labor in the labor market in the private sector. βNA is the vector of coefficients for non-aggressed women and βA is the vector of coefficients for battered women. XNA and XA are the vectors of media characteristics of non-aggressed and battered people, respectively.

The first term on the right side of equation (10), $\beta^*(\overline{X}_{NA} - \overline{X}_A)'$ refers to the portion of the differential attributed to the difference in productive characteristics between non-aggressed and battered women, called the "endowment effect". The second term, $\overline{X}'_{NA}(\widehat{\beta}_{NA} - \beta^*)$, refers to the share of the wage differential attributed to women who were not battered. The third term, $\overline{X}'_A(\beta^* - \widehat{\beta}_A)$, in turn, refers to the portion of the wage differential attributed to battered women. The wage differential attributed to discrimination would be given by the sum of the second and third terms of the equation, the "coefficient-effect". In the absence of discrimination, the differential is explained only by human capital and other measurable variables. Oaxaca and Ransom work with an adequate selection of the non-discriminatory structure and propose to estimate it as a weighted average return of the two structures, determining its value by the expression:

$$\beta^* = \Omega\widehat{\beta}_{NA} + (I - \Omega)\widehat{\beta}_A \quad (11)$$

where W = is a weighting matrix and I is a diagonal unit matrix (identity matrix as explained by Oaxaca and Ransom. The weights W are calculated as $(X'X)^{-1}(X'_{NA}X'_A)$ where X is the matrix of regressors for the entire sample of groups.

5 Analysis of Results: Oaxaca and Ransom Propensity and Decomposition Score

5.1 Propensity score

Table 6 reports the variables chosen to calculate the propensity score: demographic (age, sex, marital status, race and family arrangement); socioeconomic (salary, education, experience, work experience, experience squared, and housework); and the treatment variable (domestic violence). These variables are considered for the calculation of the propensity score because they are associated with the observed characteristics of the woman to quantify the effects of treatment as confounding components in a cross-sectional population-based household study carried out by the PNAD/IBGE in 2009. Real salaries (2009) were deflated according to the IPCA/FGV deflator at May 2019 prices, in natural logarithm, conditioned by working hours.

Table 6 - Description of the Variables used in the Models: PSM

Terminology	Variable	Definition
1.Treat	Treated	=1 if the woman was assulted and O c.c.
2.Educ	Eduction	Years od Studies
3.Experience	Experience	Experience = age-studies-6 years old
4.Exper2	Experience^2	Experience squared
5.Domes	Domestic	=1 if the individual is a domestic and O c.c.
6.Divor	Divorced	=1 if the individual is divorced and O c.c.
7.Cas	Married	=1 if the individual is a married and O c.c.
8.NpessFam	NpessFam	Number of people in the family
9.NanosWork	NanosWork	Number of years of work
10.CheDom	Head of Household	=1 if the head of household has a job and O c.c.
11.DomSpouse	Supose at Domicile	=1 if the domicile supouse has a job and O c.c.
12.FilDom	Son at Home	=1 if the children live in the household and O c.c.
13.Black	Black	=1 if the person is black and O c.c.
14.White	White	=1 if the person is white and O c.c.
15.Motheralive	Mother alive	=1 if the woman has a live mother and O c.c.
16.Age	Ages	Ages of residents living in the households
17.ExpEduc	ExpEduc	Experience times Education
18.Wreal	Wages	Real Wages of Woman

Source: PNAD2009/IBGE. Own elaboration based on MS/SVS/CGIAE – SIM.

The microdata from the Basic and Supplementary Surveys on Victimization and Justice of the PNAD 2009/ IBGE report some statistics on battered and non-abused women in 2009 (Table 7). It can be seen that the battered women had, on average, an income from their main job (Rendatrab) of R$ 528,4 and education (educ) of 7,7 less than those not battered who had an income from their main job of R$ 1,021 and education (educ) of 8,4. These data may indicate that, in general, having less than one year of schooling and being a victim of domestic violence causes strong differences in the salary gains of these women. Another point to highlight is the age, which, on average, is lower for battered women, 33,1 years when compared to non-aggressed women, 37,3 years.

