London School of Economics and Political Science

Department of Economics

Motherhood and Violence

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I warrant that this authorisation does not, to the best of my belief, infringe the rights of any third party.

I declare that my thesis consists of 27941 words.

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Abstract

Intimate Partner Violence (IPV) imposes large psychological and economic costs for women worldwide, and it is positively correlated with motherhood. This thesis explores why. I propose a model and an empirical test for two alternative explanations which look observationally equivalent if we use usual IPV data. The first is that having a baby triggers men's violent behavior; the second is that motherhood makes women more likely to stay with a violent partner. I use Mexican survey data with information on fertility, relationship history and violence history with current and past partners; this history allows me to disentangle the mechanisms. I find that motherhood is associated with a higher probability of current violence and a lower probability of leaving but I find no relationship between motherhood and men's violent behavior. Evidence for this selection channel is further supported by exploiting the fertility shock induced by the opening of pharmacies, where I show that women are less likely to leave violent partners when they are mothers compared to when they are not. My results suggest that policies which strengthen women's control over their fertility can reduce the incidence of IPV by enabling them to leave violent relationships before they are locked in by motherhood.

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Chapter 1

Introduction

The birth of the first child brings big changes in household dynamics, often increasing women's economic dependence on their partners (Kleven et al., 2019; Kleven, 2022; Kleven et al., 2023). Given the global prevalence of Intimate Partner Violence (IPV)-with over one in four women affected (WHO, 2021)- and the profound impact on children raised in violent households (Wolfe et al., 2003; Smith et al., 2011; Aizer, 2010), understanding the relationship between motherhood and IPV is critical. Most empirical studies suggest that mothers are more likely to experience violence compared to non-mothers (Massenkoff and Rose, 2024; Britto et al., 2024; Bø Vatnar and Bjørkly, 2010). Yet, the mechanisms behind this relationship remain largely unexplored, and understanding them is essential for designing effective policies.

Does motherhood increase the risk that a woman experiences violence and, if so, why? In this paper, I propose and test two mechanisms. The first is that having a baby causes changes in men's violent behavior[1]. The second is that motherhood makes women more likely to stay with a violent partner[2]. This will result in mothers being at higher risk of violence, even if men's violent behavior does not change after childbirth. The challenge is that changes in violent behavior and separation can appear observationally equivalent in usual IPV data sources, as they often only capture current IPV. Both a woman who leaves a violent partner and a woman not experiencing violence would report no current violence.

[1]This could be driven by changes in financial stress, emotional stress or changes in bargaining power. For example, Britto et al. (2024) argue that their findings could be driven by financial distress or increased time spent together after childbirth.

[2]This could be driven by changes in the labor market (Kleven, 2022), unequal costs of childbearing (Doepke and Kindermann, 2019), or psychological factors.

To address this, I develop a game-theoretical model that informs the identification of the channels and test it empirically using a novel dataset. Both channels predict that mothers will be at higher risk of experiencing violence than non-mothers, but they yield different predictions in terms of men's violent behavior and women's separation behavior. Testing these predictions requires data on past violence and separation history. Using Mexican survey data with these characteristics, I construct a proxy for men's violent behavior independent of separation. I show that motherhood is associated with higher prevalence of current violence and lower separation rates, but I find no association between motherhood and men's violent behavior.

To further test the mechanisms, I use quasi-exogenous variation in access to pharmacies, an important source of contraceptives for Mexican women. I find that pharmacy openings reduce the probability of motherhood and the likelihood of experiencing physical violence in the past year. Consistent with the correlational results, they also increase the probability of relationship dissolution. Overall, my findings suggest that while some men are violent regardless of fatherhood, motherhood imposes significant separation costs on women, making it harder for them to leave abusive relationships.

The thesis proceeds as follows. In the second chapter, I show a set of descriptive facts using Mexican survey data on domestic violence. These facts serve as motivation for the theoretical framework. First, I document that mothers are more than twice as likely as non-mothers to report physical and sexual violence in the last year. Second, I show that 31.8% of women who experience physical violence leave their partners, compared to 9.2% of women who do not experience violence. This suggests that, contrary to popular belief, women do leave their abusers. Third, I show that leaving a violent partner shields women from further violence. Five years after leaving an abuser, only 7.5% of women continue to experience violence from their ex-partner. Lastly, I show that Mexican women tend to have their first child soon after starting a relationship: the median woman has her first child two years after the relationship begins.

In the third chapter of the thesis, I propose a simple two-period model based on the four facts above. Men decide whether to exert violence and women decide whether to leave the relationship. Men vary in their (private) satisfaction for violence, where some derive a positive utility from exerting violence. At the beginning of the first period, some couples exogenously become parents, while the rest wait until the second period. Having a baby brings women utility, but

decreases their outside option, as they bear the cost of child-rearing outside of the relationship. This results in mothers being (weakly) less likely to leave abusers compared to non-mothers.

I show that abusive men's strategy in the first period is a function of the satisfaction for violence. I focus on two cases of interest. When the satisfaction for violence is medium, only abusive fathers exert violence, while abusive non-fathers wait until they become fathers to exert violence. I refer to this case as *direct channel* as it highlights a situation where the birth of a child has a direct effect on men's violent behavior. The predictions of the model are as follows. Fathers will be more likely to exert violence compared to non-fathers. Mothers with low dissolution cost will leave and the rest will stay. Consequently, mothers will be more likely to be separated and more likely to experience violence compared to non-mothers.

When the satisfaction for violence is high, all abusive men exert violence irrespective of whether they are fathers or not. However, mothers will be strictly less likely to leave. Consequently, mothers will be more likely to experience violence compared to non-mothers. I refer to this case as *selection channel* as the changes in sample composition are driving the results. Both channels predict that mothers will be more likely to experience violence compared to non-mothers, but they yield different predictions in terms men's violent behavior and women's separation behavior.

In the fourth chapter of the thesis, I explain why disentangling the two channels faces an empirical challenge. The first issue is that common IPV data sources such as administrative records or surveys where women report IPV in the last 12 months are proxies for whether women experience violence, and both channels look observationally equivalent in terms of this variable. In other words, if we observe an increased risk that women experience violence after becoming mothers, it could be driven by changes in men's violent behavior or women's separation behavior.

Additionally, I use a directed acyclical graph framework and simulations to show that focusing on a sample of partnered women (e.g. to isolate changes in violent behavior within intact marriages) or controlling for civil status would result in *collider bias*, also known as sample selection bias. Intuitively, if violence increases separation and motherhood decreases separation, a sample of partnered women would be missing an important group: non-mothers who experienced violence and were able to leave their partner. Conditioning on civil status results in

spurious correlation between motherhood and violence.

Hence, to test the model's predictions, we need data with two key features. First, the sample must include both partnered and separated women to avoid collider bias. Second, the data must allow us to construct a measure of men's violent behavior that is not mechanically influenced by separation. One way to achieve this is to ask women whether they experienced violence at any point in their relationship with both current and past partners. This approach enables us to identify whether separated women experienced IPV with their ex-partners, even if they are no longer subject to violence.

In the fifth chapter, I test the model empirically using *ENDIREH*, a national representative survey of household dynamics in Mexico, which includes women of all civil status and has violence history of current and past partners. In particular, they ask women whether their (ex)partner exerted violence in the last 12 months and whether their (ex)partner exerted violence at any point in the relationship. The first is a proxy for current violence and a function of both violence and separation behavior, while the second is a proxy for violent behavior as both separated and partnered women with an abusive (ex)partner will answer positively.

I test the model's predictions using a sample of women who recently began their first cohabiting relationship. I find that mothers are more likely to currently experience physical violence from their first partner, a result consistent with both the direct and selection channels. However, mothers and non-mothers are equally likely to have experienced physical violence at any point in the relationship. Under the direct channel, fathers are more likely to exert violence, so we would expect mothers to be more likely than non-mothers to report having experienced violence at some point. In contrast, under the selection channel all men are equally likely to exert violent, which implies no difference in lifetime exposure to violence between mothers and non-mothers. Lastly, I find that mothers are less likely to be separated from their first partner than non-mothers. Taken together, these findings are consistent with the selection channel.

Additionally, I show that mothers who wait longer to have their first child are less likely to have experienced violence from their first partner, further supporting the selection channel. These mothers represent a selected group of women who chose to become mothers with full knowledge of their partner's type—either because they are with non-violent partners or because they face high costs of separation. Under the direct channel, by contrast, the timing of motherhood

would not affect the likelihood of experiencing violence, as women only learn about their partner's type once they become mothers.

In the sixth chapter of the thesis, I use pharmacy openings as a natural experiment to causally test the predictions of the model. In Mexico, pharmacies play an important role in providing contraceptives, particularly for non-mothers. Nearly 80% of non-mothers who use contraceptives obtain them from a pharmacy. To calculate access to pharmacies, I use three data sources. First, I use three cross-sectional waves[3] of *ENDIREH*, the national representative survey of household dynamics. I obtained confidential access to the location of the women at the block level. I complement this data with i) DENUE: Universe of businesses in Mexico, which provides the coordinates of all businesses in Mexico (including pharmacies), and ii) maps of Mexico at the block level collected by the National Institute of Statistics (INEGI). For each woman in the survey, I calculate the Euclidean distance to the nearest pharmacy in 2011 and 2016, allowing me to identify women who gained access to a pharmacy between these waves.

Using variation across time and access to pharmacies, I estimate the effect of a pharmacy opening on fertility, violence and separation in a difference-in-difference framework. The treated group is women who did not have a pharmacy within a one kilometer radius in 2011 and did in 2016 and the control group is women who had no pharmacies within a one kilometer radius in both waves. The main sample of interest are women who were not mothers five years before the survey, as I focus on the extensive margin of motherhood. The main identifying assumption is that treatment and control groups would have followed a parallel trend in terms of fertility, violence and separation in the absence of a pharmacy opening. I use a previous wave of the survey to show that there were no differential trends between treatment and control groups before the pharmacy opening.

Since pharmacies provide a wide range of products, it is unlikely that the decision to open a pharmacy is driven by trends in fertility, violence, or separation. Nonetheless, pharmacy openings may still correlate with other local factors that affect these outcomes, potentially violating the parallel trends assumption. To address this concern, I identify the eight fastest-growing types of businesses between 2011 and 2016 and estimate the effect of these business openings on the

[3]The waves 2011 and 2016 are used for the main analysis. The wave of 2006 is used to verify that previous to pharmacy openings, there were no differential trends between treatment and control groups.

outcomes of interest. I show that only a pharmacy opening, and not other business openings, has the expected effects on fertility, violence and separation.

My main results are as follows. I first show that pharmacies are an effective mechanism for reducing fertility. I find that women are 9 percentage points less likely to be mothers after a pharmacy opening compared to women in the control group (p-value=.016). Then, I test the three predictions of the model: whether a woman experiences violence, whether her partner exerts violence and whether she leaves the relationship.

The first prediction of the model is the effect of motherhood on current violence. I use as an outcome variable a binary variable that equals one if the woman experienced physical violence in the last twelve months. Both channels predict that a pharmacy opening will reduce the probability that a woman experiences violence. Under the direct channel, fewer men become parents, resulting in fewer men exerting violence and fewer women experiencing it. Under the selection channel, all abusive men are equally likely to exert violence. Consequently, a pharmacy opening does not change men's propensity to exert violence, but gives women time to learn about their partner's type and leave, resulting in less women experiencing violence. I find that treated women are 4.4 percentage points less likely to have experienced physical violence in the last twelve months (p-value=.018).

The second prediction of the model is the effect of motherhood on men's violent behavior. I use women's relationship history and violence history to identify whether the partner from five years before the survey (before the pharmacy opening) was physically violent at any point in the relationship[4]. The direct channel predicts a negative coefficient in this variable, because fewer men become violent as a result of the pharmacy opening. Instead, the selection channel predicts that the coefficient would be zero, as having a child does not change men's propensity to exert violence. Consistent with the selection channel, I find that women in the treatment and control groups are as likely to have experienced violence with their partner from before the pharmacy opening.

The third and last prediction of the model is the effect of motherhood on separation behavior. I use as an outcome variable whether a woman had a break-up in the last five years. Under the direct channel, a pharmacy opening would result in a decrease in the probability of break-up. As fewer men become violent,

[4]This is a proxy for violence on the extensive margin, but I also show the same results for violence on the intensive margin.

fewer women experience violence, which leads to lower separation rates. Instead, the coefficient would be positive under the selection channel, as delaying pregnancy allows women time to find out whether their partner is violent and leave. Consistent with the selection channel, I find that pharmacy access increases the probability of break-up by 7.2 percentage points (p-value=.063).

To use pharmacy openings as an instrument for fertility, we need two additional assumptions beyond parallel trends: the exclusion restriction—pharmacies affect violence and separation only through changes in fertility—and monotonicity, meaning there are no defiers. I use a sample recent mothers prior to the pharmacy opening as a placebo group. These women had access to all services that a pharmacy provides, but the timing of the opening was after they became mothers. For this group, I find no effect on fertility, violence, or separation. I conclude that for the compliers, a one standard deviation in the predicted probability of motherhood increases the risk of experiencing physical violence in the last 12 months by 11.7 percentage points, has no effect on men's propensity to exert violence, and reduces the probability of break-up by 20 percentage points[5].

In conclusion, I use two empirical exercises to show that motherhood increases the risk of violence by raising separation costs for women. The first tests all the model's predictions using a general population sample, but is correlational. The second identifies the causal effect of motherhood on violence and separation within the specific sub-population of compliers. My findings highlight the importance of reproductive rights for women. Given that motherhood imposes separation costs, delaying pregnancy allows women to time to exit a violent relationship before having children.

Recent empirical literature has used event-study designs around the birth of the first child, using as comparison groups future parents. The evidence has been mixed. My findings are aligned with evidence from the USA (Massenkoff and Rose, 2024) and Brazil (Britto et al., 2024), who find a sharp increase in police arrests after the birth of the first child. Bergvall and Rodríguez-Planas (2024) find the opposite in Sweden using hospital data. However, they suggest that the long-term decrease in hospitalizations might be due to women exiting toxic relationships, which is pointing to the same (although opposite direction) mechanism. It's plausible that in countries with stronger social support systems and lower rates of unplanned pregnancies, such as Sweden, motherhood may release constraints to leave a violent relationship.

[5]The large coefficients suggests that it is a particularly vulnerable group of women.

There is a vast literature that has used game theoretical models with asymmetric information to model IPV's relationship to dowries (Bloch and Rao, 2002; Calvi and Keskar, 2023), cash transfers (Bobonis et al., 2013) and employment (Sanin, 2024; Adams et al., 2024). I contribute to this literature by incorporating fertility as a mechanism that changes the dynamics of IPV[6]. Most of the models incorporate the threat of leaving as a mechanism to explain changes in a man's violent behavior, most do not consider the direct channel of the end of the relationship. One notable exception is work by Adams et al. (2024), who show that the break-up channel is an important mechanism to consider[7]. I extend this literature by providing a framework which allows to test both changes in violent behavior and separation behavior.

I also contribute to the literature on the relationship between access to contraception and women's outcomes. A large body of evidence shows that improved access to contraceptives enhances women's educational attainment and labor market participation. Following increased availability, more women enroll in college and enter the labor force, both at the extensive and intensive margins (Goldin and Katz, 2002; Bailey, 2006; Miller, 2009). These studies also find that women tend to marry and have their first child at later ages. In addition to these socioeconomic outcomes, access to contraception has been shown to improve women's mental health, even when fertility remains unchanged (Ashraf et al., 2024).

Regarding the impact of access to reproductive health services on IPV, reduced abortion access has been found to increase violence against women (Muratori, 2024), and abortion legalization in Mexico has led to a decrease in IPV (Garcia-Ramos and Pineda-Torres, 2024). However, in India, increased political representation for women led to greater access to contraception, but also an increase in IPV (Anukriti et al., 2024). I contribute to this literature by showing that access to contraceptives can reduce the risk of violence by allowing women to exit violent relationships before having children.

The remainder of my thesis is organized as follows. Chapter 2 presents a set of descriptive facts that motivate the theoretical framework. Chapter 3 presents the theoretical model. Chapter 4 discusses how to go from the model to the data.

[6] Anderberg et al. (2023) study the relationship between motherhood and IPV through a dynamic model where women learn about their partner's type over time, but abuse is non-strategic

[7] They show that as women's outside options quasirandomly increase, there is an increase in the rate of breakup amongst abusive couples, with no impact on otherwise similar non-abusive couples.

Chapter 5 tests descriptively the model's predictions. Chapter 6 uses pharmacy openings as a natural experiment to test the model's predictions. Chapter 7 concludes.

Chapter 2

Empirical facts

This chapter presents four descriptive facts about IPV, separation, and fertility that motivate the model. The first fact is the central motivation of the thesis and the main outcome the model seeks to explain: mothers are more likely to experience violence than non-mothers. The remaining facts support key assumptions of the model. Specifically, I show that (i) women who experience violence are more likely to separate from their partners, (ii) separation protects women from further violence, and (iii) many women have a child shortly after entering a relationship.

Facts 1-3 are based on data from the Mexican National Survey on the Dynamics of Relationships (ENDIREH) 2011 and 2016. This survey is designed and conducted by the National Institute of Statistics (INEGI) every five years, with each wave surveying over 100,000 women and with response rate exceeding 85%. It adheres to international standards on privacy, consent, and safety. Each respondent answers approximately 30 questions about IPV, categorized into physical, sexual, and emotional violence. Emotional violence includes insults, humiliation, and threats. Physical violence includes slapping, hitting, and beating, while sexual violence involves forced intercourse and other forms of sexual coercion. See Appendix A for all the survey questions related to emotional, physical, and sexual violence. The survey also collects information on relationship history and fertility.

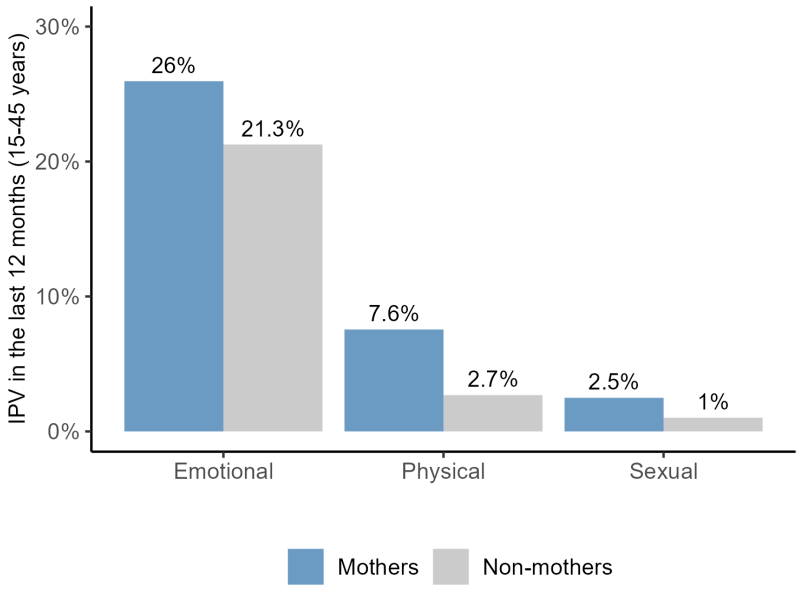
Fact 4 is based on data from the National Survey on Demographic Dynamics (ENADID) 2014, also conducted by INEGI. ENADID provides information on demographic dynamics in Mexico, including fertility, mortality, and migration.

It includes a module on sexual and reproductive health, which contains questions on contraceptive use and reasons for non-use.

Fact 1: Mothers are more likely to experience violence than non-mothers.

Figure 2.1 illustrates the probability of experiencing violence in the last 12 months for mothers and non-mothers in Mexico. The sample includes all women between 15 and 45 years old who have had a romantic relationship (boyfriend or partner) at some point in their lifetime.

Figure 2.1: Prevalence of current IPV by motherhood status



Notes: This figure shows the population-weighted share of women who report having experienced emotional, physical and sexual violence in the last twelve months by motherhood status.

Descriptively, 26% of mothers experienced emotional violence in the last 12 months compared to 21.3% of non-mothers. The gap in IPV for physical violence is even larger: 7.6% of mothers experienced physical violence in the last 12 months compared to 2.7% of non-mothers. Lastly, mothers are also more likely to experience sexual violence (2.1% vs 1%)[1]. This fact is consistent with

[1]This figure includes all women who have ever had a romantic relationship, including women who have a boyfriend or ex-boyfriend. Figure B.1 in the Appendix shows the motherhood gap in IPV if we only consider women who have had a partner (marriage or cohabitation). It is smaller, but mothers remain more likely to currently experience emotional, physical and sexual violence.

recent literature that finds the birth of a child is associated with an increase in the probability of male arrests for domestic violence by 50-100% in the US (Massenkoff and Rose, 2024) and by 215% in Brazil (Britto et al., 2024).

Fact 2: Women who experience physical violence are more likely separate.

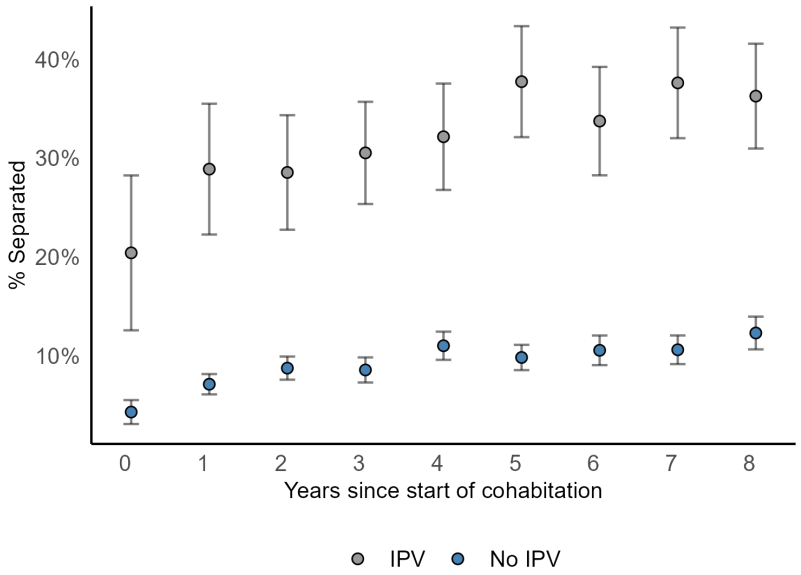
Figure 2.2 shows that experiencing physical violence is associated with a greater likelihood of being separated. It plots coefficients from a regression analysis on a sample of women who began their most recent cohabiting relationship less than eight years before the survey. The x-axis represents years since the start of cohabitation, while the y-axis shows the proportion of women who are separated at each time point. Grey dots represent women in physically violent relationships, while blue dots represent those in non-violent relationships[2].

Averaging across years, 9.2% of women who do not experience physical violence are separated compared to 31.8% of women who experienced physical violence with their partner. Therefore, women in physically abusive relationships are, on average, 3.4 times more likely to be separated than those in non-physically abusive relationships. Most bargaining models of domestic violence view separation as a threat that does not happen in equilibrium. That is, a woman's outside option affects a man's propensity to exert violence because she is more/less likely to leave. However, this figure suggests separation is not an off-equilibrium outcome and it is important to understand how leaving an abuser affects the likelihood of experiencing violence.

Note that this fact is not particular to Mexico; Anderberg et al. (2023) use longitudinal data from the UK to show that the rate of separation following a period of abuse is about five times (6.3 percentage points) higher than the corresponding rate following a period without abuse. Using Canadian survey data, Bowlus and Seitz (2006) show that abused women between 15 and 29 years old are 245 percent more likely to be divorced than their non-abused counterparts. Lastly, Adams et al. (2024) show that when a woman's outside option quasi-randomly increases, she is more likely to leave an abusive relationship.

[2]In the survey, women report whether they experienced each form of violence with their reference partner in the past 12 months and at any point in the relationship. A woman is classified as having been in a physically violent relationship if she reports experiencing physical violence at any point.

Figure 2.2: Separation by violence status



Notes: This figure shows the separation rate for women who are separated from their most recent cohabiting partner by IPV status. The grey dots represent the share of separated women among those who report experiencing physical violence at some point in the relationship. The blue dots represent the share of separated women among those who did not experience physical abuse during the relationship. All regressions use survey weights and use heteroskedasticity-robust standard errors.

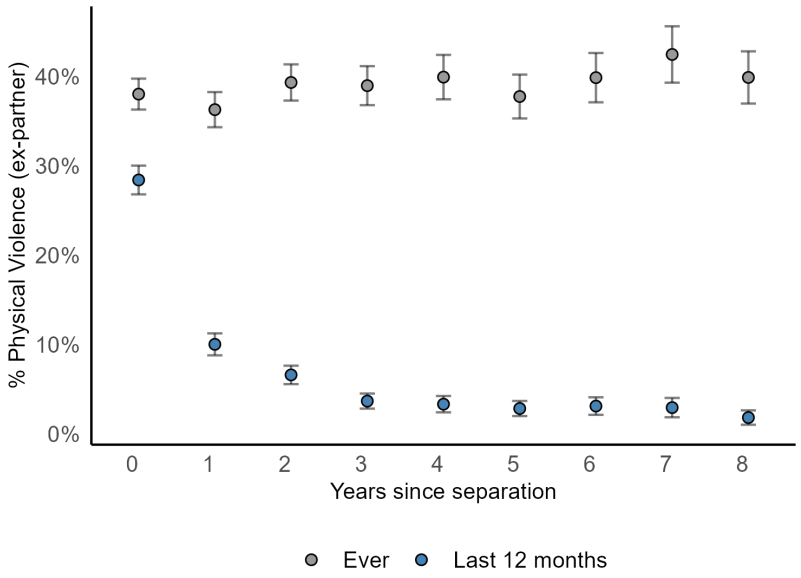
Fact 3: Separation shields women from experiencing violence.

Leaving an abusive partner can serve as a mechanism for reducing women's exposure to violence. By physically distancing themselves from their abuser, women may lower their risk of experiencing further harm. Figure 2.4 provides evidence in support of this idea.

To illustrate this, I focus on all women in the sample who report being separated at the time of the survey and who ended their relationship within the past eight years. The reference partner in this analysis is the individual from whom they separated. The figure presents two key data points: the gray dots indicate the proportion of women who experienced physical violence at any point in the relationship with their ex-partner (approximately 40%), while the blue dots represent the share who reported experiencing physical violence from the same partner in the past 12 months.

The results reveal a clear pattern: the risk of violence declines following separation. In the first year after leaving, some women still experience continued abuse, but over time, the incidence of violence decreases. By the five-year mark, only 2.8% of women report experiencing physical violence in the past 12 months—a figure that corresponds to 7.5% of those who had an abusive ex-partner. This downward trend suggests that separation is an effective means of reducing ongoing violence.

Figure 2.3: Violence after separation



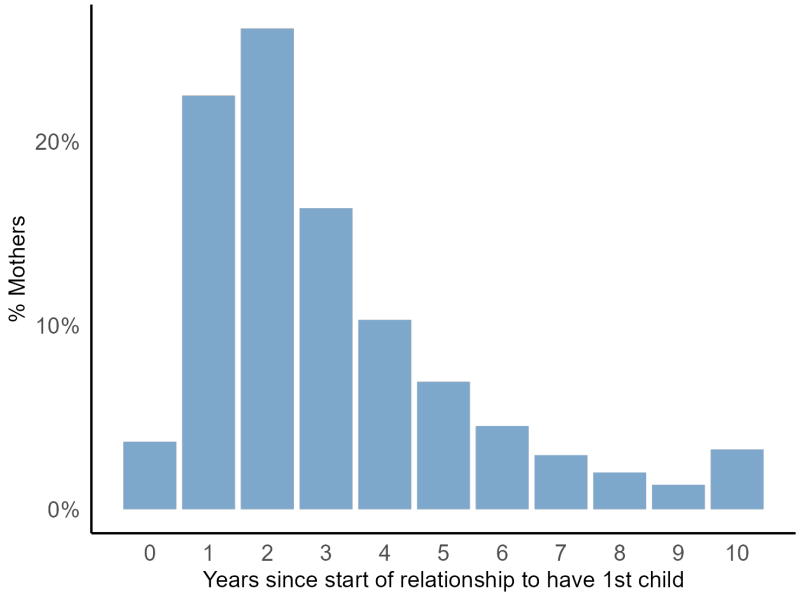
Note: This figure shows the share of separated women who report experiencing physical violence from their reference partner at some point in the relationship (gray dots) and during the last twelve months (blue dots). The reference partner is the one from whom they separated. All regressions use survey weights and use heteroskedasticity-robust standard errors.

Fact 4: Women have a child soon after they start dating

The last empirical fact is that Mexican women become mothers soon after starting a new relationship. Figure 2.4 shows the distribution of the time between the start of the relationship and the birth of the first child. The x-variable is created by subtracting the woman's age when she started dating her partner from the age when she had her first child. The sample includes all women who had their children with their current (or previous) partner. The median time between the start of the relationship and the birth of the first child is two years. Considering

that pregnancy lasts around ten months, the median woman gets pregnant one year after she starts dating.

Figure 2.4: Time between start of relationship and first child



Notes: This histogram shows the years women take to have their first child since the beginning of the relationship. It includes all women who had their first child after their relationship started and it is weighted using survey weights.

Additionally, 45% of mexican women between 15 and 24 years old did not use contraceptives when they first had sex (ENADID, 2015). Figure B.2 in the Appendix shows that the main reasons for not using contraceptives on the first sexual encounter are: unplanned sexual activity (32%), desire to have a child (21.7%), lack of knowledge about contraceptives or where to obtain them (18.8%), and the belief that they would not become pregnant (16.3%)[3]. This further suggests that many women are at risk of having a child before having full information about their partner.

[3]Interestingly, only 2.7% of women reported not using contraceptives because their partner did not want them to, and 2.3% due to personal opposition to contraceptive use.

