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Skin Color Gap within Couples and Intimate Partner Violence in Northeast, Brazil: Evidence from the PCSVDF^{Mulher}

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Abstract

In this paper, we investigate whether women in interracial couples are more likely to be exposed to IPV than women in monoracial couples in Brazil. We explore a unique data source on intimate partner violence in Northeast Brazil, known as Pesquisa de Condições Socioeconômicas e de Violência Doméstica e Familiar contra a Mulher – PCSVDF^{Mulher}. The survey provides information on the skin color shade of women and their partners in addition to collecting information on women's exposure to emotional, physical, and sexual IPV. Using probit models that account for unobservable heterogeneity, our results provide striking evidence that the skin color gap within couples positively predicts the risk of IPV in Northeast Brazil. This relationship is particularly driven by skin color hierarchy within couples. We provide evidence on two behavioural mechanisms that contribute to such women's exposure to IPV: partner's drinking and controlling behaviour.

Keywords: Intimate partner violence, skin color gap, Brazil.

JEL codes: I0, I12 and J12.

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1. Introduction

Intimate partner violence (IPV) is a curse of humanity that has condemned one-third of women globally to humiliation and fear (WHO 2021). IPV can not only reap women's life (Matias et al. 2020) but compromise the physical and mental health of surviving ones (Campbell 2002). Moreover, abused women face adverse conditions in the labor market (Showalter 2016; Węziak-Białowolska et al. 2019) and have their autonomy undermined (Bloch and Rao 2002; Eswaran and Malhotra 2011). When IPV occurs during pregnancy, the human capital of future generations is also at risk (Aizer 2011; Currie et al. 2022).

However, certain demographic groups of women tend to be more exposed to IPV than others. Empirical evidence shows a much larger risk of IPV among interracial couples when compared to monoracial counterparts (Brownridge et al. 2021). For instance, police reports in the US show that the prevalence of mutual assault is 31,2% in interracial couples, which is at least twice larger than the prevalence rate in monoracial couples (Fusco 2010). Similar differences are provided by probability samples of couples in the US and Canada. The prevalence rate of severe violence is 25% in interracial couples in the US, which is 4.5 times larger than the rate for monoracial white, 1.9 times larger than the rate for monoracial Hispanic, and 1.2 times larger than for monoracial black couples (Chartier and Caetano 2012). Nonetheless, these differences are smaller in data from the National Violence Against Women Survey (1995/1996), where the prevalence rate of severe violence is 2.8% for interracial couples, 1.5% for monoracial white and 2.8% for monoracial minorities (Carbone-Lopez 2013). In Canada, the prevalence of severe violence is 3.3% in interracial couples and 1.2% for non-interracial couples (Brownridge 2016). Therefore, women in interracial couples are more likely to experience IPV than those in monoracial relationships.

There are some stress factors that may increase the risk of intimate partner violence in interracial couples relative to their monoracial counterparts (Bratter and Eschbach 2006; Brownridge 2016; Carbone-Lopez 2013; Fusco 2010; Martin 2010). For instance, racism/discrimination may occur inside and outside the relationship, creating conflicts within interracial couples that can potentially result in IPV (Carbone-Lopez 2013; Fusco 2010). Jealousy also appears as another potential stressor, given that such individual behaviour is more frequent in interracial couples compared to monoracial counterparts (Brownridge et al. 2021). Partner jealousy is found as an important risk factor for IPV (Gage and Hutchinson 2006). Another relevant stress factor is drinking behaviour which is an important mediating factor of IPV (Klostermann and Fals-Stewart 2006) and has been found to be associated with an elevated risk of IPV within interracial couples (Chartier and Caetano 2012; Espinoza and Cancio 2021). In addition to those stress factors, the literature provides other potential explanations for the differences in the risk of IPV due to the dissimilarity in race/color within couples. It includes the existence of social status incompatibilities (or heterogamy) within couples, complex relationship history, as well as differences in certain sociodemographic characteristics such as individual's education, cohabitation, and the duration of the relationships (Brownridge 2016).

All this literature is restricted to developed countries. There is no evidence on whether women in interracial couples are more exposed to IPV than their monoracial counterparts in middle and low-income countries, where violence against women tends to be more frequent (Sardinha et al. 2022). Remarkably, there is a lack of studies that measure the risk of IPV for women in interracial couples in countries where miscegenation is a social norm (see Telles 2004).

In this paper, we aim to fill this gap in the literature by investigating whether the risk of IPV is responsive to the skin color gap within couples in Brazil, a large developing country with a high rate of miscegenation. Evidence from cross-country studies shows moderate prevalence rates of IPV in Brazil. The WHO multi-country study shows a prevalence rate of 28.9-36.9% for a lifetime and 9.3-14.8% for the last 12 months between 2000 and 2003 (Garcia-Moreno et al. 2006). Recent global statistics show reduced prevalence rates of 20-24% for lifetime IPV and 5-9% for the last 12 months in 2018 (Sardinha et al. 2022). These prevalence rates of IPV are below the measured rates for most Latin American countries and are comparable to prevalence rates in developed countries like the US, France and the UK. In Northeast Brazil, our study region, the prevalence rate for lifetime IPV is approximately 35% and 16% for the last 12 months in 2016/2017 (Carvalho et al. 2018).[1]

This investigation contributes to the existing literature in several ways. First, we explore a unique data source on intimate partner violence in Brazil, known as Pesquisa de Condições Socioeconômicas e de Violência Doméstica e Familiar contra a Mulher – PCSVDF[Mulher] (Survey on Socioeconomic Conditions and Domestic and Family Violence Against Woman). This survey provides information on emotional, physical, and sexual IPV faced by women aged 15-49 in the nine state capitals of Northeast Brazil. It is historically the poorest region of the country, and where race/color intermarriage is more

[1] The two cross-countries studies (Garcia-Moreno et al. 2006; Sardinha et al. 2022) consider only physical and sexual violence to compute prevalence rates of IPV, whereas the subnational study for Northeast Brazil (Carvalho et al. 2018) considers emotional violence, in addition to physical and sexual violence.

frequent (Telles 1993). We can also access relevant information on couples that includes the skin color shade of women and of their partners based on the NIS/NLSY Skin Color Rating Card (Massey and Martin 2003). This measure of colorism has been previously used in several studies on labour market discrimination (Han 2020; Hersch 2008; 2011a; Katz et al. 2020; Kreisman and Rangel 2015), economic opportunity (Visser 2017), and physical attractiveness (Hersch 2011b). The skin color gradation varies from lighter to darker skin tone (1 to 10), which allows us to compute the skin color gap for each couple in our sample. With this measure, we test whether the risk of IPV face by women is predicted by the dissimilarity in the skin tone among women and their partners. To the best of our knowledge, there are no previous studies measuring the contribution of the skin color gap within couples to the probability of women experiencing IPV.

Second, we explore three potential mechanisms that are related to stress within interracial couples and may explain the association between the risk of IPV and the skin color gap. For instance, we test whether race/color hierarchy (or race/color discrimination) within interracial couples plays a role in predicting the contribution of the skin color gap to the risk of women experiencing IPV, despite the high miscegenation of the Brazilian population. Race/color hierarchy refers to the popular belief that light skin is considered more desirable and modern, whereas darker skin is considered less valuable and primitive (Dixon and Telles 2017). In our study, we measure the role of race/color hierarchy by testing whether the risk of IPV is more responsive to the skin color gap for women who show darker skin color than their partners compared to women who show lighter skin color.

We also investigate whether controlling behaviour within couples is associated with the skin color gap between woman and partner. Controlling behaviour may be a mediating factor of stressors like racism/discrimination from outside the relationship and jealousy on the risk of IPV. Empirical evidence shows that controlling behaviour is directly related to women's exposure to IPV (Aizpurua et al. 2021; Antai 2011; Gage and Hutchinson 2006; Krantz and Vung 2009; Mukherjee et al. 2021; Wandera et al. 2015). Lastly, we test whether drinking behaviour within couples is associated with skin color dissimilarity between woman and partner. Drinking behaviour not only leads to partners' violent behaviour, but also increases the chance of women's victimization (Eckhardt et al. 2015; Devries et al. 2014; Klostermann and Fals-Stewart 2006).

Third, we methodologically contribute to the existing literature by modelling the risk of IPV as a function of the skin color gap of couples considering women's unobservable heterogeneity, once the PCSVDF^{Mulher} survey collects a baseline and a follow-up wave

(2016 and 2017). Specifically, we model IPV using the random effect (RE) probit model. It is worth noting that the existing literature provides evidence of the association of IPV with intermarriage based on cross-sectional samples (Brownridge 2016; 2021; Carbone-Lopez 2013; Fusco 2009; Martin et al. 2013). These studies are likely to produce misleading estimates due to omitted variables bias. Moreover, we also estimate the relationship between IPV and the skin color gap within couples by considering interviewers' subjective rating regarding women's skin color (Kreisman and Rangel 2015). We, therefore, model IPV using the mixed-effect probit approach in which both women's and interviewers' unobservable heterogeneity are modelled as nested random effects. We also investigate whether sample attrition is a potential issue by comparing adjusted and unadjusted estimates from pooled probit model using the inverse probability weighted estimation (Wooldridge 2002a).

Our results provide striking evidence that the skin color gap within couples positively predicts the risk of IPV in Northeast Brazil. Specifically, the likelihood of physical IPV is approximately 0.006 (or 0.6%) larger if the skin color gap within couples rises by 1 standard deviation. This estimated relationship is particularly driven by women who show darker skin color than their partners. These results are aligned with the existing evidence that shows an increased risk of IPV for women in interracial couples relative to those in monoracial relationships (Brownridge 2016; Brownridge et al. 2021; Carbone-Lopez 2013; Fusco 2010; Martin 2010). Moreover, we provide evidence that race/color hierarchy (or race/color discrimination) coexists with high miscegenation of the population in Brazil (Telles 2004) by showing that darker women are more likely to face an elevated risk of physical IPV from the lighter partner. This evidence supports the hypothesis that racism/discrimination inside interracial couples is a potential stress factor that may induce IPV (Brownridge 2016).

Investigating the behavioural mechanisms that lead to higher women's exposure to IPV, we find valuable evidence that the skin color gap within couples is positively associated with the risk of controlling and drinking behaviour. For instance, we find that the risk of partner-to-women controlling behaviour increases by 0.0202 (or 2%) as the skin color gap within couples positively varies in 1 SD. The same variation in the skin color gap is associated with a risk of partners' drinking behaviour 0.0296 (or 3%) larger, and with a higher probability of both partner and women showing a high frequency of alcohol consumption. These predictions are also driven by race/color hierarchy; women with darker skin color than their partners are more likely to be exposed to partners' controlling and drinking behaviour when compared to counterpart women.

The rest of the paper is organized as follows. Section 2 presents the background literature and the behavioural mechanisms which can help to explain the relationship between the risk of IPV and the skin color gap within couples. Section 3 presents our data source. The empirical strategy is presented in Section 4, while the results are presented and discussed in Section 5. Finally, the conclusion and a summary of our findings are provided in Section 6.

2. Background Literature and Behavioural Mechanisms

In contrast the US, Brazil shows fluid boundaries for race/color intermarriage and there is no distinction between race and color, in which race is rarely used to describe the Brazilian population; color, however, is often used because it captures the existing color gradient reflecting more phenotype rather than ancestry (Telles 2004; Dixon and Telles 2017). In Brazil, miscegenation of the population is a central pillar of national identity, showing historically high rates of race/color intermarriage (Telles 2004; Telles and Esteve 2019). For instance, black–white intermarriage is 10 times as likely in Brazil compared to the US, and Brazilian *mulatos* are four times as likely to marry whites than blacks (Telles and Esteve 2019). However, racial/color intermarriage is less likely to happen at high education levels (Telles 2004; Telles and Esteve 2019).[2] This negative association is induced by the existence of "status exchange" in interracial couples, which penalizes the darker population (Gullickson and Torch 2014).[3]

In Brazil, low levels of racism on the horizontal dimension (i.e., race/color intermarriage) coexist with high levels race/color hierarchy (Gullickson and Torch 2014; Telles 2004; Telles and Sue 2009). In this context, conflicts and inappropriate behaviour may arise within interracial couples, which increases the risk of intimate partner violence. Therefore, an immediate research question that arises is whether the probability of women's experiencing IPV increases with the skin color gap within couples in a context of a high level of miscegenation.

Albeit the lack of a formal theory explaining why interracial couples face an elevated risk of IPV, the existing literature has provided some potential behavioural mechanisms (Brownridge 2016). We concentrate on three potential mechanisms that are

[2] According to Gordon's (1964) assimilation theory, interracial couples in Brazil would experience high levels of social tolerance and low levels of social distance. Nonetheless, this theory does not conciliate with the evidence on differences in racial/color intermarriage across social classes in Brazil (Telles 2004).

[3] Status exchange in interracial marriage refers to members of racially subordinated groups who can marry members of the racially dominant group in exchange for bringing other valued status characteristics to the marriage, such as education or social class (Telles 2004).

associated with stress in interracial relationships (Farrington 1986). A common mechanism is the existence of racism/discrimination inside interracial couples, i.e., the existence of race/color hierarchy within couples. For instance, the lighter partner may fail to fully understand the unique circumstance faced by the darker one which may generate stress within couples and, consequently, end up in IPV (Brownridge 2016; Fusco 2010). Moreover, inappropriate racist statements made by one of the members of the couple during arguments can also lead to an elevated risk of IPV within interracial couples (Carbone-Lopez 2013). Because of the lack of suitable measures on racism/discrimination within couples in our data, a way to overcome this limitation is to test whether the risk of IPV is more responsive to the skin color gap among women with darker skin tone than their partner or to women with lighter skin color. Our hypothesis is that we shall not expect heterogeneous responses of IPV to the skin color gap on whether women are darker or lighter skin color than their partners in case of the inexistency of race/color hierarchy in interracial relationships.