Table 7 – Descriptive Statistics if PNAD 2009

Variables	Aggressed Woman Average Standard Deviation		Non-Aggressed Woman Average Standard Deviation	
Lnwage	528,40	634,0	1021	1869,4
Educ	7,70	3,8	8,4	4,3
Age	33,10	9,5	37,3	13,1
NpessFam	3,30	1,7	3,5	1,4
Motheralive	0,81	0,39	0,75	0,43
Exper	19,3	11,0	22,9	14,7
NanosTrab	3,8	5,8	7,2	9,2
Fildom	0,34	0,47	0,39	0,49
Chedom	0,39	0,49	0,30	0,46
Conjdom	0,19	0,39	0,20	0,40
White	0,43	0,50	0,46	0,50
Black	0,08	0,27	0,07	0,26
ExpEduc	127,4	84,8	159,7	126,7
Married	0,25	0,43	0,48	0,50
Divor	0,16	0,37	0,06	0,24
Domes	0,31	0,46	0,08	0,28

Source: IBGE/PNAD/2009

Table 8 shows twelve explanatory variables: educ, exper, exper2, domes, desq, anostrab, chedom and conjdom, which are statistically significant at the 5% significance level. However, these independent variables, Npessfam, fildom, black and white are not statistically significant. The point worth noting is that when only the explanatory variables that are statistically non-null are included in the propensity score model, the variables were unbalanced between the treated and untreated units. When all explanatory variables were included, the specification of the propensity score model satisfactorily met the condition of balancing the variables. Thus, it was decided to include them in the propensity score model because they are associated with the attribution of treatment.

Table 8 – Estimates of the Coefficients of the Probit Model (psmatch2) to Determine the propensity Score.

Variables	Coefficient	t - test
Educ	-0,027***	(-5.41)
Exper	0,020***	(3,82)
Exper2	-0,001***	(-5,90)
Domes	0,475***	(11,19)
Divor	0,405**	(7,43)
Npessfam	-0,004	(0,83)
Nanostrab	-0,012***	(-3,79)
Chefedom	0,212***	(2,17)
Conjuguedom	0,192	(3,02)
Filhodom	0,034	(0,66)
Black	0,027	(0,40)
White	0,040	(-1,1)
Cons	-2,785***	(-24,11)
N = 189.998,	Loglikelihood	-2402,08
LR chi^2 (13) = 342,69	McFaddens Pseudo R^2	0,062

Source: IBGE/PNAD/2009. T statistic in parentheses. *p < 0,10, ** p < 0,05, *** p < 0,01

The variables included in the model showed the expected signs (Table 8). A positive coefficient means that an increase in the predictor leads to an increase in the predicted probability. A negative coefficient means that an increase in the predictor leads to a decrease in the predicted probability, for example: the coefficient of educ is –0,027. This means that an increase in the educ score decreases the predicted probability of treatment; the chedom coefficient is 0,21. This means that an increase in the children's score increases the predicted probability of treatment; the coefficient of desq is 0,40. This means that an increase in the dissociated score reduces the predicted probability of treatment. The prediction of the probability of the woman having declared suffering domestic violence is 28,2%.

After several estimates were made, the set of these variables provided the best fit of the model. Brookhart et al.[31], suggested that variables that do not affect exposure, but that do affect outcome, should always be included in the propensity score model. In addition, they noted that including variables that affect exposure, but not outcome, will increase the variance in the estimated treatment effect without a concomitant reduction in bias (Table 9). In this case, a graph was made of residuals versus variables not included in the model.

Table 9 – Balancing the Variables used in Pairing.

	Mean		%	t-test	
Variables	Treated	Control	Bias	t statistic	p > t
Educ	7,728	8,108	9,3	-1,26	0,209

[31] BROOKHART M. A.; SCHNEEWEISS S.; ROTHMAN K. J.; GLYNN R. J.; AVORN, J.; STÜRMER, T. Variable selection for propensity score models. *American Journal of Epidemiology,* v. 163, p. 1149–1156, 2006.