Chapter 3

Theoretical framework

3.1 Environment

In this chapter, I present the theoretical framework. I consider a two-period model where a unit mass of men and women are randomly matched into couples before the beginning of the game. I assume couples want to delay childbirth until the second period, but only $\rho \in [0, 1]$ have access to contraceptives[1]. In the empirical section, I use changes in access to contraceptives through pharmacy openings as an instrument for fertility, so we can think of the couples in the model as the compliers.

Private types: There are two sources of private information in the model. At the beginning of the game, men know their type, which is either abusive or non-abusive, and women know their dissolution cost.

Men's abusive type: Before the game starts, men draw a private abusive type $\alpha \in \{\alpha^{NA}, \alpha^{A}\}$. Men with $\alpha^{A} > 0$ are abusive types as they derive positive utility from exerting violence[2]. I refer to these men as abusive to differentiate between the type (whether they derive positive utility from violence) and the choice they make each period about whether to exert violence. Non-abusive men

[1] This is equivalent to a setting where only women want to delay childbirth and they have access to conceivable contraceptives.

[2] This is known in the literature as *expressive violence* and need not be interpreted solely as a sadistic pleasure of violence but also as a way of relieving stress or expressing frustration (Farmer and Tiefenthaler, 1997).

receive a disutility from inflicting violence as $\alpha^{NA} < 0$. A man is abusive with probability q, which is a common prior.

Women's dissolution cost: Women draw a dissolution cost $\delta > 0$ before the start of the game. δ is a random variable with support $(0, \infty)$ and a cumulative density function $F(\delta)$. The dissolution cost can be thought of as the inverse of the outside option, as women with lower dissolution cost are those who can leave more easily. The dissolution cost consists of non-observable aspects of the outside option, such as social networks and support, self-esteem and psychological factors or hidden financial assets. The observable component of the outside option, such as education, wage and institutional context is normalized to zero.

Timing and Choices: There are two periods. At the beginning of the first period, all couples are matched.

Nature's choices: At the beginning of the first period, nature decides whether a couple becomes parents or not $p_t \in \{0, 1\}$. In period 1, a share $1 - \rho$ of couples become parents. In period 2, all couples who remain together and are not parents become parents.

Men's choices: In period 1, men decide whether to exert violence after observing fertility outcomes. Violence is a binary decision, $v_t \in \{0, 1\}$. In the second period, if they are still partnered, they decide whether to exert violence. If their partner leaves in the first period, they remain single in the second period and do not make any decisions.

Women's choices: Women decide whether to stay or leave the relationship at the end of the first period, after observing fertility and violence outcomes. The decision is binary, $s \in \{0, 1\}$. In the second period, women do not make any decisions[3].

Note that the timing of the game is such that $1 - \rho$ couples have a child before the decision to exert violence is made. This means that these women have a child before they get a chance to know their partner's abusive type. This assumption is motivated by Figure 2.4 in the section above, where I show that the median woman becomes a mother two years after she starts dating.

Preferences: At the end of each period, after all choices are made, each person

[3]The model is yields the same equilibrium if I allow women to leave in the second period. However, allowing women to leave in the second period only complicates the model without any additional insights. The extension of the model is available upon request.

gets utility $U_t^{g,c}$ where $g \in \{m, w\}$ refers to whether the person is a man (m) or woman (w) and $c \in \{r, s\}$ refers to their civil status; whether they are in a relationship (r) or single (s).

Utility of being in a relationship: The utility of being in a relationship is given by the utility of being a parent and the (dis)utility of violence. The utility of being a parent is normalized to 1.

$$U_t^{w,r} = p_t - v_t\bar{\alpha}$$
$$U_t^{m,r} = p_t + v_t\alpha$$

If a man exerts violence, the woman pays the cost $\bar{\alpha}$, which is common for all women. The utility from exerting violence is positive for abusive men $(\alpha^A > 0)$ and negative for non-abusive men $(\alpha^{NA} < 0)$.

Utility of being single: If a woman decides to leave a relationship in the first period, she and her partner stay single for the remainder of the game. The within-period cost of dissolution for women is denoted by δ and, if she is a mother, she enjoys the utility of having a child but pays an additional cost of being a single mother, denoted by $\bar{c}$. Hence, having a child decreases a woman's outside option[4]. Men have a constant dissolution cost $\bar{\delta}$, which is observable. The within-period utility of being single is:

$$U_t^{w,s} = -\delta + p_t - p_t\bar{c}$$
$$U_t^{m,s} = -\bar{\delta} + p_t$$

The total utility over the two periods is given by $U^g = U_1^{g,c} + \beta U_2^{g,c}$, where β is

[4]This assumption comes from several empirical facts. First, women bear the cost of child-bearing. In Mexico, 75% of children with separated parents do not receive any alimony from their father. Moreover, women spend a weekly average of 12.3 hours taking care of household members compared to men who 5.4 hours per week (INEGI, 2019). This is not unique to Mexico. Doepke and Kindermann (2019) shows that in EU countries, women carry out the majority of childcare tasks. Second, having a child lowers women's labor force participation. Kleven et al. (2023) show that as countries develop, child penalties become the dominant driver of gender inequality. In particular, after the birth of the first child, Mexican women face a child penalty of 44%. Lastly, other factors such as the psychological costs of being a single mother, or a worse marriage market could also decrease the outside option.

a discount factor.

Assumptions: I impose the following assumptions on the parameters of the model:

1. $\bar{\alpha} > \bar{c} \geq \frac{\beta}{1+\beta}$
2. $\alpha^{NA} < -(\beta + \bar{\delta}(1+\beta))$
3. $q\bar{\alpha} < 1$
4. $F(\bar{\alpha} - \frac{\beta}{1+\beta}) \leq \frac{1}{1+\beta}$

Assumption 1 establishes that the within-period cost of violence is higher than the within-period cost of being a single mother, $\bar{\alpha} > \bar{c}$. This assumption implies that the cost of violence is high enough such that if the dissolution cost was zero, all women would prefer to be a single mother than to be in a violent relationship. This assumption ensures that some women will leave a violent relationship independently of their motherhood status. Moreover, I assume that $\bar{c} \geq \frac{\beta}{1+\beta}$, which implies that the total cost of single motherhood is higher than the present value of having a child in $t = 2$. This assumption ensures that mothers are (weakly) more likely to stay in violent relationships than non-mothers[5].

Assumption 2 guarantees that the cost of exerting violence for non-abusive men is high enough that they will never be violent. Assumption 3 implies that the percentage of violent men is low enough in the population. This assumption results in women not leaving a relationship out of fear of experiencing violence in the future, without observing violence beforehand. Finally, Assumption 4 guarantees the existence of a fully separating equilibrium, where violent men reveal their type in the first period independently of their fertility outcomes. In a separating equilibrium, $F(\bar{\alpha} - \frac{\beta}{1+\beta})$ represents the probability that a non-mother leaves a violent relationship. Intuitively, if the risk of her leaving is too high, non-fathers will never exert violence in the first period and will wait until the second period to exert violence.

Strategies: Let $h_t^m \in H_t^m$ be the information set that the man has at period t when he decides whether to exert violence. In period 1, he observes the fertility

[5]If the relative cost of being a single mother is very low compared to the value of having a child ($\bar{c} < \frac{\beta}{1+\beta}$), we would have an equilibrium where non-mothers are more likely to stay after experiencing violence in period 1 than mothers. This is because non-mothers have the incentive to stay in the relationship to have a child in the second period.

outcome. In period 2, h_2^m is characterized by his observations- the fertility outcomes and her decision to stay or leave in the first period. Let $h^w \in H^w$ be the information set of women when they make their decision to stay or leave in the first period, after observing fertility and violence outcomes.

Let $\sigma(\delta)$ be the strategy of a woman with outside option δ and $\sigma(\alpha)$ be the strategy of a man with abusive parameter α. For convenience, I introduce the notation for behavior strategies at each information set. i.e $\sigma_t^\alpha : H_t^m \to [0,1]$, the violence strategy for each period for each type of man $\alpha \in \{\alpha^{NA}, \alpha^A\}$, $\sigma^\delta : H^w \to [0,1]$, the leaving strategy in period one for woman with outside option δ.

Let $\hat{q}(p_1, v_1) = \text{Prob}(\alpha = \alpha^A | p_1, v_1)$ the updated probability that the man's type is abusive at the end of the first period. As I am focusing on a Perfect Bayesian Nash Equilibrium, beliefs are determined by Bayes' rule whenever possible. Hence:

$$\begin{aligned}\hat{q}(p_1, v_1) &= \text{Prob}(\alpha^A | p_1, v_1) \\ &= \frac{\text{Prob}(v_1 | p_1, \alpha^A) q}{\text{Prob}(v_1 | p_1, \alpha^{NA})(1-q) + \text{Prob}(v_1 | p_1, \alpha^A) q}\end{aligned}$$

3.2 Equilibrium

I study Perfect Bayesian Equilibrium (PBE). Formally, I solve for i) a woman's strategy σ^δ which consists of her separation decision in period one, ii) σ_t^α: the man's decision to exert violence in period 1 and period 2 and iii) $\hat{q}$: a woman's belief about her partner's violence type, after observing his behavior in period 1. The conditions for on-equilibrium behavior for i-iii are:

1. Beliefs $\hat{q}(p_1, v_1)$ respect Bayes' rule.
2. A woman's strategy $\sigma(\delta)$ maximizes her expected utility, given beliefs and her partner's strategy.
3. A man's strategy $\sigma(\alpha)$ maximizes his expected utility, given beliefs and his partner's strategy.

Theorem 1: *For the same parameters, there exists a unique equilibrium:*

1. *For all parameters of the model, non-abusive men do not exert violence.*
2. *Violence arises in equilibrium as a function of the satisfaction of violence α^A. If the satisfaction for violence is low, all abusive men do not exert violence in the first period. If the satisfaction for violence is medium, only abusive fathers exert violence in the first period. If the satisfaction for violence is high, all abusive men exert violence in the first period.*
3. *If there is no violence, women stay in the relationship. If there is violence, mothers will be (weakly) more likely to stay in the relationship compared to non-mothers.*

A. Optimal Strategies in $t = 2$

Lemma 1: In $t = 2$ all abusive men exert violence and non-abusive men do not exert violence.

In the second period, there are no dynamic incentives. All remaining couples have a child in period two and men choose whether they inflict violence. Women no longer have the option to leave in this period. Therefore, men exert violence if $1 + \alpha \geq 1$. It is straightforward to see that all abusive men ($\alpha = \alpha^A > 0$) are strictly better off by exerting violence and all non-abusive men ($\alpha = \alpha^{NA} < 0$) are strictly better off by not exerting violence.

B. Optimal Strategies in $t = 1$

I now consider the equilibrium strategies at $t = 1$. This is the period where there is variation in motherhood status so these strategies will serve as the main testable predictions.

B.1 Women

Proposition 1: For any value of α^A, women follow a constant strategy: They stay if there is no violence and if there is violence they stay if their dissolution cost is higher than a threshold. The threshold is a function of motherhood status.

After observing fertility and violent behavior in the first period, women make the decision to stay or leave the relationship. They decide to leave if:

$$\mathbb{E}(U^{w,r}) = p_1 - v_1\bar{\alpha} + \beta(1 - \hat{q}(p_1, v_1)\bar{\alpha}) \leq (1+\beta)(-\delta + p_1 - p_1\bar{c}) = \mathbb{E}(U^{w,s}) \quad (3.1)$$

Where $\hat{q}$ is the updated probability that her partner is abusive. Rearranging Equation 3.1, women leave as long as their dissolution cost is lower than the following threshold:

$$\delta \leq \bar{\alpha}\frac{v_1 + \beta\hat{q}(p_1, v_1)}{1+\beta} - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta} \quad (3.2)$$

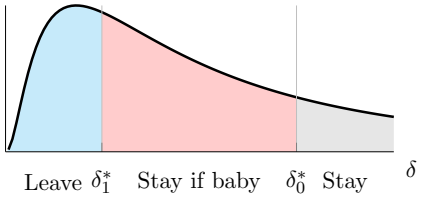
If there is no violence in the first period ($v_1 = 0$), there are two possible scenarios. First, they could be in a separating equilibrium, where they have full information about their partner's type when they make the decision to leave[6]. Under this scenario, $\hat{q}(p_1, v_1 = 0) = 0$, the left-hand side of Equation 3.2 is negative, so all women stay. Alternatively, they could be in a pooling equilibrium, where abusive men do not exert violence in the first period and wait until the second period to exert violence. Under this scenario, women do not have any additional information about their partner's type when they decide to leave, so $\hat{q}(p_1, v_1 = 0) = q$. By Assumption 1 and Assumption 3, $q\bar{\alpha}\frac{\beta}{1+\beta} < \frac{\beta}{1+\beta} \leq \bar{c}$. The left-hand side of Equation 3.2 is negative, so all women stay.

If there is violence in the first period ($v_1 = 1$), women are certain their partner is abusive and will exert violence in period 2, as non-abusive men never engage in violence. Here, $\hat{q}(p_1, v_1 = 1) = 1$, and women with $\delta \leq \bar{\alpha} - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta}$ leave. Women with lower dissolution cost (or higher outside option) will be the ones who leave[7]. The threshold rule is a function of her motherhood status. If she is a mother, she will leave if $\delta \leq \bar{\alpha} - \bar{c} \equiv \delta_1^*$, if she is not a mother, she leaves if $\delta \leq \bar{\alpha} - \frac{\beta}{1+\beta} \equiv \delta_0^*$, where $\delta_1^* \leq \delta_0^*$ (by Assumption 1). Figure 3.1 illustrates the relationship between a woman's dissolution cost and her decision to stay.

[6] This happens when α^A is high enough and abusive men do not have strategic incentives to not exert violence in $t = 1$.

[7] This result of the model is consistent with Adams et al. (2024) who show that as women's outside options quasirandomly increase, the rate of breakup amongst abusive couples increases, with no such impact on otherwise similar non-abusive couples.

Figure 3.1: Woman's strategy



There are three types of women, those with low dissolution cost, who will leave a violent relationship independently of their motherhood status, those with high dissolution cost who will stay in a violent relationship independently of their motherhood status and those with medium dissolution cost who will leave if they are not mothers and stay if they are. Importantly, the share of women who stay once they are mothers is determined by the magnitude of $\bar{c}$; the larger the cost of being a single mother, the more women will stay once they are mothers[8].

B.2 Men

In the first period, a share $1 - \rho$ of men are fathers. After observing fertility outcomes, they decide whether to exert violence.

Lemma 2: Non-abusive men do not exert violence in the first period

In Appendix C.4.1, I show that for any possible belief about the probability that a woman will stay, non-abusive men are strictly better off not exerting violence. This is driven by Assumption 2, which ensures that the cost of violence is sufficiently high to eliminate any strategic incentive for non-abusive men to resort to violence.

The strategy of abusive men depends on the satisfaction for violence α^A. I describe each of them below:

Proposition 2: When the satisfaction of violence is low, abusive men do not exert violence in the first period and wait until the second period to exert violence.

The proof is in Appendix C.1. In this scenario, all abusive men decide to delay their violent behavior until the second period. Recall that although violence

[8]Note that in the limit, when the $\delta_1^* = \delta_0^*$, then having a child does not affect the decision to stay. Consequently, there will only be two types of women; those who stay after violence and those who leave.

brings them utility, it also increases the probability that she leaves. If the satisfaction of violence is low enough, all abusive men hide their type in the first period to guarantee her staying. This is true irrespective of their fatherhood status. As there is no violence in the first period in this equilibrium, it is not informative for the purposes of this paper. I will not discuss it further.

Proposition 3: When the satisfaction of violence is medium, abusive men who have a child in the first period exert violence in both periods. Abusive men who are not fathers in $t = 1$ do not exert violence in the first period and wait until $t = 2$ to be violent.

The proof is in Appendix C.2. When the satisfaction for violence is medium, abusive non-fathers have a dynamic incentive to hide their type in the first period and wait until the second period to exert violence. There are two reasons for this. First, mothers are (weakly) more likely to stay in a violent relationship. Hence abusive non-fathers, compared to abusive fathers, need higher satisfaction for violence in order to compensate for the greater risk of her leaving. Additionally, non-fathers have a second dynamic incentive to pool in the first period: they want to become fathers and by exerting violence they risk being single and fatherless for the rest of the game[9]. Abusive men who are fathers in the first period exert violence in both periods. They already have a child, and their partner is already (weakly) more likely to stay. Consequently, they have no incentives to delay violence. Note that the range of α^A that supports this equilibrium increases as the cost of being a single mother increases. As $\bar{c}$ becomes larger, mothers become less likely to leave a violent relationship, increasing the incentives for fathers to reveal their type in the first period.

Proposition 4: When the satisfaction of violence is high, all abusive men exert violence in both periods.

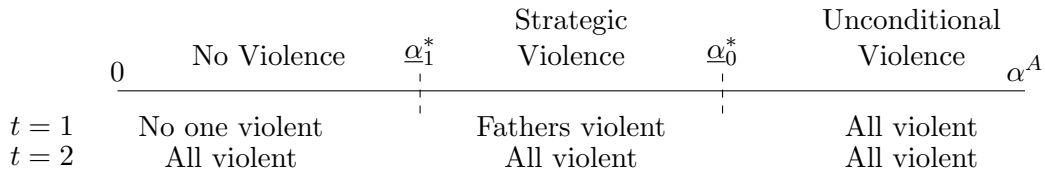
The proof is in Appendix C.3. In this scenario, all abusive men reveal their type in the first period, independently of their fatherhood status. This is because the satisfaction of violence is higher than the dynamic incentives to delay violence. In this scenario, having a child does not affect the decision to exert violence.

[9] If the only reason non-fathers delayed violence was because mothers are less likely to separate, then at $\bar{c} = \frac{\beta}{1+\beta}$—where mothers and non-mothers are equally likely to stay—no value of α^A could sustain this equilibrium. However, non-fathers also have an incentive to delay violence to increase their chances of fatherhood, which ensures that there is an α^A that supports this equilibrium.

Abusive men will exert violence in both periods and non-abusive men will not exert violence. Women have full information about their partner's type after observing his behavior in the first period.

Figure 3.2 below summarizes the strategy of abusive men as a function of the satisfaction of violence α^A:

Figure 3.2: Abusive man's strategy



When α^A is low, there is no violence in the first period. This case is uninformative for the purposes of the paper, so I will not discuss it further. When α^A is medium, only abusive fathers exert violence, while abusive non-fathers wait until they become fathers. In this scenario, violence is strategic, mirroring a situation where becoming a father causes a man to exert violence, since the same abusive man only exerts violence once he is a father. Lastly, when α^A is high, there is unconditional violence in the first period. That is, the same abusive man exerts violence both as a father and as a non-father. I rule out the existence of other equilibria. In Appendix C.4.1, I show that there is no equilibrium where non-abusive men exert violence in the first period. In Appendix C.4.2, I show there is no equilibrium where abusive fathers do not exert violence in the first period while abusive non-fathers do.

Cases of Interest

I ignore the situation where α^A is low, as there is no violence in the first period. That leaves two cases of interest: when the satisfaction for violence is medium and violence is strategic, and when the satisfaction for violence is high and violence is unconditional.

1. *Direct channel*: When the satisfaction for violence is medium, violence is strategic and only abusive men exert violence. This case mirrors a situation where having a child causes men to become violent.

2. *Selection channel*: When the satisfaction for violence is high and the cost of being a single mother is high, abusive men are unconditionally violent, but mothers are strictly more likely to stay in a violent relationship.

Under the direct channel, I am considering both the case where mothers are strictly more likely to stay than non-mothers and the case where mothers and non-mothers are equally likely to stay with a violent partner. The predictions of the model are qualitatively equivalent under either scenario[10].

Under the selection channel, I assume that $\bar{c} > \frac{\beta}{1+\beta}$, which results in mothers being strictly more likely to stay in a violent relationship compared to non-mothers. If $\bar{c} = \frac{\beta}{1+\beta}$, then mothers and non-mothers are equally likely to stay and violence and separation would be orthogonal to motherhood, resulting in an uninformative case.

3.3 Predictions

I derive four predictions of the model under the two channels of interest. Predictions 1-3 provide information about the causal effect of motherhood on the probability that a woman experiences violence V^W, the probability that a man exerts violence V^M and the probability of separation L. The period of interest is period 1[11]. Prediction 4 provides information about whether waiting to have a child allows women to avoid violent partners.

Let $V^M = P(v_1 = 1|p_1)$ be the probability that a man exerts violence, conditional on his fatherhood status. Let $L = P(v_1 = 1|p_1)F(\delta^*_{p_1})$ be the probability that a woman is separated[12]. Lastly, let $V^W = P(v_1 = 1|p_1)(1 - F(\delta^*_{p_1}))$ be the probability that a woman experiences violence, which is defined as the probability that he exerts violence and she stays partnered.

[10] This arises because, when the satisfaction for violence is medium, only abusive fathers exert violence, so there are no men who are violent irrespective of their fatherhood status. In the alternative version of the model, I consider this extension and I discuss how the predictions change if mothers are strictly more likely to stay or equally likely to stay.

[11] Period 2 is useful in the model as it creates dynamic incentives for abusive non-fathers to wait to exert violence when they are fathers. However, in this period there is no variation in fertility (all remaining couples have a child), no variation in violent behavior (all abusive men exert violence) and no variation in separation behavior (women do not have the choice of separation).

[12] In this simple model, women only leave if there is violence, so the probability of separation is defined as the probability of violence times the probability of separation conditional on violence.

3.3.1 Prediction 1: Effect of having a child on the probability that a woman experiences violence V^W

Both channels predict that having a child increases the probability that a woman experiences violence. Under the direct channel, only abusive fathers exert violence. Mothers with high dissolution cost who have a violent partner will stay, resulting in mothers being at higher risk of experiencing violence at the end of the period. In the selection channel, having a child is orthogonal to violent behavior, meaning all women are equally likely to have a violent partner. However, mothers are more likely to remain in a violent relationship, which leads to a higher likelihood of experiencing violence by the end of the period.

Direct channel

Suppose we are in scenario 1 where having a child causes men to become violent. In this case, the probability of current violence is given by:

$$V^W(1) = q(1 - F(\delta_1^*))$$
$$V^W(0) = 0$$

Note that under this scenario, the only men who exert violence are the abusive fathers. Consequently, mothers are more likely to experience violence than non-mothers.

Selection channel

Suppose that having a child is orthogonal to men's violence, but causes women to stay in violent relationships. In this case, the probability of current violence is given by:

$$V^W(1) = q(1 - F(\delta_1^*))$$
$$V^W(0) = q(1 - F(\delta_0^*))$$

Under this scenario, both mothers and non-mothers have an equal probability q of experiencing violence. However, after experiencing violence, non-mothers are

more likely to end the relationship. Therefore $V^W(1) - V^W(0) = F(\delta_0^*) - F(\delta_1^*) > 0$ and mothers are more likely to experience violence.

3.3.2 Prediction 2: Effect of having a child on men's violent behavior V^M

The two channels yield different predictions in terms of men's violent behavior V^M. Recall that the direct channel mirrors a situation where having a child triggers violent behavior, so fathers are more likely to exert violence than non-fathers. Alternatively, under the selection channel, all abusive men exert violence irrespective of their fatherhood status, which means that fathers and non-fathers are equally likely to exert violence.

Direct channel

Suppose we are in scenario 1 where having a child causes men to become violent. In this case, the probability that a man exerts violence is given by:

$$V^M(1) = q$$
$$V^M(0) = 0$$

As only fathers become violent, the probability of a father being violent is q. Hence, mothers are more likely to have had a violent partner.

Selection channel

Suppose having a child is orthogonal to men's violence, but causes women to stay in violent relationships. In this case, the probability that a man exerts violence is given by:

$$V^M(1) = q$$
$$V^M(0) = q$$

Hence, all women are as likely to have had a violent partner, irrespective of their motherhood status.

3.3.3 Prediction 3: Effect of having a child on separation L

The predictions for separation behavior also differ under the two channels. The direct channel predicts that having a child will increase the probability of separation. In this scenario, men only reveal their type if they are fathers so all non-mothers remain partnered (as women do not leave if they do not experience violence). However, mothers with lower dissolution cost who experience violence will leave, resulting in mothers being more likely to be separated. The selection channel predicts that mothers will be less likely to be separated than non-mothers. Although all women are as likely to experience violence, mothers have a lower outside option and are more likely to stay in violent relationships.

Direct channel

Suppose that having a child causes men to become violent. In this case, the probability that a woman is separated is:

$$L(1) = qF(\delta_1^*)$$
$$L(0) = 0$$

Note that non-fathers do not exert violence, so all non-mothers remain partnered. As abusive fathers exert violence, some mothers separate. Hence, mothers are more likely to be separated at the end of the first period.

Selection channel

Suppose having a child is orthogonal to men's violence, but causes women to stay in violent relationships. In this case, the probability that a woman separates is given by:

$$L(1) = qF(\delta_1^*)$$
$$L(0) = qF(\delta_0^*)$$

In this case, both mothers and non-mothers have the same probability of experiencing violence. However, mothers find it harder to separate as they have a

lower outside option, resulting in a higher separation rate for non-mothers.

3.3.4 Prediction 4: Effect of delaying pregnancy on violent behavior V^M

The last prediction compares the probability of having had a violent partner (V^M) between mothers who had a child in the first period and mothers who had a child in the second period. Under the direct channel, men only reveal their type once they are fathers. Consequently, women who wait are as likely to have a violent partner than those who do not wait. Under the selection channel, all men reveal their type at the end of the first period. Hence for women who had their child in the first period, the probability of having had a violent partner is q, the share of violent men in the population. Instead, women who have a child in the second period, know their partner's type before making the decision. Hence, this is a selected sample of women who i) have a non-violent partner or ii) have a violent partner and a high dissolution cost. Consequently, mothers who wait are less likely to have had a violent partner than mothers who do not wait. Note that this result is driven by selection and not a causal effect of waiting on violent behavior. Having a child does not change men's probability of exerting violence, but mothers who wait are different from those who don't wait.

Let $V^M(p_1 = 1) = Pr((v_1 = 1 \text{ or } v_2 = 1)|p_1 = 1)$ be the probability that a mother who has a child in $t = 1$ has experienced violence at some point in the relationship. Similarly, let $V^M(p_1 = 0, p_2 = 1) = Pr((v_1 = 1 \text{ or } v_2 = 1)|p_1 = 0, p_2 = 1)$ be the probability that a mother who has a child in $t = 2$ has experienced violence during $t = 1$ or $t = 2$.

Direct channel

Under this scenario, men reveal their type once they are fathers. Hence all women who delay childbearing do not experience violence in $t = 1$, they all stay and have a child on the second period, and find out their partner's type in $t = 2$. The probability of having had a violent partner is then:

$$V^M(p_1 = 1) = q$$
$$V^M(p_1 = 0, p_2 = 1) = q$$

Hence, mothers who wait are equally likely to have had a violent partner as those who do not wait.

Selection channel

Under the selection channel, all men reveal their type in $t = 1$. Hence, women who do not have a child in $t = 1$ can decide whether to become mothers with full information. The probability of having had a violent partner is then:

$$V^M(p_1 = 0) = q$$
$$V^M(p_1 = 0, p_2 = 1) = \frac{q(1 - F(\delta_0^*))}{(1 - q) + q(1 - F(\delta_0^*))}$$

The difference between these two probabilities is given by $V^M(p_1 = 0, p_2 = 1) - V^M(p_1 = 0) = -\frac{q(1-q)F(\delta_0^*)}{1-qF(\delta_0^*)} < 0$. Hence, conditional on motherhood, women who wait are less likely to have had a violent partner.

The table below summarizes the main predictions of the model.

	Direct Channel	*Selection Channel*
P1: Women experience violence V^W	↑	↑
P2: Violent behavior V^M	↑	-
P3: Separation behavior L	↑	↓
P4: Waiting on violent behavior	-	↓

3.4 Alternative model: State-dependent preferences

In the main model, I assume that men's taste for violence is exogenously given before the game starts and does not change through the game. The mechanism behind the direct channel is that non-fathers do not exert violence because i) their partner is more likely to leave and ii) they have dynamic incentives to wait until the second period and have a baby. However, this is not the only explanation for why fathers may be more likely to exert violence than non-fathers. An alternative explanation would be that men have state-dependent preferences, meaning that some men do not enjoy exerting violence when they are not fathers but once they are fathers the satisfaction for violence is positive. This could be interpreted as

stress or as bully syndrome- they only enjoy exerting violence when their partner has a lower outside option.

Additionally, in the main model, I am assuming that the satisfaction for violence is common among abusive men. The aim is to understand whether we are under the direct channel (medium satisfaction for violence) or under the selection channel (high satisfaction for violence). However, given this assumption, the model does not permit a situation where some abusive men are violent only if they have a child while others are always violent. Instead, either all abusive men are violent if baby or all abusive men are always violent.

In this section, I extend the model in two ways. First, I allow satisfaction from violence to depend on fatherhood status. Second, the model accommodates two types of abusive men at the same time: those who are always violent and those who are violent only if they have a child.

I show that the three main predictions remain qualitatively equivalent under both channels, with one exception: under the direct channel, if mothers are strictly more likely to stay than non-mothers, the prediction for separation becomes ambiguous.[13] On one hand, motherhood triggers violence, increasing the likelihood of separation. On the other, it raises the costs of leaving, reducing the probability of separation. The overall effect of motherhood on separation depends on which of these opposing forces dominates.