A behavioural mechanism that helps us to shed light on the relationship between the risk of IPV and the skin color gap within couples is the existence of controlling behaviour of partners over women, or women over the partners, or the presence of mutual controlling behaviour (Graham-Kevan and Archer 2009; Johnson, 2006). Controlling behaviour is a form of IPV that consists of isolating a person from family and friends; monitoring their movements; and restricting access to financial resources, employment, education, or medical care (see WHO, 2012).[4] In our study, controlling behaviour is defined as the high frequency at which one member of the couple restricts the other from contacting her/his family or friends, or reading her/his text messages or e-mails (see Krantz and Vung, 2009).

Controlling behaviour is found to be straight correlated to intimate partner violence (Matias et al., 2020). For instance, evidence shows that women exposed to controlling behaviour from their partners are more likely to experience physical and sexual violence (Aizpurua et al., 2021; Antai, 2011; Gage and Hutchinson, 2006; Krantz and Vung, 2009; Wandera et al., 2015). Besides, intimate violent victimization and perpetration are both highly associated with mutual controlling behaviour within couples (Jankey et al. 2011).

[4] A detailed definition is provided by the UK Home Office which says defines controlling behaviour as a range of acts designed to subject individuals to isolation from their sources of support; exploiting their resources and capacities for personal gain; depriving them of the means needed for independence, resistance, and escape; and regulating their everyday behaviour (Home Office 2015).

We, therefore, test whether the probability of controlling behaviour is predicted by the skin color gap within couples. Our hypothesis is that controlling behaviour is more likely to happen in interracial couples than in monoracial couples. Controlling behaviour may be associated with stress factors in interracial relationships such as racism/discrimination outside the relationship and/or jealousy. For instance, interracial relationships may face disapproval and ostracism from family and friends (Carbone-Lopez 2013; Martin et al. 2013), which may lead interracial couples to hide their relationships due to fear of rejection (Fusco 2010). It may induce a member of the couple to adopt a controlling behaviour over the actions of the other. Because of the high social tolerance of intermarriage in Brazil (Telles 2004), racism/discrimination from outside the relationship seems to be a less plausible explanation for controlling behaviour in interracial couples. Instead, jealousy appears as a credible explanation given that it has been listed a relevant risk factor for controlling behaviour within couples in the literature (Gage and Hutchinson 2006; Kyegombe et al. 2022; Wandera 2015) and has been found to be positively associated with the elevated risk of IPV in interracial couples (Brownridge et al. 2021).

Furthermore, one of the most important risk factors associated with IPV is drinking behaviour (Klostermann and Fals-Stewart 2006), which may generate stress within couples (Brownridge 2016). Males in interracial couples are more likely to exhibit abusive alcohol consumption and experience social problems due to drinking behaviour (Chartier and Caetano 2012). As a mediating factor of IPV, alcoholic consumption may trigger partners' violent behaviour, potentialize their aggressive or anti-social traits, as well as reduce their effectiveness of inhibitory efforts to aggressive behaviour (Eckhardt et al. 2015). Moreover, the high consumption of alcoholic beverages by women is positively associated with the risk of victimization (Devries et al. 2014). Therefore, we test whether the likelihood of high frequency of alcohol consumption by women and partners, as well as the consumption of alcohol of both, is predicted by the skin color gap, and by race/color hierarchy.

3. Data

The PCSVDF^{Mulher} is a unique data source on intimate partner violence in Brazil. The survey gathers information relative to emotional, physical, and sexual violence, during the lifetime and during the last 12 months relative to the date of the interview as recommended by WHO (2005). The survey also collected information on socioeconomic characteristics and other relevant aspects related to women's exposure to IPV, including information about partners (Carvalho et al. 2018).

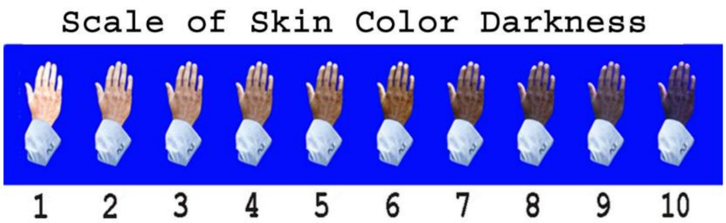
3.1 Sample size and attrition

The PCSVDF^Mulher^ was designed as a longitudinal study with a baseline wave in 2016 (N = 10,096) and a follow-up wave in 2017 (N = 10,518). A common issue in longitudinal population surveys focused on sensitive research questions such as IPV is the elevated attrition rate in the sample (see Hidrobo and Fernald 2013). Our final sample is restricted to women with partners at the date of the interview, and with valid information on the exposure to emotional, physical and sexual IPV in the last 12 months, socioeconomic characteristics and skin color shade of couples. The unbalanced sample contains 3,692 observations, while our balanced sample has 1,926 observations. It results in an attrition rate of 54.5%. We, therefore, check whether our observed outcomes and explanatory variables differ relative to the balanced and unbalanced samples.

3.2 Skin color shade

Figure 1 displays the Skin Color Rating Card developed by Massey and Marting (2003), which is used in the PCSVDF^Mulher^ survey to rate the skin color shade of women and partners.[5]

Fig. 1 NIS/NLSY Skin Color Rating Card (Massey and Martin, 2003)



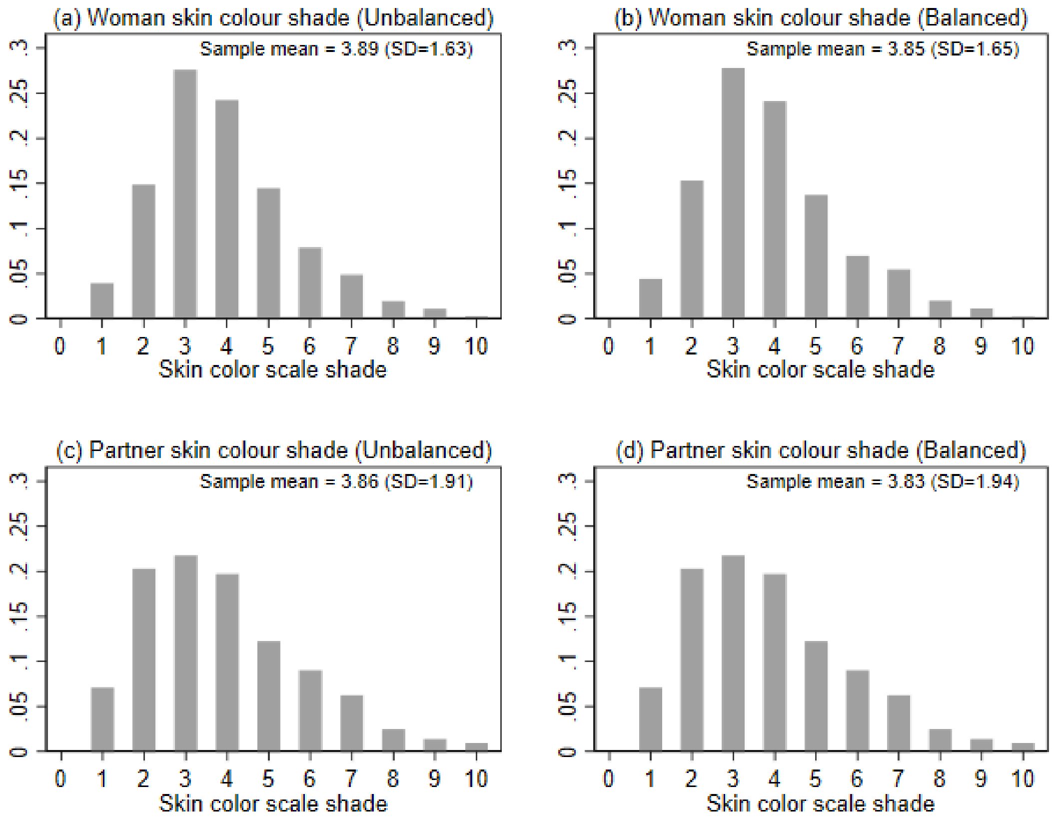
In the PCSVDF^Mulher^, women's skin color is informed by the interviewers who must indicate the correct value of the card displayed in the CAPI software (Computer-Assisted Personal Interviewing). In contrast, partners' skin color is rated by women. The survey ensures that interviewed women have no access to the interviewer's rating about their skin color. Therefore, any subjective evaluation of the skin color shade of women and partners is likely to be independent of each other.

Figure 2 displays the histograms for the skin color shade of women and partners for unbalanced and balanced samples. Attrition in the sample has no implications for the distributions of skin color shade for both women and partners. For instance, the average

[5] It was first printed in an appendix to the Field Interviewer Manual during the baseline round of the New Immigrant Survey.

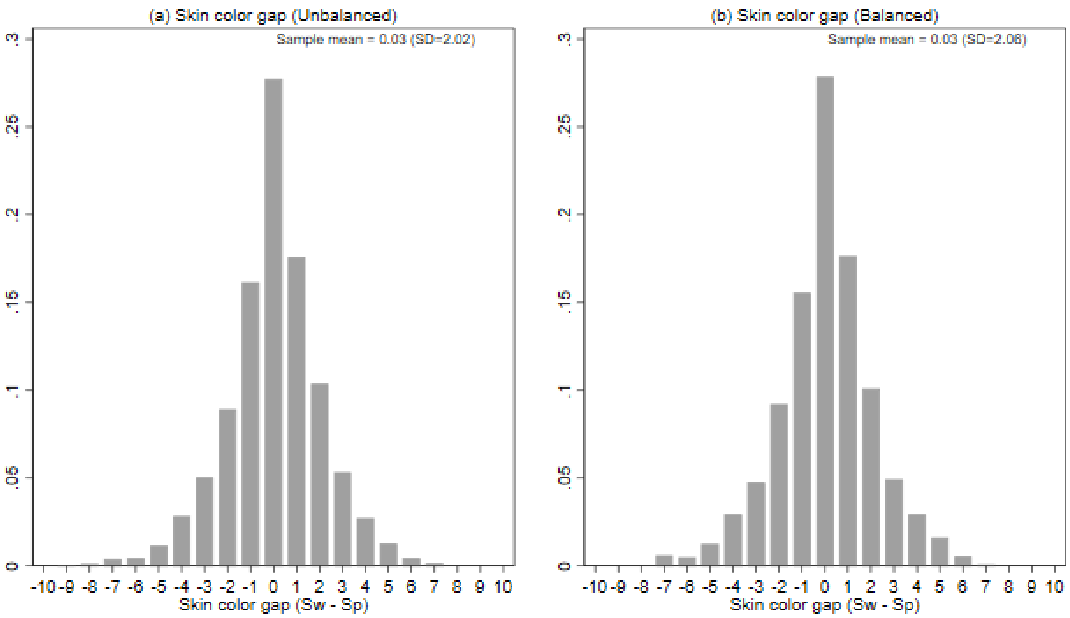
skin color shade of women is 3.89 and 3.85 respectively for unbalanced and balanced samples. Regarding partners' skin color shade, the average values are 3.9 and 3.8 for both samples. Moreover, the standard deviations are very close, indicating similar dispersion of the distributions.

Fig. 2 Histogram of skin color shade for woman and partner for unbalanced and balanced samples



Despite the very close distributions of skin color shade for women and partners, there is a high dissimilarity of this attribute within the couples. Figure 3 displays the distribution of the skin color gap between women and their partners for unbalanced and balanced samples. Almost three-quarters of women in our unbalanced sample (72%) show different skin color shades from their partners; 35% of women are lighter than their partners, while 38% are darker. The same distribution of skin color dissimilarities is found for our balanced sample. In Figures 3(a) and 3(b), the fraction of the sample is decreasing with the size of the skin color gap regardless its direction. The correlation between the skin color shade of women and their partners is 0.36 (p-value=0.000) for the unbalanced sample, and 0.35 (p-value=0.000) for the balanced sample. This evidence suggests a high frequency of interracial marriage in Brazil, corroborating the existing literature (see Telles 2004).

Fig. 3 Histogram for skin color gap between woman and partner



3.3 IPV measure in the PCSVDF^{Mulher}

Table 1, in turn, displays the mean, standard deviation, and sample size related to our measures of IPV. In our unbalanced sample, the prevalence of emotional IPV in the last 12 months is 12.1%; 5.1% for physical violence, and 2.3% for sexual violence. Restricting to our balanced sample, we find very close prevalence rates; 11.7% for emotional violence, 4.3% for physical violence and 2% for sexual violence.