	Mean		%	t-test	
Variables	Treated	Control	Bias	t statistic	p > t
Exper	19,155	18,461	5,4	0,82	0,411
Exper2	484,07	452,86	4,5	0,78	0,438
Domes	0,328	0,334	-1,6	-0,17	0,867
Divor	0,164	0,127	11,9	1,34	0,181
Npessfam	3,347	3,173	11,1	1,39	0,164
Nanostrab	3,678	3,081	7,8	1,44	0,151
Chefedom	0,071	0,096	-10,5	-1,14	0,256
Conjuguedom	0,229	0,229	0,00	0,00	1,000
Filhodom	0,223	0,223	0,00	0,00	1,000
Black	0,084	0,077	2,30	0,29	0,773
White	0,418	0,409	1,90	0,24	0,811

Source: IBGE/PNAD/2009.

The evidence presented in Table 10 reports the test of the difference of the means of the variables in the treatment and in the control before and after the pairing. It is observed that the treatment records 604 cases in both the paired and 323 unpaired samples, while the control reports 169.580 cases in the unpaired sample and 323 in the paired sample. The null hypothesis test is that the difference in the means is null, that is, the means of the two groups are statistically equal. Before matching, almost all means were statistically non-null, however after matching, the test result indicates that the null hypothesis of equality of means between the treatment and control groups cannot be rejected. This means that the balancing condition is satisfied. The differences between the treatment group and the control group are no longer significant, that is, the covariates after matching become similar in both groups.

Table 10 – Treatment and Control Groups, before and after Matching by

Variables	Sample		Nearest Neighbor			
		Treatment	Control	Difference	D.S.	t-Value
Educ	Unmatched	7,728	8,41	-0,683	0,242	-2,83
	Matched	7,728	8,10	-0,381	0,305	-1,25
Exper	Unmatched	19,155	22,855	-3,700	0,818	-4,52
	Matched	19,155	18,461	0,693	0,848	0,82
Exper2	Unmatched	484,065	738.461	-254,396	46,483	-5,47
	Matched	484,065	452.858	31,207	40,469	0,77
Domes	Unmatched	0,328	0,085	0,243	0,016	15,62
	Matched	0,328	0,334	-0,006	0,037	-0,17
Npessfam	Unmatched	3,347	3,498	-0,152	0,080	-0,189
	Matched	3,347	3,173	0,173	0,125	1,39
Nanostrab	Unmatched	3,678	7,182	-3,504	0,509	-6,88
	Matched	3,678	3,080	0,598	0,418	1,43
Chedom	Unmatched	0,071	0,048	0,024	0,012	1,98
	Matched	0,071	0,096	-0,025	0,022	-1,13
Conjdom	Unmatched	0,229	0,166	0,063	0,021	3,06
	Matched	0,229	0,229	0,000	0,033	0,00
Fildom	Unmatched	0,223	0,255	-0,032	0,024	-1,31
	Matched	0,223	0,223	0,000	0,033	0,00
Black	Unmatched	0,084	0,072	0,011	0,014	0,79
	Matched	0,084	0,077	0,006	0,021	0,29
White	Unmatched	0,418	0,452	-0,034	0,028	-1,23
	Matched	0,418	0,409	0,009	0,039	0,24

Variables	Sample		Nearest Neighbor			
		Treatment	Control	Difference	D.S.	t-Value
Ps R^2		0,002				

Source: IBGE/PNAD/2009. t statistic in parentheses. *p < 0,10, ** p < 0,05, *** p < 0,01

5.2 Decomposition of Oaxaca and Ransom

Table 11 shows the results of three regressions using estimators by the OLS, V.I. (instrumental variables) and GMM with Bootstrap, allowing the verification of their relative performances, as well as the examination of the parameters estimated with the data obtained. Given the probability that education is an endogenous variable, and if the salary equation is estimated by ordinary least squares (OLS), the parameter estimators will be biased and inconsistent. Estimates from the OLS equation is reported in column (1). Columns (2) and (3) report the results of the instrumental variable methods that make it possible to correct the problem of endogeny or reverse causality between salary and education. The estimations made it possible to do exercises with the use of different instruments. The instruments used consisted of family socioeconomic variables and regional factors. Column 3 of table 12 reports the results of the estimated coefficients of the model by GMM-VCE (Bootstrap). Efron[32], as well as Efron and Tibshirani[33] developed a statistical method, called Bootstrap, which makes it possible to estimate confidence intervals for the parameters by more precise points and with less distortion of the standard deviations, from a resampling system with replacement. to the original sample.