The setting of the model is very similar as before, the only difference is that the satisfaction for violence α is now a function of fatherhood status and that men draw their satisfaction for violence after their fertility realization. I also assume that the satisfaction for violence is high enough so there are no strategic incentives to exert violence. Then, a man's utility if he is partnered is:

$$U_t^{m,r} = p_t + v_t \alpha(p_t)$$

There are three types of men in the population:

1. Always violent: A share q^A have violence preferences $\alpha(p_t) = \alpha^A$ for $p_t \in$

[13] In the main model, the prediction for separation under the direct channel remains qualitatively the same whether mothers are strictly more likely or equally likely to stay compared to non-mothers. This is because all abusive men have the same satisfaction from violence, so under the direct channel, violence does not occur among non-fathers in the first period.

$\{0, 1\}$.

2. Violent if baby: A share q^B have violence preferences $\alpha(0) = \alpha^{NA}$ and $\alpha(1) = \alpha^A$.

3. Never violent: A share $q^N = 1 - q^A - q^B$ have violence preferences $\alpha(p_t) = \alpha^{NA}$ for $p_t \in \{0, 1\}$.

Importantly, some men do not know ex-ante the type of man they are. I am ruling out the possibility of a man enjoying violence only when he is not a father ($(\alpha(0), \alpha(1)) = (\alpha^A, \alpha^{NA})$). Therefore, non fathers who draw $\alpha(0) = \alpha^A$ know that they are always-abusive and fathers draw $\alpha(1) = \alpha^{NA}$ know their type is never-abusive. The only men who do not have full information about their type are non-fathers who do not enjoy exerting violence. They know there is a probability $\frac{q^B}{1-q^A}$ that they will become violent once they are fathers. This assumption mirrors a stress scenario, where men ex-ante do not know whether having a baby will change their preference for violence.

The assumptions of the model are the following:

Assumptions: I impose the following assumptions on the parameters of the model:

1. $\bar{\alpha} > \bar{c} \geq \frac{\beta}{1+\beta}$
2. $\alpha^{NA} < -(\beta + \bar{\delta}(1 + \beta))$
3. $\frac{q^B}{1-q^A}\bar{\alpha} < 1$
4. $F(\bar{\alpha} - \frac{\beta}{1+\beta}) \leq \frac{1}{1+\beta}$
5. $\alpha^A > \underline{\alpha}_0^*$

Assumptions 1, 2, and 4 are identical to those in the main model. Assumption 3 is a weaker version of the original assumption. In the original model, the overall share of violent men must be sufficiently low so women do not leave out of fear of future violence. In this alternative version, only the share of abusive men who become violent after becoming fathers needs to be low enough. This ensures that if a woman does not have a child in the first period and does not experience violence, she will not leave out of fear that her husband might become violent later. Finally, Assumption 5 ensures that abusive men's satisfaction from

violence is high enough that they have no strategic incentive to refrain from it in the first period.

I solve the model by backwards induction.

Period 2

In the second period abusive men exert violence and abusive men do not exert violence. Proof is identical to Lemma 1.

Period 1

Decision to stay

Women decide whether to stay or leave after observing fertility and violent outcomes.

Note that if she is a mother, she knows her partner's type[14] and whether she will experience violence in the next period. Consequently, if $v_1 = 0$, she stays with certainty because $1 + \beta > (-\delta + 1 - \bar{c})(1 + \beta)$. Instead, if $v_1 = 1$, she will stay as long as $\delta \geq \bar{\alpha} - \bar{c}$.

If she is not a mother and $v_1 = 0$, there are two alternatives. He is either never violent type, or he is violent when baby type. She will stay as long as:

$$\beta(1 - pr(v_2 = 1|v_1 = 0 \text{ and } p_1 = 0)\bar{\alpha}) \geq -\delta(1 + \beta) \tag{3.3}$$

Where $pr(v_2 = 1|v_1 = 0 \text{ and } p_1 = 0) = \frac{q^B}{1-q^A}$, the updated belief about whether she will experience violence in $t = 2$. Rearranging, she stays as long as $\delta \geq \frac{\beta}{1+\beta}(\frac{q^B}{1-q^A}\bar{\alpha} - 1)$. By Assumption 3, we know $\frac{q^B}{1-q^A}\bar{\alpha} < 1$ and all women stay. If she is not a mother and he is violent, she knows he is always-violent type. Consequently, she stays if $\delta \geq \bar{\alpha} - \frac{\beta}{1+\beta}$.

In conclusion, the strategy of a woman is identical to the main model: stay if there is no violence and if there is violence, stay if $\delta \geq \bar{\alpha} - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta}$. The threshold rule is a function of her motherhood status. If she is a mother, she will leave if $\delta \leq \bar{\alpha} - \bar{c} \equiv \delta_1^*$, if she is not a mother, she leaves if $\delta \leq \bar{\alpha} - \frac{\beta}{1+\beta} \equiv \delta_0^*$, where $\delta_1^* \leq \delta_0^*$ (by Assumption 1).

[14] I am ruling out the scenario where some men are violent if they are not fathers and non-violent once they are fathers.

Decision to exert violence

Suppose a man has a positive satisfaction for violence $\alpha(p_t) = \alpha^A > 0$. In Appendix C.3 I show that if the satisfaction for violence is high enough ($\alpha^A > \underline{\alpha}_0^*$), he will exert violence in the first period. By Assumption 5, all men who draw $\alpha(p_t) = \alpha^A$ exert violence in the first period.

Now, suppose that a man has a negative satisfaction for violence $\alpha^{NA} < 0$. If $p_1 = 1$, then he is sure he is non-abusive. By Assumption 2, he does not exert violence (see Appendix C.4.1 for the proof).

Instead, if $p_1 = 0$, he knows he is either non-abusive or abusive when baby. He will not exert violence if:

$$\beta(1 + \frac{q^B}{1-q^A}\alpha^A) \geq \hat{s}(0,1)(\alpha^{NA} + \beta(1 + \frac{q^B}{1-q^A}\alpha^A)) - (1 - \hat{s}(0,1))(1+\beta)\bar{\delta} \tag{3.4}$$

Where $\hat{s}(0,1) = 1 - F(\bar{\alpha} - \frac{\beta}{1+\beta})$ is the expected probability that she will stay conditional on $p_1 = 0$ and $v_1 = 1$. The left hand side of Equation 3.4 is strictly larger than the right hand side. Intuitively, if these men exert violence, he pays a cost α^{NA} and increases the probability that she leaves.

Therefore, in this version of the model, all men with $\alpha(p_t) = \alpha^A$ exert violence and all men with $\alpha(p_t) = \alpha^{NA}$ do not exert violence.

Predictions of the model

Women's behavior is identical to the main model. Consequently, we know mothers and non-mothers are as likely to separate if $\bar{c} = \frac{\beta}{1+\beta}$ and less likely to separate if $\bar{c} > \frac{\beta}{1+\beta}$. However, men's behavior is different in this version of the model. In this version of the model, there is a share q^B that only enjoy exerting violence if they are fathers. Note that if $q^B > 0$ having a baby causes violent behavior for some men. Instead, if $q^B = 0$, there are only two types of men never abusive and abusive always and having a child is orthogonal to men's violent behavior. The cases of interest are described below:

1. *Direct Channel:* If $q^B > 0$ and $\bar{c} = \frac{\beta}{1+\beta}$ some men become violent once they are fathers and mothers and non-mothers are equally likely to stay with a violent partner.

2. *Selection Channel:* If $q^B = 0$ and $\bar{c} > \frac{\beta}{1+\beta}$ men are either violent or non violent, so having a baby does not cause men to become violent. However, mothers are strictly more likely to stay after experiencing violence compared to non-mothers.

3. *Both Channels:* If $q^B > 0$ and $\bar{c} > \frac{\beta}{1+\beta}$ some men become violent once they are fathers and mothers are strictly more likely to stay.

I do not focus on the case where $q^B = 0$ and $\bar{c} = \frac{\beta}{1+\beta}$ as having a child does not change men's propensity to exert violence nor women's propensity to stay.

In the main model, the direct channel referred to a situation where having a child increased the likelihood that men exert violence, and mothers were at least as likely to stay as non-mothers. However, in this version of the model, the prediction for separation depends on whether mothers are *equally* likely or *strictly* more likely to stay. This distinction is why I separate the direct channel into two cases: Case 1, where mothers and non-mothers are equally likely to stay, and Case 3, where mothers are strictly more likely to stay.

Prediction 1: Effect of motherhood on V^W

Channels 1-3 predict that mothers are more likely to experience violence than non-mothers.

Under the direct channel, the probability that a woman experiences violence if she is a mother is $V^W(1) = (q^A + q^B)(1 - F(\underline{\delta}_1^*))$. Instead, if she is not a mother, the probability that she experiences violence is $V^W(1) = q^A(1 - F(\underline{\delta}_0^*))$. Note that mothers are more likely to experience violence because $q^B > 0$. Given that $F(\underline{\delta}_0^*) = F(\underline{\delta}_1^*)$, the effect is driven solely by changes in men's violent behavior.

Under the selection channel, the probability that a woman experiences violence if she is a mother is $V^W(1) = q^A(1 - F(\underline{\delta}_1^*))$. Instead, if she is not a mother, the probability that she experiences violence is $V^W(1) = q^A(1 - F(\underline{\delta}_0^*))$. Mothers are more likely to experience violence because they are more likely to stay in violent relationships than non-mothers ($1 - F(\underline{\delta}_1^*) > 1 - F(\underline{\delta}_0^*)$).

Under both channels, the prediction is qualitatively equivalent to the direct channel, but larger in magnitude. Mothers being more likely to stay reinforces the effect.

Prediction 2: Effect of motherhood on V^M

Under the direct channel, the probability that a man exerts violence if he is a father is $V^W(1) = q^A + q^B$. Instead, if he is not a father, the probability that he exerts violence is $V^W(1) = q^A$. Fathers are more likely to exert violence because $q^B > 0$.

Under the selection channel, $q^B = 0$. That means there are only two types of men in the population: a share q^N who are never violent and a share q^A who are always violent. Hence the probability that fathers and non-fathers exert violence is q^A. Mothers and non-mothers are equally likely to have had a violent partner.

If both channels are at play, the prediction is identical to the direct channel.

Prediction 3: Effect of motherhood on separation behavior L

Under the direct channel, the probability that a woman separates if she is not a mother is $L(0) = q^A F(\underline{\delta}_0^*)$. If she is a mother, she separates with probability $L(1) = (q^A + q^B)F(\underline{\delta}_1^*)$. Given that $F(\underline{\delta}_1^*) = F(\underline{\delta}_0^*)$, mothers will be more likely to separate than non-mothers. This is driven by the fact that mothers are more likely to experience violence, which leads to separation.

Under the selection channel, the probability that a woman separates if she is not a mother is $L(0) = q^A F(\underline{\delta}_0^*)$. If she is a mother, she separates with probability $L(1) = q^A F(\underline{\delta}_1^*)$. Given that $F(\underline{\delta}_1^*) < F(\underline{\delta}_0^*)$, mothers will be less likely to separate than non-mothers.

If both channels are at play, the effect on separation will be ambiguous. The probability that a woman separates if she is not a mother is $L(0) = q^A F(\underline{\delta}_0^*)$. If she is a mother, she separates with probability $L(1) = (q^A + q^B)F(\underline{\delta}_1^*)$. The effect of motherhood on separation is ambiguous because $L(1) - L(0) = q^B F(\underline{\delta}_1^*) - q^A(F(\underline{\delta}_0^*) - F(\underline{\delta}_1^*))$. On the one hand, becoming a mother increases the probability that men exert violence, which leads to separation (first term). On the other hand, becoming a mothers decreases the probability that women leave conditional on violence (second term). The overall effect depends on the relative magnitude of these forces.

In conclusion, the three main predictions align with those of the main model under the selection channel. The direct channel also produces the same predictions in the special case where motherhood does not affect a woman's likelihood of leaving a violent partner. However, if mothers are strictly more likely to stay, the direct channel leads to an ambiguous effect on separation.

3.5 Endogenous fertility

So far, the model treats the decision to have a child in period 1 as exogenous. Although restrictive, this assumption aligns with the empirical context, where I use pharmacy openings as a shock to fertility. The compliers are women who want to delay pregnancy and do so only when they have access to the pharmacy. Therefore, compliers in the treatment group represent the share ρ of couples that exogenously delays childbearing.

For broader applicability, I discuss an extension where fertility timing is endogenous. While a full derivation is beyond this thesis's scope, I discuss how the three key comparative-static predictions—women's violence risk V^W, men's violent behavior V^M, and separation L—would potentially change when fertility is a strategic choice.

In Figure 6.3, I show 55% of childless women who use contraceptives rely on condoms. Therefore, in period 1, I assume the man chooses whether to conceive or wait to become a father before deciding on violence v_1, with all other timing and payoffs as in the baseline model.

Under this extension, abusive men would anticipate that choosing to become parents raises their partner's separation cost, making her more likely to stay even if violence occurs. Consequently, we would expect to see a larger fraction of abusive men self-selecting into fatherhood.

Implications for V^W. I would expect that mothers would be at even higher risk of experiencing violence compared to non-mothers because now mothers are disproportionally more likely to have an abusive partner. Hence, $V^W(1) - V^W(0)$ would be even larger under endogenous fertility.

Implications for V^M. Even in the absence of any direct effect, we would observe $V^M(1) - V^M(0) > 0$ since abusive men disproportionately choose to become fathers. Under this scenario, the causality runs opposite to the standard interpretation: fathers are more likely to exert violence because abusive men become fathers, rather than babies causing violence. Under the violence channel, this selection-driven increase by abusive men combines with the additional direct effect of having a baby on violence.

Implications for L. Under the direct channel, we would expect an even larger effect for separation. In the baseline model, mothers are more likely to separate

since they are the ones that learn their partner's type. Adding endogenous fertility increases the share of mothers with violent partners, resulting in a higher separation probability. Under the selection channel, the prediction would likely be ambiguous. On the one hand, mothers are more likely to experience violence, which would lead to separation. On the other hand, they are also more likely to stay with a violent partner, which would lead to a lower probability of separation. The overall effect would depend on the relative magnitude of these two forces.

In conclusion, the main difference from the original model is that fathers will be more likely to exert violence across all parameter values simply because abusive men are more inclined to become fathers. In the empirical section, however, I show that this pattern does not hold in the data, suggesting that abusive men do not disproportionally select into fatherhood. All of these comparative-static insights are suggestive. A complete formal derivation of the endogenous-fertility extension is needed to confirm these predictions and to characterize the full range of parameter values over which they hold.

Chapter 4

Empirical challenges

Before testing the predictions of the model, we need to determine what data is required to disentangle the mechanisms. There are two main empirical challenges that arise when trying to disentangle changes in separation behavior from changes in men's violent behavior.

First, many data sources include only a sample of partnered women. However, controlling for civil status can result in *collider bias*, leading to biased estimates of the relationship between motherhood and IPV. Second, even if the data includes partnered and separated women, usual measures of IPV are proxies for whether women *currently* experience violence. In the section above, I show theoretically that both changes in violent behavior and separation behavior can observationally equivalent in terms of this variable.

While this thesis aims to understand the relationship between motherhood and violence, the two empirical challenges outlined above are not specific to motherhood. More generally, any treatment that affects a woman's outside option can influence both separation and violence dynamics. For this reason, I will discuss these empirical challenges in the context of a generic treatment T.

Why is separation important in the context of IPV?

The first important point is to distinguish men's violent behavior (denoted as V^M in the model) from women's exposure to violence (denoted as V^W in the model). In a world without separation, knowing whether women are currently exposed to violence would be sufficient to understand men's violent behavior. However, many women do leave their abusers (see Figure 2.2) so women's exposure to

violence is not only a function of violent behavior but also their decision of staying. In other words, a woman who leaves a violent relationship will stop experiencing violence because she is no longer exposed to it and not because the man has changed his behavior.

Despite its importance, separation has received relatively little attention in the empirical IPV literature. While theoretical models of IPV do account for separation, they typically incorporate it as a threat that influences men's violent behavior rather than as a mechanism that directly determines exposure to violence. Few models explicitly consider the impact of ending a relationship. A notable exception is Adams et al. (2024), whose model predicts that a higher outside option reduces a woman's likelihood of experiencing violence both by discouraging violent behavior and by increasing the probability of separation.

Failing to account for the direct role of separation introduces two key empirical challenges, which I describe below.

4.1 Separation as a collider

The first challenge is that many data sources include only partnered women. Table 4.1 shows a summary of recent papers in the Economics IPV literature. Column 3 indicates whether a study uses a sample of partnered women, while Column 4 shows whether the authors conduct heterogeneity analysis by civil status, use a sample of partnered women for robustness, or control for civil status in their regressions. About 50% of the studies either restrict their sample to partnered women or control for civil status, often due to data limitations or to try to isolate the effect of the treatment within intact marriages.

Paper	**Main IPV Variable**	**Partnered Sample**	**Other CS Control**
A. Administrative data			
Adams et al. (2024)	Police reports		
Aizer (2010)	Female hospitalizations		
Aizer and Dal Bó (2009)	Police reports; Homicides; Hospitalizations		X
Bergvall and Rodríguez-Planas (2024)	Hospital records		X

Bhalotra et al. (2024a)	DV court cases; Shelters		X
Bhalotra et al. (2024b)	Police calls and reports; Public shelters		
Britto et al. (2024)	Criminal cases: Health units		
Bullinger et al. (2021)	Police calls, reports and arrests		
Card and Dahl (2012)	Police reports		
Dave et al. (2024)	Police reports		
Hsu and Henke (2021)	Police reports		
Ivandić et al. (2024)	Police calls		X
Iyengar (2009)	Homicides		
Massenkoff and Rose (2024)	Police arrests		X
Stevenson and Wolfers (2007)	Homicides; Suicides		
B. Survey Data			
Alesina et al. (2021)	IPV ever	X	
Anderberg et al. (2015)	IPV last 12 months		
Anderberg et al. (2023)	IPV last 12 months		
Angelucci (2008)	Other	X	
Alamir (2024)	IPV last 12 months	X	
Arenas-Arroyo et al. (2021)	Other	X	
Bhalotra et al. (2024a)	IPV last 12 months		
Bobonis et al. (2013)	IPV last 12 months	X	
Bowlus and Seitz (2006)	IPV last 12 months		
Brassiolo (2016)	IPV last 12 months		X
Calvi and Keskar (2023)	IPV ever		
Chin (2012)	IPV last 12 months		
Erten and Keskin (2018)	IPV ever		
Erten and Keskin (2021)	IPV last 12 months	X	
Erten and Keskin (2024)	IPV last 12 months		
Erten and Stern (2024)	IPV last 12 months		X
García-Ramos (2021)	IPV last 12 months		X
Guarnieri and Rainer (2021)	IPV last 12 months		

Haushofer et al. (2019)	IPV last 12 months	X	
Heath (2014)	IPV ever	X	
Heath et al. (2020)	IPV last 12 months		
Hidrobo and Fernald (2013)	Other	X	
Hidrobo et al. (2016)	IPV last 6 months	X	
Kotsadam and Villanger (2022)	IPV last 3 months		
La Mattina (2017)	IPV last 12 months	X	
Luke and Munshi (2011)	IPV last year	X	
Roy et al. (2019)	IPV last 6 months		
Sanin (2023)	IPV last 12 months		X
Sanin (2024)	IPV last 12 months	X	
Shah et al. (2023)	IPV last year + IPV often		
Stevenson and Wolfers (2007)	IPV last 12 months	X	
Tur-Prats (2019)	"At the moment"		X
Tur-Prats (2021)	"At the moment"		

Table 4.1: Summary of IPV papers

I use a Directed Acyclical Graph (DAG) framework to explain why this is problematic. A DAG is a tool used to represent causal relationships between variables. In a DAG, nodes stand for variables, and arrows indicate the direction of causality, showing how one variable may affect another. This structure is useful to outline assumptions about how variables interact, identify potential confounders, and guide the analysis of causal effects. Judea Pearl (Pearl, 1995) did pioneering work using DAGs for causality, and this framework has been widely used in computer science and machine learning (Chernozhukov et al., 2024) and more recently in economics (Hünermund and Bareinboim, 2023).

Suppose we want to determine whether a treatment T causally affects violent behavior V^M. Specifically, we want to know whether the correct DAG corresponds to Figure 4.1a, in which the treatment has no effect on violence, or to Figure 4.1b, where the treatment changes men's violent behavior. There are two assumptions in the DAG. First, the treatment affects separation ($T \to L$). Most treatments—such as employment, cash transfers, education, divorce laws, or fertility— affect a woman's outside option which affects separation (L), though

the extent of this effect depends on the context. Second, violent behavior affects separation ($V^M \to L$). As shown in Figure 2.2, when men exert violence, women are more likely to leave[1].

Figure 4.1: DAG for the relationship between treatment, separation, and violent behavior

(a) T has no causal effect on V^M (b) T has causal effect on V^M

The issue with controlling for civil status or using a sample of partnered women is that separation is a *collider* in the DAG. Colliders are patterns of the form $X \to Z \leftarrow Y$, meaning that both X and Y have an effect on Z. Conditioning on Z induces a non-causal association between X and Y (Cinelli et al., 2022). This is also known as sample selection bias. Therefore, we may incorrectly conclude that a treatment affects violent behavior when it does not, or vice versa. The following examples illustrate this point.

Example 1: Outside Option and IPV

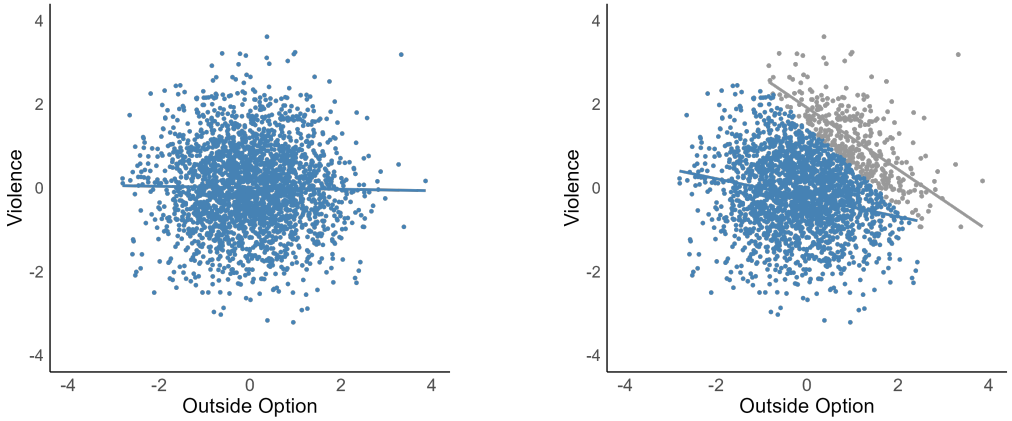
Consider the relationship between a woman's outside option O and violent behavior V^M, with V^M thought of as a continuous variable so that higher values mean more severe or frequent violence. Let O also be continuous, including factors such as income, education, number of children, gender norms, and other cultural or institutional influences. Assume that $V^M \sim N(0,1)$ and $O \sim N(0,1)$, and that there is no relationship between the two (i.e. $V^M \perp O$). This means that a woman with a high outside option is just as likely to be with a violent man as a woman with a low outside option. We also assume that a higher outside option makes it more likely that a woman will separate and that experiencing violence affects the decision to leave.

For this example, assume that a woman separates if the sum of her outside option and the violent behavior exceeds the 85th percentile of their combined

[1] Although this is not definitive causal evidence, it is plausible. Anderberg et al. (2023) show using UK panel data that the separation rate after abuse is about five times higher than after non-abuse. Adams et al. (2024) show that women in abusive relationships are more likely to break up when their outside option improves.

distribution. Under this rule, women who experience high levels of violence will leave if their outside option is not too low, and women with very high outside options will leave even if violence is moderate. Figure 4.2a shows that including all women in the analysis correctly estimates the null relationship between a woman's outside option and violent behavior. However, Figure 4.2b shows that if we only use partnered women, we might incorrectly conclude that women with higher outside options are less likely to have experienced violence.

Figure 4.2: Collider bias in the relationship between outside option and violent behavior



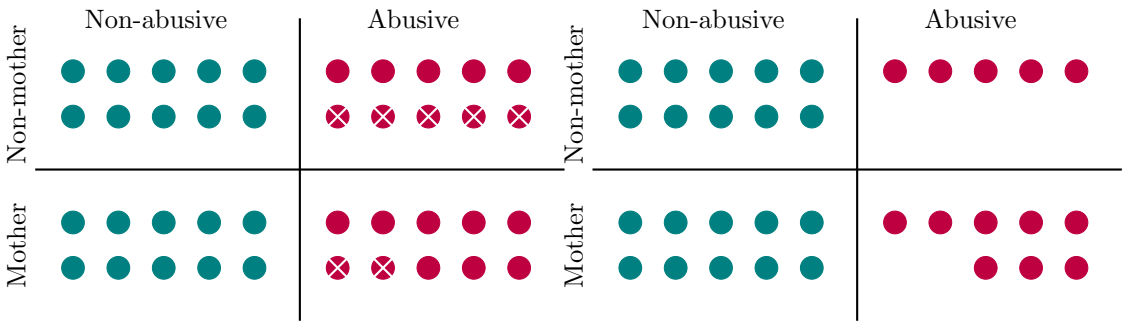
(a) Without controlling for separation

(b) Controlling for separation

Example 2: Motherhood and IPV

Now suppose we are under the selection channel of the model, where having a baby does not affect violent behavior V^M but decreases a woman's likelihood of separating L. Figure 4.3a below shows an equilibrium under a certain set of parameters, where green dots represent women who do not experience violence, red dots represent women who do, and red dots with a white cross represent women who left abusive partners. In the full sample, if we ask women about their partner's violent behavior, we find that mothers and non-mothers are equally likely to have experienced violence. However, as shown in Figure 4.3b, if we focus only on partnered women, we would incorrectly conclude that motherhood reduces within-couple violent behavior.

Figure 4.3: Collider bias in the relationship between motherhood and violent behavior



(a) All women (b) Partnered women

I conclusion, we should use data that includes both partnered and separated women and we should not control for civil status. This is the only way to avoid collider bias and correctly estimate the relationship between a treatment and violent behavior.

4.2 Observational equivalence

The second empirical challenge is that even when data includes both partnered and separated women, standard measures of IPV are proxies for whether women currently experience violence. Column 2 in Table 4.1 summarizes the main IPV outcome variables used in the literature. About 85.4% of studies rely on two types of measures: (i) administrative records (e.g., police or hospital records) and (ii) self-reported data from violence surveys (e.g., DHS), where the key variable is whether a woman experienced violence in the past twelve months.[2]

Both measures reflect current exposure to violence and are therefore a function of both actual violent behavior and separation dynamics. If a woman separates, she will not appear in hospital records or report violence in the last twelve months because she is no longer exposed to it (see Figure 2.3).

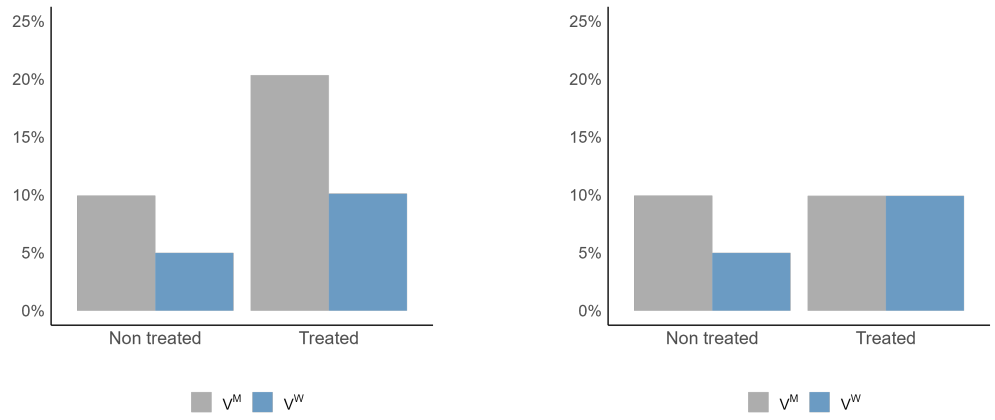
In the model, I theoretically show that changes in separation and changes in violent behavior produce the same prediction for whether women currently experience violence. I now illustrate this empirically using a simple simulation. Suppose we have 100 couples, with 10% of the men being violent. Women only

[2]Some studies use different time frames, such as violence in the past six or three months.

separate if there is violence, with a 50% chance of leaving after violence occurs. Assume that separation fully shields women from violence and that the data reflect V^W. Now, consider a treatment that affects either V^M or L.

In the first scenario, the treatment increases violent behavior by 10 percentage points, so that 20% of the men are violent while the probability of separation remains constant. Figure 4.4a illustrates this case, leading to the conclusion that V^W increases by 10 percentage points. In the second scenario, the treatment decreases the probability of separation after violence by 50 percentage points, raising the chance of staying from 50% to 100%. Figure 4.4b shows that we would also conclude that V^W increases by 10 percentage points. It would be incorrect to attribute this effect to a change in violent behavior V^M, as men's behavior remains unchanged.

Figure 4.4: Observational equivalence of V^W under two different regimes



(a) $T \to V^M$ (b) $T \to S$

In conclusion, if the data only captures current violence, we cannot separate changes in violent behavior from changes in separation behavior. This means that a change in the probability that women experience violence should not be automatically interpreted as a change in men's violent behavior.

4.3 What data allows us to disentangle the mechanisms?

In order to disentangle the mechanisms, we need to address the two main issues described above. I propose the following data strategy:

1. The sample should include both women who are currently in relationships and those who have separated, to avoid sample selection bias.

2. The data should allow us to construct proxies for three key outcomes: whether women currently experience violence (V^W), whether men exert violence (V^M), and whether women leave the relationship (L). Proxies for current violence and separation are relatively straightforward. However, constructing a proxy for violent behavior V^M requires a measure that is independent of separation dynamics. One way to achieve this is by asking women whether their partner—or ex-partner, if they have separated—has ever been violent during the relationship, rather than whether they experienced violence in the last twelve months. This approach allows us to identify abusive men regardless of a woman's current relationship status. In other words, it enables us to determine whether women who have left their partners experienced violence, even if they are no longer exposed to it.