Table 1 Descriptive statistics about IPV measures

	Unbalanced sample			Balanced sample		
	Emotional	Physical	Sexual	Emotional	Physical	Sexual
All sample	0.121	0.051	0.023	0.117	0.043	0.020
	(0.326)	(0.219)	(0.151)	(0.322)	(0.203)	(0.139)
		3692			**1926**	
Sw < Sp	0.125	0.053	0.027	0.117	0.036	0.020
	(0.331)	(0.224)	(0.163)	(0.322)	(0.187)	(0.138)
		1283			**666**	
Sw = Sp	0.106	0.042	0.016	0.106	0.034	0.013
	(0.308)	(0.201)	(0.124)	(0.309)	(0.180)	(0.114)
		1022			**536**	
Sw > Sp	0.128	0.055	0.025	0.126	0.057	0.025
	(0.335)	(0.228)	(0.157)	(0.332)	(0.231)	(0.156)
		1387			**724**	

Note. Standard deviations are in parentheses.

However, the prevalence rates of IPV are larger for women with different skin color shades (i.e., lighter or darker) than their partners. These differences are systematic regardless of the type of IPV, or sample size. However, they may be confounded by omitted characteristics of couples that are potentially related to assortative mating (Chiappori et al. 2016; Hamilton et al. 2009), or due to subjective rating of interviewers regarding women's skin color (Kreisman and Rangel 2015). Therefore, we need an appropriate model to estimate those differences accounting for such hidden factors.

3.4 Demographic and socioeconomic characteristics

To explore the association between IPV and the skin color gap between women and their partners, we account for the demographic and socioeconomic characteristics of women and partners as displayed in Table 2. It allows us to account for risk and protective factors related to IPV, as well as to account for potential assortative mating and status incompatibilities within couples.

Table 2 Descriptive statistics on socioeconomic characteristics

	Descriptive statistics by sample			
	Unbalanced (N=3,692)		Balanced (N=1,926)	
Explanatory variables	**Mean**	**SD**	**Mean**	**SD**
Woman's age	33.105	9.444	33.992	9.357
Women with secondary/superior education	0.596	0.491	0.593	0.491
Partner with secondary/superior education	0.569	0.495	0.547	0.498
Employed women	0.393	0.489	0.392	0.488
Employed partner	0.826	0.380	0.817	0.387
Married	0.500	0.500	0.521	0.500
Cohabiting	0.291	0.454	0.288	0.453
Living in separate domiciles	0.209	0.407	0.191	0.393
Woman has no children	0.267	0.443	0.234	0.424
Woman has 1 child	0.242	0.428	0.234	0.423
Woman has 2 children	0.275	0.446	0.288	0.453
Woman has 3 children or more	0.216	0.412	0.245	0.430
Log of equivalized household income	5.254	2.214	5.163	2.254
High frequency of street fights	0.569	0.495	0.562	0.496
High frequency of robbery	0.114	0.318	0.106	0.308

The set of covariates includes women's age, women's and partners' education (e.g., assigning 1 to secondary or superior education, and 0 otherwise), women's and partners' employment status (e.g., assigning 1 to employed, and 0 otherwise), type of union (e.g., married, cohabiting, and living in separate domiciles), equivalized household income, and the number of children (e.g., no children, 1 child, 2 children, and 3 children or more), high frequency of street fights in the neighbourhood, and high frequency of robbery in the neighbourhood. Table 2 shows limited differences for women’s age, women with no children, and women with 3 children or more. Overall, we find very close mean values and standard deviation between unbalanced and balanced samples, suggesting that attrition may not be correlated with demographic and socioeconomic characteristics.

4. Empirical Strategy

Exploring the panel data structure of the PCSVDF[mulher], we investigate how the risk of partner violence against woman respond to the skin color gap within couples. Our dependent variable is IPV_{it} which refers to the specific measures of intimate partner violence, i.e., emotional, physical, and sexual IPV for each woman i in wave t. Specifically, our dependent variable is binary and assigns value 1 to women who reported having experienced IPV in the last 12 months, and 0 otherwise. The underlying latent variable model associated with our dependent variable is given by:

$$IPV_{it}^{*} = \alpha + \delta|Sw_{it} - Sp_{it}| + \mathrm{X}_{it}\beta + u_{it} \tag{1}$$

where $IPV_{it} = 1[IPV_{it}^{*} > 0]$. Our variable of interest is $|Sw_{it} - Sp_{it}|$, i.e., the absolute difference in skin color gradation of women and partners. Demographic and socioeconomic characteristics of women and partners are captured by X_{it} (see Table 2), including the specific skin color shade of women (Sw_{it}) and partners (Sp_{it}).

Because our dependent variable is dichotomous and varies over time, we rely on a random effect (RE) probit approach to model the risk of IPV. This model accounts for unobservable time-invariant heterogeneity, where a random effect term (c_i) is included as part of the error structure, i.e., $u_{it} = c_i + \varepsilon_{it}$ (Wooldridge 2002a). The time-invariant unobservable heterogeneity component helps us to account for potential women's subjective rating regarding their partner's skin color. Besides, models that fail to account for individuals' unobservable heterogeneity are likely to produce biased estimates (Wooldridge 2002b). A random effects (RE) probit model can be estimated as:

$$\Pr(IPV_{it} = 1) = \Phi(\alpha + \delta_c|Sw_{it} - Sp_{it}| + \mathrm{X}_{it}\beta_c + c_i + \varepsilon_{it}) \tag{2}$$

where, c_i and ε_{it} are assumed to be normally distributed and independent of the explanatory variables, and of each other. $\Phi(\cdot)$ is the cumulative distribution function (CDF) of the normal distribution. The set of parameters, δ_c, β_c and σ_c^2, is consistently estimated by conventional maximum likelihood estimation (MLE) methods, alongside the Gaussian quadrature procedure (Butler and Moffitt 1982; Greene 2003; Wooldridge

2002b). Marginal effects are estimated for the pooled and random effects models with standard errors estimated using the delta method (Wooldridge 2005).[6]

5. Results

5.1 Is Attrition a Relevant Issue for the Analysis?

Although our sample shows a considerable attrition rate, it has not led to substantial differences in the distribution of skin color shade of couples, or to discrepancies in the descriptive statistics of demographic and socioeconomic characteristics between unbalanced and balanced samples. However, attrition may be associated with women's exposure to IPV, which would indicate the presence of selection bias. Following Becketti et al. (1988), we test whether the probability of being exposed to IPV is associated with our attrition variable which indicates 1 for women that appear in both waves, and 0 for women who appear only in wave 2016.[7] To verify whether the potential association between IPV outcomes and attrition is driven by demographic and socioeconomic characteristics, we also add interactions between the attrition variable and all explanatory variables. We, thus, estimate a probit model for IPV outcomes using only data from the wave 2016.

Results in Table 3 show no significant association between the probability of emotional, physical, and sexual IPV with the attrition variable. However, interactions suggest that the association between attrition and physical IPV is relevant for employed women, women living in high-income households, and in neighbourhoods with a high frequency of robbery. The joint significant test for the coefficient of our attrition variable and the interaction terms leads us to reject the null hypothesis that attrition is random for physical IPV. However, we do not reject null hypothesis when modelling emotional and sexual IPV.

[6] The marginal effect for the random effect probit model takes into account the variance of unobserved heterogeneity, i.e., $\delta_c = \delta/(1+\sigma_c^2)^{1/2}$ and $\beta_c = \beta/(1+\sigma_c^2)^{1/2}$ (Wooldridge 2002b). Moreover, the marginal effect for a specific explanatory variable keeps all other variables in their mean values.

[7] Our attrition variable does not intend to adjust estimates to such selection bias, but it can be informative about which type of IPV may suffer with such sample issue.

Table 3 Test for attrition in wave 2016 based on Becketti et al. (1988)

	Emotional IPV	**Physical IPV**	**Sexual IPV**
Attrition	-0.1141	-0.0741	0.0637
	(0.4195)	(0.5371)	(0.6957)
Interaction between Attrition and:			
$\|S_W-S_P\|$	-0.0498	-0.1222	0.0673
	(0.0493)	(0.0654)	(0.0882)
S_W	0.0361	-0.0028	-0.0027
	(0.0448)	(0.0547)	(0.0812)
S_P	-0.0316	0.0366	-0.0175
	(0.0379)	(0.0490)	(0.0616)
Age	-0.0014	-0.0008	-0.0077
	(0.0084)	(0.0119)	(0.0120)
High-educated women	-0.0591	-0.1570	-0.1618
	(0.1604)	(0.2223)	(0.2587)
High-educated partner	-0.1061	-0.0868	-0.3219
	(0.1609)	(0.2244)	(0.2693)
Employed women	-0.0360	-0.4786**	-0.0987
	(0.1461)	(0.1949)	(0.2478)
Employed partner	0.1851	-0.3639	-0.2557
	(0.1724)	(0.2446)	(0.3115)
Cohabiting	0.0482	-0.0631	0.0634
	(0.1632)	(0.2146)	(0.2797)
Living in separate domiciles	-0.0283	0.0558	0.1147
	(0.1957)	(0.2743)	(0.3440)
Woman has 1 child	-0.0302	0.2941	0.0263
	(0.2110)	(0.3003)	(0.4345)
Woman has 2 children	0.2993	0.4042	0.6164
	(0.2320)	(0.3195)	(0.4643)
Woman has 3 children or more	-0.2141	0.0502	-0.5101
	(0.2338)	(0.3098)	(0.3753)
Log of equivalized HH income	0.0318	0.0884**	0.1326**
	(0.0329)	(0.0442)	(0.0553)
High frequency of robbery	0.1170	0.6065***	0.4495**
	(0.1388)	(0.1809)	(0.2268)
High frequency of street fights	0.3512	0.1550	-0.1885
	(0.2136)	(0.2653)	(0.3728)
Joint significance test			
Attrition & interactions	18.4	39.3***	21.7
Loglikelihood	**-937.8**	**-503.8**	**-275.3**
Observations	**2729**	**2729**	**2729**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

The next step is to verify whether the attrition effectively biases the relationship between the risk of IPV and the skin color gap within couples. Table 4 shows estimated marginal responses of emotional, physical, and sexual IPV (baseline estimates) on skin color gap within couples, as well as the heterogeneous marginal estimates. We compare weighted and unweighted estimates from pooled probit model using our balanced sample. The adjusted specification uses inverse probability weighted (IPW) estimation, which adjusts the estimates for sample attrition (Wooldridge, 2002a,b).[8] Because we have only one follow-up wave, the IPW is obtained by estimating the probability of attrition ($\hat{p}_{it}$) as a function of all covariates (see Table 2), including our measure of skin color gap and skin color shade of couples. We also add the corresponding measure of IPV for which the probit model will be adjusted, and a binary variable that indicates whether the interviewed woman intends to move out from the current address in the next 12 months. In 2016, about 30% of sampled women reported expecting to move to another address in the next 12 months.

Table 4 Estimated marginal response of the risk of IPV to skin color gap from pooled probit model with and without adjustment for attrition

	Baseline estimates		**Heterogeneous estimates**	
	Unadjusted for attrition	**Adjusted for attrition**	**Unadjusted for attrition**	**Adjusted for attrition**
Panel A: Emotional IPV				
|Sw - Sp|	0.0120	0.0123		
	(0.0074)	(0.0071)		
|Sw - Sp| x I(Sw > Sp)			0.0109	0.0119
			(0.0089)	(0.0085)
|Sw - Sp| x I(Sw < Sp)			0.0100	0.0096
			(0.0075)	(0.0072)
Loglikelihood	**-664.7**	**-1034.1**	**-664.7**	**-1034.1**
Panel B: Physical IPV				
|Sw - Sp|	0.0072**	0.0068***		
	(0.0028)	(0.0025)		
|Sw - Sp| x I(Sw > Sp)			0.0072**	0.0069**
			(0.0031)	(0.0027)
|Sw - Sp| x I(Sw < Sp)			0.0054	0.0049
			(0.0030)	(0.0026)
Loglikelihood	**-300.8**	**-438.7**	**-300.8**	**-438.7**
Panel C: Sexual IPV				
|Sw - Sp|	0.0013	0.0015		
	(0.0022)	(0.0019)		
|Sw - Sp| x I(Sw > Sp)			0.0023	0.0023
			(0.0026)	(0.0023)
|Sw - Sp| x I(Sw < Sp)			-0.0002	0.0003
			(0.0020)	(0.0017)
Loglikelihood	**-165.0**	**-237.6**	**-165.0**	**-237.6**
Observations	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. Individual's controls: woman's age, woman's education attainment, partner's education attainment, woman's occupation status, partner's occupation status, types of union, number of children, log of equivalized household income, high frequency of street fights, high frequency of robbery in the neighbourhood, city-specific FEs (8 dummies) and a dummy for wave 2017. ** p<0.05; *** p<0.01.

[8] This relies on the selection on observables and implies that attrition can be treated as ignorable non-response, conditional on a set of characteristics and auxiliary variable(s) which can be related to both attrition and the outcome variable (Fitzgerald et al. 1998; Wooldridge 2002b).

The lack of statistical differences between adjusted and unadjusted estimates in Table 4 allows us to conclude that attrition in our sample is not relevant to bias the relationship between the skin color gap and the risk of IPV. The rest of our analysis presents the results taking into account the unobservable heterogeneity at the woman's and interviewer's level.

5.2 Baseline Response of IPV to Skin Color Gap

Table 5 provides estimated coefficients and marginal responses from the RE probit model. The intra-class correlation coefficient (Rho) captures women's unobservable heterogeneity, including their subjective rating regarding the thei partner's skin color. We find that about 57% of the unexplained risk of emotional IPV is attributed to unobservable heterogeneity. This contribution is approximately 60% with respect to the risk of physical, and 66% for sexual IPV. It suggests that unbservable heterogeneity responds for more than half of the unexplained risk of IPV and, therefore, RE probit model is the most appropriate approach to obtain consistent estimates when compared with pooled probit model.