Table 11 – Estimates of the Effects of Domestic Violence: PNAD 2009

LnWage	OLS	t	2SLS	z	GMM	z
Treat	-0.349	-8.06***	-0.346	-7.78***	-0.346	-7.75***
Npessfam	-0,025	-16,3***	-0,029	-18,6***	0.029	-29.9***
Exper2	-0.001	-74.8***	-0.001	-73.1***	-0.001	86.9***
Educ	0.122	229***	0.110	178***	0.110	161***
Exper	0.045	103***	0.043	96.1***	0.043	86.9***
Married	0.173	41.2***	0.182	41.8***	0.182	44.4***
White	0.227	58.3***	0.256	62.9***	0.256	63.2***
Chefedom	0.016	10.5***	0.100	9.57***	0.100	7.41***
Filhodom	0.013	2.77***	0.014	2.94***	0.014	3.67***
Constant	4.726	462***	4.841	437***	4.842	411***
N	157.699		157.699		157.699	
R^2 Adjusted	0.33		0.33		0.33	
F(9, 157689)	9623		7094			
Wald chi^2 (9)					47039	
Sargan test			0.1739			
0.165						

Source: IBGE/PNAD/2009. Victimization and Justice Supplement – PNAD – National Survey by Household Sampling. Brazilian Geographic and Statistical Institute. t statistic in parentheses. *p < 0,10, ** p < 0,05, *** p < 0,01.

Both the F statistic in the models in columns 1 and 2 and the Wald test in column 3 have as a null hypothesis, the joint nullity of the parameters of the estimated models. The values are listed at the bottom of Table 11. Null hypotheses are rejected at the 1% significance level, so the estimated models are statistically

[32] EFRON, B. *The jackknife, the bootstrap and other resampling plans*. Philadelphia, Penn: Society for Industrial and Applied Mathematics, 1982.

[33] EFRON, B.; TIBSHIRANI, R. J. An Introduction to the Bootstrap (Chapman and Hall/CRC Monographs on Statistics and Applied Probability). 1993.

different from zero. Thus, the null hypothesis is rejected, and it is concluded that the applied model has statistical relevance to interpret the phenomenon. The statistical importance of each explanatory variable on the studied variable is given by Student's t and standardized normal statistics that have the null hypothesis H0: the explanatory variable is statistically null, that is, it is not statistically important to explain the dependent variable. All parameter estimates presented statistically significant results at the 1% significance level, and the expected signs are in accordance with the theoretical model of human capital. The degree of fit of an estimated model can be seen by the coefficient of determination, R^2. R^2 is the explanatory power of the equation. The three equations obtained equal values, $R^2 = 0,33$. The value of 0,33 means that 33% of the variations that occurred with the dependent variable are explained by the explanatory variables. This value is considered a good degree of fit as it is obtained using a cohort database (cross-section).

For testing the instruments, the 2SLS and GMM estimator, the test statistic is the Sargan statistic. The joint null hypothesis is that the instruments are valid instruments, that is, the instrumental variables used are not correlated with the error term and the excluded instruments are correctly excluded from the estimated equation. No evidence was found against the null hypothesis at a 10 percent significance level that the overidentification constraints are a valid hypothesis. The distribution values of the Sargan test range from 0,1739 [(column (2)] to 0,1635 [column (3)].

There is a negative causal relationship between domestic violence and real wages, estimated by estimation methods with matching propensity score for the treatment variable. Thus, it is revealed that women victims of domestic violence, when compared to those who do not suffer domestic violence, have a loss of 34,6% (so that the coefficient of violence is $\beta < 0$) of the real wage (Table 11).). Domestic violence is one of the predominant factors in reducing women's wages. Even when controlled for other determinant variables (Educ, Exper, Expe2, Casado, Npessfam, Chefedom, Branca and Filhodom) of wages, the effect remains high. Regarding the education variable, in general, we would expect the coefficient of this variable to be $\beta > 0$ since the higher level of education should increase the real wage.

Education makes possible for many favorable socioeconomic effects. The two estimated models in columns 2 (2SLS) and 3 (GMM) produced equal return to schooling rates of 0,110, while the model in column 1 (OLS) resulted in a return to schooling of 0,122. On average, married women earn 17,3% more than unmarried women. Of course, on average, married women in this sample have more years of experience than unmarried women, and therefore are expected to earn more. White women earn 22,7% more than non-white women.