Chapter 5

Testing the model: Descriptive evidence

In this chapter, I provide descriptive evidence supporting the selection channel of the model. I test the model's four predictions using data from the Encuesta Nacional de Dinámica de las Relaciones en los Hogares (ENDIREH), focusing on women who recently entered their first cohabiting relationship.

The results show that mothers are more likely to currently experience violence. However, they are just as likely as non-mothers to have experienced violence at some point in their first relationship and are less likely to be separated. Additionally, mothers who delayed pregnancy are less likely to have had an abusive partner. These findings align with the selection channel of the model; all men are equally likely to exert violence, but mothers are less likely to separate from their partners, which results in a higher probability of experiencing violence.

5.1 Data

To avoid the issues described in the chapter above, we need data that includes both partnered and separated women and proxies for the three key outcomes: whether women currently experience violence (V^W), whether their (ex-)partner has exerted violence (V^M), and whether they are separated (L). Crucially, the data should include information on violence with both current and past partners, so we can identify if women who left their partner previously experienced violence.

I use the Encuesta Nacional de Dinámica de las Relaciones en los Hogares (ENDIREH), a nationally representative survey on household dynamics in Mexico, for two main reasons: First, it includes women of all civil statuses, which helps avoid sample selection bias. Second, it provides detailed information on violence history with both current and former partners, allowing me to construct different proxies for whether a woman currently experiences violence (V^W) and whether her partner has been violent (V^M).

The survey asks women about their experiences with various types of violence (e.g., slapping, pushing) at two points in time by their reference partner. For women who have a boyfriend or cohabiting partner, the reference partner is the current partner. For women who are separated or single but with a previous boyfriend, the reference partner is the ex-partner. There is also information- albeit more limited- about previous partners to the reference partner[1].

The enumerator first asks the woman if she experienced a particular type of violence (e.g. slapping) by their reference partner at any point in the relationship. If she answers affirmatively, the enumerator then asks if the violence occurred within the last 12 months.

First, I test the predictions of the model using a sample of all women who began their first cohabiting relationship six years before the survey and did not have any children when they first began cohabitation. I use this sample to test the four predictions of the model and the reference partner is the first cohabiting partner. The table below shows the main variables in the model and what I am using in the data:

Variable	Model	ENDIREH
V^W	Current violence	IPV in the last 12 months
V^M	Violent partner	IPV at any point in the relationship
L	Separation	Relationship history

In the model V^W is a binary variable that equals one if the woman experiences violence at the end of the period. It is defined as the probability that her partner exerts violence and she stays in the relationship. In the survey, I identify whether the woman experienced physical violence in the last twelve months by her first partner[2].

[1] They ask women how many other partners they've had in the past and ask them about whether they've experienced physical violence with any of the previous partners.

[2] I have this information for all women who are partnered with the first partner or separated but who currently don't have a partner. I also know whether a woman has ever experienced

The second variable of interest is whether the man exerts violence, V^M. In the survey, I identify whether the woman experienced physical violence with her first partner at *any* point in the relationship. This variable serves as a proxy for men's violent behavior because it is not a function of separation. If men exert violence in the relationship, then their partner will answer affirmatively to this question, regardless of whether they are still together.

Lastly, I use as a proxy of separation L a binary variable that equals one if she is no longer in a relationship with her first cohabiting partner.

5.2 Specification and results

Predictions 1-3 test the effect of having a child on the probability of experiencing violence, violent behavior and separation. To test these predictions, I estimate the following regression:

$$Y_i = \alpha + \beta \text{Mother}_i + X_i + \epsilon_i \tag{5.1}$$

The outcome variables are V^W, V^M and L and $Mother_i$ is a binary variable that equals one if the woman became a mother with her first partner. In all regressions I include age fixed effects, years of schooling fixed effects, wealth quintile fixed effects and years since beginning of cohabitation fixed effects. The idea is to compare women who have the same age, the same schooling and wealth and have been in the relationship for the same amount of time, but some had a child with their partner and some did not.

violence with a previous partner, so for women who have never experienced physical violence, I know they are not currently experiencing violence. For women who have separated from their first partner, experienced physical violence with them and have a new partner (1.8% of the sample), I assume that 10% of them experienced violence from their first partner during the last 12 months before the survey. I assume this because, on average, these women have been with their new partner for 3 years. Consequently, they have been separated for at least three years from their first partner. In Figure 2.3, we can observe that among those women who have been separated for 3 years and had an abusive partner, 10% continue to experience violence after separation.

Table 5.1: Predictions of the model using sample of first cohabitation

	V^W (1)	V^M (2)	L (3)	V^M (4)
Mother	0.013**	-0.003	-0.103***	
	(0.006)	(0.009)	(0.011)	
Wait 4+ years				-0.039***
				(0.009)
Observations	24,456	24,456	24,456	17,829
Mean Ref. Group	0.056	0.091	0.165	0.134
Age fixed effects	✓	✓	✓	✓
Wealth Quintile fixed effects	✓	✓	✓	✓
School level fixed effects	✓	✓	✓	✓
Years since start cohab. fixed effects	✓	✓	✓	✓
Years since first child fixed effects				✓

Notes: Columns (1)-(3) show coefficient β from Equation 5.1. Column (4) shows the coefficient β from Equation 5.2. All regressions control for age fixed effects, wealth quintile fixed effects, school fixed effects, and years since the start of cohabitation fixed effects. Column (4) additionally controls for years since the first child fixed effects. All regressions use survey weights Heteroskedasticity-robust standard errors are reported in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Column (1) in Table 5.1 shows that mothers are 1.3 percentage points more likely to experience violence than non-mothers. On average, 5.6% of non-mothers experienced violence in the last 12 months. Consequently, we can conclude that mothers are 23% more likely to experience physical violence than non-mothers. Recall that both channels predict that motherhood increases the probability of experiencing violence.

I show the results of violent behavior V^M in Column (2) of Table 5.1. Under the direct channel, fathers are more likely to exert violence, so we would expect that mothers are more likely to have experienced violence at some point in the relationship. Instead, the coefficient is a precisely estimated zero. Women who had a child with their first partner are as likely to have had an abusive partner as those who did not. This result is consistent with the selection channel, where having a baby does not change the probability of having a violent partner.

Next, I test whether mothers are more or less likely to be separated from their first partner compared to non-mothers. The direct channel predicts that mothers will be more likely to be separated, while the selection channel predicts mothers

will be less likely to be separated. Consistent with the latter channel, Column (3) of Table 5.1 shows that mothers are 10.3 percentage points less likely to be separated from their partner compared to non-mothers. Considering that 16.5% of non-mothers are separated, this implies that mothers are 62% less likely to separate than non-mothers[3].

Lastly, Prediction 4 tests whether mothers who wait more years to have their first child are less likely to have an abusive partner compared to those who have their first child early into the relationship. To test this prediction, I estimate the following regression among the sample of women who had a baby with their first partner:

$$V_i^M = \alpha + \beta \text{Wait}_i + X_i + \epsilon_i \tag{5.2}$$

$Wait_i$ is a binary variable that equals one if the woman had a child at least four years after she began dating her first partner. I use the same fixed effects as in the previous regressions and include years since first child fixed effects.

If men become violent once they have a baby, waiting to have a child would be uncorrelated with whether a woman's partner is abusive, as women learn the type only after the child is born. Alternatively, under the selection channel, waiting to have a child allows women to learn about their partner's type. Hence, the women who have a child later are a selected sample who either i) have a non-violent partner or ii) have a violent partner and a very high dissolution cost. Consequently, we would expect a negative coefficient for the variable $Wait_i$. Consistent with the selection channel, Column (5) in Table 5.1 shows that mothers who delay pregnancy are 3.9 percentage points less likely to have experienced violence with their partner. On average, 13.4% of women who have a child early have experienced violence with their partner. Hence, waiting to have a child is associated with a 29% decrease in the probability of having had a violent partner.

The table below shows the predictions under each channel and the empirical results:

[3]This also holds if we condition on violence. Conditional on having an abusive partner, mothers are 21 percentage points less likely to be separated from their partners than non-mothers. Almost half of the non-mothers who experience violence are separated (47.3%). Consequently, mothers who experience violence are 44% less likely to be separated than non-mothers who experience violence.

	Direct channel	*Selection channel*	Data
P1: Women experience violence V^W	↑	↑	↑
P2: Violent behavior V^M	↑	-	-
P3: Separation behavior L	↑	↓	↓
P4: Waiting on violent behavior	-	↓	↓

So far, I have shown descriptive evidence that mothers are more likely to experience violence than non-mothers, as likely to have had an abusive partner and less likely to be separated. Moreover, mothers who delay pregnancy are less likely to have experienced violence with their partner. All facts are consistent with the selection channel. Although these results are suggestive, they provide a first step towards understanding the mechanisms of the model. The next chapter provides a causal interpretation of these results.

5.3 Robustness

5.3.1 Alternative explanations for null effect

The key descriptive finding is that mothers and non-mothers report the same lifetime probability of having an abusive partner. Under the model's logic, if there was a direct effect of childbirth on men's violent behavior we would see higher lifetime IPV rate among mothers.

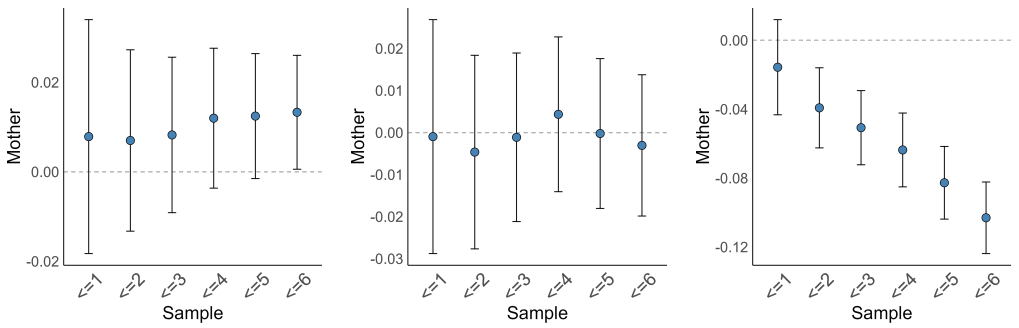
However, a more complex cancellation story could, in principle, generate this null finding. Suppose (1) childbirth genuinely induces some men to become more violent, and (2) women who correctly perceive their partner's abusiveness opt not to have children. In that case, the group of mothers would see elevated violence because of the direct effect, while the non-mother group would also have high violence rates as women with abusive partners self select into non-mothers. For this mechanism to happen, women have to know their partner's type before deciding to have a child.

To explore whether such pre-fertility screening could be at work, I exploit the information on relationship tenure. Women who have cohabited for less than one year have had less opportunity to observe persistent abuse prior to a first pregnancy; if the cancellation story holds, we should unmask a positive "baby → violence" effect in this short-tenure subsample. Concretely, I re-estimate Equation 5.1 on samples defined by maximum cohabitation durations of ≤ 1

year, $\leq$ 2 years, ... through $\leq$ 6 years. Figure 5.1 shows the results for the three main predictions. First, note that the coefficients for violent partner in Figure 5.1b are zero across subsamples. If childbirth directly increases violent behavior, the coefficient on "Mother" should be positive among women with less time in the relationship—when selection-out is least plausible. Instead, I find that the coefficient remains effectively zero for all tenure cut-offs.

Moreover, 5.1c shows that the estimated coefficient for separation becomes more negative as the sample includes women who have been longer in the relationship. This is potentially driven by the fact that separation takes time. The coefficients for current violence also become stronger as women are longer in the relationship (Figure 5.1a). This pattern is consistent with the selection channel, as the increase in current violence is driven by the decrease in separation.

Figure 5.1: Results by years since first cohabitation



(a) Current IPV (b) Violent partner (c) Separation

Notes: This figure shows coefficient β from Equation 5.1 using different samples. The x-axis represents the sample cut-off. For instance, $\geq$ 1 means the regression only includes women who have been cohabiting for less than one year. All regressions use survey weights and use heteroskedasticity-robust standard errors.

This discussion does not fully reject more elaborate heterogeneity scenarios, but it reinforces the selection channel as a plausible explanation for the zero motherhood-violence correlation. Alternative mechanisms could in principle generate a null association—for example, if some men become violent after fatherhood while other men stop exerting violence, their aggregate effects might cancel. I conclude that, under the assumptions of the model, these findings provide strong evidence for selection and no support for a direct effect of fatherhood on violence, but there is still room for alternative explanations.

5.3.2 Intensive margin of violence

Another potential channel is that while fatherhood does not cause new violence on the extensive margin, men who were already violent may exert more severe or frequent violence once they become fathers. To capture this, the survey asks women, for each type of violent act, both the frequency ("never," "once," "a few times," or "many times") and their perception of its severity ("unimportant," "serious," or "very serious").

I construct a severity-frequency index in three steps. First, for each act of violence (e.g. slapping) I compute the mean severity score among women who experienced it. Second, I assign numerical values to frequency: 0 = never, 1 = once, 2 = a few times, 3 = many times. Third, I multiply the act's average severity by its frequency score and sum across acts to form a raw index.

About 1.4% of women in the sample have left their abusive first partner and formed a new union, and there is missing data on severity and frequency from the first partner. I keep these women in the analysis and impute their missing severity-frequency scores using the mean (5.23) and median (4.00) calculated from the subsample of separated women with abusive first partners who have no missing data. Finally, I standardize the index by subtracting its overall mean and dividing by its standard deviation.

I estimate Equation 5.1 using the standardized index as the dependent variable. The results are shown in Table 5.2. I find no evidence that mothers are more likely to experience more severe or frequent violence than non-mothers. The coefficient is small and not statistically significant.

Table 5.2: Violence intensity and frequency

	Severity-frequency index			
	(1)	(2)	(3)	(4)
Mother	0.014	-0.030	0.033	-0.008
	(0.023)	(0.025)	(0.022)	(0.024)
Observations	24,456	24,456	24,456	24,456
Imputation	Mean	Mean	Median	Median
Mean Ref. Group	-0.043	-0.043	-0.052	-0.052
Years since start cohab. fixed effects	✓	✓	✓	✓
Age fixed effects		✓		✓
Wealth Quintile fixed effects		✓		✓
School level fixed effects		✓		✓

Notes: This Table shows coefficient β from Equation 5.1 using as dependent variable a severity-frequency index of violence that the woman experienced from her first partner. In columns (1) and (2) I impute the mean index for missing data. In columns (3) and (4) I impute the median index. All regressions use survey weights Heteroskedasticity-robust standard errors are reported in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Chapter 6

Testing the model: Causal evidence

To arrive to causal estimates of motherhood on violence and separation, we need some exogenous variation in ρ (the share of couples in the model that do not have a child in the first period). Specifically, we need a fertility shock that enables women to delay motherhood. Canonical fertility instruments focus on the intensive margin of fertility, e.g. sex of first child or having twins. We need an instrument for motherhood on the extensive margin.

Potentially, different policies could increase the share of couples that do not become parents. For example, changes in access to abortion, an information campaign about the benefits of delaying pregnancy, or changes in access to contraceptives. In this thesis, I use changes in access to pharmacies as a natural experiment to test the predictions of the model. Having access to a pharmacy increases the probability of using contraceptives, which in turn decreases the probability of having a child.

The chapter proceeds as follows. First, I present descriptive evidence on contraceptive use in Mexico. Next, I describe the data used in the analysis. I then examine the effects of pharmacy openings on motherhood, violence, and separation, followed by an estimation of the causal effect of motherhood on violence and separation. Finally, I conduct a series of robustness checks.

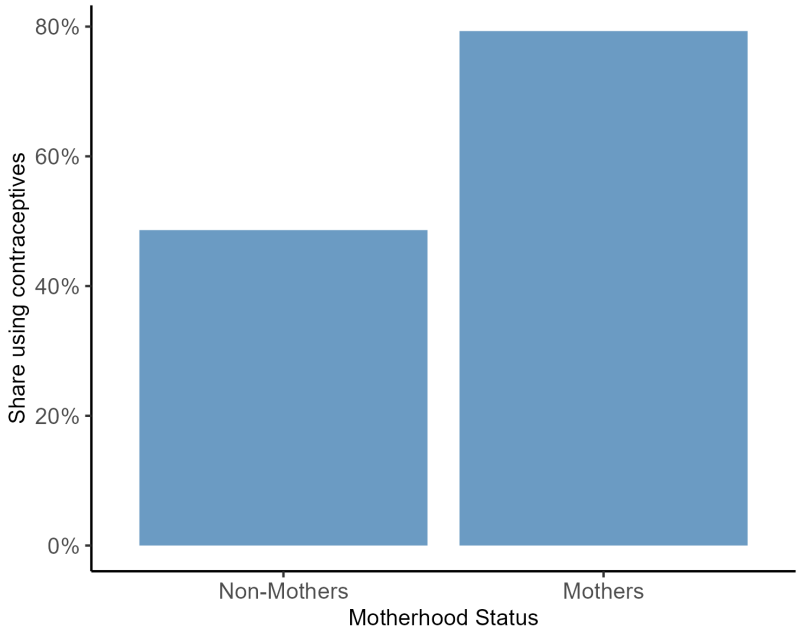
6.1 Contraceptive use in Mexico

This section will present descriptive facts about contraceptive use and pharmacy use in Mexico. The data comes from the National Survey on Demographic Dynamics (ENADID) 2009 and 2014. The survey is designed and collected by the National Institute of Statistics and Geography (INEGI) every five years. It's objective is to update statistical information on the level and trends of demographic dynamics, including fertility, mortality, and migration (both internal and international), as well as other topics related to the population, households, and housing in Mexico. It surveys women between 15 and 54 years old and collects information on contraceptive use, fertility, and other demographic variables.

A. Contraceptive use by motherhood status

Figure 6.1 presents the share of sexually active women who use any contraceptive method. Women without children are less likely to use contraceptives, with only 48.6% using a method compared to 79.3% of mothers.

Figure 6.1: Share of women who use contraceptives by motherhood status



Notes: This figure shows the population-weighted share of women who currently use a contraceptive method. The sample includes all women who report being sexually active.

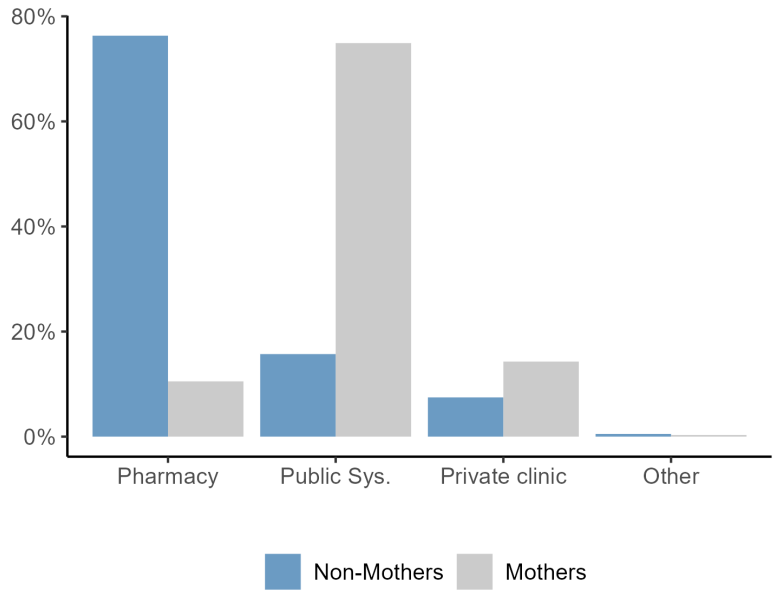
The following figures will examine the types of contraceptives women use and

where they obtain them. Therefore, I will focus on sexually active women who use contraceptives at the time of the survey.

B. Place of access to contraceptives

Among those women who use contraceptives, 70.4% get them from the public sector[1], 15.4% from a pharmacy and 13.7% from a private hospital or clinic. However, mothers and non-mothers have starkly different patterns of contraceptive use.

Figure 6.2: Place of access to contraceptives by motherhood status



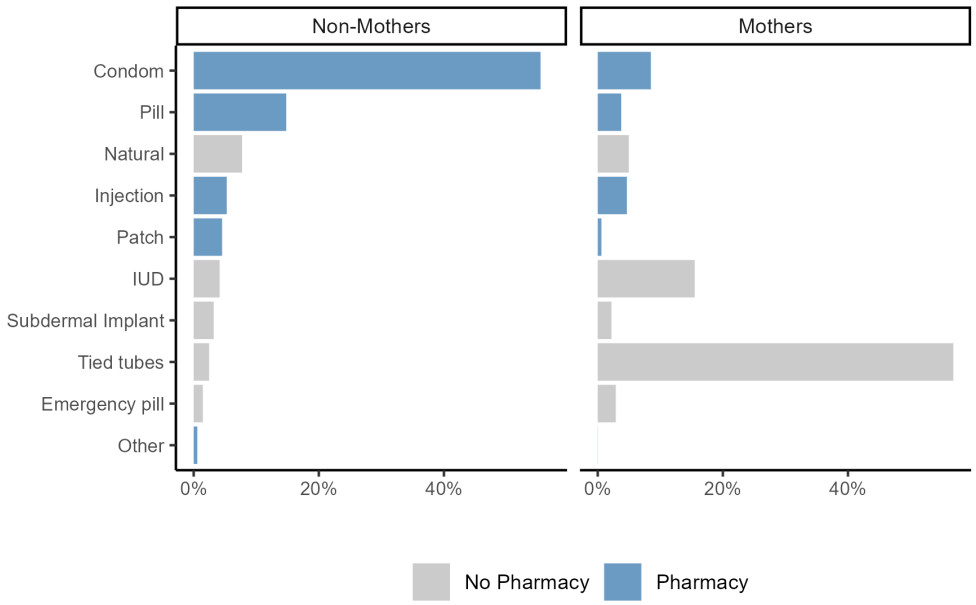
Notes: This figure shows the population-weighted share of women who get their contraceptives in each type of place (pharmacies, public system, private clinic or other) by motherhood status. The sample includes all women who report using a contraceptive method at the time of the survey. *Source:* ENADID 2009 and 2014

Figure 6.2 shows that 76.3% of non-mothers get their contraceptives from a pharmacy, while only 10.5% of mothers do. Mothers are much more likely to use the public system (e.g. government clinics). This could be driven by the fact that mothers are more likely to use long-term contraceptives, which are more likely to be provided by the public sector.

C. Type of contraceptives used by motherhood status

[1]Seguro Social (IMSS), IMSS Oportunidades (IMSS Solidaridad), ISSSTE, ISSSTE Estatal, Clinic or hospital of Health Ministry or other public centers

Figure 6.3: Contraceptive use by motherhood status



Notes: This figure shows the share of women who each type of contraceptive by motherhood status. The sample includes all women who report to be currently using a contraceptive method at the time of the survey. The blue bars represent contraceptives that can be found in pharmacies and the gray bar contraceptives that are not found in pharmacies. Other contraceptives include vasectomy, sponge, female condom and other methods. Natural contraceptives include the pull-out method and rhythm. All means are weighted by survey weights. *Source:* ENADID 2009, 2014.

In Figure 6.3, I show the type of contraceptives that mothers and non-mothers use. The most used contraceptives of non-mothers are male condoms (55.44%), contraceptive pills (14.7%), natural methods (pull-out method or rhythm method) (7.7%), and injectables (5.2%). All of these methods (except for natural methods) can be found in a pharmacy. On the other hand, the most used contraceptives of mothers are tied tubes (56.8%), IUD (15.4%), male condoms (8.4%), natural methods (4.9%) and injectables (4.6%). The only place where women can get their tubes tied or an IUD is in a clinic.

Additionally, I did ten qualitative interviews with pharmacists and asked them why they think women prefer to buy contraceptives from their pharmacy than the public clinic (where contraceptives are free). They gave two main reasons: convenience and privacy. First, pharmacies are more convenient than public clin-

ics, which have long waiting times and more restricted opening hours[2]. Second, pharmacies provide privacy that clinics do not. In the public clinics, doctors keep a record of women's contraceptive use and ask for personal information[3]. In pharmacies, you don't need a prescription to buy contraceptives, and the pharmacist does not keep a record of the purchase.

These facts suggest that pharmacies are an important source of contraceptives for Mexican women, particularly for women with no children.

6.2 Data

I construct a novel dataset by merging three existing datasets from Mexico: i) ENDIREH: Violence survey in Mexico with location at the block level, ii) DENUE: Universe of businesses in Mexico collected by INEGI and iii) maps of Mexico at the block level collected by INEGI.

1. Encuesta Nacional sobre las Relaciones de los Hogares en México (ENDIREH)

ENDIREH is a cross-sectional survey conducted every five years with the goal of providing insights into violence against women in Mexico. It gathers information on physical, emotional, psychological, and economic violence experienced by women aged 15 and above in various settings, including their family of origin, school, workplace, community, and relationships. The survey is designed and collected by the National Institute of Statistics and Geography (INEGI) every five years. It follows international standards on privacy, consent and security for the surveyed women and enumerators. I use waves 2011 and 2016[4] for my main analysis and wave 2006 for pre-trend analysis.

To calculate access to pharmacies, I need granular data on the location of the women on the survey. I obtained access to the location of the women at the

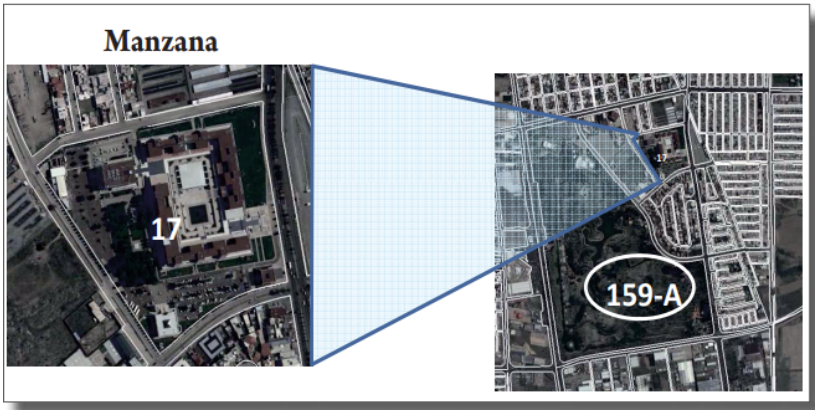
[2]Big pharmacy chains are open until late. For instance, Farmacias Similares, the largest chain, is open until 22:00 and some stores are open 24 hours.

[3]For instance, one pharmacist said "In the clinic, the doctor keeps control of the methods the woman should use. For example, young women who want the morning-after pill may be ashamed to go to the doctor. Or people who are not married prefer to come to the pharmacy. Once they get married, they go to the public center."

[4]I do not use data from 2003 due to significant methodological differences. Specifically, the survey in that year exclusively targeted married or cohabitating women, preventing the study of separation behavior, a crucial mechanism in the model. Similarly, I exclude data from 2021 because of potential interactions between COVID-19, pharmacy openings, and IPV.

block level ("Manzana") through *Laboratorio de Microdatos*. This information is collected by INEGI in many surveys but it is not publicly available for security and confidentiality reasons. A block is the smallest geographical unit recorded by INEGI and it is defined as one or more adjacent dwellings, which are separated from other blocks by streets, avenues, railroads, rivers, ravines, etc. The median area of a block is 5,653m^2 (equivalent to a square with sides of 75m). Figure 6.4 shows an example of a block in Mexico.

Figure 6.4: Example of a block in Mexico



Notes: This is an example of a block in Mexico. A block is the smallest geographical unit recorded by INEGI and it is defined as one or more adjacent dwellings, which are separated from other blocks by streets, avenues, railroads, rivers, ravines, etc. Each block is designated as either urban or rural, based on the characteristics of the locality it belongs to. *Source:* Manual de Cartografía Censal 2010, INEGI.

2. National Directory of Economic Units (DENUE):

The Directorio Estadístico Nacional de Unidades Económicas (DENUE) contains information on all the active businesses in Mexico. The first edition is from 2010 and it is updated every year [5]. It contains information on the name of the business, legal organization (individuals or legal entities), economic activity, size of the business and location. The establishments are classified according to the North America Industrial Classification System for Mexico (NAICS) and I use two categories for the analysis: pharmacies without mini-supermarkets (464111)

[5]The most comprehensive updates are after the Economic Census (2009, 2014 and 2019), although large businesses are also updated through administrative records between census years. Pharmacies are small enough that most of them are added to the directory after the census. Consequently, I am unable to identify most pharmacies that opened between 2009 and 2011 and between 2014 and 2016.

and pharmacies with mini-supermarkets (464112). The former are establishments that only sell pharmaceutical products, while the latter are establishments that sell pharmaceutical products and other products such as food, beverages, and cleaning products. I use DENUE 2011 and 2016 to create a dataset of the universe of pharmacies in Mexico in those years[6]. I also use this dataset of other businesses in Mexico in 2011 and 2016, which I use to construct the placebo treatment.

3. Maps of Mexico (INEGI)

I use maps from Marco Geoestadístico INEGI that are comprised of shapefiles for all 32 Mexican states at the block level. I use the 2010 version because ENDIREH 2011 and 2016 are designed to be compatible with it.

Calculating access to pharmacy

To calculate a measure of pharmacy access, I follow these steps:

1. Identify the block ID of each woman in the survey and merge it with the shapefile from Marco Geoestadístico.

2. Merge this data with DENUE, which contains a complete listing of pharmacies in 2011 and 2016.

3. Calculate the distance between the centroid of each block and the nearest pharmacy using latitude and longitude coordinates for pharmacies in 2011 and 2016.

I follow the same steps to calculate access to other types of businesses, which I use for placebo estimations. The final dataset combines the domestic violence survey (ENDIREH) with additional variables at the individual level on access to pharmacies and other types of businesses in 2011 and 2016.