Table 5 also provides marginal responses that take into account the unobservable heterogeneity at the individual level. For instance, we find that the probability of experiencing emotional IPV increases by approximately 0.0123 (or 1.2%) as the skin color gap of couples rises in 1 SD; while the probability of exposure to physical IPV increases by 0.0055 (or 0.6%) for the same variation in the skin color gap. We do not find significant marginal responses with respect to the risk of sexual IPV. This evidence for Brazil is aligned with the literature that shows an elevated risk of IPV for interracial couples when compared to monoracial couples in the US and Canada (Brownridge 2016; Brownridge et al. 2021; Carbone-Lopez 2013; Chartier and Caetano 2012; Fusco 2009; Hattery 2009; Martin et al. 2013).

Table 5 Results from random effect (RE) probit model for the risk of IPV: coefficients and marginal effects.

	Coefficients			Marginal effects		
	Emotional IPV	**Physical IPV**	**Sexual IPV**	**Emotional IPV**	**Physical IPV**	**Sexual IPV**
|Sw - Sp|	0.1119	0.2287***	0.0923	0.0123**	0.0055**	0.0014
	(0.0611)	(0.0882)	(0.1197)	(0.0060)	(0.0026)	(0.0022)
Sw	-0.0498	0.0337	-0.0407	-0.0070	0.0009	-0.0009
	(0.0417)	(0.0518)	(0.0850)	(0.0066)	(0.0013)	(0.0026)
Sp	-0.0074	-0.0227	-0.1025	-0.0009	-0.0008	-0.0030
	(0.0331)	(0.0432)	(0.0653)	(0.0042)	(0.0018)	(0.0029)
Age	-0.0094	-0.0250**	-0.0007	-0.0014	-0.0021	0.0000
	(0.0081)	(0.0118)	(0.0146)	(0.0015)	(0.0018)	(0.0003)
High-educated women	-0.0054	-0.0720	0.1004	-0.0007	-0.0024	0.0018
	(0.1402)	(0.2164)	(0.2572)	(0.0169)	(0.0073)	(0.0048)
High-educated partner	-0.2321	-0.4601**	-0.1423	-0.0283	-0.0158	-0.0026
	(0.1457)	(0.2269)	(0.2828)	(0.0180)	(0.0090)	(0.0053)
Employed women	-0.1455	0.4018	0.2262	-0.0173	0.0142	0.0042
	(0.1387)	(0.2121)	(0.2624)	(0.0163)	(0.0092)	(0.0062)
Employed partner	-0.1294	0.1259	0.3678	-0.0161	0.0040	0.0056
	(0.1635)	(0.2407)	(0.3366)	(0.0211)	(0.0073)	(0.0056)
Cohabiting	0.3314**	0.4937**	0.4420	0.0423**	0.0189	0.0090
	(0.1474)	(0.2273)	(0.2994)	(0.0199)	(0.0104)	(0.0087)
Living in separate domiciles	0.2677	0.3762	0.2806	0.0345	0.0145	0.0056
	(0.1942)	(0.2527)	(0.3699)	(0.0265)	(0.0119)	(0.0088)
Woman has 1 child	0.3209	0.1421	-0.3427	0.0415	0.0049	0.0010
	(0.2054)	(0.3022)	(0.4140)	(0.0285)	(0.0117)	(0.0079)
Woman has 2 children	-0.0193	-0.2226	-0.3427	-0.0023	-0.0070	-0.0056
	(0.2239)	(0.3286)	(0.4140)	(0.0268)	(0.0088)	(0.0069)
Woman has 3 children or more	0.5437**	0.7440***	1.0206**	0.0733**	0.0319	0.0267
	(0.2222)	(0.2752)	(0.4081)	(0.0328)	(0.0206)	(0.0202)
Log of equivalized HH income	0.0284	0.0045	-0.0339	0.0030	0.0001	-0.0008
	(0.0265)	(0.0389)	(0.0499)	(0.0025)	(0.0012)	(0.0015)
High frequency of robbery	0.0894	-0.1512	0.0016	0.0107	-0.0051	0.0000
	(0.1291)	(0.1812)	(0.2335)	(0.0154)	(0.0067)	(0.0042)
High frequency of street fights	0.0395	0.4089	-0.0557	0.0048	0.0167	-0.0010
	(0.1886)	(0.2480)	(0.4145)	(0.0233)	(0.0129)	(0.0072)
Wave 2017	0.2532**	0.1455	0.1641	0.0306**	0.0048	0.0029
	(0.1013)	(0.1487)	(0.2111)	(0.0121)	(0.0051)	(0.0041)
Sigma(u)	1.1516***	1.2203***	1.3796***			
	(0.1406)	(0.2185)	(0.3503)			
Rho	0.5701***	0.5983***	0.6556***			
	(0.0598)	(0.0861)	(0.1147)			
Loglikelihood	**-632.3**	**-286.7**	**-156.7**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Some demographic and socioeconomic characteristics are systematically associated with the risk of emotional IPV. For instance, the risk of emotional IPV is 0.0423 (or 4.2%) larger for women living in cohabitation relative to those women who are formally married. The risk of emotional IPV is 0.0733 (or 7.3%) greater for women with 3 children or more compared to women with no children. Besides, the risk of emotional IPV is 0.0306 (or 3.1%) larger in 2017 relative to the previous year. Nonetheless, we do not find robust marginal responses for demographic and socioeconomic characteristics on the risk of physical and sexual IPV.

5.3 Heterogeneous Responses

Our results so far have shown that the risk of IPV is increasing with the skin color gap of couples, specifically the exposure to emotional and physical violence. In this subsection, however, we investigate whether the probability of experiencing IPV is responsive to the skin color gap for specific groups of women, i.e., women with darker or lighter skin color than their partners. Our interest is to test whether skin color hierarchy explains our baseline results. For this purpose, we reestimate pooled and RE probit models with the following variables of interest: $|Sw_i - Sp_i| \times I(Sw_i - Sp_i > 0)$ and $|Sw_i - Sp_i| \times I(Sw_i - Sp_i < 0)$. The first variable is the skin color gap for women who show darker skin color shade than their partners, while the second variable refers to the skin color gap for women with lighter skin color shade.[9] Similar to the skin color gap, estimates of marginal responses are interpreted as the variation in the risk of IPV due to an increase of 1 SD in the skin color gap, considering the specific group of women.

Table 6 provides the estimated coefficients and marginal effects from RE probit models. The results are qualitatively similar to those reported in Table 5, showing a very large contribution of individuals' heterogeneity to the error component. Considering estimates for our variables of interest, we find that the probability of experiencing physical IPV increases by 0.0062 for women with darker skin color than their partners as the gap rises by 1 SD. Albeit the estimate for women with lighter skin color than their partners is positive, it is not statistically significant at the level of 5%. This evidence suggests that our baseline estimate regarding the skin color gap is driven by women with darker skin tone than their partners. In other words, the elevated risk of IPV among darker women is likely to be associated with skin color hierarchy within the couple. Furthermore, no significant effects are found for emotional and sexual IPV.

[9] To avoid perfect multicollinearity, the skin color shade of partners is not included as an explanatory variable in this specification.

Table 6 Heterogeneous estimates from random effect (RE) probit model for the risk of IPV: coefficients and marginal effects.

	Coefficients			**Marginal Effects**		
	Emotional IPV	**Physical IPV**	**Sexual IPV**	**Emotional IPV**	**Physical IPV**	**Sexual IPV**
|Sw - Sp| x I(Sw > Sp)	0.1052	0.2242**	0.2056	0.0120	0.0062**	0.0031
	(0.0719)	(0.0945)	(0.1367)	(0.0078)	(0.0031)	(0.0031)
|Sw - Sp| x I(Sw < Sp)	0.0902	0.1746	-0.0489	0.0104	0.0051	-0.0009
	(0.0627)	(0.0939)	(0.1286)	(0.0068)	(0.0028)	(0.0023)
Sw	-0.0572	0.0110	-0.1432	-0.0082	0.0003	-0.0050
	(0.0475)	(0.0589)	(0.0884)	(0.0078)	(0.0017)	(0.0066)
Age	-0.0094	-0.0250**	-0.0007	-0.0014	-0.0021	0.0000
	(0.0081)	(0.0118)	(0.0146)	(0.0015)	(0.0018)	(0.0003)
High-educated women	-0.0054	-0.0720	0.1004	-0.0007	-0.0024	0.0018
	(0.1402)	(0.2164)	(0.2572)	(0.0169)	(0.0073)	(0.0048)
High-educated partner	-0.2321	-0.4601**	-0.1423	-0.0283	-0.0158	-0.0026
	(0.1457)	(0.2269)	(0.2828)	(0.0180)	(0.0090)	(0.0053)
Employed women	-0.1455	0.4018	0.2262	-0.0173	0.0142	0.0042
	(0.1387)	(0.2121)	(0.2624)	(0.0163)	(0.0093)	(0.0062)
Employed partner	-0.1294	0.1259	0.3678	-0.0161	0.0040	0.0056
	(0.1635)	(0.2407)	(0.3366)	(0.0211)	(0.0073)	(0.0056)
Cohabiting	0.3314**	0.4937**	0.4420	0.0423**	0.0189*	0.0090
	(0.1474)	(0.2273)	(0.2994)	(0.0199)	(0.0104)	(0.0087)
Living in separate domiciles	0.2677	0.3762	0.2806	0.0345	0.0145	0.0056
	(0.1942)	(0.2527)	(0.3699)	(0.0265)	(0.0119)	(0.0088)
Woman has 1 child	0.3209	0.1421	-0.3427	0.0415	0.0049	0.0010
	(0.2054)	(0.3022)	(0.4140)	(0.0285)	(0.0117)	(0.0079)
Woman has 2 children	-0.0193	-0.2226	-0.3427	-0.0023	-0.0070	-0.0056
	(0.2239)	(0.3286)	(0.4140)	(0.0268)	(0.0088)	(0.0069)
Woman has 3 children or more	0.5437**	0.7440***	1.0206**	0.0733**	0.0319	0.0267
	(0.2222)	(0.2752)	(0.4081)	(0.0328)	(0.0206)	(0.0202)
Log of equivalized HH income	0.0284	0.0045	-0.0339	0.0030	0.0001	-0.0008
	(0.0265)	(0.0389)	(0.0499)	(0.0025)	(0.0012)	(0.0015)
High frequency of robbery	0.0894	-0.1512	0.0016	0.0107	-0.0051	0.0000
	(0.1291)	(0.1812)	(0.2335)	(0.0154)	(0.0067)	(0.0042)
High frequency of street fights	0.0395	0.4089	-0.0557	0.0048	0.0167	-0.0010
	(0.1886)	(0.2480)	(0.4145)	(0.0233)	(0.0129)	(0.0072)
Wave 2017	0.2532**	0.1455	0.1641	0.0306**	0.0048	0.0029
	(0.1013)	(0.1487)	(0.2111)	(0.0121)	(0.0051)	(0.0041)
Sigma(u)	1.1516***	1.2203***	1.3796***			
	(0.1406)	(0.2185)	(0.3503)			
Rho	0.5701***	0.5983***	0.6556***			
	(0.0598)	(0.0861)	(0.1147)			
Loglikelihood	**-632.3**	**-286.7**	**-156.7**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

5.4 Behavioural Mechanisms: Drinking and Controlling Behaviour

In this subsection, we investigate two potential behavioural mechanisms that mediate the relationship between the probability of IPV and the skin color gap. Specifically, we investigate whether controlling and drinking behaviour are associated with the level of dissimilarity in skin color shade between women and their partners.

5.4.1 Controlling Behaviour

In the PCSVDF^{Mulher}, controlling behaviour is captured by the following three questions: i) *Have your partner tried to keep you from seeing your friends?*; ii) *Have your partner tried to restrict contact with your family?*; iii) *Have your partner read your e-mails or phone text messages?*. The same three questions are made to women to capture their controlling behaviour over their partners. The alternative answers to these questions are: "1" Never, "2" Rarely, "3" Sometimes, "4" Frequently, and "5" Always.

To capture partner-to-women controlling behaviour, we create a binary variable that assigns value 1 to a partner who frequently/always keeps the woman from contact with friends or her family or reads her emails/text messages, and 0 otherwise. A similar binary variable is created to capture women-to-partner controlling behaviour. Mutual controlling behaviour, in turn, is a binary variable obtained from the multiplication of the first two variables. In our (un)balanced sample, 13.7% (13.4%) refers to partner-to-woman controlling behaviour; 16.5% (16%) is related to woman-to-partner controlling behaviour; and, finally, 7.9% (7.2%) is associated with mutual controlling behaviour within couples.

