Unemployment and Domestic Violence: Theory and Evidence[☆]

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Abstract

Is unemployment the overwhelming determinant of domestic violence that many commentators expect it to be? The contribution of this paper is to examine how changes in unemployment affect the incidence of domestic abuse. Theory predicts that male and female unemployment have opposite-signed effects on domestic abuse: an increase in male unemployment *decreases* the incidence of intimate partner violence, while an increase in female unemployment *increases* domestic abuse. Combining data on intimate partner violence from the British Crime Survey with locally disaggregated labor market data from the UK's Annual Population Survey, we find strong evidence in support of the theoretical prediction.

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1. Introduction

During each global recession of the past decades there have been recurrent suggestions in the media that domestic violence increases with unemployment. In 1993, for example, the British daily newspaper *The Independent* cited a senior police officer as saying of the increase in domestic violence:

> "With the problems in the country and unemployment being as high as it is and the associated financial problems, the pressures within family life are far greater. That must exacerbate the problems and, sadly, the police service is now picking up the pieces of that increase." (Andrew May, Assistant Chief Constable South Wales, The Independent, 9 March 1993)

In a 2008 interview for *The Guardian*, the Attorney General for England and Wales argued that domestic violence will spread as the recession deepens:

> "When families go through difficulties, if someone loses their job, or they have financial problems, it can escalate stress, and lead to alcohol or drug abuse. Quite often violence can flow from that." (Baroness Scotland of Asthal, The Guardian, 20 December 2008)

And in 2012, the executive director of a Washington-based law enforcement think-tank expressed his concerns about rising domestic violence rates in a *USA Today* article:

> "You are dealing with households in which people have lost jobs or are in fear of losing their jobs. That is an added stress that can push people to the breaking point." (Chuck Wexler, USA Today, 29 April 2012)

All these accounts are based on the same underlying logic and suggest that high unemployment may provide the "trigger point" for violent situations in the home. Yet, from a research perspective, it is far from clear whether unemployment is the overwhelming determinant of domestic violence that many commentators a priori expect it to be.[1] Indeed, a basic intra-household bargaining model would suggest that what really matters is the gender-profile of unemployment: an increase in male unemployment and/or a decrease in female unemployment should improve females' relative bargaining power, thereby reducing violence against women in much the same way as a decrease in the gender wage gap (Aizer, 2010).[2]

However, recent empirical evidence also points to factors such as emotional cues (Card and Dahl, 2011) and alcohol (Angelucci, 2008) as potential triggers of partner abuse. Such findings cast doubts on a theory that portrays partner abuse as intentional and rational acts that occur as part of Pareto efficient bargained outcomes. Nevertheless, even in settings where abuse is not an intentionally chosen action, as long as potential abusers have some influence over the likelihood of violent conflicts one would expect the economic logic of the bargaining power argument to carry over.

[1] Specifically, we focus on violence against women perpetrated by their partners. While the term "domestic violence" generally also includes violence between other individuals within households, we will refer to partner violence and domestic violence interchangeably.

[2] The bargainng model provided by Aizer (2010) can be readily extended to include unemployment risk to derive this empirical prediction. An Appendix containing such an extension is available on request from the authors.

To verify this, we first present a novel model of partner abuse with gender-specific unemployment risk and where marriage allows couples to partially diversify income risk through consumption sharing. The model, which has parallels to the behavioural framework provided by Card and Dahl (2011), has the innovative feature that a female does not know the exact type of her husband. For a given couple, the male partner may or may not have a violent predisposition, and his spouse infers his true nature from his behavior. In equilibrium, a male with a violent predisposition can either reveal or conceal his type. When a male with a violent predisposition faces a high unemployment risk, he has an incentive to conceal his true nature by mimicking the behavior of non-violent men as his spouse, given his low expected future earnings, would have a strong incentive to leave him if she were to learn his violent nature. As a consequence, higher male unemployment is associated with a lower risk of violence. Conversely, when a female faces a high unemployment risk, her low expected future earnings would make her less inclined to leave her partner even if she were to learn that he has a violent nature. Anticipating this, a male with a violent predisposition has weakened incentives to conceal his true nature, thus making female unemployment associated with a higher risk of violence. We therefore argue that, at a general level, a robust prediction from economic theory is that high relative male unemployment rate should strengthen females' relative economic position and lower partner violence against them.