[6]Although all of this data is publicly available, some of the earlier versions of DENUE do not have a unique identifier for the business (CLEE). I was able to get this data through INEGI and can be obtained by other researchers

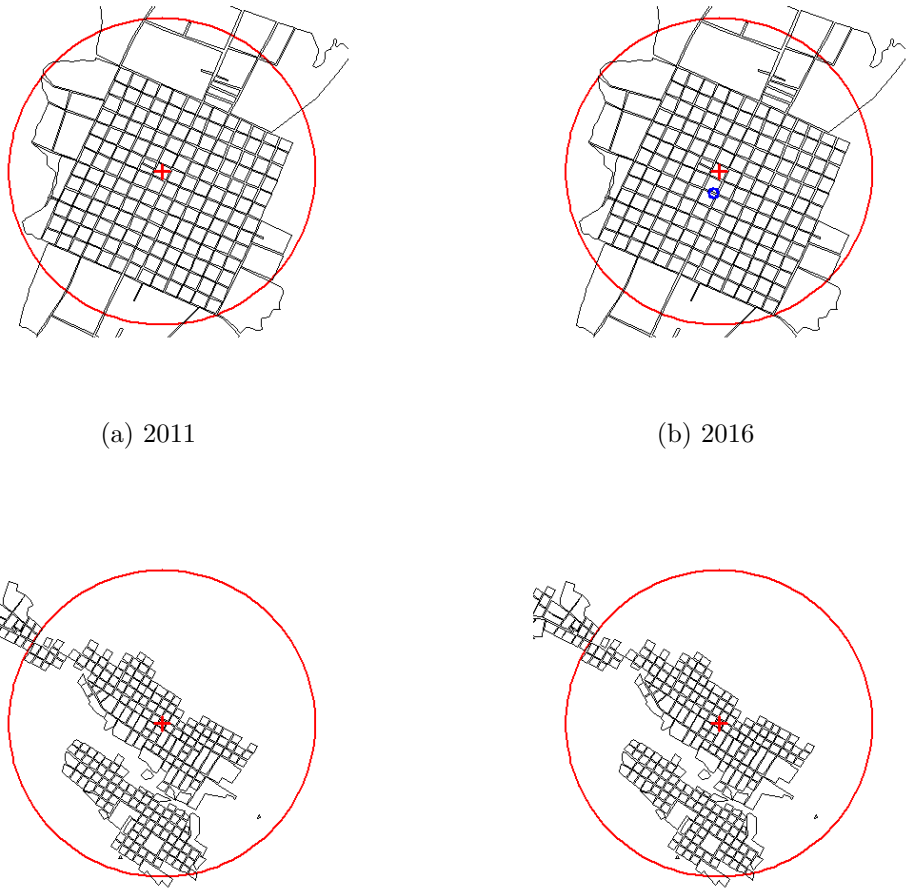
6.3 Causal effect of pharmacy openings

6.3.1 Empirical strategy

I estimate the causal effect of a pharmacy opening on motherhood, the probability that a woman experiences violence V^W, the probability that a man exerts violence V^M and separation L, using a difference-in-differences framework. There are two periods (2011 and 2016) and two groups (treatment and control). I define the treatment group as those women who live in a block that did not have a pharmacy within a 1 km[7] radius in 2011 and had at least one pharmacy in 2016. The control group is defined as women who live in a block with no pharmacy within a one km radius in 2011 and 2016. Figure 6.5 below shows an example of a block that would be considered as treated and an example of a control block. Panels (a) shows a block (red cross) with no access to a pharmacy within a 1 kilometer radius (red circle) in 2011 and panel (b) shows that the same block has access to a pharmacy (blue circle) in 2016. Panel (c) and (d) show a block in 2011 and 2016 that does not have access to a pharmacy within a 1 kilometer radius.

[7]In the robustness section, I conduct a series of sensitivity analyses to show that other thresholds yield similar results.

Figure 6.5: Example of a treated and control block



(a) 2011 (b) 2016

(c) 2011 (d) 2016

Notes: This figure shows an example of a treated block (panels (a) and (b)) and a control block (panels (c) and (d)). The red cross represents the centroid of the block, the red circus a one km radius and the blue dot the pharmacy in the area.

My main sample includes young women (under 30 years old) who were not mothers five years before the survey[8], because I am interested on the extensive margin of motherhood.

In theory, focusing on a group of relatively young women could amplify both the separation and the violence channels. On the one hand, younger women may

[8]This means that for the 2011 survey, the sample includes all women who were non-mothers in 2006 and for the 2016 survey, the sample includes all women who were non-mothers in 2011.

have lower dissolution costs, as they are more likley to find a new partner after a break-up. This could result in stronger effects for the selection channel. On the other hand, younger couples may have higher emotional or financial stress after the birth of a child, which could result in finding stronger effects for the direct channel of violence.

In practice, however, focusing on women under 30 is not overly restrictive. First, Mexican women typically become mothers very early: the average age of first birth in Mexico is 21 years old (INMUJERES, 2020); 63% of women who are 25 years old are mothers and 78% are mothers by the age of 25 (See Figure B.3 in the Appendix). Therefore, the sample captures the vast majority of first-time mothers. Second, robustness checks using older age thresholds (see Figure 6.10) yield similar estimates, suggesting that the findings hold well beyond the under-30 group.

Table 6.1 presents the summary statistics. On average, women in the sample are 20.5 years old and have 9.9 years of schooling. Approximately 27% of them are employed at the time of the survey, and 8% are indigenous. In 2011, women in the treatment group had a pharmacy located about 2 km from their home, while in 2016, their closest pharmacy was just 500 meters away. In contrast, women in the control group had their nearest pharmacy approximately 5 km away in both 2011 and 2016. Regarding the outcome variables, 37% of women were mothers at the time of the survey. Around 4% of women reported experiencing physical violence in the last 12 months, and 3% experienced physical violence from a partner five years prior to the survey. Lastly, approximately one in every four women in the sample experienced a break-up in the last five years.

I estimate the following specification for each outcome variable of interest:

$$Y_{ibt} = \beta_0 + \beta_1 \text{Treat}_b + \beta_2 \text{Post}_t + \beta_3 \text{Post}_t \times \text{Treat}_b + X_{ibt} + \epsilon_{ibt} \tag{6.1}$$

The variable Post_t is a dummy variable that takes the value of 1 if the observation is from 2016 and 0 otherwise. The variable Treat_b is a dummy variable that takes the value of 1 if the observation is from a block that had access to a pharmacy within a one-kilometer radius in 2016 and zero otherwise. The vector X_{ibt} contains a set of control variables including years of schooling, change in market access[9], distance to closest pharmacy in 2011, baseline number of phar-

[9]Defined as the number of businesses in a 3km radius in 2016 minus the number of businesses in a 3km radius in 2011

Table 6.1: Summary statistics main sample

	Control	Treated	All Women
A. Individual Characteristics			
Mean Age	20.42	20.89	20.51
Mean Schooling	9.71	10.94	9.92
Mean Wealth Quintile	2.43	2.93	2.52
% Work (lw)	0.25	0.34	0.27
% Indigenous	0.09	0.04	0.08
B. Pharmacy Access			
Dist. to nearest pharmacy 2011	5465.25	2038.13	4859.97
Dist. to nearest pharmacy 2016	5363.76	561.79	4515.67
C. Outcome Variables			
% Mothers	0.37	0.34	0.37
% Physical (ly)	0.04	0.05	0.04
% Physical (5y prior partner)	0.03	0.03	0.03
% Break-up (last 5 years)	0.23	0.30	0.24
N	7055	1526	8581

Notes: This table presents summary statistics for the main sample used in the analysis. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Control women are those who did not have a pharmacy within a 1 km radius in either 2011 or 2016.

macies, wealth quintile fixed effects, and state fixed effects. All standard errors are clustered at the AGEB level, the basic statistical unit[10] of INEGI. The coefficient of interest is β_3, which captures the differential effect of having access to a pharmacy on the outcome variable of interest.

I estimate Equation 6.1 in four outcome variables:

1. Motherhood: A binary variable equal to 1 if the woman is a mother at the time of the survey.

2. Current violence (V^W): A binary variable equal to 1 if the woman reported experiencing physical violence in the last 12 months.

3. Violent partner (V^M): A proxy for whether men exert violence. Instead of using violence in the last 12 months (which is a function of violent

[10]The geo-statistical framework divides the country into states, municipalities, localities, and AGEBs (basic geo-statistical unit). Urban AGEB's include between one and fifty blocks and are perfectly delimited by streets, avenues, or any other trait easily identifiable in the field. Rural AGEB's are more variable in size and are delimited by natural features (e.g. river, ravine) or other features (e.g. roads, pipelines, railways)

behavior and separation behavior), I identify the partner from five years before the survey and construct a binary variable equal to 1 if that partner was physically violent at any point in the relationship[11].

4. Separation (L): A binary variable indicating whether the woman experienced a break-up in the last five years.

6.3.2 Assumptions and threats to identification

Treatment and control groups differ on observable dimensions—such as baseline distance to the nearest pharmacy in 2011 and the share of working women—but covariate balance is not required for a differences-in-differences design. The key identifying assumption is parallel trends: in the absence of pharmacy openings, fertility, IPV, and separation would have followed similar trajectories in both groups[12]. I perform two placebo exercises before showing the main results.

[11] For all partnered, separated, and widowed women, I have information about the number of partners and length of the relationship. However, for single women (defined as those who have never been partnered), I only have information about their current boyfriend or last ex-boyfriend. Hence, I can identify whether these women were with said partner five years before the survey. If they were not with them, I assume they were single and the outcome variable is equal to 0. For 87% of the sample, there is no uncertainty of whether they experienced violence with their partner from five years before the survey. Results are identical if I assume that the remaining 13% had non-abusive partners five years ago or all had abusive partners five years ago.

[12] To address concerns that control-group women (e.g. more rural, less exposed to gender-rights norms) may follow different trends in the outcome variables, I do the following tests throughout the thesis:

1. I compare trends of fertility, violence, and separation using the 2006 ENDIREH wave and find no systematic differences, confirming that the two groups were on a parallel trend before any pharmacy opening (See Table 6.2).
2. I run placebo regressions on openings of other businesses (e.g.bakeries) and observe no effects on the four outcomes (See Figure 6.6). If the effects observed in the main analysis were driven by differences in trends between control and treatment groups, we would expect to see similar effects from the openings of other businesses.
3. I estimate the effect of pharmacy openings the subgroup of women whose first birth occurred before the opening and find no effects on fertility, violence, or separation (See Figure 6.7). If the effects observed in the main analysis were driven by differences in trends between control and treatment groups, we would expect to see similar effects for women who were already mothers.
4. I replicate the analysis with an "urban" control group—women who lived within 1 km of a pharmacy in both 2011 and 2016—and obtain qualitatively similar estimates (See Table 6.10).
5. I include additional controls for initial pharmacy distance, local business growth, and urbanization; the main coefficients remain unchanged.

Pretrend analysis

First, I use data from ENDIREH 2006 to perform a falsification test. In particular, I check for the existence of pre-trends for the main sample of interest by estimating Equation 6.1 on data from 2006 and 2011 where the variable $Post_i$ is equal to one if the year is 2011. If there were previous differences in trends between the women who gained pharmacy access between 2011 and 2016 and those who did not, we would find a statistically significant coefficient on the newly defined interaction term.

Table 6.2: Pre-trend analysis

	Mother (1)	Curr. Vio. (2)	Violent partner (3)	Break-up (4)
Post × Treat	-0.032	0.001	0.002	-0.032
	(0.033)	(0.016)	(0.009)	(0.038)
Observations	9,496	9,496	9,496	9,496
Mean Dep.Var	0.296	0.029	0.017	0.228
State fixed effects	✓	✓	✓	✓
Age fixed effects	✓	✓	✓	✓
Wealth Quintile fixed effects	✓	✓	✓	✓
School Years	✓	✓	✓	✓

Notes: This table presents the coefficient β_3 from Equation 6.3 using data from 2006 and 2011. Mother is a binary variable that equals one if the woman had a child at the time of the survey. Current violence is a binary variable equal to one if the woman experienced physical violence in the last 12 months. Violent partner is a binary variable equal to one if she experienced physical violence at any point in her relationship with her partner from five years before the survey. Break-up is a binary variable equal to one if she had a break-up in the last five years. Treated women are those who gain access to a pharmacy between 2011 and 2016. Post is a binary variable that equals one if the year is 2011. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 6.2 shows that the treatment group was not on a significantly different trajectory than women in the control group regarding fertility, violence and separation outcomes. The coefficient on the interaction term between the treatment and the post-period is not statistically significant for any of the outcomes. This provides evidence that the results are not driven by pre-existing differences in trends between the treatment and control groups.

Local economic growth

Given that contraceptives are one among hundreds of products sold in pharmacies, it is unlikely that pharmacy openings target areas based on specific trends in fertility, violence, or separation. However, contemporaneous shocks correlated with pharmacy openings could affect outcomes. Specifically, a pharmacy opening could coincide with regional economic growth, which might influence fertility, violence, and separation, potentially violating parallel trends.

If regional shocks were driving the results, we would expect to see similar effects from the openings of other businesses. To test this, I conduct a placebo estimation using businesses that experienced similar growth to pharmacies between 2011 and 2016. Specifically, I estimate the impact of their openings on violence, fertility, and separation.

The initial criterion for selecting placebo businesses was that they had at least 30,000 establishments in 2011 (compared to 46,341 pharmacies) and a growth rate of at least 15% (compared to 21% for pharmacies). The businesses meeting this criterion are listed in Table 6.3.

A second criterion required that these businesses had at least as many treated women as the pharmacy sample (1,526). Businesses that did not meet this requirement included beauty salons, religious centers, restaurants, and tortillerias. Ultimately, I selected the following eight businesses as placebos: bakeries, candy shops, car workshops, car parts stores, dentists, hardware stores, pawnshops, and poultry shops. I then estimate the impact of each business opening, controlling for pharmacy openings, using the following specification:

$$\begin{aligned} Y_{ibt} =& \beta_0 + \beta_1 \text{Treat}_b + \beta_2 \text{TreatPharm}_b + \beta_3 \text{Post}_t + \beta_4 \text{Treat}_b \times \text{TreatPharm}_b + \\ & \beta_5 \text{Treat}_b \times \text{Post}_t + \beta_6 \text{TreatPharm}_b \times \text{Post}_t + \beta_7 \text{Treat}_b \times \text{TreatPharm}_b \times \text{Post}_t + \\ & X_{ibt} + \epsilon_{ibt} \end{aligned} \tag{6.2}$$

Similar to Equation 6.1, the treatment group here includes women who did not have access to a particular business (e.g., bakery) within a one-kilometer radius in 2011 but gained access to at least one by 2016. Women in the control group are those without access to the business in both 2011 and 2016. I control for the

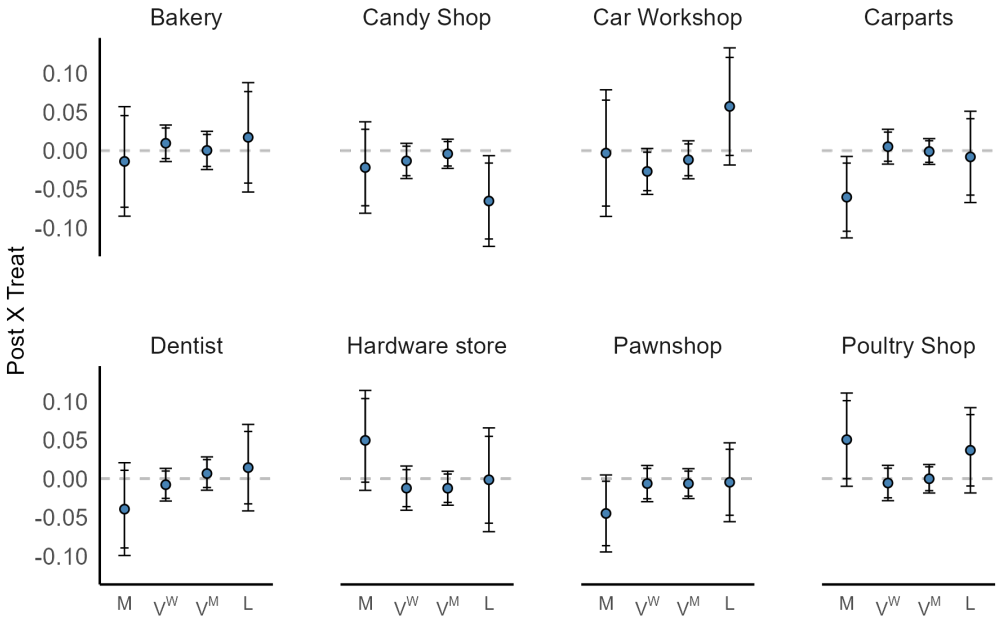
Table 6.3: Summary statistics of businesses considered for analysis

Business Name	**Code**	**N. 2011**	**N. 2016**	**Growth Rate**	**N. Treated Women**
Bakery	311812	44965	55385	0.23	1713
Beauty Salon	812110	152355	181269	0.19	830
Candy Shop	461160	36641	43953	0.20	2583
Car Workshop	811111	69891	84135	0.20	1498
Carparts	468211	30154	38436	0.27	3029
Dentist	621211	45459	54299	0.19	2403
Hardware	467111	46078	61070	0.33	1872
Pawnshop	466410	32605	44418	0.36	4325
Pharmacy	464111 464112	46341	56218	0.21	1526
Poultry Shop	461122	36727	46572	0.27	2487
Religious Center	813210	59237	76838	0.30	833
Restaurant	72251*	379962	519874	0.37	599
Tortilleria	311830	85837	100587	0.17	762

Notes: This table presents summary statistics for the businesses included in the analysis. The Code column corresponds to the NAICS code of each business. For restaurants, I include all businesses categorized under codes starting with 72221 in DENUE 2011 and 72251 in DENUE 2016. N. 2011 represents the number of businesses in Mexico in 2011, while N. 2016 indicates the number of businesses in 2016. The growth rate is calculated as the ratio of the number of businesses in 2016 to those in 2011. Lastly, the Treated Women column refers to women in the ENDIREH survey who meet the following criteria belong to the treated sample.

same variables as in the main analysis and for pharmacy access. The coefficient of interest, β_5, measures the impact of the business opening for women who did not experience a pharmacy opening.

Figure 6.6: Other business openings



Notes: Each panel represents the effect of a business opening on fertility, violence and separation (coefficient β_5 from Equation 6.2). M is a binary variable that equals one if the woman is a mother at the time of the survey, V^W is a binary variable that equals one if the woman experienced physical IPV in the last 12 months, V^M is a binary variable that equals one if the partner from five years before the survey exerted violence at any point in the relationship, and L is a binary variable that equals one if the woman had a breakup in the last five years.

Figure 6.6 plots the coefficients on the interaction term between the treatment and the post-period for this placebo treatment, along with 90% and 95% confidence intervals. Overall, there is no statistically significant effect of other business openings on the outcomes of interest[13]. Importantly, no clear pattern emerges across business types; for example, the coefficients for fertility are positive for hardware store and poultry shop openings, negative for car parts store and dentist openings, and zero for the rest. Averaging across the coefficients, business openings reduce the probability of motherhood by one percentage point. For violence and separation, the average effect is zero (0.007 percentage points

[13]Only two out of 32 coefficients (6.25%) are significant at the 5% level, and four (12.5%) at the 10% level

for V^W, 0.003 percentage points for V^M and 0.006 percentage points for L).

These two exercises show that (i) treatment and control groups followed similar trends prior to pharmacy openings, and (ii) regional economic development correlated with a business openings does not appear to affect fertility, violence, or separation outcomes.

6.3.3 Results

Motherhood

In the model, some couples (ρ) exogenously delay parenthood. Hence, the first step is to verify that access to pharmacies allows women to delay childbirth. I estimate Equation 6.1 using a binary outcome variable, which equals one if the woman is a mother and zero otherwise.

Table 6.4 shows the results. The first column shows β_3 without controlling for any covariates. Column (2) controls for individual characteristics (age fixed effects, wealth quintile fixed effects and years of schooling). Column (3) adds state fixed effects and change in market access, defined as the number of businesses in a 3km radius in 2016 minus the number of businesses in a 3km radius in 2011. Finally, column (4) controls for the distance to the nearest pharmacy in 2011 to control for initial access to pharmacies.

The coefficients are stable across specifications. The preferred specification is the one shown in column (3). Having access to a pharmacy reduces the probability of being a mother by 9 percentage points. This effect represents 23.5% reduction from the implied counterfactual[14]. These results suggest a substantial unmet need for contraceptive access among Mexican women and indicate that pharmacy access effectively allows women to control their fertility.

Prediction 1: Probability of experiencing violence V^W

Both channels predict that a pharmacy opening should decrease the risk of current violence, as fewer women become mothers. I estimate Equation 6.1 using as an outcome variable a binary variable that is equal to one if the woman experienced physical violence in the last 12 months and zero otherwise.

[14]The counterfactual is calculated by adding $\hat{\beta_0} + \hat{\beta_1} + \hat{\beta_2}$ from Equation 6.1.

Table 6.4: Effect of pharmacy access on motherhood

	Mother			
	(1)	(2)	(3)	(4)
Constant	0.428***			
	(0.012)			
Post	-0.081***	-0.029**	-0.027*	-0.027*
	(0.016)	(0.015)	(0.015)	(0.015)
Treat	0.040	0.079**	0.059*	0.043
	(0.034)	(0.034)	(0.032)	(0.032)
Post × Treat	-0.091**	-0.087**	-0.090**	-0.086**
	(0.041)	(0.039)	(0.037)	(0.038)
Observations	8,581	8,581	8,581	8,581
Mean Dep.Var	0.368	0.368	0.368	0.368
$\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2$	0.386			
Age fixed effects		✓	✓	✓
Wealth Quintile fixed effects		✓	✓	✓
State fixed effects			✓	✓
School years		✓	✓	✓
Dist. nearest pharmacy 2011				✓
Δ Mkt. Access			✓	✓

Notes: This table presents the effect of a pharmacy opening on motherhood status (coefficient β_3 from Equation 6.1). Mother is a binary variable that equals one if the woman is a mother at the time of the survey. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 6.5 show the effect of having access to a pharmacy on the probability of experiencing violence in the last 12 months. The coefficients are stable across specifications and we conclude that having access to a pharmacy reduces the probability that a woman experiences violence by 4.4 percentage points. The effect represents a 51.2% reduction from the implied counterfactual[15].

Table 6.5: Effect of pharmacy access on current violence V^W

	Current Violence			
	(1)	(2)	(3)	(4)
Constant	0.033***			
	(0.005)			
Post	0.012*	0.017**	0.018**	0.018**
	(0.007)	(0.007)	(0.007)	(0.007)
Treat	0.035**	0.041**	0.040**	0.034**
	(0.017)	(0.017)	(0.017)	(0.017)
Post × Treat	-0.041**	-0.042**	-0.044**	-0.042**
	(0.019)	(0.019)	(0.019)	(0.018)
Observations	8,581	8,581	8,581	8,581
Mean Dep.Var	0.042	0.042	0.042	0.042
$\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2$	0.08			
Age fixed effects		✓	✓	✓
Wealth Quintile fixed effects		✓	✓	✓
State fixed effects			✓	✓
School years		✓	✓	✓
Dist. nearest pharmacy 2011				✓
Δ Mkt. Access			✓	✓

Notes: This table presents the effect of a pharmacy opening on women's risk of experiencing violence (coefficient β_3 from Equation 6.1). Current violence is a binary variable that equals one if the woman experienced physical violence in the last twelve months. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Prediction 2: Violent Behavior V^M

The theory yields different predictions about the effect of a pharmacy opening on violent behavior. Under the direct channel, having a baby triggers violent behavior. Hence, we would expect a negative coefficient on this variable, as

[15]The counterfactual is calculated by adding $\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2$ from Equation 6.1.

fewer men become parents and exert violence. Under the selection channel, the coefficient would be zero, because all abusive men are equally likely to exert violence irrespective of whether they become parents or not. To test the effect of a pharmacy opening on violent behavior, I estimate Equation 6.1 using as an outcome variable a binary variable that is equal to one if the partner from five years prior to the survey was violent towards the woman at some point in the relationship.

Table 6.6 presents the results from the estimation. Columns (1)-(4) show the reduced form effects of access to pharmacy on V^M. In all specifications, a pharmacy opening has a precise null effect on the probability that a woman experienced violence with her baseline partner. This result is consistent with the selection channel, where having a child does not cause men to become violent.

Prediction 3: Separation Behavior L

The model also yields opposing predictions regarding the effect of a pharmacy opening on separation. Under the direct channel, we would expect to see that a pharmacy opening decreases the probability of separation. The intuition is that having a child reveals the man's abusive type, which leads to break-up. When fewer men become parents, less women find out about their type and separation decreases. On the other hand, the selection channel predicts a positive coefficient. When women delay motherhood, they have time to get to know their partner and leave.

To test Prediction 3, I estimate Equation 6.1 using as an outcome variable a binary variable that is equal to one if the woman had a break-up during the last five years. Table 6.7 shows the results. Columns (1)-(4) show that having access to a pharmacy increases the probability that a woman had a break-up by 7.6 percentage points. The effect represents a 23.6% increase from the implied counterfactual[16].

[16]The counterfactual is calculated by adding $\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2$ from Equation 6.1.

Table 6.6: Effect of pharmacy access on violent behavior V^M

	Violent Partner			
	(1)	(2)	(3)	(4)
Constant	0.022***			
	(0.004)			
Post	0.008	0.013**	0.014**	0.014**
	(0.005)	(0.005)	(0.005)	(0.005)
Treat	0.002	0.005	0.004	0.002
	(0.012)	(0.012)	(0.013)	(0.013)
Post × Treat	0.003	0.003	0.003	0.004
	(0.017)	(0.016)	(0.017)	(0.017)
Observations	8,581	8,581	8,581	8,581
Mean Dep.Var	0.028	0.028	0.028	0.028
$\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2$	0.032			
Age fixed effects		✓	✓	✓
Wealth Quintile fixed effects		✓	✓	✓
State fixed effects			✓	✓
School years		✓	✓	✓
Dist. nearest pharmacy 2011				✓
Δ Mkt. Access			✓	✓

Notes: This table presents the effect of a pharmacy opening on men's violent behavior (coefficient β_3 from Equation 6.1). Violent partner is a binary variable equal to one if the woman's partner from five years before the survey was physically abusive at any point in the relationship. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 6.7: Effect of pharmacy access on separation L

	Break-up			
	(1)	(2)	(3)	(4)
Constant	0.190***			
	(0.011)			
Post	0.059***	0.048***	0.045***	0.045***
	(0.015)	(0.015)	(0.015)	(0.015)
Treat	0.017	0.000	-0.009	-0.018
	(0.032)	(0.030)	(0.034)	(0.034)
Post × Treat	0.063	0.069*	0.076*	0.078*
	(0.041)	(0.039)	(0.041)	(0.041)
Observations	8,581	8,581	8,581	8,581
Mean Dep.Var	0.241	0.241	0.241	0.241
$\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2$	0.266			
Age fixed effects		✓	✓	✓
Wealth Quintile fixed effects		✓	✓	✓
State fixed effects			✓	✓
School years		✓	✓	✓
Dist. nearest pharmacy 2011				✓
Δ Mkt. Access			✓	✓

Notes: This table presents the effect of a pharmacy opening on separation (coefficient β_3 from Equation 6.1). Break-up is a binary variable equal to one if the woman had a break-up in the last five years. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

6.4 Causal effect of motherhood on violence and separation

6.4.1 Empirical strategy

To estimate the causal effect of motherhood on the variables of interest, I use an instrumented difference-in-differences strategy. Specifically, I scale the DD effect on violence and separation by the DD effect on motherhood[17]. Estimates of Equation 6.1 on the binary motherhood variable provide evidence of the effect of pharmacy openings on the likelihood of becoming a mother but they also serve as the first stage in a two-stage least squares (2SLS) estimation of the impact of motherhood on violence and separation. I run the following regression:

$$Y_{ibt} = \beta_0 + \beta_1 \text{Treat}_b + \beta_2 \text{Post}_t + \beta_3 \hat{Mother}_{ibt} + X_{ibt} + \epsilon_{ibt} \tag{6.3}$$

Where $\hat{Mother}_{ibt}$ is the predicted probability of motherhood instrumented by the interaction between the treatment and post variables (i.e., the difference-in-differences estimator from the first stage). In other words, it captures the portion of motherhood status that is explained by exposure to a pharmacy opening. The outcome variables are i) whether a woman experienced physical violence in the last 12 months, ii) whether her partner from five years before the survey exerted physical violence at some point in the relationship and iii) whether the woman had a break-up in the last 5 years. I use the same controls as Equation 6.1 and cluster the standard errors at the AGEB level.