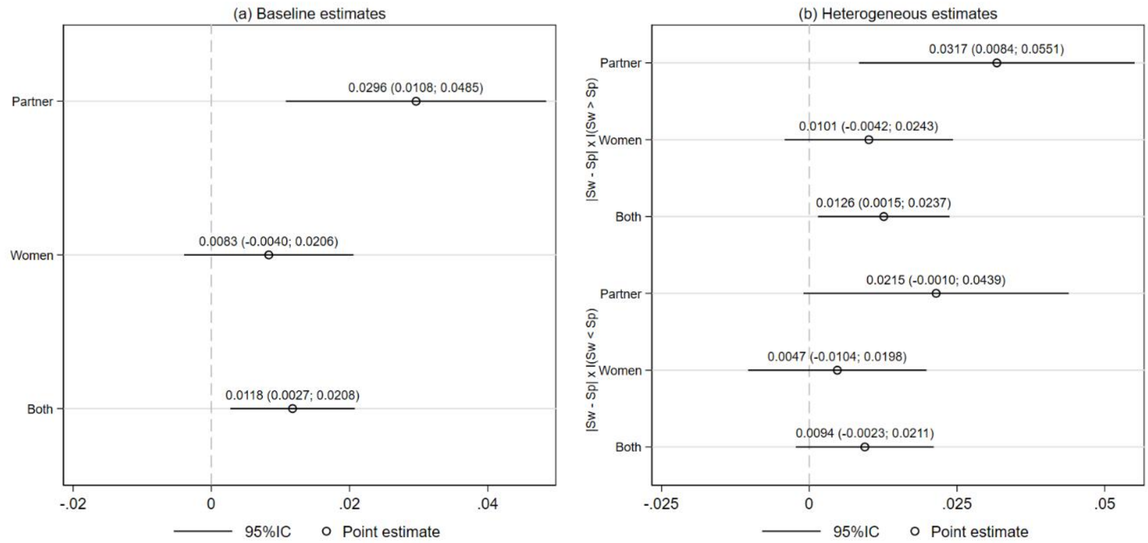
Figures 4(a) and 4(b) present the marginal responses and the corresponding confidence intervals for the probability of controlling behaviour within couples (i.e., partner-to-woman, woman-to-partner, and mutual controlling behaviour) with respect to the skin color gap, as well as the heterogeneous marginal responses for women with darker and lighter skin color than their partners.

Results from Figure 4(a) show that the probability of partner-to-woman controlling behaviour is 0.0202 (or 2%) larger if the skin color gap within couples increases by 1 SD, while the likelihood of woman-to-partner controlling behaviour is 0.0164 (or 1.6%) greater for the same variation in the skin color gap. We do not find a significant marginal response with respect to mutual controlling behaviour. Figure 4(b), in turn, shows a marginal response of 0.0263 (or 2.6%) in the likelihood of partner-to-women controlling behaviour due to a 1 SD increase in the skin color gap for women who shows darker skin color than their partners. We do not find heterogeneous responses with respect to women-to-partner or mutual controlling behaviour.[10] This evidence is aligned with the elevated risk of physical IPV as a response to a high dissimilarity in skin color within couples.

[10] The corresponding coefficients and marginal estimates with respect to controlling behaviour within couples can be accessed in Tables A1 and A2 in the Appendix.

Heterogeneity responses show that women with darker skin color than their partners are the most exposed group to partner-to-women controlling behaviour.

Fig. 4 Baseline and heterogeneous estimates of the association between drinking behaviour and skin color gap

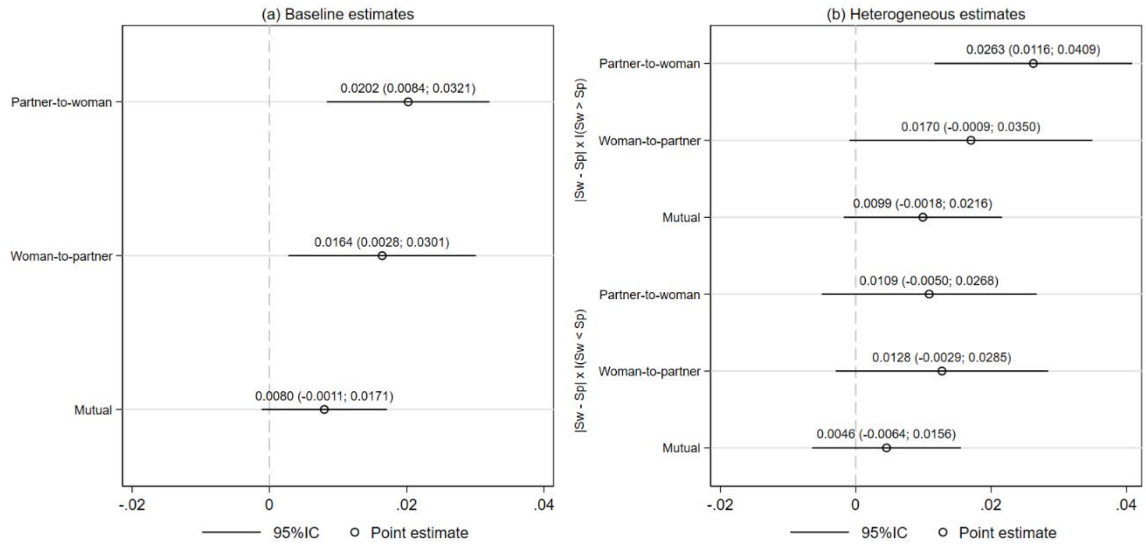


5.4.2 Drinking Behaviour

The PCVDF^{Mulher} survey provides information about women's and partners' frequency of alcohol consumption. Specifically, the PCVDF^{Mulher} asks to women *"Do you currently drink alcoholic beverages?"*. The responses are: "1" Yes, every day or almost every day; "2" Yes, from once or twice a week; "3" Yes, from 1 to 3 times a month; "4" Yes, less than once a month; "5" No, but used to drink; "6" No, I never drink. Interviewed woman answered the same question relative to her partner. We create a binary variable that assigns value 1 to women who reported drinking alcoholic beverages every day or from once to twice a week, and 0 otherwise. A similar variable is created for partners. In our (un)balanced sample, 28.7% (28.5%) of partners show a high frequency of alcohol consumption, while this proportion is 12.6% (12.7%) among women. The proportion of high frequency of alcohol consumption of both partner and woman is 9.2% (9.5%) of (un)balanced sample.

We investigate whether the probability of high frequency of alcohol consumption by partners, by women, or by both, is predicted by the skin color gap within couples. Figures 5(a) and 5(b) display the marginal responses and the corresponding confidence intervals for the probability of high frequency of alcohol consumption (i.e., partners' consumption, women's consumption, or both) with respect to the skin color gap, as well as the heterogeneous marginal responses for women with darker and lighter skin color than their partners. Results from Figure 4(a) show that the probability of high consumption of acholic beverages by partners is about 0.0296 (or 3%) larger if the skin color gap within couples rises by 1 SD. Despite women's drinking behaviour is not responsive to the skin color gap, we find that the probability of both partner and woman showing a high frequency of alcohol consumption increases by 0.0118 (or 1.2%) as the skin color gap within couples rises in 1 SD.

Fig. 5 Baseline and heterogeneous estimates of the association between controlling behaviour and skin color gap



Investigating the role of skin color hierarchy, Figure 5(b) shows heterogeneity response of drinking behaviour with respect to darker and lighter women. For instance, the probability of partners' showing a high frequency of alcohol consumption is 0.0317 (or 3.2%) larger if the skin color gap rises by 1 SD for women with darker skin tone than their partners. This marginal response is approximately 0.0126 (or 1.3%) for the probability of both partner and woman showing heavy drinking behaviour for the same group of women. However, we do not find significant marginal estimates regarding drinking behaviour when considering the group of women with lighter skin color than their partner. Our results suggest that partners' drinking behaviour is a mechanism that mediates the relationship between the risk of physical IPV and the skin color gap, specifically for women who show darker skin color than their partners.[11]

[11] The corresponding coefficients and marginal estimates with respect to drinking behaviour within couples can be accessed in Tables A3 and A4 in the Appendix.

5.5 Accounting for Unobservable Heterogeneity from Interviewers

Albeit we use a standardized skin color measure, the skin color gradation following Massey and Martin (2003) may be affected by a subjective rating from interviewers (Kreisman and Rangel 2015). While women may subjectively evaluate partners' skin color shade, interviewers may subjectively evaluate woman's skin color shade. Because the RE probit specification models the unobservable heterogeneity at the individual level, the error structure already accounts for women's subjective rating regarding their partner's skin color shade. To account for both woman's and interviewer's subjective ratings, we rely on the multilevel mixed-effect (ME) probit model (Guo and Zhao, 2000; Rabe-Hesketh and Skrondal, 2012). This approach allows for modelling both woman's and interviewer's unobservable heterogeneity as random effects, assuming their independence relative to the error term ε_{it} and or each other. Specifically, the interviewer's random effect is the second level, which is nested within the first level, i.e., woman's random effect.

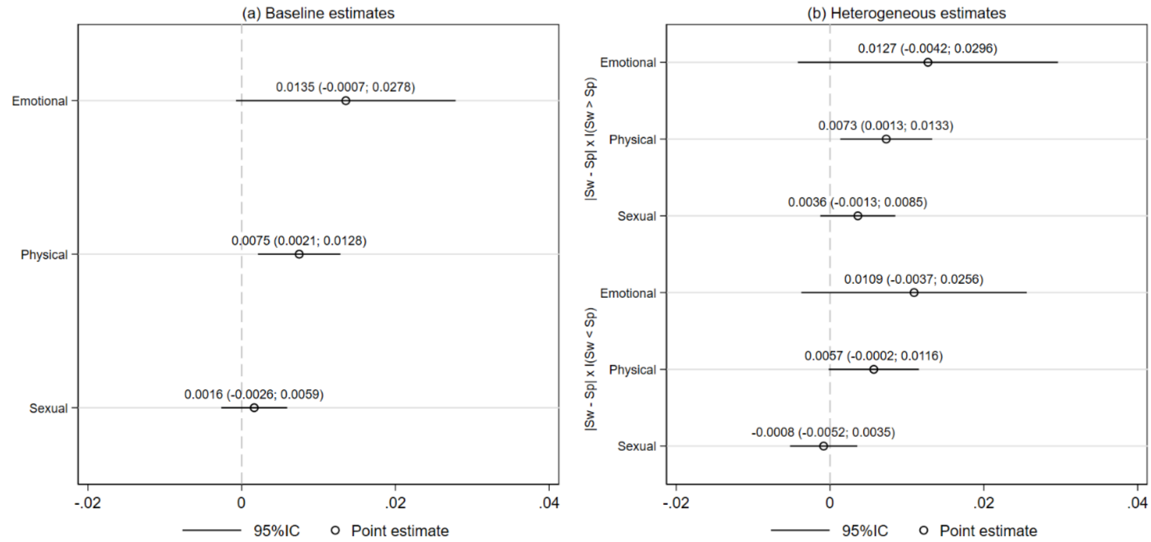
Figure 6 displays the marginal responses to the risk of IPV with respect to the skin color gap within couples. Results show that the estimates are very close to those obtained from RE probit models, either for the baseline or heterogeneous estimates. For instance, Figure 6(a) shows that the likelihood of physical IPV is 0.0075 larger if the skin color gap within couples rises by 1 SD. Figure 6(b) presents a similar marginal response of the probability of physical IPV relative to a variation of 1 SD in the skin color gap for women with darker skin color than their partners, respectively 0.0073.[12] This evidence suggests that our results are robust to interviewers' subjective ratings.

We also estimate the probability of controlling and drinking behaviour using the mixed effect probit model, accounting for both individuals' and interviewers' subjective ratings. Our results remain robust to those sources of unobservable heterogeneity and show that women in interracial relationships with large dissimilarity in skin color within couples are more likely to be exposed to elevated partners' controlling behaviour and frequent alcohol consumption.[13]

[12] The corresponding coefficients and marginal estimates with respect to the risk of IPV using the mixed effect probit model can be accessed in Tables A5 and A6 (Appendix).

[13] Tables A7 and A8 (Appendix) display coefficients and marginal estimates with respect to the probability of controlling behaviour using the same approach; Tables A9 and A10 (Appendix), in turn, provide coefficients and marginal estimates with respect to the probability of drinking behaviour using the mixed effect probit model.

Fig. 6 Baseline and heterogeneous estimates from ME probit model for the association between exposure to IPV and skin color gap



6. Conclusion

In this paper, we explore the panel structure of a unique data source on intimate partner violence in Northeast Brazil. The PCSVDF^{Mulher} survey provides information on women's exposure to emotional, physical, and sexual abuse from their partners, as well as information about the couples such as skin color shade. Taking advantage of this data source, we find that 72% of our sampled women show different skin color shade than their partners. This suggests that interracial relationship is very frequent in Northeast Brazil, as expected (see Telles, 2004). We, then, investigate whether the risk of IPV is responsive to the level of dissimilarity in skin color among women and their partners. We also investigate which group of women is more exposed to IPV due to the dissimilarity of skin color within couples to verify the existence a potential skin color hierarchy within couples. Related to these hypotheses, we test whether controlling and drinking behaviours are valid mechanisms that may explain the relationship between the risk of IPV and the skin color gap within couples.

Our results show that the risk of experiencing IPV is larger for women in couples with a large skin color gap. This evidence is relevant to the existing literature once previous evidence of the relationship between IPV and interracial marriage is documented in the context of the low miscegenation rate of the population in high-income countries (Brownridge 2016; 2021; Carbone-Lopez 2013; Fusco 2009; Martin et al. 2013). Moreover, our evidence shows that skin color hierarchy is a driving force of our baseline result, in which women with darker skin color than their partners show an increased probability of suffering physical IPV. Skin color hierarchy also predicts the controlling behaviour of the partners and the higher probability of abusive alcohol consumption, which are two important stress factors associated with IPV in interracial couples.