The standard methodology breaks down the wage gap between two groups of people, in this case, non-aggressed women and battered women. The salary differential is split between two parts: a part that is explained by endowments (education, experience, experience versus education, married, education squared) and a part that cannot be explained by such group differences (measurable variables).

Table 12 reports the decomposition distribution that relates the average forecasts by groups and their difference in the first part of the panel. In our data, the average salary calculated in logarithms is 6,473 for non-aggressed women, Prediction 1 and 5,960 for battered women, Prediction 2 generating a wage gap of 0,513 in favor of the group of non-aggressed women, which is equivalent to 51, 3% more in wages. In the second part of the decomposition panel, the wage gap is divided into two parts. The explained part means how much the group of non-aggressed women would receive if they had the same endowment as the group of battered women. However, the unexplained part is associated with wage discrimination.

The detailed breakdown of the wage differential is 0,513 between the two groups of non-battered women, Prediction 1 and battered women, Prediction 2 allows us to assess the relative contribution of women's endowment characteristics and the returns on those characteristics. In this way, it is observed that the coefficient of characteristics/endowments, the decomposition of the wage differential explained, is 0,175, revealing that this is the value for battered women, Prediction 2, would add to their wages if they were in the place

of unattacked women. 1. This value represents the observable characteristics that distinguish them between the two groups of women. The unexplained decomposition of the wage gap is 0,338, which is attributed to discrimination. According to the standard technique of the Oaxaca decomposition of the wage differential of 51,3% between the two groups of women, 34,1% are related to the observable attributes included in the model and 65,9% is the percentage that configures the presence of discrimination in the labor market.

Table 12 - The Oaxaca – Ransom Decomposition: non-aggressed women (1) and aggressed women (2) vce (Bootstrap)

LnWage	Coef.	Std. Error	z	P>z	(95% Coef. Interval)
Differential					
Prediction 1	6,473	0,002	2621,4	0,0	6,468 < *B* < 6,478
Prediction 2	5,960	0,048	125,34	0,0	5,687 < *B* < 6,053
Difference	0,513	0,048	10,68	0,0	0,419 < *B* < 0,607
Decomposition					
Explained	0,175	0,021	8,19	0,0	0,133 < *B* < 0,217
Unexplained	0,338	0,046	7,28	0,0	0,247 < *B* < 0,429

Source: IBGE/PNAD/2009.

6 Final Comments

It appears that the abused women had, on average, income from their main job (Rendatrab) of R$ 528.4 and education (educ) of 7.7 less than those not battered who had an income from their main job of R$ 1,056.1 and education (educ) of 8.4. These data may indicate that, in general, women with less than one year of schooling and being victims of domestic violence suffer strong differences in salary gains. Another point to highlight is the age, which, on average, is lower for battered women, 32.9 when compared to non-aggressed women, 37.3. The 2009 PNAD presents the statistics of battered women who reported and those who did not. Hence, of the 5.534 women who suffered domestic violence, 56.4%, 3,119 battered women made complaints, while 43.6%, 2.415 battered women did not report physical aggression.

A negative causal relationship is observed by the match method with pairing by propensity score of the treatment variable with the real salary. Thus, it is revealed that women victims of domestic violence, when compared to those who do not suffer domestic violence, have a loss of 33.6% of their real salary (Table 12). Domestic violence is one of the predominant factors in reducing women's wages. Detailed decomposition of the wage differential of 0,513 between the two groups of non-battered women, (Prediction 1) and battered women, (Prediction 2) allows us to assess the relative contribution of women's endowment characteristics and the returns of these characteristics. In this way, it is observed that the coefficient of characteristics/endowments, the decomposition of the wage differential explained, is 0,175, revealing that this is the value that battered women (Prediction 2) would add to their wages if they had in the place of women not attacked (Prediction 1). This value represents the observable characteristics that distinguish them between the two groups of women, while the unexplained decomposition of the wage gap is 0,338, being attributed to discrimination. According to the standard technique of the Oaxaca decomposition of the wage differential of 51.3% between the two groups of women, 34.1% is related to the observable attributes included in the model and 65.9% is the percentage that configures the presence of discrimination in the labor market.

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