6.4.2 Assumptions and threats to identification

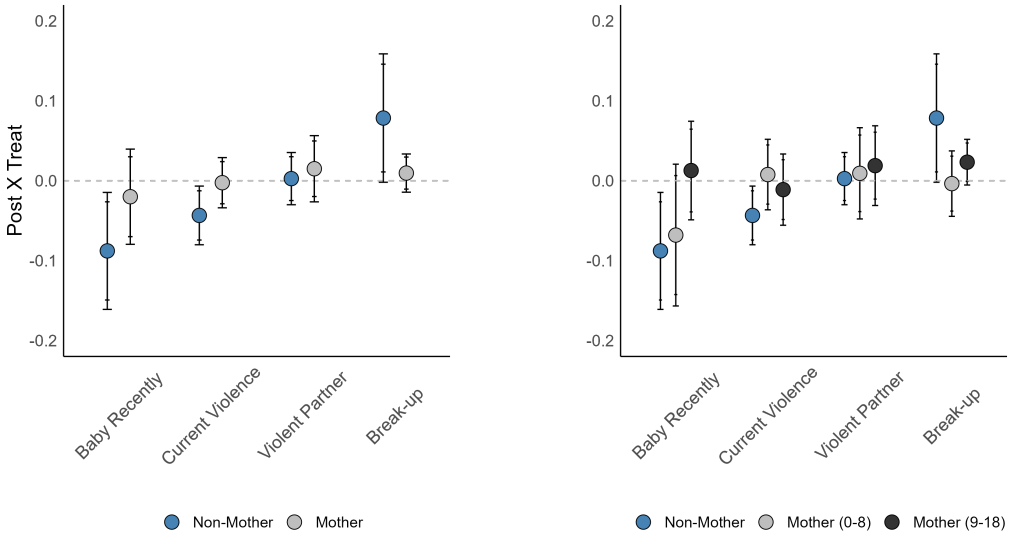
Conditional on parallel trends holding, we need two additional assumptions: monotonicity and the exclusion restriction (Hudson et al., 2017). Monotonicity requires that there are no "defiers", meaning no woman is more likely to become a mother because she has access to a pharmacy. While this assumption cannot be directly tested, I find no evidence in the heterogeneity or subgroup analyses that pharmacy openings reduce the likelihood of becoming a mother for any group.

[17] A canonical example of this strategy is Duflo (2001), where she employs a difference-in-differences to estimate the effects of school construction on education and wages.

The exclusion restriction requires that pharmacy access affects violence and separation only through its impact on motherhood. One potential concern is that pharmacies provide contraceptives as well as other medications. Access to a pharmacy might therefore improve the health of women or other household members, which could reduce stress and indirectly affect violence.

To test this, I focus on women who were recent mothers before the pharmacy opening[18]. If pharmacy access influences violence and separation through alternative channels, such as improved health, we would expect to see similar changes in these outcomes among recent mothers. I estimate Equation 6.1 on the four main outcomes of interest. However, for fertility, I use a variable that equals one if the woman had a baby in the last five years[19].

Figure 6.7: Effect of pharmacy access by baseline motherhood status



Note: This figure plots the effect of a pharmacy opening (coefficient β_3 from Equation 6.1) on fertility, violence and separation separately for women who were non-mothers at baseline and who were mothers at baseline. Non-mothers are defined as women who were not mothers five years before the survey. Mothers are women whose first child was between 0 and 18 years old five years before the survey. Panel a) shows the results for these two groups. Panel b) splits the sample of mothers into two groups. Mother (0-8) refers to those women whose first child was between 0 and 8 years 5 years before the survey. Mother (9-18) includes all women whose first child was between 9 and 18 years old 5 years before the survey.

Figure 6.7 shows the results. Panel (a) shows the effect of a pharmacy opening

[18]Their first child was between zero and eighteen years old five years prior to the survey

[19]For the main sample, the outcome of interest is a binary variable that equals one if she is a mother, so I cannot use the same variable for mothers.

on the main sample (blue circles) and the sample of recent mothers (gray circles). For recent mothers, all coefficients are small and statistically insignificant. In Panel (b), I further separate the sample of recent mothers into two subgroups: those with a young first-born (light gray circles), where the first child was between zero and eight years old five years prior to the survey, and those with an older first-born (dark gray circles), where the first child was older before the pharmacy opening.

Among mothers with younger first-born children—those more likely to be in their childbearing years—the probability of having had a child within the last five years decreases by 6.8 percentage points following a pharmacy opening. Although this coefficient is imprecise, it is large and suggests that pharmacies are also effective at reducing fertility on the intensive margin. Interestingly, despite this decline in fertility among recent mothers, there is no observed effect on violence or separation. This reinforces the evidence that only motherhood on the extensive margin affects outcomes related to violence and separation[20].

Another potential threat to the exclusion restriction is that improved contraceptive access could trigger partners' jealousy—if they suspect infidelity or resent their partner's autonomy—and thereby affect IPV. However, the exercise with recent mothers suggests this is not the case. If jealousy were a significant factor, we would expect to see an increase in violence among all women who use contraceptives following pharmacy openings. Yet, for women who show a decrease in fertility at the intensive margin after the pharmacy opening—implying they are using contraceptives—there is no significant change in violence. This suggests that contraceptive use itself does not directly lead to higher partner violence.

That said, I cannot fully rule out all alternative channels given data limitations. For example, pharmacy access might directly alter women's propensity to enter or exit relationships—by lowering the perceived risk of casual sex and reshaping relationship dynamics—and thus affect separation independently of motherhood. It seems unlikely that this pathway would operate similarly for mothers and non-mothers (the latter being more prone to casual partnerships), but without measures of women's perceived risk of casual sex, I cannot test it. Unfortunately, the ENDIREH survey does not include questions on attitudes toward casual sex, leaving this as an important area for future research.

[20] These findings also provide further support for the parallel trends assumption, as they help rule out mechanisms that would similarly impact mothers and non-mothers.

6.4.3 Who are the compliers?

Before presenting the results, it is important to understand who the compliers are, as the estimated causal effect of motherhood on violence and separation applies specifically to this group. The coefficient β_3 in Equation 6.3 represents the Local Average Treatment Effect (LATE) of motherhood on violence and separation. The compliers are women who become mothers when they lack access to a nearby pharmacy but delay motherhood when a pharmacy is accessible. Notably, these pregnancies are unplanned; otherwise, they would not delay motherhood when they have a nearby pharmacy. One plausible explanation for their behavior is low autonomy, which might prevent them from traveling further to access contraceptives. To explore this further, I analyze heterogeneity by age and wealth quintiles.

Heterogeneity by age

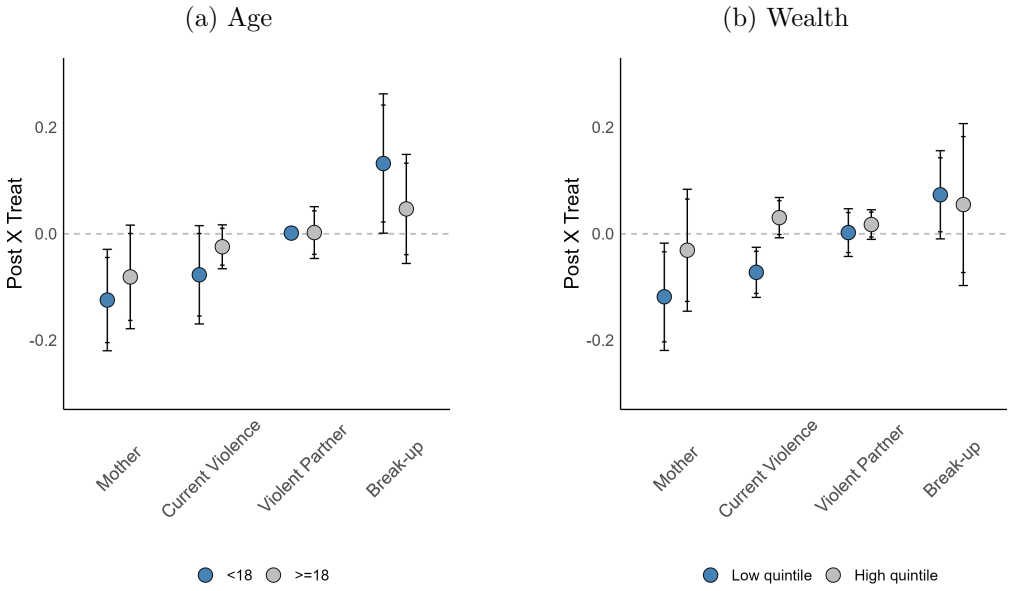
The first heterogeneity analysis examines differences between teenagers (women younger than 18 at the time of the survey) and adult women. The left panel of Figure 6.8a shows that the impact of a pharmacy opening on both violence and separation is primarily driven by teenagers. While the direction of the estimated effects remains consistent across both groups, the magnitude is larger for teenagers, suggesting that younger women may face greater constraints in leaving violent relationships once they become mothers. This finding aligns with the idea that teenagers have lower outside options and find it harder to exit abusive relationships, making them more vulnerable to the selection channel identified in this thesis.

Heterogeneity by wealth

The second heterogeneity analysis examines differences by wealth quintiles. I divide the sample into two groups: women who are below the median wealth quintile and those who are above. The right panel of Figure 6.8b shows that women below the median wealth quintile are most affected by the pharmacy opening. For those women in the upper wealth quintiles, there is no first stage. That is, a pharmacy opening does not affect their motherhood status. This suggests that wealthier women face fewer constraints in accessing contraceptives and planning their fertility. These findings further support the exclusion restriction,

as effects on violence and separation are observed only among women whose fertility is influenced by the pharmacy opening.

Figure 6.8: Heterogeneity by age and wealth



Notes: This figure plots coefficient β_3 from Equation 6.1 for two heterogeneity analyses. The left panel divides the main sample into women who were teenagers at the time of the survey (blue dots) and those aged 18–30 (gray dots). The right panel divides the sample by wealth, with women in wealth quintiles 1–3 represented by blue dots and those in quintiles 4–5 by gray dots.

In conclusion, compliers are more likely to be girls (younger than eighteen years old), in the lower wealth quintiles, who do not want to become mothers. This is a particularly vulnerable group, and therefore the effects of motherhood on violence and separation are more likely to be larger for them than for the general population.

6.4.4 Results

Table 6.8 presents the 2SLS regression results. Column (1) shows that a one percentage point increase in the predicted probability of motherhood increases the risk of experiencing violence by .48 percentage points (p-value = 0.082). In other words, a one standard deviation (.24) increase in the predicted probability of motherhood increases the risk of physical violence by 11.7 percentage points. Column (2) shows that motherhood has no effect on the probability that men exert violence. Column (3) shows large negative effects of motherhood on

relationship dissolution. A one standard deviation increase in the predicted probability of motherhood decreases the probability of separation by 20.3 percentage points. All results are consistent with the selection channel.

Table 6.8: Effect of motherhood on violence and separation: 2SLS estimates

	Current violence (1)	Violent partner (2)	Break-up (3)
Mother	0.488*	-0.034	-0.843*
	(0.280)	(0.183)	(0.485)
Observations	8,581	8,581	8,581
F-test (1st stage), Mother	11.011	11.011	11.011
Age fixed effects	✓	✓	✓
State fixed effects	✓	✓	✓
Wealth Quintile fixed effects	✓	✓	✓
School years	✓	✓	✓
Δ Mkt. Access	✓	✓	✓

Notes: This table presents the effect of motherhood on violence and separation (coefficient β_3 from Equation 6.3). Current violence is a binary variable equal to one if the woman experienced physical violence in the last 12 months. Violent partner is a binary variable equal to one if she experienced physical violence at any point in her relationship with her partner from five years before the survey. Break-up is a binary variable equal to one if she had a break-up in the last five years. Mother is instrumented in the first stage using pharmacy openings. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Summary of Results

The table below summarizes the results. It presents the four predictions of the model under the two channels; the effect of motherhood on i) the probability that a woman experiences violence V^W, ii) the probability that a man exerts violence V^M and iii) the probability of separation L. The fourth prediction is about whether waiting to have a child allows women to learn about their partner's type. The third column shows the (correlational) results using a sample of recently partnered women. The last column shows the causal effects for the compliers. All results are consistent with the selection channel: decreasing fertility on the extensive margin allows women to leave violent relationships before having children which, in turn, reduces the probability of experiencing violence. In other words, motherhood entraps women in violent marriages rather than causing previously non-violent men to become violent.

	Direct Ch.	*Selection Ch.*	Data	IV-DD
P1: Women experience violence V^W	↑	↑	↑	↑
P2: Violent behavior V^M	↑	–	–	–
P3: Separation behavior L	↑	↓	↓	↓
P4: Waiting on violent behavior $V^M \vert W$	-	↓	↓	

Note that the descriptive analysis offers suggestive evidence for the general population, while the causal analysis identifies effects specifically for young, poor women whose fertility responds to pharmacy access. We can therefore ask whether these causal findings would generalize to a sample of wealthier, more educated women with planned pregnancies.

The theoretical framework helps guide this discussion. The model hinges on two key assumptions. First, women become mothers soon after the relationship begins. Second, the cost of single motherhood is high, so motherhood reduces the probability of leaving a violent partner. While both assumptions are plausible for many Mexican women, wealthier, better-educated women typically (i) delay childbearing and (ii) face lower financial and social costs of single motherhood. As a result, for this subgroup the effect of motherhood on intimate partner violence and separation may be substantially smaller—or even absent.

6.5 Robustness

In this section, I perform a series of robustness checks. I show that the results are robust to alternative definitions of access to pharmacy, alternative sample age cut-offs, alternative cluster levels and an alternative proxy for separation. I also find no evidence that having a child increases violent behavior on the intensive margin or that a pharmacy opening increases help-seeking behavior.

6.5.1 Alternative definitions of access to pharmacies

Having access to a pharmacy is an empirical question. Suppose a woman already has a pharmacy within 200 meters of her house and a new pharmacy opens 100 meters closer. It is plausible that the opening of the new pharmacy does not affect her fertility, as she already had access. On the other hand, consider a woman who has no pharmacy within 10 km of her house and a new pharmacy

opens 9 km away. In this case, it is plausible that the opening of the new pharmacy does not affect her fertility outcomes, as she remains with no access to a pharmacy.

In the main analysis, I defined the treated group as those women who did not have a pharmacy within 1 km in 2011 and had at least one in 2016 [21]. In this exercise, I change the threshold used to define access to a pharmacy. I consider thresholds of 300 meters to 1700 meters, increasing by 100 meters. For instance, if the threshold is 500 meters, it means that the treated women are those who did not have a pharmacy within a 500 radius in 2011 and had at least one in 2016, while the control group are those who did not have a pharmacy within a 500m radius in both waves.

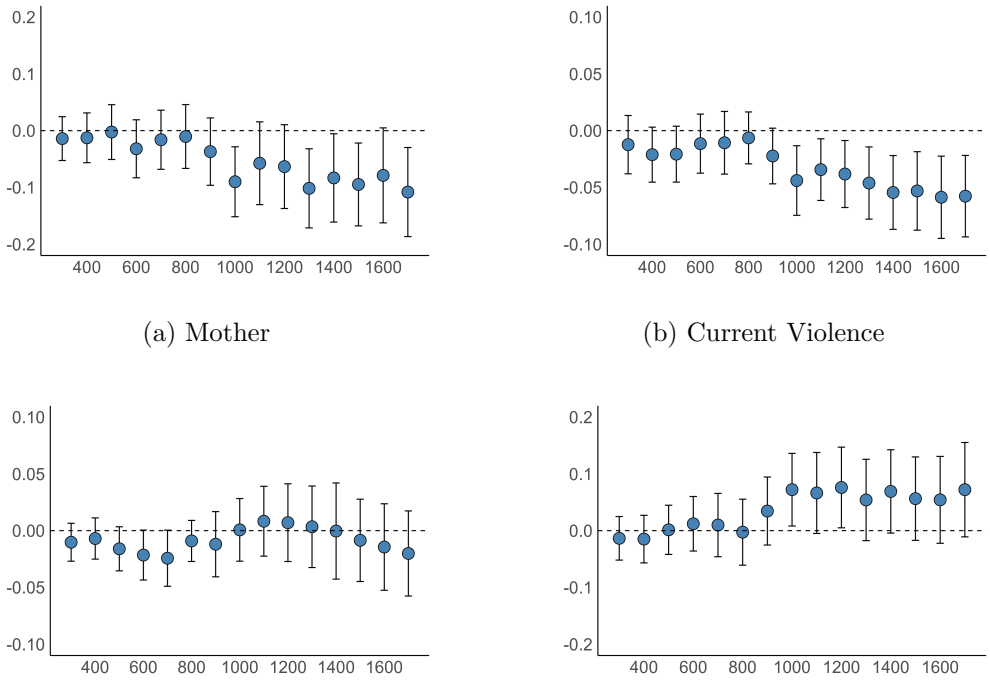
I estimate Equation 6.1 using these different definitions of access to pharmacy. We expect to see that the effect of current violence and separation will closely mirror the effect of fertility. If we were to find that the effect of pharmacy openings on violence and separation is not consistent with the effect on fertility, it would suggest that there is another omitted variable that is driving the results.

In Figure 6.9, I present the results. The x-axis represents the threshold used to define access to a pharmacy. The y-axis shows the coefficient on the interaction term between the treatment and the post-period. The blue dots represent the effect of pharmacy openings on the outcome of interest and I plot the 95% confidence intervals.

Panel a) shows the results for fertility. Note that the effect is small and mostly statistically insignificant for values below the one-kilometer threshold. This is consistent with the idea that pharmacy openings may not have an impact on those women who already live close to a pharmacy. Around the 1km threshold, the effect becomes larger and statistically significant. On average, a pharmacy opening decreases fertility by 8.4 percentage points for those women who at least 1km away before the pharmacy opening. In Panel b), the coefficients for V^W mirror the pattern observed for fertility. After the 1km threshold, women are on average 4.8 percentage points less likely to experience violence in the last 12 months after a pharmacy opening. Panel c) shows that the effect of pharmacies on violence with the baseline partner is consistently zero (on average, the effect is -.003 after the one km threshold). Lastly, in Panel d), the coefficients for

[21] I chose this threshold because one km is approximately the distance that a person can walk in 25 minutes (back and forth). Additionally, the treated sample size decreases if I impose larger thresholds than 1 km.

Figure 6.9: Alternative definition of pharmacy access



(a) Mother

(b) Current Violence

(c) Violent Partner

(d) Break-up

Notes: This figure shows β_3 from Equation 6.1 using different thresholds to define the treatment and control group. The x-axis represents the threshold distance at which treatment is defined. Mother is a binary variable that equals one if the woman is a mother at the time of the survey, Current violence is a binary variable that equals one if the woman experienced physical IPV in the last 12 months, Violent partner is a binary variable that equals one if the partner from five years before the survey exerted violence at any point in the relationship, and Break-up is a binary variable that equals one if the woman had a breakup in the last five years. All regressions include survey sample weights and standard errors are clustered at the AGEB level.

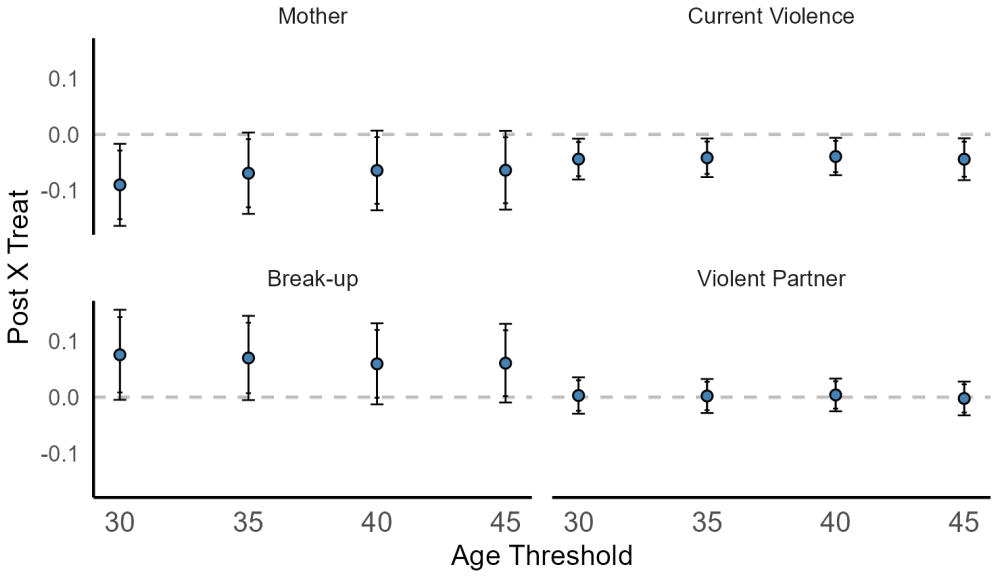
separation also mirror the (inverse) shape found for fertility outcomes, although the coefficients are less precise. The effect is zero before the one km threshold and then stabilizes around 6.5 percentage points.

Overall, the results for current violence and separation closely mirror the results for fertility. The correlation between the coefficients for fertility and violence in the last 12 months is .91 and between fertility and separation is -.88. This further supports the idea that the results are driven by the opening of a pharmacy rather than other omitted variables.

6.5.2 Alternative age cut-offs

In the main analysis, I define the sample as women younger than 30 years old, as younger women are more likely to be in their childbearing years and thus more affected by a pharmacy opening. Figure 6.10 presents results using different age cut-offs. The x-axis represents the age threshold used to define the sample, while the y-axis displays the coefficient on the interaction term between the treatment and the post-period. The blue dots indicate the estimated effect of pharmacy openings on the outcome of interest, with 90% and 95% confidence intervals. Overall, the results remain consistent across age groups, though they gradually decline and become less precise as the age threshold increases, suggesting that the effects are primarily driven by younger women.

Figure 6.10: Alternative age cut-offs



Notes: This figure replicates the main analysis using different age cut-offs. The x-axis represents the age cut-off used to define the sample. The y-axis shows the coefficient on the interaction term between the treatment and the post-period. The blue dots represent the effect of pharmacy openings on the outcome of interest and I plot the 95% confidence intervals.

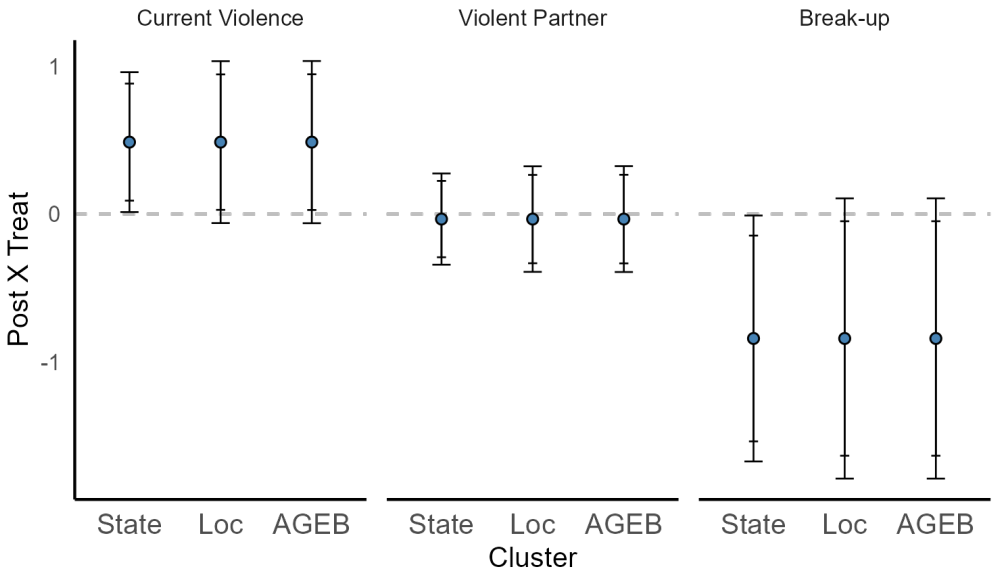
6.5.3 Alternative cluster levels

The geo-statistical framework divides the country into states, municipalities, localities, and AGEBs (basic geostatistical unit). In the main analysis, I cluster the standard errors at the AGEB level, which is formed by a group of blocks. I test whether the results are sensitive to the choice of cluster level. I estimate Equation 6.1 using different cluster levels: AGEB, locality and state. A locality is defined as any place occupied by one or more dwellings, whether inhabited or not; this place is recognized by a name given by law or custom. The IV results are shown in Figure 6.11. The coefficients are very similar across different cluster levels, suggesting that the results are robust to the choice of cluster level.

6.5.4 Alternative proxy for separation

My main proxy for separation is a binary variable that equals one if the woman experienced a recent break-up. However, due to data limitations, this variable

Figure 6.11: Alternative cluster levels



Notes: This figure replicates the main analysis using alternative cluster levels. The x-axis represents the cluster level used to cluster the standard errors. The y-axis shows the coefficient on the interaction term between the treatment and the post-period. The blue dots represent the effect of pharmacy openings on the outcome of interest and I plot the 95% confidence intervals.

may not capture all separations. For some women, there is not enough relationship history to determine whether a break-up occurred. For example, if a woman is single at the time of the survey and has been with her current boyfriend for less than five years, I cannot observe whether she had a prior break-up. As an alternative, I use a broader proxy: a binary variable that equals one if the woman does not have a partner or boyfriend at the time of the survey. This measure is available for all women in the sample.

Table 6.9 presents the results. The coefficient is very similar to that found in the main analysis and more precise. A pharmacy opening increases the probability that a woman is single by 8.4 percentage points, compared to a 7.6 percentage point increase in the probability of having experienced a recent break-up.

Table 6.9: Effect of pharmacy access on pr. of being single

	Single			
	(1)	(2)	(3)	(4)
Constant	0.349***			
	(0.014)			
Post	0.094***	0.060***	0.059***	0.059***
	(0.018)	(0.017)	(0.017)	(0.017)
Treat	-0.034	-0.039	-0.021	-0.024
	(0.037)	(0.036)	(0.036)	(0.037)
Post × Treat	0.095**	0.081*	0.084**	0.084**
	(0.044)	(0.043)	(0.042)	(0.042)
Observations	8,581	8,581	8,581	8,581
Mean Dep.Var	0.419	0.419	0.419	0.419
$\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2$	0.409			
Age fixed effects		✓	✓	✓
Wealth Quintile fixed effects		✓	✓	✓
State fixed effects			✓	✓
School years		✓	✓	✓
Dist. nearest pharmacy 2011				✓
Δ Mkt. Access			✓	✓

Notes: This table shows the effect of a pharmacy opening on the probability of being single at the time of the survey (coefficient β_3 from Equation 6.1). The dependent variable is a binary variable that equals one if the woman does not have a romantic partner at the time of the survey. Treated women are those who did not have a pharmacy within a 1km radius in 2011 and had at least one in 2016. Women in the control group are those who had a pharmacy within a 1km radius in 2011 and 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

6.5.5 Alternative control group

In the main analysis, the control group includes all women who did not have a pharmacy within a one km radius in 2011 and did not have one in 2016. However, the control group can also be defined as those women who had a pharmacy within a one kilometer radius in 2011 and in 2016. This analysis compares women who gained access to contraceptives to those who already had access. Table 6.10 shows the results. All coefficients are around 30% smaller than the main analysis and less precise. However, they follow the same pattern as the main analysis. A pharmacy opening decreases the probability of being a mother, reduces the probability of experiencing violence and increases the probability of separation.

The IV results are very similar to those found in the same analysis, using this alternative control group, we conclude that motherhood increases the probability of experiencing violence by 47.6% (compared to 48.8% in the main analysis) and reduces the probability of break-up by 87.4% (compared to 84.3% in the main analysis).

6.5.6 Intensive margin of violence

My main results focus on the extensive margin of violence. I reject the null hypothesis that having a child increases violence on the extensive margin. However, it is possible that men who were already violent become more violent after a child is born. For each violence question, women are asked the frequency and their perceived severity of the violence. In particular, women are asked whether the violence has happened never, once, a few times or many times. In terms of severity, women are asked whether they believe the violence is unimportant, serious or very serious.

I create a severity/frequency index as follows. First, I calculate the average seriousness of the violence (e.g. the average severity of pushing among women who have been pushed by a partner). Then I assign a value of 0 if the violence never happened, 1 if it happened once, 2 if it happened a few times and 3 if it happened many times. I then multiply the average seriousness by the frequency of the violence. Lastly, I standardize this index for the sample of interest. I estimate Equation 6.1 using the standardized index as the dependent variable.

Table 6.10: Alternative control group: Reduced form results and IV results

	Mother	V^W	V^M	S	V^W	V^M	S
		Reduced form				IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × Treat	-0.058	-0.027	0.016	0.050			
	(0.037)	(0.019)	(0.016)	(0.037)			
Mother					0.476	-0.276	-0.874
					(0.438)	(0.310)	(0.707)
Observations	33,810	33,812	33,812	33,812	33,810	33,810	33,810
F-test (1st stage), Mother					5.6851	5.6851	5.6851
Mean Dep.Var	0.286	0.044	0.029	0.269			
State fixed effects	✓	✓	✓	✓	✓	✓	✓
Age fixed effects	✓	✓	✓	✓	✓	✓	✓
Wealth Quintile fixed effects	✓	✓	✓	✓	✓	✓	✓
School years	✓	✓	✓	✓	✓	✓	✓
Δ Mkt. Access	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents reduced form results and IV results using an alternative control group. V^W is a binary variable equal to one if the woman experienced physical violence in the last 12 months. V^M is a binary variable equal to one if the woman experienced physical violence at any point in her relationship with her partner from five years before the survey. L is a binary variable equal to one if the woman had a break-up in the last five years. Treated women are those who did not have a pharmacy within a 1km radius in 2011 and had at least one in 2016. Women in the control group are those who had a pharmacy within a 1km radius in 2011 and 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 6.11: Effect of a pharmacy opening on the intensive margin of violence

	Std. Violence Index (Intensive)			
	(1)	(2)	(3)	(4)
Post × Treat	-0.038	-0.037	-0.051	-0.048
	(0.090)	(0.088)	(0.086)	(0.086)
Observations	8,499	8,499	8,499	8,499
Mean Dep.Var	0.000	0.000	0.000	0.000
Age fixed effects		✓	✓	✓
Wealth Quintile fixed effects		✓	✓	✓
State fixed effects			✓	✓
School years		✓	✓	✓
Dist. nearest pharmacy 2011				✓
Δ Mkt. Access			✓	✓

Notes: This table presents the effect of a pharmacy opening on men's violent behavior (coefficient β_3 from Equation 6.1) on the intensive margin. The dependent variable is a standardized index that reflects the intensity and severity of the violence exerted by the partner from five years before the survey. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

The results are shown in Table 6.11. I find no evidence that having a child increases violent behavior on the intensive margin.