Despite the relevance of our results, our study shows two important limitations related to the data source. First, we find a high attrition rate in our sample. First, we find a high attrition rate in our sample. Nonetheless, pooled probit model using IPW to adjust for attrition shows that it does not compromise our results. Second, our sample is restricted to the Northeast region, which excludes states where interracial marriage is less frequent (Telles 2004). However, our study directly contributes to public policies that aim to fight violence against women by providing evidence that women in interracial couples are more likely to be exposed to physical IPV than women in monoracial couples, especially women with darker skin color than their partners. The existence of behavioural mechanisms helps policymakers to design effective policies to reduce such exposure faced by those women.

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APPENDIX

Table A1 Estimates from random effect (RE) probit model for controlling behaviour: coefficients and marginal effects

	Coefficients			Marginal effects		
	Partner	Women	Both	Partner	Women	Both
|Sw - Sp|	0.1629***	0.1008**	0.0952	0.0202***	0.0164**	0.0080
	(0.0588)	(0.0471)	(0.0614)	(0.0060)	(0.0070)	(0.0047)
Sw	-0.0167	0.0076	0.0016	-0.0025	0.0013	0.0001
	(0.0353)	(0.0322)	(0.0389)	(0.0056)	(0.0054)	(0.0036)
Sp	-0.0518*	-0.0119	-0.0268	-0.0086	-0.0022	-0.0028
	(0.0310)	(0.0270)	(0.0348)	(0.0058)	(0.0051)	(0.0040)
Age	-0.0338***	-0.0325***	-0.0342***	-0.0089***	-0.0095***	-0.0077***
	(0.0078)	(0.0064)	(0.0086)	(0.0026)	(0.0021)	(0.0029)
High-educated women	-0.1324	0.0835	-0.0923	-0.0192	0.0147	-0.0087
	(0.1335)	(0.1169)	(0.1511)	(0.0195)	(0.0204)	(0.0143)
High-educated partner	-0.0727	-0.0926	-0.1122	-0.0104	-0.0164	-0.0105
	(0.1304)	(0.1160)	(0.1453)	(0.0187)	(0.0206)	(0.0136)
Employed women	-0.0827	-0.0497	-0.1161	-0.0118	-0.0087	-0.0107
	(0.1226)	(0.1074)	(0.1407)	(0.0172)	(0.0188)	(0.0126)
Employed partner	-0.0676	-0.0863	-0.0501	-0.0099	-0.0156	-0.0048
	(0.1406)	(0.1235)	(0.1603)	(0.0208)	(0.0227)	(0.0154)
Cohabiting	0.1868	0.2621**	0.1563	0.0276	0.0483**	0.0151
	(0.1325)	(0.1141)	(0.1476)	(0.0203)	(0.0217)	(0.0146)
Living in separate domiciles	0.4781**	0.1632	0.1911	0.0769***	0.0300	0.0190
	(0.1680)	(0.1454)	(0.1816)	(0.0294)	(0.0276)	(0.0189)
Woman has 1 child	-0.0915	-0.0856	-0.1017	-0.0128	-0.0149	-0.0280
	(0.1731)	(0.1559)	(0.2163)	(0.0238)	(0.0266)	(0.0151)
Woman has 2 children	0.0491	-0.0224	-0.1017	0.0071	-0.0039	-0.0093
	(0.1875)	(0.1620)	(0.2163)	(0.0273)	(0.0284)	(0.0193)
Woman has 3 children or more	0.1761	0.1757	-0.0406	0.0262	0.0321	-0.0038
	(0.1951)	(0.1724)	(0.2218)	(0.0299)	(0.0325)	(0.0202)
Log of equivalized HH income	0.0476	0.0528**	0.0758**	0.0055**	0.0074***	0.0045***
	(0.0261)	(0.0238)	(0.0330)	(0.0023)	(0.0025)	(0.0013)
High frequency of robbery	0.2365**	0.2452**	0.1439	0.0335**	0.0429**	0.0133
	(0.1160)	(0.1039)	(0.1336)	(0.0164)	(0.0179)	(0.0124)
High frequency of street fights	0.2995	0.0158	0.2255	0.0471	0.0028	0.0231
	(0.1668)	(0.1518)	(0.1877)	(0.0284)	(0.0271)	(0.0210)
Wave 2017	0.0819	0.0244	0.0924	0.0117	0.0043	0.0086
	(0.0903)	(0.0828)	(0.1074)	(0.0129)	(0.0146)	(0.0101)
Sigma(u)	1.0115***	0.8891***	0.9981***			
	(0.1227)	(0.1069)	(0.1484)			
Rho	0.5057***	0.4415***	0.4990***			
	(0.0607)	(0.0593)	(0.0744)			
Loglikelihood	**-698.7**	**-801.5**	**-486.0**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A2 Heterogeneous estimates from random effect (RE) probit model for controlling behaviour: coefficients and marginal effects

	Coefficients			**Marginal effects**		
	Partner	**Women**	**Both**	**Partner**	**Women**	**Both**
|Sw - Sp| x I(Sw > Sp)	0.2037***	0.1012	0.1147	0.0263***	0.0170	0.0099
	(0.0673)	(0.0574)	(0.0737)	(0.0075)	(0.0092)	(0.0060)
|Sw - Sp| x I(Sw < Sp)	0.0788	0.0746	0.0504	0.0109	0.0128	0.0046
	(0.0612)	(0.0487)	(0.0639)	(0.0081)	(0.0080)	(0.0056)
Sw	-0.0685	-0.0043	-0.0253	-0.0120	-0.0008	-0.0026
	(0.0406)	(0.0375)	(0.0457)	(0.0082)	(0.0068)	(0.0051)
Age	-0.0338***	-0.0325***	-0.0342***	-0.0089***	-0.0095***	-0.0077***
	(0.0078)	(0.0064)	(0.0086)	(0.0026)	(0.0021)	(0.0029)
High-educated women	-0.1324	0.0835	-0.0923	-0.0192	0.0147	-0.0087
	(0.1335)	(0.1169)	(0.1511)	(0.0195)	(0.0204)	(0.0143)
High-educated partner	-0.0727	-0.0926	-0.1122	-0.0104	-0.0164	-0.0105
	(0.1304)	(0.1160)	(0.1453)	(0.0187)	(0.0206)	(0.0136)
Employed women	-0.0827	-0.0497	-0.1161	-0.0118	-0.0087	-0.0107
	(0.1226)	(0.1074)	(0.1407)	(0.0172)	(0.0188)	(0.0126)
Employed partner	-0.0676	-0.0863	-0.0501	-0.0099	-0.0156	-0.0048
	(0.1406)	(0.1235)	(0.1603)	(0.0208)	(0.0227)	(0.0154)
Cohabiting	0.1868	0.2621**	0.1563	0.0276	0.0483**	0.0151
	(0.1325)	(0.1141)	(0.1476)	(0.0203)	(0.0217)	(0.0146)
Living in separate domiciles	0.4781***	0.1632	0.1911	0.0769***	0.0300	0.0190
	(0.1680)	(0.1454)	(0.1816)	(0.0294)	(0.0276)	(0.0189)
Woman has 1 child	-0.0915	-0.0856	-0.1017	-0.0128	-0.0149	-0.0280
	(0.1731)	(0.1559)	(0.2163)	(0.0238)	(0.0266)	(0.0151)
Woman has 2 children	0.0491	-0.0224	-0.1017	0.0071	-0.0039	-0.0093
	(0.1875)	(0.1620)	(0.2163)	(0.0273)	(0.0284)	(0.0193)
Woman has 3 children or more	0.1761	0.1757	-0.0406	0.0262	0.0321	-0.0038
	(0.1951)	(0.1724)	(0.2218)	(0.0299)	(0.0325)	(0.0202)
Log of equivalized HH income	0.0476	0.0528**	0.0758**	0.0055**	0.0074***	0.0045***
	(0.0261)	(0.0238)	(0.0330)	(0.0023)	(0.0025)	(0.0013)
High frequency of robbery	0.2365**	0.2452**	0.1439	0.0335**	0.0429**	0.0133
	(0.1160)	(0.1039)	(0.1336)	(0.0164)	(0.0179)	(0.0124)
High frequency of street fights	0.2995	0.0158	0.2255	0.0471	0.0028	0.0231
	(0.1668)	(0.1518)	(0.1877)	(0.0284)	(0.0271)	(0.0210)
Wave 2017	0.0819	0.0244	0.0924	0.0117	0.0043	0.0086
	(0.0903)	(0.0828)	(0.1074)	(0.0129)	(0.0146)	(0.0101)
Sigma(u)	1.0115***	0.8891***	0.9981***			
	(0.1227)	(0.1069)	(0.1484)			
Rho	0.5057***	0.4415***	0.4990***			
	(0.0607)	(0.0593)	(0.0744)			
Loglikelihood	**-698.7**	**-801.5**	**-486.0**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A3 Estimates from random effect (RE) probit model for drinking behaviour: coefficients and marginal effects

	Coefficients			**Marginal effects**		
	Partner	**Women**	**Both**	**Partner**	**Women**	**Both**
|Sw - Sp|	0.1609***	0.0933	0.1656***	0.0296***	0.0083	0.0118**
	(0.0561)	(0.0753)	(0.0735)	(0.0096)	(0.0063)	(0.0046)
Sw	0.0153	0.0984**	0.0957**	0.0029	0.0072***	0.0057***
	(0.0366)	(0.0496)	(0.0478)	(0.0069)	(0.0026)	(0.0020)
Sp	-0.0244	-0.0252	-0.0205	-0.0049	-0.0025	-0.0018
	(0.0324)	(0.0418)	(0.0396)	(0.0067)	(0.0045)	(0.0037)
Age	0.0166**	0.0151	0.0207**	0.0025***	0.0010**	0.0009***
	(0.0079)	(0.0099)	(0.0099)	(0.0008)	(0.0004)	(0.0002)
High-educated women	0.0092	-0.5141***	-0.1586	0.0018	-0.0504***	-0.0132
	(0.1346)	(0.1953)	(0.1847)	(0.0264)	(0.0193)	(0.0156)
High-educated partner	-0.1329	0.0218	-0.0636	-0.0261	0.0021	-0.0052
	(0.1311)	(0.1797)	(0.1729)	(0.0258)	(0.0170)	(0.0142)
Employed women	-0.1388	-0.0511	0.0317	-0.0271	-0.0048	0.0026
	(0.1190)	(0.1712)	(0.1647)	(0.0230)	(0.0161)	(0.0136)
Employed partner	-0.0314	0.0167	-0.0193	-0.0062	0.0016	-0.0016
	(0.1431)	(0.1855)	(0.1909)	(0.0282)	(0.0175)	(0.0158)
Cohabiting	0.5489***	0.6235***	0.6401***	0.1114***	0.0644***	0.0589***
	(0.1338)	(0.1872)	(0.1990)	(0.0279)	(0.0211)	(0.0202)
Living in separate domiciles	0.2296	1.1245***	1.0650***	0.0461	0.1319***	0.1137***
	(0.1716)	(0.2425)	(0.2278)	(0.0352)	(0.0330)	(0.0292)
Woman has 1 child	0.3507	0.1764	0.2628	0.0708	0.0173	0.0330
	(0.1966)	(0.2613)	(0.2641)	(0.0407)	(0.0264)	(0.0253)
Woman has 2 children	0.2501	0.3302	0.2628	0.0499	0.0328	0.0226
	(0.2058)	(0.2699)	(0.2641)	(0.0417)	(0.0282)	(0.0242)
Woman has 3 children or more	0.2516	-0.0631	0.0596	0.0504	-0.0059	0.0050
	(0.2092)	(0.2876)	(0.2854)	(0.0426)	(0.0267)	(0.0241)
Log of equivalized HH income	0.0425	0.0344	0.0301	0.0076	0.0029	0.0022
	(0.0247)	(0.0349)	(0.0344)	(0.0040)	(0.0026)	(0.0021)
High frequency of robbery	-0.0307	0.0164	-0.0858	-0.0060	0.0016	-0.0071
	(0.1149)	(0.1554)	(0.1609)	(0.0226)	(0.0147)	(0.0133)
High frequency of street fights	0.3851**	0.3082	0.4650**	0.0792**	0.0316	0.0443
	(0.1628)	(0.2312)	(0.2271)	(0.0347)	(0.0253)	(0.0244)
Wave 2017	-0.0045	0.0832	0.0462	-0.0009	0.0079	0.0038
	(0.0813)	(0.1128)	(0.1168)	(0.0159)	(0.0107)	(0.0096)
Sigma(u)	1.3808***	1.6421***	1.4203***			
	(0.1180)	(0.1820)	(0.1820)			
Rho	0.6559***	0.7295***	0.6686***			
	(0.0386)	(0.0438)	(0.0568)			
Loglikelihood	**-1013.1**	**-595.6**	**-503.7**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A4 Heterogeneous estimates from random effect (RE) probit model for drinking behaviour: coefficients and marginal effects