6.5.7 Changes in help-seeking behavior

An alternative explanation for the results is that a pharmacy opening provides women with exit resources. For example, if pharmacies offer information on where to report violence or access shelters, their presence could increase the probability of separation, which in turn might influence fertility and violence. In this case, the observed decline in fertility could be driven by increased separation rather than the other way around. However, for this to hold, the additional resources would need to affect only women without children, as the opening of a pharmacy does not impact fertility, separation, or violence for women who were already mothers at the time.

The survey includes questions about women's reporting behavior to authorities, allowing me to test whether a pharmacy opening increases the likelihood of seeking help. I estimate Equation 6.1 using five different outcome variables, all binary indicators equal to one if a woman sought help from a specific organization. DIF is a public agency that protects children's rights and supports family well-being, while INMUJERES is the national women's institute.

If pharmacy openings do not provide women with information and exit options, we would expect the coefficients to be weakly negative[22]. Conversely, a positive coefficient would suggest that pharmacies do offer women information and exit strategies.

Table 6.12 presents the results. The coefficients are weakly negative and mostly statistically insignificant, providing no strong evidence that pharmacy openings influence women's likelihood of seeking help. This is perhaps unsurprising, given that only 20% of women in the survey who experienced physical violence reported seeking help from any organization.

[22] If women do not seek help after experiencing violence, the coefficient would be zero. On the other hand, if women do seek help after violence, the coefficient would be negative, as pharmacy openings reduce the likelihood of experiencing violence.

Table 6.12: Effect of a pharmacy opening on help-seeking behavior

	DIF	INMUJERES	Pub. Pros.	Municipality	Police
	(1)	(2)	(3)	(4)	(5)
Post × Treat	-0.020*	-0.001	-0.018	-0.003	0.003
	(0.011)	(0.001)	(0.012)	(0.011)	(0.002)
Observations	8,543	8,540	8,543	8,543	8,543
Mean Dep.Var	0.004	0.001	0.004	0.005	0.002
State fixed effects	✓	✓	✓	✓	✓
Age fixed effects	✓	✓	✓	✓	✓
Wealth Quintile fixed effects	✓	✓	✓	✓	✓
School years	✓	✓	✓	✓	✓
Δ Mkt. Access	✓	✓	✓	✓	✓

Notes: This table presents the effect of a pharmacy opening on help-seeking behavior (coefficient β_3 from Equation 6.1). The dependent variable is a standardized index that reflects the intensity and severity of the violence exerted by the partner from five years before the survey. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

6.5.8 Additional controls

I have added three additional covariates to the baseline specifications —(i) an indicator for whether the woman resides in an urban versus rural locality, (ii) a binary variable for self-identified indigenous status, and (iii) a dummy for labor force participation —to verify that the main results are robust to these dimensions of socioeconomic and cultural heterogeneity.

Table 6.13 reports the estimates from these extended models. Across all four outcomes—fertility, current violence, violent partner, and break-up—the inclusion of urban/rural status, indigenous identity, and recent employment leaves the "Post X Treat" coefficients virtually unchanged. In particular, columns (2)-(4) remain almost identical to the main specification, while the fertility effect (column 1) is slightly larger in magnitude and more precisely estimated. Hence, controlling for these covariates does not meaningfully alter our estimates of how pharmacy access affects fertility, violence, and separation.

One potentially relevant covariate that I cannot include is religion: the survey has no question on religious affiliation or attendance. Nevertheless, I consider that this omission is unlikely to bias the estimates. According to the 2020 Mexican census, just 8.1% of the population report no religious affiliation, and among those who do, 84.5% identify as Catholic (INEGI, 2023). Given this overwhelming Catholic majority and the relative homogeneity of religious identity at the national level, variation in religion is unlikely to correlate with the treatment. That said, this broad category masks important differences: some Catholics are very strict and oppose contraception, while others are more permissive. A measure of individual religiosity—such as frequency of worship attendance or specific denomination—would be needed to capture that heterogeneity, and it would be an interesting addition for future work.

In the next subsection, I include a proxy for religiosity by measuring the distance to the nearest religious center and show that the results are robust to this additional control.

6.5.9 Controlling for distance to religious centers

One potentially important omitted variable is religiosity, since a woman's faith and religious practice can directly shape her attitudes toward contraception and

Table 6.13: Additional controls

	Mother (1)	Current Violence (2)	Violent Partner (3)	Break-up (4)
Post	-0.036**	0.019**	0.013**	0.043***
	(0.015)	(0.008)	(0.006)	(0.016)
Treat	0.052	0.037**	0.005	-0.026
	(0.032)	(0.017)	(0.013)	(0.034)
Post × Treat	-0.099***	-0.040**	0.004	0.077*
	(0.037)	(0.018)	(0.017)	(0.039)
Observations	8,581	8,581	8,581	8,581
Mean Dep.Var	0.368	0.042	0.028	0.241
Urban fixed effects	✓	✓	✓	✓
State fixed effects	✓	✓	✓	✓
Age fixed effects	✓	✓	✓	✓
Wealth Quintile fixed effects	✓	✓	✓	✓
School years	✓	✓	✓	✓
Δ Mkt. Access	✓	✓	✓	✓
Indigenous	✓	✓	✓	✓
Worked last week	✓	✓	✓	✓
Dist. nearest pharmacy 2011	✓	✓	✓	✓

Notes: This table presents the effect of a pharmacy opening on fertility, current violence, violent behavior, and separation (coefficient β_3 from Equation 6.1) on the intensive margin. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

family planning. As discussed in the previous subsection, the survey does not directly include a proxy for religiosity. To address this gap, I construct a proxy by measuring each woman's distance to the nearest religious center at both 2011 and 2016.

I use the same methodology as in the main analysis to define the treatment and control groups. I then estimate Equation 6.1 using distance to religious centers as a covariate. The results are shown in Table 6.14. The coefficients are very similar to those found in the main analysis, suggesting that the results are robust to this additional control.

Table 6.14: Distance to religious centers

	Mother (1)	Current Violence (2)	Violent Partner (3)	Break-up (4)
Post	-0.028*	0.018**	0.014**	0.044***
	(0.015)	(0.007)	(0.005)	(0.015)
Treat	0.042	0.033*	0.003	-0.019
	(0.033)	(0.017)	(0.013)	(0.034)
Post × Treat	-0.091**	-0.043**	0.005	0.075*
	(0.038)	(0.019)	(0.017)	(0.041)
Observations	8,581	8,581	8,581	8,581
Mean Dep.Var	0.368	0.042	0.028	0.241
State fixed effects	✓	✓	✓	✓
Age fixed effects	✓	✓	✓	✓
Wealth Quintile fixed effects	✓	✓	✓	✓
School years	✓	✓	✓	✓
Δ Mkt. Access	✓	✓	✓	✓
Nearest rel. center 2011	✓	✓	✓	✓
Nearest rel. center 2016	✓	✓	✓	✓

Notes: This table presents the effect of a pharmacy opening on fertility, current violence, violent behavior, and separation (coefficient β_3 from Equation 6.1) on the intensive margin. Treated women are those who did not have a pharmacy within a 1 km radius in 2011 but had at least one in 2016. Women in the control group did not have a pharmacy within a 1 km radius in either 2011 or 2016. "Post" is a binary variable equal to one if the survey year is 2016. All regressions use survey sample weights, with standard errors clustered at the AGEB level (in parentheses). Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

6.5.10 Pharmacy stock

One key assumption of the model is that pharmacy openings are not driven by local demand for contraceptives or by trends in violence and separation. Table 6.15

reports the stock of sexual-health products for three major Mexican pharmacy chains. Note that "sexual-health products" include not only contraceptives but also items like erectile-dysfunction pills and vibrators—so contraceptives alone make up an even smaller share.

Across all chains, sexual-health items account for only 0.7-3.2 percent of total products. For instance, in 2016 Farmacias del Ahorro carried 390 sexual-health products—just 3.2 percent of its 12,268 total items. Benavides and Farmacia San Pablo show similarly low shares. This small proportion suggests that pharmacy entry is unlikely to reflect targeted demand for contraceptives.

Table 6.15: Pharmacy stock for three pharmacy chains

Pharmacy	**Sexual-Health**		**Other Products**	
	N. products	Share (%)	N. products	Share (%)
Farmacias del Ahorro	390	3.2	11,878	96.8
Benavides	177	2.8	6,248	97.2
Farmacia San Pablo	79	0.67	11,711	99.33

Notes: This table shows the total number of products and the share of sexual-health products for three pharmacy chains in Mexico. The first column shows the name of the pharmacy chain, the second column shows the number of sexual-health products, and the third column shows the share of sexual-health products. The last two columns show the number of other products and their share. The data was obtained from the pharmacy chains' websites.

What about changes in stock due to changing attitudes?

Because sexual-health items (and contraceptives in particular) represent a tiny fraction of total merchandise and yield relatively low profit margins, it is likely that pharmacies have little commercial incentive to fine-tune their contraceptive inventory based on marginal shifts in local attitudes.

Even if some pharmacies were to increase their contraceptive inventory in response to shifting attitudes, the results would remain unchanged. Because treatment is defined on the extensive margin—the presence versus absence of any pharmacy—variation in stocking levels simply averages out across better- and worse-stocked locations. It would be interesting to explore the intensive margin of contraceptive access, but the data from DENUE does not allow for this analysis.

6.5.11 Migration

The treatment and control groups are defined based on the location of the women *at the time of the survey*. However, it is possible that some women moved to a different block in the five years prior to the survey. The main concern is that fertility and separation decisions may themselves be influenced by pharmacy access, potentially affecting relocation choices—for example, a woman might become pregnant and move in with her partner as a result. This introduces measurement error in the treatment variable, as treatment is measured based on the current location rather than where the woman lived at the time the outcome was determined. Such misclassification would bias the results towards zero. Since I find significant effects on fertility, violence, and separation, the greatest concern about attenuation bias applies to the null results for violent behavior.

To quantify how large the measurement error would need to be to explain the observed null results for men's violent behavior, I conduct a sensitivity analysis following the approach found in Pischke (2007). Suppose the true effect of treatment (pharmacy openings) on violent behavior is $\beta = -0.02$. Due to measurement error—misclassification of women's treatment status caused by relocation—the observed effect $\hat{\beta}$ is attenuated towards zero as follows:

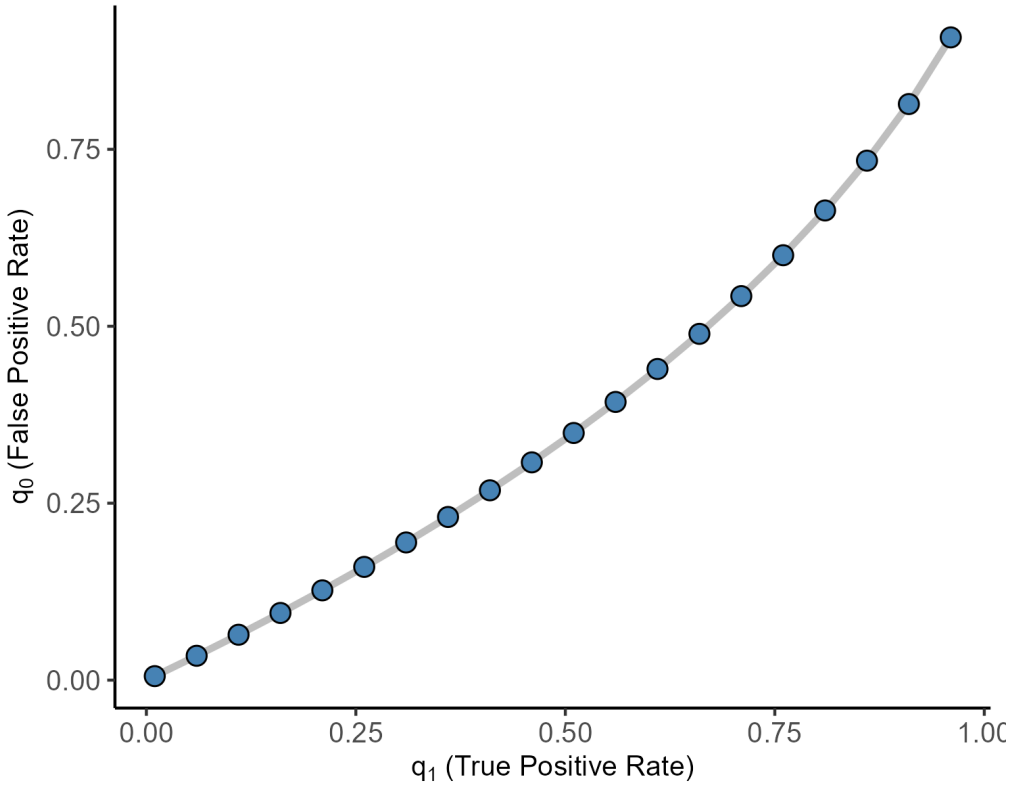
$$\text{plim}(\hat{\beta}) = \beta \left[\frac{\pi q_1}{\pi q_1 + (1-\pi) q_0} - \frac{\pi(1-q_1)}{\pi(1-q_1) + (1-\pi)(1-q_0)} \right], \tag{6.4}$$

where π is the true proportion of treated women (approximately 17.8% in my data), q_1 is the probability of correctly classifying treated women (true-positive rate), and q_0 is the probability of incorrectly classifying untreated women as treated (false-positive rate).

Using this framework, I numerically solve for combinations of q_1 and q_0 that would produce substantial attenuation. Figure 6.12 plots the combinations of true-positive rates (q_1) and corresponding false-positive rates (q_0) that would yield a 90% attenuation of the true coefficient, reducing it from -0.02 to an observed effect of -0.002. For example, if more than 80% of treated women are correctly classified ($q_1 > 0.80$), the false-positive rate (q_0) would need to exceed 67%—meaning nearly seven out of every ten untreated women would have to be wrongly classified as treated—for such attenuation to occur. Conversely, if the false-positive rate is low (e.g., below 20%), then the true positive rate would need to be below 31%. Such extreme levels of misclassification are highly implausi-

ble. Thus, while misclassification due to relocation could in theory attenuate estimates, these calculations suggest it is unlikely to fully explain the observed null effect for men's violent behavior.

Figure 6.12: Attenuation bias due to misclassification



Notes: This figure plots combinations of true-positive rates (q_1) and the corresponding false-positive rates (q_0) that would reduce the observed treatment effect to 10% of the true effect (i.e., 90% attenuation). The calculation assumes a true coefficient of $\beta = -0.02$ and a treatment share $\pi = 0.178$ based on my data.

Chapter 7

Conclusion

This thesis examines how motherhood affects women's exposure to intimate partner violence (IPV), focusing on two key mechanisms: changes in men's violent behavior and changes in women's separation behavior. Across theoretical and empirical chapters, I show that these mechanisms are often observationally equivalent, which presents significant empirical challenges.

I begin by developing a game-theoretic model to guide the empirical analysis. A central insight of the model is that motherhood can increase women's exposure to violence either because it makes them more likely to stay in an abusive relationship (the selection channel), or because it increases the likelihood that their partner becomes violent (the direct channel). Both channels can generate the same observed increase in violence after the birth of a child, making it difficult to distinguish between them in the data.

I identify two empirical limitations. First, many studies rely on samples of partnered women, which introduces sample selection bias. Second, most IPV measures capture current exposure to violence, making it impossible to distinguish whether a woman is not experiencing violence because her partner is non-violent or because she left an abusive relationship. To overcome these challenges, I propose a data strategy that includes women of all civil statuses and uses lifetime measures of violence.

I test the model's predictions using two empirical exercises based on Mexican data that meet these criteria. The first uses a sample of women who recently entered their first cohabiting relationship. Although not causal, the results come from a representative sample of the general population. The second uses phar-

macy openings as an exogenous shock to fertility, allowing me to estimate the causal effect of motherhood on IPV and separation for the subpopulation of compliers. Across both exercises, the results are consistent: motherhood increases the probability of experiencing violence and decreases the probability of separation. I find no evidence that motherhood directly increases men's violent behavior—supporting the selection channel of the model.

While this thesis focuses on motherhood, the broader point is that most interventions can influence exposure to IPV through both violent behavior and separation. For instance, a cash transfer targeted at women might reduce violence by alleviating financial stress but may also empower women to leave. Similarly, the issue of sample selection bias applies whenever the treatment affects the decision to stay or leave a relationship. Future work should examine whether the break-up channel is a key driver in other intervention contexts as well.

So, how applicable are these results to other settings? Two key assumptions in the model are central to the findings. First, becoming a mother increases the cost of leaving an abusive partner—an assumption likely to hold in countries with strong family norms or weak institutional support for single mothers. Second, there is hidden information about men's type early in the relationship and women become mothers early into a relationship. Hence, many women do not know their partner is abusive until after they have already had a child. In Mexico, where 50% of women become pregnant within the first year of a relationship, this assumption is particularly plausible. In contrast, in countries where women have children later and receive stronger support from the state, the dynamics may be different. This could explain why studies in the U.S., Mexico, and Brazil find increases in IPV following childbirth, while studies in Sweden find decreases.

Although the results are disheartening, they point to clear directions for policy. First, exit options for recent mothers should be a priority. Programs that provide financial, legal, and housing support for women with young children could lower the cost of leaving abusive relationships. Second, the findings highlight the importance of women's reproductive autonomy. If motherhood increases the cost of leaving, then the ability to choose when and with whom to have a child is critical. While previous research has shown that delaying pregnancy improves outcomes in health, education, and labor markets, this thesis shows that it may also reduce the risk of intimate partner violence by allowing women more time to learn about their partners before forming a family.

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Appendix A

Data

A. Physical Violence

To create the binary variable of current physical violence, I create a binary variable that equals one if the woman answers yes to any of the following questions:

During the last 12 months has you partner (ex-partner)..

- Pushed you or pulled your hair?
- Kicked you?
- Thrown an object at you?
- Hit you with his hands or other objects?
- Tried to strangle or suffocate you?
- Assaulted you with a knife or razor?
- Shot you with a weapon?

To create the binary variables of ever physical violence, I create a binary variable that equals one if the woman answers yes to any of the the question regarding whether the partner (ex-partner) has done any of the previous actions at any point in the relationship.

B. Emotional Violence

To create the binary variable of current emotional violence, I create a binary variable that equals one if the woman answers yes to any of the following questions:

During the last 12 months has you partner (ex-partner)..

- Embarrassed, belittled, or humiliated you?
- Ignored you, not taken you into account or not given you affection?
- Told you that you are cheating on him?
- Made you feel afraid?
- Spied on you?
- Stopped talking to you?
- Become very angry because house work is not ready, because the food is not the way he wants or because he believes you did not fulfill your duties?
- Threatened you with a weapon?
- Threatened to kill you or himself?

C. Sexual Violence

To create the binary variable of current sexual violence, I create a binary variable that equals one if the woman answers yes to any of the following questions:

During the last 12 months has you partner (ex-partner)..

- Demanded that you have sexual relations, even if you didn't want to?
- Used his physical force to force you to have sexual relations?

Appendix B

Figures

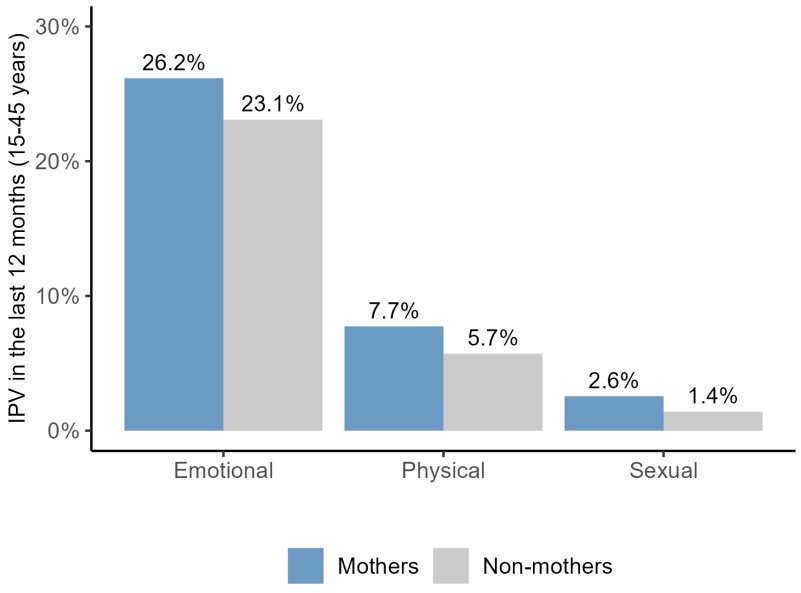

Figure B.1: Prevalence of current IPV by motherhood status (ever partnered)

Note: The sample includes women who have have been in a cohabiting or marital relationship at some point in their lives.

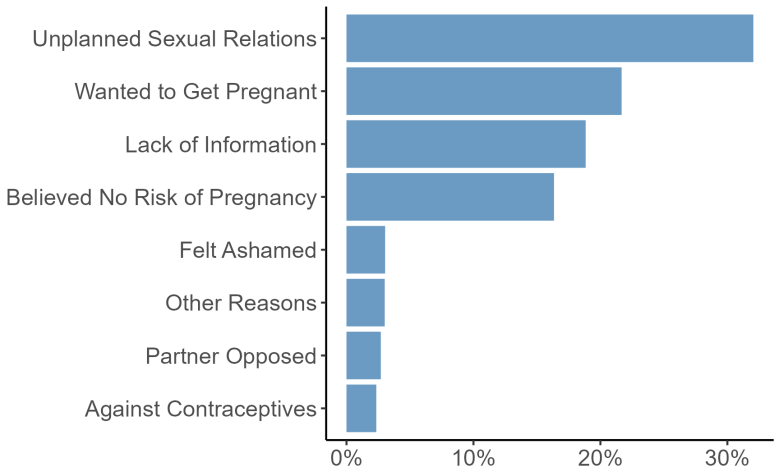

Figure B.2: Reasons for not using contraception in first sexual encounter

Note: This figure shows the reasons why women did not use contraception on their first sexual encounter. Sample includes all women younger than 25 years old who have ever had a sexual relationship and reported not using any contraceptive in their first sexual encounter. Means are calculated using survey weights. *Source:* ENADID 2014.

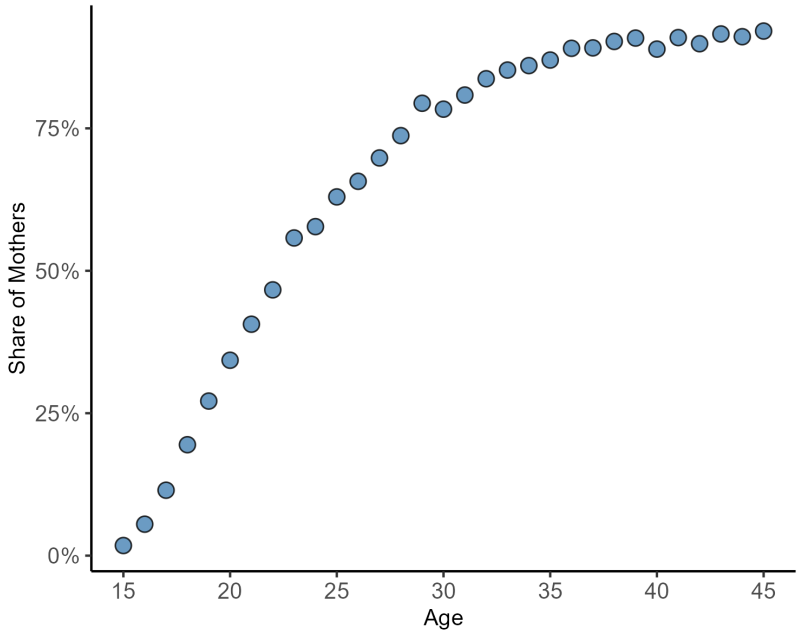

Figure B.3: Share of mothers by age group

Note: This figure shows the percentage of women who are mothers by age. The sample includes women between 15 and 45 years old. Means are calculated using survey weights. *Source:* ENADID 2014.

Appendix C

Theory

C.1 Proof of Proposition 2

Suppose that $\alpha^A < \alpha_1^*$, where $\alpha_1^* = \frac{\bar{\delta}(1+\beta)F(\bar{\alpha}-\bar{c})}{(1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta}$. Then, there exists a pooling equilibrium characterized by the following strategies and beliefs.

Non-abusive men do not exert violence in either period. Abusive men do not exert violence in the first period and exert violence in the second period.

$$\sigma_t^{NA}(p_t) = 0 \text{ for } p_t \in \{0,1\} \text{ and } t \in \{0,1\} \tag{C.1}$$

$$\sigma_1^{A}(p_t) = 0 \text{ for } p_t \in \{0,1\} \tag{C.2}$$

$$\sigma_2^{A}(1) = 1 \tag{C.3}$$

If there is no violence, women have beliefs $\hat{q}(p_1, v_1 = 0) = q$ and stay with certainty. If there is violence, women have beliefs $\hat{q}(p_1, v_1 = 1) = 1$ and leave if following a threshold rule.

$$\sigma^{\delta} = \begin{cases} 0, \text{if } v_1 = 1 \text{ and } \delta \leq \bar{\alpha} - p_1\bar{c} - (1-p_1)(\frac{\beta}{1+\beta}) \\ 1, \text{otherwise} \end{cases} \tag{C.4}$$

Proof:

2.1 Decision to exert violence

By Lemma 1, in the second period, all abusive men exert violence and non-abusive men do not.

1.2 Decision to separate

At the end of the first period, women decide whether to leave their partner after observing fertility outcomes and violent behavior. On the equilibrium path, no man exerts violence in the first period, so $\hat{q}(v_1 = 0) = q$. Her utility from staying is $U^{w,r} = p_t + \beta(1 - q\bar{\alpha})$. If she leaves, her utility is $U^{w,s} = -\delta + p_t - p_t\bar{c}$. She leaves if:

$$\delta \geq \frac{\beta}{1+\beta} q\bar{\alpha} - p_1\bar{c} - (1 - p_1)\frac{\beta}{1+\beta} \tag{C.5}$$

Suppose $p_1 = 0$, then she stays as long as $\delta \geq \frac{\beta}{1+\beta}(q\bar{\alpha} - 1)$. By A3, the right-hand side of the equation is negative, so all women stay. Now, suppose $p_1 = 1$, then she stays as long as $\delta \geq \frac{\beta}{1+\beta} q\bar{\alpha} - \bar{c}$. By A1, we know that $\bar{c} \geq \frac{\beta}{1+\beta}$ and by A3, $q\bar{\alpha} < 1$. Therefore, the left-hand side of the expression is negative and all women stay.

I have shown that women are best responding on the equilibrium path. However, we still need to specify off-equilibrium beliefs and her best response to them. Let $\hat{q}(p_1, v_1 = 1) = 1$[1]. That is, if she observes violence, she believes her partner is abusive. This is because non-abusive men never exert violence (proof below) Her utility of staying is $U^{w,r} = p_1 - \bar{\alpha} + \beta(1 - \bar{\alpha})$. If she leaves, her utility is $U^{w,s} = (-\delta + p_t - p_t\bar{c})(1 + \beta)$. She leaves if:

$$\delta \geq \bar{\alpha} - p_1\bar{c} - (1 - p_1)\frac{\beta}{1+\beta} \tag{C.6}$$

Therefore, if she were to observe violence, she would leave following a threshold rule, which is a function of her motherhood status.

The strategy for women is summarized below:

[1] These are not the only beliefs on the off-equilibrium path that support a pooling equilibrium.

$$\sigma^{\delta} = \begin{cases} 0, \text{if } v_1 = 1 \text{ and } \delta \leq \bar{\alpha} - p_1\bar{c} - (1-p_1)(\frac{\beta}{1+\beta}) \\ 1, \text{otherwise} \end{cases} \tag{C.7}$$

1.1 Decision to exert violence

A man decides whether to exert violence knowing their partner's strategy. If he does not exert violence, he knows she will stay for certain. However, if he is violent, there is uncertainty about whether she will stay because δ is private information. Consequently, men calculate the expected probability $\hat{s}(p_1, v_1)$ that she will stay, conditional on fertility outcomes and violent behavior. From above, the expected probability that she will stay is:

$$\hat{s}(p_1, 0) = 1 \tag{C.8}$$

$$\hat{s}(p_1, 1) = 1 - F(\alpha - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta}) \tag{C.9}$$

Non-Abusive Men: I show that non-abusive men are always better off not exerting violence. They do not exert violence if

$$p_1 + \beta \geq \hat{s}(p_1, 1)(p_1 + \alpha^{NA} + \beta) + (1 - \hat{s}(p_1, 1))(-\bar{\delta} + p_1)(1 + \beta) \tag{C.10}$$

The left-hand side of Equation C.10 is the utility they get from not exerting violence in the first period. The right-hand side their expected utility of exerting violence. Rearranging, they do not exert violence as long as:

$$(1 - \hat{s}(p_1, 1))\beta(1 - p_1) \geq \hat{s}(p_1, 1)\alpha^{NA} - (1 - \hat{s}(p_1, 1))\bar{\delta}(1 + \beta) \tag{C.11}$$

Note that, for any possible $\hat{s} \in [0, 1]$, the left-hand side of Equation C.11 is weakly larger than zero and the right-hand side is strictly negative, so non-abusive men do not exert violence. They do not exert violence as i) it brings them disutility, ii) she may leave and he will pay the cost of separation and iii) if he is not a

father, she may leave and he will remain childless. All of these go in the same direction and non-abusive men are best responding by not exerting violence.