	Coefficients			**Marginal effects**		
	Partner	**Women**	**Both**	**Partner**	**Women**	**Both**
|Sw - Sp| x I(Sw > Sp)	0.1681**	0.1111	0.1674**	0.0317***	0.0101	0.0126**
	(0.0659)	(0.0837)	(0.0823)	(0.0119)	(0.0073)	(0.0057)
|Sw - Sp| x I(Sw < Sp)	0.1120	0.0510	0.1212	0.0215	0.0047	0.0094
	(0.0612)	(0.0846)	(0.0802)	(0.0115)	(0.0077)	(0.0060)
Sw	-0.0091	0.0732	0.0751	-0.0018	0.0057	0.0048
	(0.0402)	(0.0538)	(0.0516)	(0.0081)	(0.0033)	(0.0025)
Age	0.0166**	0.0151	0.0207**	0.0025***	0.0010**	0.0009***
	(0.0079)	(0.0099)	(0.0099)	(0.0008)	(0.0004)	(0.0002)
High-educated women	0.0092	-0.5141***	-0.1586	0.0018	-0.0504***	-0.0132
	(0.1346)	(0.1953)	(0.1847)	(0.0264)	(0.0193)	(0.0156)
High-educated partner	-0.1329	0.0218	-0.0636	-0.0261	0.0021	-0.0052
	(0.1311)	(0.1797)	(0.1729)	(0.0258)	(0.0170)	(0.0142)
Employed women	-0.1388	-0.0511	0.0317	-0.0271	-0.0048	0.0026
	(0.1190)	(0.1712)	(0.1647)	(0.0230)	(0.0161)	(0.0136)
Employed partner	-0.0314	0.0167	-0.0193	-0.0062	0.0016	-0.0016
	(0.1431)	(0.1855)	(0.1909)	(0.0282)	(0.0175)	(0.0158)
Cohabiting	0.5489***	0.6235***	0.6401***	0.1114***	0.0644***	0.0589***
	(0.1338)	(0.1872)	(0.1990)	(0.0279)	(0.0211)	(0.0202)
Living in separate domiciles	0.2296	1.1245***	1.0650***	0.0461	0.1319***	0.1137***
	(0.1716)	(0.2425)	(0.2278)	(0.0352)	(0.0330)	(0.0292)
Woman has 1 child	0.3507	0.1764	0.2628	0.0708	0.0173	0.0330
	(0.1966)	(0.2613)	(0.2641)	(0.0407)	(0.0264)	(0.0253)
Woman has 2 children	0.2501	0.3302	0.2628	0.0499	0.0328	0.0226
	(0.2058)	(0.2699)	(0.2641)	(0.0417)	(0.0282)	(0.0242)
Woman has 3 children or more	0.2516	-0.0631	0.0596	0.0504	-0.0059	0.0050
	(0.2092)	(0.2876)	(0.2854)	(0.0426)	(0.0267)	(0.0241)
Log of equivalized HH income	0.0425	0.0344	0.0301	0.0076	0.0029	0.0022
	(0.0247)	(0.0349)	(0.0344)	(0.0040)	(0.0026)	(0.0021)
High frequency of robbery	-0.0307	0.0164	-0.0858	-0.0060	0.0016	-0.0071
	(0.1149)	(0.1554)	(0.1609)	(0.0226)	(0.0147)	(0.0133)
High frequency of street fights	0.3851**	0.3082	0.4650**	0.0792**	0.0316	0.0443
	(0.1628)	(0.2312)	(0.2271)	(0.0347)	(0.0253)	(0.0244)
Wave 2017	-0.0045	0.0832	0.0462	-0.0009	0.0079	0.0038
	(0.0813)	(0.1128)	(0.1168)	(0.0159)	(0.0107)	(0.0096)
Sigma(u)	1.3808***	1.6421***	1.4203***			
	(0.1180)	(0.1820)	(0.1820)			
Rho	0.6559***	0.7295***	0.6686***			
	(0.0386)	(0.0438)	(0.0568)			
Loglikelihood	**-1013.1**	**-595.6**	**-503.7**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A5 Baseline estimates from mixed-effects probit model for exposure to IPV: coefficients and marginal effects

	Coefficients			Marginal effects		
	Emotional IPV	**Physical IPV**	**Sexual IPV**	**Emotional IPV**	**Physical IPV**	**Sexual IPV**
|Sw - Sp|	0.1128	0.2298***	0.0912	0.0135	0.0075***	0.0016
	(0.0615)	(0.0889)	(0.1185)	(0.0073)	(0.0027)	(0.0022)
Sw	-0.0505	0.0335	-0.0410	-0.0061	0.0011	-0.0007
	(0.0419)	(0.0520)	(0.0839)	(0.0050)	(0.0017)	(0.0015)
Sp	-0.0074	-0.0228	-0.1001	-0.0009	-0.0008	-0.0018
	(0.0332)	(0.0433)	(0.0642)	(0.0040)	(0.0014)	(0.0011)
Age	-0.0094	-0.0252**	-0.0007	-0.0011	-0.0008**	0.0000
	(0.0081)	(0.0119)	(0.0145)	(0.0010)	(0.0004)	(0.0003)
High-educated women	-0.0071	-0.0732	0.0979	-0.0009	-0.0024	0.0018
	(0.1406)	(0.2176)	(0.2555)	(0.0169)	(0.0071)	(0.0046)
High-educated partner	-0.2324	-0.4617**	-0.1384	-0.0279	-0.0153**	-0.0025
	(0.1461)	(0.2287)	(0.2794)	(0.0175)	(0.0075)	(0.0050)
Employed women	-0.1464	0.4032	0.2282	-0.0176	0.0133	0.0041
	(0.1392)	(0.2134)	(0.2598)	(0.0167)	(0.0070)	(0.0048)
Employed partner	-0.1296	0.1274	0.3659	-0.0156	0.0042	0.0066
	(0.1641)	(0.2420)	(0.3342)	(0.0197)	(0.0080)	(0.0059)
Cohabiting	0.3318	0.4952	0.4372	0.0399	0.0164	0.0078
	(0.1480)	(0.2290)	(0.2962)	(0.0177)	(0.0073)	(0.0049)
Living in separate domiciles	0.2681	0.3782	0.2752	0.0322	0.0125	0.0049
	(0.1948)	(0.2544)	(0.3667)	(0.0232)	(0.0083)	(0.0065)
Woman has 1 child	0.3217	0.1431	0.0506	0.0387	0.0047	0.0009
	(0.2056)	(0.3035)	(0.4352)	(0.0247)	(0.0101)	(0.0078)
Woman has 2 children	-0.0206	-0.2243	-0.3463	-0.0025	-0.0074	-0.0062
	(0.2241)	(0.3331)	(0.4205)	(0.0269)	(0.0108)	(0.0073)
Woman has 3 children or more	0.5453**	0.7478***	1.0053**	0.0655**	0.0247***	0.0180**
	(0.2226)	(0.2738)	(0.4068)	(0.0264)	(0.0094)	(0.0072)
Log of equivalized HH income	0.0285	0.0046	-0.0340	0.0034	0.0002	-0.0006
	(0.0266)	(0.0392)	(0.0494)	(0.0032)	(0.0013)	(0.0009)
High frequency of robbery	0.0902	-0.1500	0.0007	0.0108	-0.0050	0.0000
	(0.1297)	(0.1823)	(0.2313)	(0.0155)	(0.0061)	(0.0041)
High frequency of street fights	0.0393	0.4101	-0.0554	0.0047	0.0136	-0.0010
	(0.1894)	(0.2487)	(0.4119)	(0.0228)	(0.0082)	(0.0074)
Wave 2017	0.2545**	0.1464	0.1625	0.0306**	0.0048	0.0029
	(0.1020)	(0.1494)	(0.2081)	(0.0121)	(0.0049)	(0.0037)
Loglikelihood	**-632.2**	**-286.7**	**-156.8**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A6 Heterogeneous estimates from mixed-effects probit model for exposure to IPV: coefficients and marginal effects

	Coefficients			Marginal effects		
	Emotional IPV	**Physical IPV**	**Sexual IPV**	**Emotional IPV**	**Physical IPV**	**Sexual IPV**
|Sw - Sp| x I(Sw > Sp)	0.1059	0.2252***	0.2016	0.0127	0.0073**	0.0036
	(0.0722)	(0.0951)	(0.1355)	(0.0086)	(0.0030)	(0.0025)
|Sw - Sp| x I(Sw < Sp)	0.0909	0.1755	-0.0467	0.0109	0.0057	-0.0008
	(0.0630)	(0.0945)	(0.1264)	(0.0075)	(0.0030)	(0.0022)
Sw	-0.0579	0.0108	-0.1410	-0.0070	0.0003	-0.0025
	(0.0477)	(0.0591)	(0.0885)	(0.0057)	(0.0019)	(0.0016)
Age	-0.0094	-0.0252**	-0.0007	-0.0011	-0.0008**	0.0000
	(0.0081)	(0.0119)	(0.0146)	(0.0010)	(0.0004)	(0.0003)
High-educated women	-0.0071	-0.0732	0.0980	-0.0009	-0.0024	0.0018
	(0.1406)	(0.2176)	(0.2556)	(0.0169)	(0.0070)	(0.0046)
High-educated partner	-0.2324	-0.4616**	-0.1384	-0.0279	-0.0149**	-0.0025
	(0.1461)	(0.2286)	(0.2794)	(0.0175)	(0.0073)	(0.0050)
Employed women	-0.1464	0.4031	0.2282	-0.0176	0.0130	0.0041
	(0.1392)	(0.2134)	(0.2598)	(0.0167)	(0.0067)	(0.0048)
Employed partner	-0.1296	0.1274	0.3660	-0.0156	0.0041	0.0066
	(0.1641)	(0.2420)	(0.3343)	(0.0197)	(0.0078)	(0.0059)
Cohabiting	0.3318**	0.4951**	0.4372	0.0399**	0.0160**	0.0078
	(0.1480)	(0.2290)	(0.2963)	(0.0177)	(0.0070)	(0.0049)
Living in separate domiciles	0.2681	0.3782	0.2753	0.0322	0.0122	0.0049
	(0.1948)	(0.2543)	(0.3668)	(0.0232)	(0.0080)	(0.0065)
Woman has 1 child	0.3217	0.1431	0.0507	0.0387	0.0046	0.0009
	(0.2056)	(0.3035)	(0.4353)	(0.0247)	(0.0098)	(0.0078)
Woman has 2 children	-0.0206	-0.2243	-0.3464	-0.0025	-0.0072	-0.0062
	(0.2241)	(0.3330)	(0.4206)	(0.0269)	(0.0105)	(0.0073)
Woman has 3 children or more	0.5453**	0.7476***	1.0055**	0.0655**	0.0241***	0.0180**
	(0.2226)	(0.2738)	(0.4070)	(0.0264)	(0.0090)	(0.0072)
Log of equivalized HH income	0.0285	0.0046	-0.0340	0.0034	0.0001	-0.0006
	(0.0266)	(0.0392)	(0.0494)	(0.0032)	(0.0013)	(0.0009)
High frequency of robbery	0.0902	-0.1500	0.0007	0.0108	-0.0048	0.0000
	(0.1297)	(0.1823)	(0.2314)	(0.0155)	(0.0059)	(0.0041)
High frequency of street fights	0.0393	0.4100	-0.0554	0.0047	0.0132	-0.0010
	(0.1894)	(0.2487)	(0.4120)	(0.0228)	(0.0080)	(0.0074)
Wave 2017	0.2545**	0.1464	0.1626	0.0306**	0.0047	0.0029
	(0.1020)	(0.1494)	(0.2082)	(0.0121)	(0.0048)	(0.0037)
Loglikelihood	**-632.2**	**-286.7**	**-156.8**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A7 Baseline estimates from mixed-effects probit model for controlling behaviour: coefficients and marginal effects

	Coefficients			**Marginal effects**		
	Partner	**Women**	**Both**	**Partner**	**Women**	**Both**
|Sw - Sp|	0.1633***	0.1009**	0.0954	0.0233***	0.0178**	0.0089
	(0.0590)	(0.0472)	(0.0615)	(0.0082)	(0.0083)	(0.0057)
Sw	-0.0169	0.0076	0.0012	-0.0024	0.0013	0.0001
	(0.0353)	(0.0322)	(0.0391)	(0.0050)	(0.0057)	(0.0036)
Sp	-0.0520	-0.0119	-0.0269	-0.0074	-0.0021	-0.0025
	(0.0311)	(0.0270)	(0.0348)	(0.0044)	(0.0048)	(0.0032)
Age	-0.0338***	-0.0325***	-0.0343***	-0.0048***	-0.0057***	-0.0032***
	(0.0078)	(0.0064)	(0.0087)	(0.0011)	(0.0011)	(0.0008)
High-educated women	-0.1326	0.0836	-0.0927	-0.0190	0.0148	-0.0086
	(0.1336)	(0.1169)	(0.1515)	(0.0191)	(0.0206)	(0.0140)
High-educated partner	-0.0727	-0.0927	-0.1122	-0.0104	-0.0164	-0.0105
	(0.1305)	(0.1160)	(0.1457)	(0.0186)	(0.0204)	(0.0135)
Employed women	-0.0832	-0.0498	-0.1170	-0.0119	-0.0088	-0.0109
	(0.1228)	(0.1075)	(0.1413)	(0.0175)	(0.0189)	(0.0130)
Employed partner	-0.0682	-0.0864	-0.0509	-0.0097	-0.0153	-0.0047
	(0.1408)	(0.1235)	(0.1607)	(0.0201)	(0.0218)	(0.0150)
Cohabiting	0.1867	0.2622**	0.1565	0.0267	0.0463**	0.0146
	(0.1326)	(0.1142)	(0.1480)	(0.0190)	(0.0200)	(0.0137)
Living in separate domiciles	0.4787***	0.1632	0.1912	0.0685***	0.0289	0.0178
	(0.1683)	(0.1454)	(0.1821)	(0.0237)	(0.0256)	(0.0168)
Woman has 1 child	-0.0917	-0.0856	-0.3292	-0.0131	-0.0151	-0.0307
	(0.1732)	(0.1560)	(0.2032)	(0.0247)	(0.0275)	(0.0185)
Woman has 2 children	0.0491	-0.0223	-0.1019	0.0070	-0.0039	-0.0095
	(0.1876)	(0.1620)	(0.2168)	(0.0268)	(0.0286)	(0.0202)
Woman has 3 children or more	0.1764	0.1758	-0.0405	0.0252	0.0311	-0.0038
	(0.1952)	(0.1724)	(0.2222)	(0.0278)	(0.0304)	(0.0207)
Log of equivalized HH income	0.0477	0.0528**	0.0761**	0.0068	0.0093**	0.0071**
	(0.0262)	(0.0238)	(0.0331)	(0.0037)	(0.0042)	(0.0030)
High frequency of robbery	0.2367**	0.2453**	0.1443	0.0338**	0.0434**	0.0135
	(0.1161)	(0.1039)	(0.1339)	(0.0167)	(0.0183)	(0.0125)
High frequency of street fights	0.3001	0.0157	0.2260	0.0429	0.0028	0.0211
	(0.1671)	(0.1519)	(0.1882)	(0.0237)	(0.0268)	(0.0174)
Wave 2017	0.0820	0.0244	0.0926	0.0117	0.0043	0.0086
	(0.0905)	(0.0829)	(0.1077)	(0.0129)	(0.0146)	(0.0100)
Loglikelihood	**-698.7**	**-801.5**	**-486.0**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A8 Heterogeneous estimates from mixed-effects probit model for controlling behaviour: coefficients and marginal effects