Abusive men: I show that abusive men do not exert violence in this equilibrium. They do not exert violence as long as:

$$p_1 + \beta(1+\bar{\alpha}) \geq \hat{s}(p_1,1)(p_1 + \alpha^A + \beta(1+\bar{\alpha})) + (1-\hat{s}(p_1,1))(-\bar{\delta} + p_1)(1+\beta) \tag{C.12}$$

Suppose that $p_1 = 1$. From Equation C.9, we know that $\hat{s}(1,1) = 1 - F(\bar{\alpha} - \bar{c})$. Plugging this into Equation C.12 and rearranging, abusive fathers do not exert violence as long as:

$$\alpha^A \leq \frac{\bar{\delta}(1+\beta)(F(\bar{\alpha}-\bar{c}))}{(1+\beta)(1-F(\bar{\alpha}-\bar{c})) - \beta} \equiv \alpha_1^* \tag{C.13}$$

Now, suppose that $p_1 = 0$. From Equation C.9, we know that $\hat{s}(0,1) = 1 - F(\bar{\alpha} - \frac{\beta}{1+\beta})$. Plugging this into Equation C.12 and rearranging, abusive non-fathers do not exert violence as long as:

$$\alpha^A \leq \frac{\bar{\delta}(1+\beta)F(\bar{\alpha}-\frac{\beta}{1+\beta})}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta})) - \beta} + \frac{\beta F(\bar{\alpha}-\frac{\beta}{1+\beta})}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta})) - \beta} \equiv \alpha_0^* \tag{C.14}$$

If $\alpha^A \leq min\{\alpha_1^*, \alpha_0^*\}$, then all abusive men are best responding by choosing $v_1 = 0$. The expression below represents the difference between the thresholds for non-fathers and fathers, $\alpha_0^* - \alpha_1^*$:

$$\frac{\bar{\delta}(1+\beta)(F(\bar{\alpha}-\frac{\beta}{1+\beta}) - F(\bar{\alpha}-\bar{c})) + \beta F(\bar{\alpha}-\frac{\beta}{1+\beta})((1+\beta)(1-F(\bar{\alpha}-\bar{c})) - \beta)}{[(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta})) - \beta][(1+\beta)(1-F(\bar{\alpha}-\bar{c})) - \beta]} \tag{C.15}$$

The denominator in Equation C.15 is positive by A1 and A4. The first term in

the numerator is (weakly) positive by A1. The second term is strictly positive by A1 and A4. Consequently, $\alpha_1^* < \alpha_0^*$. We assumed that $\alpha^A < \alpha_1^*$, resulting in all abusive men not exerting violence in the first period.

□

C.2 Proof of Proposition 3

Suppose that $\alpha_1^* \leq \alpha^A < \alpha_0^*$, where $\alpha_1^* = \frac{\bar{\delta}(1+\beta)F(\bar{\alpha}-\bar{c})}{(1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta}$ and $\alpha_0^* = \frac{F(\bar{\alpha}-\frac{\beta}{1+\beta})(\bar{\delta}(1+\beta)+\beta)}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta}$. Then, there exists a partially separating equilibrium characterized by the following strategies and beliefs.

Non-abusive men do not exert violence in either period. Abusive men who have a child in $t = 1$ exert violence in both periods. Abusive men who don't have a child in $t = 1$ only exert violence in the second period.

$$\sigma_t^{NA}(p_t) = 0 \text{ for } p_t \in \{0,1\} \text{ and } t \in \{0,1\} \tag{C.16}$$

$$\sigma_t^{A}(p_t) = \begin{cases} 1, \text{if } t = 1 \text{ and } p_1 = 1 \text{ or } t = 2 \\ 0, \text{otherwise} \end{cases} \tag{C.17}$$

Non-mothers who don't observe violence have beliefs $\hat{q}(0,0) = q$ and stay with certainty. If they observe violence, they have beliefs $\hat{q}(0,1) = 1$ and leave following a threshold rule. Mothers who don't observe violence have beliefs $\hat{q}(1,0) = 0$ and stay with certainty. If they observe violence, they have beliefs $\hat{q}(1,1) = 1$ and leave following a threshold rule.

$$\sigma^{\delta} = \begin{cases} 0, \text{if } v_1 = 1 \text{ and } \delta \leq \bar{\alpha} - p_1\bar{c} - (1-p_1)(\frac{\beta}{1+\beta}) \\ 1, \text{otherwise} \end{cases}$$

Proof:

2.1 Decision to exert violence

By Lemma 1, in the second period, all abusive men exert violence and non-abusive men do not.

1.2 Decision to separate

At the end of the first period, women decide whether to leave their partner after observing fertility and violent behavior. On the equilibrium path, only abusive fathers exert violence in period 1. Consequently, fathers are in a separating equilibrium and non-fathers are in a pooling equilibrium.

Suppose $p_t = 1$. Mothers are in a separating equilibrium, so they know their partner has already revealed their type. Consequently, her belief about his violent type is $\hat{q}(1, v_1) = v_1$.

If he exerts violence in period 1, her utility from staying is $(1 - \bar{\alpha})(1 + \beta)$, as she knows she will experience violence in both periods. Instead, if she leaves, her utility will be $(-\delta + 1 - \bar{c})(1 + \beta)$. She will stay as long as:

$$\delta \geq \bar{\alpha} - \bar{c} \tag{C.18}$$

If he does not exert violence, then she is certain his type is non-abusive and she will stay as $1 + \beta > (-\delta + 1 - \bar{c})(1 + \beta)$.

Now, suppose $p_1 = 0$. In this equilibrium, abusive men will not exert violence in the first period. Therefore, if a woman does not observe violence, she remains with her prior and $\hat{q}(0, 0) = q$. Her utility from staying is $\beta(1 - q\bar{\alpha})$. If she leaves, her utility is $= -\delta(1 + \beta)$. Note that the utility of leaving is positive by A3, hence she is strictly better off staying in the relationship.

I have shown that women are best responding on the equilibrium path. However, we still need to specify off-equilibrium beliefs and her best response to them. Let $\hat{q}(0, v_1 = 1) = 1$[2]. That is, if she observes violence, she believes her partner is abusive. This is because non-abusive men never exert violence (proof below). Her utility of staying is $U^{w,r} = -\bar{\alpha} + \beta(1 - \bar{\alpha})$. If she leaves, her utility is $U^{w,s} = (-\delta)(1 + \beta)$. She leaves if:

[2]These are not the only beliefs on the off-equilibrium path that support a partially separating equilibrium.

$$\delta \geq \bar{\alpha} - \frac{\beta}{1+\beta} \tag{C.19}$$

Therefore, all women stay if there is no violence in the first period, either because mothers are in a separating equilibrium or because non-mothers do not leave out of fear of violence. If there is violence, they leave if $\delta \leq \bar{\alpha} - p_1\bar{c} - (1-p_1)(\frac{\beta}{1+\beta})$.

1.1 Decision to exert violence

A man decides whether to exert violence knowing their partner's strategy. If he does not exert violence, he knows she will stay for certain. However, if he is violent, there is uncertainty about whether she will stay because δ is private information. Consequently, men calculate the expected probability $\hat{s}(p_1, v_1)$ that she will stay, conditional on fertility outcomes and violent behavior. From above, the expected probability that she stays is:

$$\hat{s}(p_1, 0) = 1 \tag{C.20}$$

$$\hat{s}(p_1, 1) = 1 - F(\alpha - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta}) \tag{C.21}$$

Non-Abusive Men: I show that non-abusive men are always better off not exerting violence. They do not exert violence if

$$p_1 + \beta \geq \hat{s}(p_1, 1)(p_1 + \alpha^{NA} + \beta) + (1 - \hat{s}(p_1, 1))(-\bar{\delta} + p_1)(1+\beta) \tag{C.22}$$

The left-hand side of Equation C.22 is the utility they get from not exerting violence in the first period. The right-hand side their expected utility of exerting violence. Rearranging, they do not exert violence as long as:

$$(1 - \hat{s}(p_1, 1))\beta(1-p_1) \geq \hat{s}(p_1, 1)\alpha^{NA} - (1 - \hat{s}(p_1, 1))\bar{\delta}(1+\beta) \tag{C.23}$$

Note that, for any possible $\hat{s} \in [0, 1]$, the left-hand side of Equation C.23 is weakly larger than zero and the right-hand side is strictly negative, so non-abusive men

do not exert violence. They do not exert violence as i) it brings them disutility, ii) she may leave and he will pay the cost of separation and iii) if he is not a father, she may leave and he will remain childless. All of these go in the same direction and non-abusive men are best responding by not exerting violence.

Abusive men: I divide the analysis by fatherhood status, as they have different strategies in the first period.

Suppose $p_1 = 1$. Then they will exert violence as long as:

$$\hat{s}(1,1)(1+\alpha^A)(1+\beta) + (1-\hat{s}(p_1,1))(-\bar{\delta}+1)(1+\beta) \geq 1+\beta(1+\bar{\alpha}) \equiv \alpha_1^* \tag{C.24}$$

From above, we know that $\hat{s}(1,1) = 1 - F(\bar{\alpha} - \bar{c})$. Plugging this into Equation C.24 and rearranging, abusive fathers exert violence as long as:

$$\alpha^A \geq \frac{\bar{\delta}(1+\beta)F(\bar{\alpha}-\bar{c})}{(1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta} \equiv \alpha_1^* \tag{C.25}$$

By assumption, we know that $\alpha_1^* \leq \alpha^A$. So all fathers are best responding by exerting violence in the first period.

Now, suppose that $p_1 = 0$. Abusive non-fathers will exert violence if:

$$\beta(1+\alpha^A) \geq \hat{s}(0,1)(\alpha^A + \beta(1+\alpha^A)) + (1-\hat{s}(0,1))(-\bar{\delta})(1+\beta) \equiv \alpha_0^* \tag{C.26}$$

According to women's strategy (off-equilibrium), we know that $\hat{s}(0,1) = 1 - F(\bar{\alpha} - \frac{\beta}{1+\beta})$. Plugging this into Equation C.26 and rearranging, abusive non-fathers do not exert violence as long as:

$$\alpha^A \leq \frac{\bar{\delta}(1+\beta)F(\bar{\alpha}-\frac{\beta}{1+\beta})}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta} + \frac{\beta F(\bar{\alpha}-\frac{\beta}{1+\beta})}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta} \equiv \alpha_0^* \tag{C.27}$$

By assumption, we know that $\alpha_0^* \geq \alpha^A$. However, to finish the proof, we need to be certain that this equilibrium exists, which implies that $\alpha_1^* < \alpha_0^*$. Note that $\alpha_0^* - \alpha_1^*$ is defined as:

$$\frac{\bar{\delta}(1+\beta)(F(\bar{\alpha}-\frac{\beta}{1+\beta})-F(\bar{\alpha}-\bar{c}))+\beta F(\bar{\alpha}-\frac{\beta}{1+\beta})((1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta)}{[(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta][(1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta]} \tag{C.28}$$

The denominator in Equation C.28 is positive by A4. The first term in the numerator is (weakly) positive by A1. $F(\bar{\alpha}-\frac{\beta}{1+\beta})-F(\bar{\alpha}-\bar{c})$ represents the difference in the probability of leaving between mothers and non-mothers. Abusive non-fathers have less incentive to exert violence than abusive fathers because they know their partner will leave with a higher probability. The second term is strictly positive by A4. This term represents the dynamic incentives that abusive non-fathers have. They have an incentive to wait until the second period so they can have a child. Consequently, $\alpha_1^* < \alpha_0^*$ and the partially separating equilibrium exists. Note that this is true for any $\bar{c} \geq \frac{\beta}{1+\beta}$. If mothers are as likely to leave as non-mothers $\bar{c} = \frac{\beta}{1+\beta}$, then the first term in the denominator of Equation C.28 is zero but the second term remains positive.

□

C.3 Proof of Proposition 4

Suppose that $\alpha^A > \alpha_0^*$, where $\alpha_0^* = \frac{F(\bar{\alpha}-\frac{\beta}{1+\beta})(\bar{\delta}(1+\beta)+\beta)}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta}$. Then, there exists a separating equilibrium characterized by the following strategies and beliefs:

Non-abusive men do not exert violence in either period. Abusive men exert violence in both periods.

$$\sigma_t^{NA}(p_t) = 0 \text{ for } p_t \in \{0,1\} \text{ and } t \in \{0,1\} \tag{C.29}$$
$$\sigma_1^{A}(p_t) = 1 \text{ for } p_t \in \{0,1\} \text{ and } t \in \{0,1\} \tag{C.30}$$

If there is no violence, women have beliefs $\hat{q}(p_1, v_1 = 0) = 0$ and stay with

certainty. If there is violence, women have beliefs $\hat{q}(p_1, v_1 = 1) = 1$ and leave if following a threshold rule.

$$\sigma^{\delta} = \begin{cases} 0, \text{if } v_1 = 1 \quad \text{and } \delta \leq \bar{\alpha} - p_1\bar{c} - (1 - p_1)(\frac{\beta}{1+\beta}) \\ 1, \text{otherwise} \end{cases} \tag{C.31}$$

Proof:

2.1 Decision to exert violence

By Lemma 1, in the second period, all abusive men exert violence and non-abusive men do not.

1.2 Decision to separate

At the end of the first period, women decide whether to leave their partner after observing fertility outcomes and violent behavior. In this equilibrium, the type is revealed in the first period, independently of the fatherhood status. Hence, if $v_1 = 1$, she knows her partner is abusive and $\hat{q}(p_1, 1) = 1$. Similarly, if $v_1 = 0$, she is certain her partner is non-abusive and $\hat{q}(p_1, 0) = 0$.

Suppose $v_1 = 0$, then, she remains in the relationship as long as her utility from staying is higher than her utility of not staying:

$$p_1 + \beta \geq (-\delta + p_1 - \bar{c})(1 + \beta) \tag{C.32}$$

Rearranging Equation C.32, she stays as long as $\delta \geq p_1\bar{c} - (1 - p_1)\beta$. As $\delta > 0$ and the right-hand side of the expression is negative, all women stay. Intuitively, if she does not observe violence, she knows her partner is non-abusive and she is better off staying.

Now suppose $v_1 = 1$, then she knows her partner is abusive and she will experience violence in both periods. She stays if:

$$p_1 - \bar{\alpha} + \beta(1 - \bar{\alpha}) \geq (-\delta + p_1 - \bar{c})(1 + \beta) \tag{C.33}$$

Rearranging Equation C.33, she stays as long as $\delta \geq \bar{\alpha} - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta}$. Therefore, if she observes violence, she will leave following a threshold rule, which is a function of her motherhood status.

1.1 Decision to exert violence

Let $\hat{s}(p_1, v_1)$ be the belief that she will stay as a function of fertility outcomes and violent behavior. From the section above, all women stay if $v_1 = 0$, hence $\hat{s}(p_1, 0) = 1$. If men exert violence, she stays with probability $\hat{s}(p_1, 1) = 1 - F(\alpha - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta})$.

Non-Abusive Men: I show that non-abusive men are always better off not exerting violence. They do not exert violence if

$$p_1 + \beta \geq \hat{s}(p_1, 1)(p_1 + \alpha^{NA} + \beta) + (1 - \hat{s}(p_1, 1))(-\bar{\delta} + p_1)(1 + \beta) \tag{C.34}$$

The left-hand side of Equation C.34 is the utility they get from not exerting violence in the first period. The right-hand side their expected utility of exerting violence. Rearranging, they do not exert violence as long as:

$$(1 - \hat{s}(p_1, 1))\beta(1 - p_1) \geq \hat{s}(p_1, 1)\alpha^{NA} - (1 - \hat{s}(p_1, 1))\bar{\delta}(1 + \beta) \tag{C.35}$$

Note that, for any possible $\hat{s} \in [0, 1]$, the left-hand side of Equation C.35 is weakly larger than zero and the right-hand side is strictly negative, so non-abusive men do not exert violence. They do not exert violence as i) it brings them disutility, ii) she may leave and he will pay the cost of separation and iii) if he is not a father, she may leave and he will remain childless. All of these go in the same direction and non-abusive men are best responding by not exerting violence.

I show that all abusive men are better off exerting violence, given their partner's belief and strategy. They exert violence if:

$$\hat{s}(p_1, 1)(p_1 + \alpha^{A} + \beta(1 + \bar{\alpha})) + (1 - \hat{s}(p_1, 1))(-\bar{\delta} + p_1)(1 + \beta) \geq p_1 + \beta(1 + \bar{\alpha}) \tag{C.36}$$

Suppose that $p_1 = 1$. Plugging in $\hat{s}(1,1)$ into Equation C.36 and rearranging, we derive the expression for abusive fathers:

$$\alpha^A \geq \frac{\bar{\delta}(1+\beta)F(\bar{\alpha}-\bar{c})}{(1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta} \equiv \alpha_1^* \tag{C.37}$$

Note that $\alpha_1^* > 0$. The numerator is strictly positive by A1 and the denominator is strictly positive by A4 and A1[3].

Now, suppose that $p_1 = 0$. Plugging in $\hat{s}(0,1)$ into Equation C.36 and rearranging, we derive the expression for abusive non-fathers:

$$\alpha^A \geq \frac{\bar{\delta}(1+\beta)F(\bar{\alpha}-\frac{\beta}{1+\beta})}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta} + \frac{\beta F(\bar{\alpha}-\frac{\beta}{1+\beta})}{(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta} \equiv \alpha_0^* \tag{C.38}$$

Note that $\alpha_0^* > 0$. The numerator is strictly positive by A1 and the denominator is strictly positive by A4.

If $\alpha^A \geq max\{\alpha_1^*, \alpha_0^*\}$, then both fathers and non-fathers are best responding by choosing $v_1 = 1$. The expression below represents the difference between the thresholds for non-fathers and fathers, $\alpha_0^* - \alpha_1^*$:

$$\frac{\bar{\delta}(1+\beta)(F(\bar{\alpha}-\frac{\beta}{1+\beta})-F(\bar{\alpha}-\bar{c}))+\beta F(\bar{\alpha}-\frac{\beta}{1+\beta})((1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta)}{[(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))-\beta][(1+\beta)(1-F(\bar{\alpha}-\bar{c}))-\beta]} \tag{C.39}$$

The denominator in Equation C.39 is positive by A1 and A4. The first term in the numerator is (weakly) positive by A1. The second term is strictly positive by A1 and A4. Consequently, $\alpha_1^* < \alpha_0^*$. We assumed that $\alpha^A \geq \alpha_0^*$, resulting in all abusive men exerting violence in the first period.

□

[3] By A1 $(1+\beta)(1-F(\bar{\alpha}-\bar{c})) \geq (1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta}))$ and, by A4, $(1+\beta)(1-F(\bar{\alpha}-\frac{\beta}{1+\beta})) > \beta$, resulting on the denumerator being strictly positive.

C.4 Other Equilibria

So far I have shown the existence of a pooling equilibrium, partially separating equilibrium and separating equilibrium. In this section, I rule out the existence of other equilibria.

C.4.1 Non-abusive men exert violence in $t = 1$

We know that in period two, all non-abusive men strictly prefer to not exert violence. Let $\hat{s}(p_1, 1)$ be the belief that she will stay in period one if he exerts violence and $\hat{s}(p_1, 0)$ the probability she will stay if he does not exert violence. He decides to not exert violence in period one if:

$$\hat{s}(p_1, 0)(p_1 + \beta) + (1 - \hat{s}(p_1, 0))(-\bar{\delta} + p_1) \geq \tag{C.40}$$

$$\hat{s}(p_1, 1)(p_1 + \alpha^{NA} + \beta) + (1 - \hat{s}(p_1, 1))(-\bar{\delta} + p_1)(1 + \beta) \tag{C.41}$$

Rearranging, he is not violent if:

$$\alpha^{NA} \leq \frac{\hat{s}(p_1, 0) - \hat{s}(p_1, 1)}{\hat{s}(p_1, 1)}(\beta(1 - p_1) + \bar{\delta}(1 + \beta))$$

Note that the right-hand side of the equation is lower bounded by $-(\beta+\bar{\delta}(1+\beta))$ and, by A2, we know that α^{NA} is lower than such bound. This means that independently of the beliefs men could have about her probability of staying, non-violent men will not exert violence in the first period.

Hence, there is no equilibrium where non-violent men exert violence in either period.

□

C.4.2 In $t = 1$, only abusive non-fathers exert violence

The last equilibrium I need to rule out is a scenario where abusive fathers pool in the first period while abusive non-fathers reveal their type. Suppose that an

equilibrium exists with the following strategies and beliefs:

Non-abusive men do not exert violence in either period. Abusive men who don't have a child in $t = 1$ exert violence in both periods. Abusive men who have a child in $t = 1$ only exert violence in the second period.

$$\sigma_t^{NA}(p_t) = 0 \text{ for } p_t \in \{0, 1\} \text{ and } t \in \{0, 1\} \tag{C.42}$$

$$\sigma_t^{A}(p_t) = \begin{cases} 1, \text{if } t = 1 \text{ and } p_1 = 0 \text{ or } t = 2 \\ 0, \text{otherwise} \end{cases} \tag{C.43}$$

Mothers who don't observe violence have beliefs $\hat{q}(1, 0) = q$ and stay with certainty. If they observe violence, they have beliefs $\hat{q}(1, 1) = 1$ and leave following a threshold rule. Non-mothers who don't observe violence have beliefs $\hat{q}(0, 0) = 0$ and stay with certainty. If they observe violence, they have beliefs $\hat{q}(0, 1) = \tilde{q}$ and leave following a threshold rule.

$$\sigma^{\delta} = \begin{cases} 0, \text{if } v_1 = 1 \text{ and } \delta \leq \frac{1+\hat{q}\beta}{1+\beta}\alpha - p_1\bar{c} - (1 - p_1)\frac{\beta}{1+\beta}) \\ 1, \text{otherwise} \end{cases}$$

I show below that for any possible off-equilibrium belief $\tilde{q} \in [0, 1]$, this equilibrium does not exist.

1.2 Decision to separate

At the end of the first period, women decide whether to leave their partner after observing fertility and violent behavior. On the equilibrium path, only abusive non-fathers exert violence in period 1. Consequently, non-fathers are in a separating equilibrium and fathers are in a pooling equilibrium. I will divide the analysis into these two cases.

Suppose $p_1 = 0$. Non-mothers are in a separating equilibrium, so they know their partner has already revealed their type. Consequently, her belief about his violent type is $\hat{q}(0, v_1) = v_1$. If he exerts violence, she will stay as long as $(-\bar{\alpha}) + \beta(1 - \bar{\alpha}) \geq (-\delta)(1 + \beta)$. rearranging, she will stay as long as:

$$\delta \geq \bar{\alpha} - \frac{\beta}{1+\beta} \tag{C.44}$$

If he does not exert violence, then she is certain his type is non-abusive and she will stay as long as $\beta > -\delta(1+\beta)$, which is true.

Now suppose $p_1 = 0$. In this equilibrium, abusive men will not exert violence in the first period. Therefore, if a woman does not observe violence, she remains with her prior and $\hat{q}(0,0) = q$. Her utility from staying is $1 + \beta(1 - q\bar{\alpha})$. If she leaves, her utility is $= -(\delta + 1 - \bar{c})(1+\beta)$. Rearranging, she stays as long as $\delta \geq \frac{\beta}{1+\beta} q\bar{\alpha} - \bar{c}$. Note that by A1, $\frac{\beta}{1+\beta} \leq \bar{c}$, hence $\frac{\beta}{1+\beta} q\bar{\alpha} - \bar{c} \leq \bar{c}(q\bar{\alpha} - 1)$. By assumption A3, $q\bar{\alpha} < 1$, so the threshold for leaving is negative and all women stay.

I have shown that women are best responding on the equilibrium path. However, we still need to specify off-equilibrium beliefs and her best response to them. Let $\hat{q}(1, v_1 = 1) = \tilde{q}$, where $\tilde{q} \in [0,1]$. Her utility of staying is $U^{w,r} = 1 - \bar{\alpha} + \beta(1 - \tilde{q}\bar{\alpha})$. If she leaves, her utility is $U^{w,s} = (-\delta + 1 - \bar{c})(1+\beta)$. She leaves if:

$$\delta \geq \frac{1 + \tilde{q}\beta}{1+\beta}\bar{\alpha} - \bar{c} \tag{C.45}$$

1.1 Decision to exert violence

Let $\hat{s}(p_1, v_1)$ be the belief that she will stay as a function of fertility outcomes and violent behavior. In this equilibrium, women stay if $v_1 = 0$, hence $\hat{s}(p_1, 0) = 1$. If men exert violence, women have off-equilibrium beliefs $\hat{q}(0,1) = 1$ and $\hat{q}(1,1) = \tilde{q}$, so she stays with probability $\hat{s}(p_1, 1) = 1 - F(\frac{1+\hat{q}\beta}{1+\beta}\alpha - p_1\bar{c} - (1-p_1)\frac{\beta}{1+\beta})$.

Non-Abusive Men: I show that non-abusive men are always better off not exerting violence. They do not exert violence if

$$p_1 + \beta \geq \hat{s}(p_1, 1)(p_1 + \alpha^{NA} + \beta) + (1 - \hat{s}(p_1, 1))(-\bar{\delta} + p_1)(1+\beta) \tag{C.46}$$

The left-hand side of Equation C.46 is the utility they get from not exerting violence in the first period. The right-hand side their expected utility of exerting

violence. Rearranging, they do not exert violence as long as:

$$(1-\hat{s}(p_1,1))\beta(1-p_1) \geq \hat{s}(p_1,1)\alpha^{NA} - (1-\hat{s}(p_1,1))\bar{\delta}(1+\beta) \tag{C.47}$$

Note that, for any possible $\hat{s} \in [0,1]$, the left-hand side of Equation C.47 is weakly larger than zero and the right-hand side is strictly negative, so non-abusive men do not exert violence. They do not exert violence as i) it brings them disutility, ii) she may leave and he will pay the cost of separation and iii) if he is not a father, she may leave and he will remain childless. All of these go in the same direction and non-abusive men are best responding by not exerting violence.

Abusive men: I divide the analysis by fatherhood status, as they have different strategies in the first period.

Suppose $p_1 = 0$. Then they will exert violence as long as:

$$\hat{s}(0,1)(\alpha^A + \beta(1+\alpha^A)) - \bar{\delta}(1-\hat{s}(0,1))(1+\beta) \geq \beta(1+\alpha^A) \tag{C.48}$$

From above, we know that $\hat{s}(0,1) = 1 - F(\bar{\alpha} - \frac{\beta}{1+\beta})$. Plugging this into Equation C.48 and rearranging, abusive non-fathers exert violence as long as:

$$\alpha^A \geq \frac{\bar{\delta}(1+\beta)(1-\hat{s}(0,1))}{(1+\beta)\hat{s}(0,1) - \beta} \equiv \alpha_0^* \tag{C.49}$$

Now, suppose that $p_1 = 1$. Abusive fathers will not exert violence if:

$$1 + \beta(1+\alpha^A) \geq \hat{s}(1,1)(1+\alpha^A)(1+\beta) + (1-\hat{s}(1,1))(-\bar{\delta}+1)(1+\beta) \tag{C.50}$$

Rearranging, abusive fathers do not exert violence as long as:

$$\alpha^A \leq \frac{\bar{\delta}(1+\beta)(1-\hat{s}(1,1))}{(1+\beta)\hat{s}(1,1) - \beta} + \frac{\beta(1-\hat{s}(1,1))}{(1+\beta)\hat{s}(1,1) - \beta} \equiv \alpha_1^* \tag{C.51}$$

For this equilibrium to exist, there needs to be an α^A such that $\alpha_0^* \leq \alpha^A \leq \alpha_1^*$, so I need to show that $\alpha_0^* \leq \alpha_1^*$. Let $\kappa_0 \equiv (1+\beta)\hat{s}(0,1)-\beta$ and $\kappa_1 \equiv (1+\beta)\hat{s}(1,1)-\beta$. Note that $\alpha_1^* - \alpha_0^*$ is defined as:

$$\frac{\kappa_0\bar{\delta}(1+\beta)(1-\hat{s}(1,1)) - \kappa_1\bar{\delta}(1+\beta)(1-\hat{s}(0,1)) - \kappa_1\beta(1-\hat{s}(0,1))}{\kappa_1\kappa_0} \tag{C.52}$$

The denominator in Equation C.52 is positive by A4. For the numerator to be positive, the following expression must be true:

$$\bar{\delta}\frac{1+\beta}{\beta}[\frac{\kappa_0(1-\hat{s}(1,1))}{\kappa_1(1-\hat{s}(0,1))} - 1] \geq 1 \tag{C.53}$$

Note that in order for Equation C.53 to hold, the following must be true:

$$\frac{\kappa_0(1-\hat{s}(1,1))}{\kappa_1(1-\hat{s}(0,1))} - 1 > 0 \tag{C.54}$$

Plugging in κ_0 and κ_1 and rearranging, Equation C.54 is true as long as $\hat{s}(1,1) > \hat{s}(0,1)$: men believe that mothers are more likely to leave after they observe violence than non-mothers. From women's strategy, we know that $\hat{s}(0,1) = 1 - F(\bar{\alpha} - \frac{\beta}{1+\beta})$, and $\hat{s}(1,1) = 1 - F(\frac{1+\tilde{q}\beta}{1+\beta}\bar{\alpha} - \bar{c})$. Consequently, $\hat{s}(1,1) > \hat{s}(0,1)$ if and only if

$$\bar{\alpha}[\frac{1+\tilde{q}\beta}{1+\beta} - 1] > \bar{c} - \frac{\beta}{1+\beta} \tag{C.55}$$

By A1, the right-hand side of Equation C.55 is weakly positive. The left-hand side of Equation C.55 is weakly negative because $\tilde{q} \in [0,1]$. Hence there does not exist any $\tilde{q}$ such that $\hat{s}(1,1) > \hat{s}(0,1)$. This results in $\alpha_0^* > \alpha_1^*$ for any value of $\tilde{q}$. Consequently, there is no α^A such that $\alpha_0^* \leq \alpha^A \leq \alpha_1^*$ and this equilibrium does not exist.

□