	Coefficients			Marginal effects		
	Partner	**Women**	**Both**	**Partner**	**Women**	**Both**
|Sw - Sp| x I(Sw > Sp)	0.2041***	0.1012	0.1150	0.0292***	0.0179	0.0107
	(0.0675)	(0.0574)	(0.0739)	(0.0093)	(0.0101)	(0.0068)
|Sw - Sp| x I(Sw < Sp)	0.0789	0.0746	0.0506	0.0113	0.0132	0.0047
	(0.0613)	(0.0487)	(0.0640)	(0.0087)	(0.0086)	(0.0059)
Sw	-0.0688	-0.0043	-0.0256	-0.0098	-0.0008	-0.0024
	(0.0407)	(0.0375)	(0.0459)	(0.0057)	(0.0066)	(0.0042)
Age	-0.0338***	-0.0325***	-0.0343***	-0.0048***	-0.0057***	-0.0032***
	(0.0078)	(0.0064)	(0.0087)	(0.0011)	(0.0011)	(0.0008)
High-educated women	-0.1326	0.0836	-0.0927	-0.0190	0.0148	-0.0086
	(0.1336)	(0.1169)	(0.1515)	(0.0191)	(0.0206)	(0.0140)
High-educated partner	-0.0727	-0.0927	-0.1122	-0.0104	-0.0164	-0.0105
	(0.1305)	(0.1160)	(0.1457)	(0.0186)	(0.0204)	(0.0135)
Employed women	-0.0832	-0.0498	-0.1170	-0.0119	-0.0088	-0.0109
	(0.1228)	(0.1075)	(0.1413)	(0.0175)	(0.0189)	(0.0130)
Employed partner	-0.0682	-0.0864	-0.0509	-0.0097	-0.0153	-0.0047
	(0.1408)	(0.1235)	(0.1607)	(0.0201)	(0.0218)	(0.0150)
Cohabiting	0.1867	0.2622**	0.1565	0.0267	0.0463**	0.0146
	(0.1326)	(0.1142)	(0.1480)	(0.0190)	(0.0200)	(0.0137)
Living in separate domiciles	0.4787***	0.1632	0.1912	0.0685***	0.0289	0.0178
	(0.1683)	(0.1454)	(0.1821)	(0.0237)	(0.0256)	(0.0168)
Woman has 1 child	-0.0917	-0.0856	-0.3292	-0.0131	-0.0151	-0.0307
	(0.1732)	(0.1560)	(0.2032)	(0.0247)	(0.0275)	(0.0185)
Woman has 2 children	0.0491	-0.0223	-0.1019	0.0070	-0.0039	-0.0095
	(0.1876)	(0.1620)	(0.2168)	(0.0268)	(0.0286)	(0.0202)
Woman has 3 children or more	0.1764	0.1758	-0.0405	0.0252	0.0311	-0.0038
	(0.1952)	(0.1724)	(0.2222)	(0.0278)	(0.0304)	(0.0207)
Log of equivalized HH income	0.0477	0.0528**	0.0761**	0.0068*	0.0093**	0.0071**
	(0.0262)	(0.0238)	(0.0331)	(0.0037)	(0.0042)	(0.0030)
High frequency of robbery	0.2367**	0.2453**	0.1443	0.0338**	0.0434**	0.0135
	(0.1161)	(0.1039)	(0.1339)	(0.0167)	(0.0183)	(0.0125)
High frequency of street fights	0.3001	0.0157	0.2260	0.0429	0.0028	0.0211
	(0.1671)	(0.1519)	(0.1882)	(0.0237)	(0.0268)	(0.0174)
Wave 2017	0.0820	0.0244	0.0926	0.0117	0.0043	0.0086
	(0.0905)	(0.0829)	(0.1077)	(0.0129)	(0.0146)	(0.0100)
Loglikelihood	**-698.7**	**-801.5**	**-486.0**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05 *** p<0.01.

Table A9 Baseline estimates from mixed-effects probit model for drinking behaviour: coefficients and marginal effects

	Coefficients			**Marginal effects**		
	Partner	**Women**	**Both**	**Partner**	**Women**	**Both**
|Sw - Sp|	0.1614***	0.0998	0.1696**	0.0311***	0.0096	0.0139**
	(0.0562)	(0.0778)	(0.0752)	(0.0108)	(0.0074)	(0.0060)
Sw	0.0156	0.1007**	0.0972**	0.0030	0.0097**	0.0080**
	(0.0367)	(0.0509)	(0.0487)	(0.0071)	(0.0048)	(0.0039)
Sp	-0.0246	-0.0272	-0.0221	-0.0047	-0.0026	-0.0018
	(0.0324)	(0.0422)	(0.0403)	(0.0062)	(0.0040)	(0.0033)
Age	0.0166**	0.0157	0.0212**	0.0032**	0.0015	0.0017**
	(0.0079)	(0.0099)	(0.0101)	(0.0015)	(0.0009)	(0.0008)
High-educated women	0.0092	-0.5320***	-0.1593	0.0018	-0.0511***	-0.0131
	(0.1345)	(0.1996)	(0.1864)	(0.0259)	(0.0185)	(0.0153)
High-educated partner	-0.1332	0.0286	-0.0647	-0.0257	0.0028	-0.0053
	(0.1310)	(0.1816)	(0.1751)	(0.0253)	(0.0174)	(0.0143)
Employed women	-0.1394	-0.0536	0.0332	-0.0269	-0.0051	0.0027
	(0.1189)	(0.1738)	(0.1669)	(0.0229)	(0.0167)	(0.0137)
Employed partner	-0.0317	0.0189	-0.0239	-0.0061	0.0018	-0.0020
	(0.1431)	(0.1888)	(0.1929)	(0.0276)	(0.0181)	(0.0158)
Cohabiting	0.5502***	0.6212***	0.6460***	0.1061***	0.0596***	0.0530***
	(0.1341)	(0.1884)	(0.2017)	(0.0262)	(0.0181)	(0.0160)
Living in separate domiciles	0.2289	1.1349***	1.0796***	0.0442	0.1090***	0.0886***
	(0.1714)	(0.2457)	(0.2319)	(0.0334)	(0.0228)	(0.0176)
Woman has 1 child	0.3520	0.1761	0.3764	0.0679*	0.0169	0.0309
	(0.1954)	(0.2564)	(0.2619)	(0.0378)	(0.0246)	(0.0214)
Woman has 2 children	0.2509	0.3370	0.2681	0.0484	0.0324	0.0220
	(0.2045)	(0.2647)	(0.2655)	(0.0395)	(0.0254)	(0.0218)
Woman has 3 children or more	0.2529	-0.0734	0.0601	0.0488	-0.0070	0.0049
	(0.2081)	(0.2836)	(0.2879)	(0.0402)	(0.0272)	(0.0236)
Log of equivalized HH income	0.0427	0.0335	0.0301	0.0082	0.0032	0.0025
	(0.0247)	(0.0355)	(0.0349)	(0.0048)	(0.0034)	(0.0029)
High frequency of robbery	-0.0307	0.0063	-0.0947	-0.0059	0.0006	-0.0078
	(0.1150)	(0.1594)	(0.1646)	(0.0222)	(0.0153)	(0.0134)
High frequency of street fights	0.3864**	0.3294	0.4737**	0.0745**	0.0316	0.0389**
	(0.1632)	(0.2404)	(0.2318)	(0.0314)	(0.0228)	(0.0186)
Wave 2017	-0.0045	0.0862	0.0467	-0.0009	0.0083	0.0038
	(0.0816)	(0.1190)	(0.1195)	(0.0157)	(0.0114)	(0.0098)
Loglikelihood	**-1012.9**	**-594.7**	**-503.4**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.

Table A10 Heterogeneous estimates from mixed-effects probit model for drinking behaviour: coefficients and marginal effects

	Coefficients			**Marginal effects**		
	Partner	**Women**	**Both**	**Partner**	**Women**	**Both**
|Sw - Sp| x I(Sw > Sp)	0.1688**	0.1191	0.1728**	0.0326***	0.0114	0.0142**
	(0.0660)	(0.0862)	(0.0845)	(0.0126)	(0.0082)	(0.0068)
|Sw - Sp| x I(Sw < Sp)	0.1123	0.0540	0.1227	0.0217	0.0052	0.0101
	(0.0613)	(0.0861)	(0.0813)	(0.0119)	(0.0082)	(0.0066)
Sw	-0.0090	0.0735	0.0751	-0.0017	0.0071	0.0062
	(0.0401)	(0.0542)	(0.0522)	(0.0077)	(0.0052)	(0.0043)
Age	0.0166**	0.0157	0.0212**	0.0032**	0.0015	0.0017**
	(0.0079)	(0.0099)	(0.0101)	(0.0015)	(0.0009)	(0.0008)
High-educated women	0.0092	-0.5320***	-0.1593	0.0018	-0.0511***	-0.0131
	(0.1345)	(0.1996)	(0.1864)	(0.0259)	(0.0185)	(0.0153)
High-educated partner	-0.1331	0.0286	-0.0647	-0.0257	0.0027	-0.0053
	(0.1310)	(0.1816)	(0.1751)	(0.0253)	(0.0174)	(0.0143)
Employed women	-0.1394	-0.0536	0.0332	-0.0269	-0.0051	0.0027
	(0.1189)	(0.1738)	(0.1669)	(0.0229)	(0.0167)	(0.0137)
Employed partner	-0.0317	0.0189	-0.0239	-0.0061	0.0018	-0.0020
	(0.1431)	(0.1887)	(0.1929)	(0.0276)	(0.0181)	(0.0158)
Cohabiting	0.5502***	0.6212***	0.6459***	0.1061***	0.0596***	0.0530***
	(0.1341)	(0.1884)	(0.2017)	(0.0262)	(0.0181)	(0.0160)
Living in separate domiciles	0.2289	1.1349***	1.0795***	0.0442	0.1090***	0.0886***
	(0.1714)	(0.2457)	(0.2319)	(0.0334)	(0.0228)	(0.0176)
Woman has 1 child	0.3520*	0.1761	0.3763	0.0679*	0.0169	0.0309
	(0.1954)	(0.2564)	(0.2619)	(0.0378)	(0.0246)	(0.0214)
Woman has 2 children	0.2509	0.3370	0.2680	0.0484	0.0324	0.0220
	(0.2045)	(0.2647)	(0.2654)	(0.0395)	(0.0254)	(0.0218)
Woman has 3 children or more	0.2529	-0.0734	0.0601	0.0488	-0.0070	0.0049
	(0.2081)	(0.2836)	(0.2879)	(0.0402)	(0.0272)	(0.0236)
Log of equivalized HH income	0.0427	0.0335	0.0301	0.0082	0.0032	0.0025
	(0.0247)	(0.0355)	(0.0349)	(0.0048)	(0.0034)	(0.0029)
High frequency of robbery	-0.0307	0.0063	-0.0947	-0.0059	0.0006	-0.0078
	(0.1149)	(0.1594)	(0.1646)	(0.0222)	(0.0153)	(0.0134)
High frequency of street fights	0.3864**	0.3294	0.4736**	0.0745**	0.0316	0.0389**
	(0.1632)	(0.2404)	(0.2317)	(0.0314)	(0.0228)	(0.0186)
Wave 2017	-0.0045	0.0862	0.0467	-0.0009	0.0083	0.0038
	(0.0816)	(0.1189)	(0.1195)	(0.0157)	(0.0114)	(0.0098)
Loglikelihood	**-1012.9**	**-594.7**	**-503.4**			
Observations	**1926**	**1926**	**1926**	**1926**	**1926**	**1926**

Note. Standard errors are clustered at individual level. The models also include city-specific FEs (8 dummies). ** p<0.05; *** p<0.01.