Our empirical analysis combines high-quality individual-level data on intimate partner violence from the British Crime Survey (BCS) with local labor market data at the Police Force Area (PFA) level from the UK's Annual Population Survey (APS). Our basic empirical strategy exploits the substantial variation in the change in unemployment across PFAs, gender, and age-groups associated with the onset of the late-2000s recession. Our main specification links a woman's risk of being abused to the unemployment rates among females and males in her local area and age group. We first use basic probit regressions to estimate the effects of total and gender-specific unemployment rates on both physical and non-physical abuse. The structure of our data allows us to control for observable socioeconomic characteristics at the individual level as well as observable economic, institutional and demographic variables at the PFA level. In addition, we control for unobservable time-invariant area level characteristics and national trends in the incidence of abuse through the inclusion of area and time fixed effects. Finally, as our basic regressions suggest that unemployment matters for the incidence of abuse primarily through the gender difference, we instrument for the unemployment gender gap by exploiting differential trends in unemployment by industry and variation in initial local industry structure.

We find no evidence to support the common perception that domestic violence increases with the *overall unemployment rate*. This result parallels findings in previous studies suggesting near zero effects of total unemployment on domestic violence (Aizer, 2010; Iyengar, 2009). However, when we model the incidence of domestic violence as a function of *gender-specific unemployment rates*, as suggested by economic theory, we find that male and female unemployment have opposite-signed effects on domestic violence: while female unemployment increases the risk of domestic abuse, unemployment among males reduces it. The effects are also quantitatively important: the estimates imply that a 3.7 percentage point increase in male unemployment, as observed in England and Wales over the sample period, 2004 to 2011, causes a *decline* in the incidence of domestic abuse by up to 12%. Conversely, the 3.0 percentage point increase in female unemployment observed over the same period causes an *increase* in the incidence of domestic abuse by up to 10%. Thus, our results provide strong support for the predictions arising from the theory. We perform a battery of robustness checks on our data and find that our results are maintained across various alternative specifications. We further note that the relationship between

gender-specific unemployment and partner abuse is unique to this type of crime: for the same group of respondents we do not find the same relationship to the personal experience of theft and general violence.

The paper contributes to a small but growing literature in economics on domestic violence. These studies can be divided into three broad categories. The first examines the relationship between the relative economic status of women and their exposure to domestic violence. Aizer (2010) specifies and tests a simple model where (some) males have preferences for violence and partners bargain over the level of abuse and the allocation of consumption in the household.[3] The key prediction of the model is that increasing a woman's relative wage increases her bargaining power and monotonically decreases the level of violence by improving her outside option. Consistent with this prediction, Aizer (2010) presents robust evidence that decreases in the gender wage gap reduce intimate partner violence against women.

The second type of study investigates the effects of public policy on domestic violence. Iyengar (2009) finds that mandatory arrest laws have the perverse effect of increasing intimate partner homicides. She suggests two potential channels for this: decreased reporting by victims and increased reprisal by abusers. Aizer and Dal Bó (2009) find that no-drop policies, which compel prosecutors to continue with prosecution even if a domestic violence victim expresses a desire to drop the charges against the abuser, result in an increase in reporting. Additionally, they find that no-drop policies also result in a decrease in the number of men murdered by intimates suggesting that some women in violent relationships move away from an extreme type of commitment device, i.e., murdering the abuser, when a less costly one, i.e., prosecuting the abuser, is offered.

The third type of study focuses more closely on male motives for violence. Card and Dahl (2011) argue that intimate partner violence represents expressive behavior that is triggered by payoff-irrelevant emotional shocks. They test this hypothesis using data on police reports of family violence on Sundays during the professional football season in the US. Their result suggests that upset losses by the home team (i.e., losses in games that the home team was predicted to win) lead to a significant increase in police reports of at-home male-on-female intimate partner violence. Bloch and Rao (2002) argue that some males use violence to signal their dissatisfaction with their marriage and to extract more transfers from the wife's family. They test their model using data from three villages in India. Pollak (2004) presents a model in which partners' behavior with respect to domestic violence is transmitted from parents to children.

The remainder of the paper is organized as follows. Section 2 establishes the theoretical prediction, linking gender-specific unemployment risks to the incidence of domestic violence against women. Section 3 describes the data that we use. Section 4 outlines the methodology we employ to test the main ideas behind the model and presents the results. Section 5 concludes.

2. Theory

The main empirical hypothesis that we will take to the data is that the gender-profile of unemployment should matter for the incidence of domestic abuse. In order to verify the generality of this prediction—which follows naturally from a standard intra-household bargaining model—we present a novel theory of domestic violence in which abuse is not an intentionally chosen action and where asymmetric information occurs. Indeed, our model is the first economic theory to

[3]Earlier studies that have also employed a household bargaining approach to analyze domestic violence include Tauchen, Witte and Long (1991) and Farmer and Tiefenthaler (1997).

examine domestic violence in a setting where wives do not have perfect information about their husbands' types. The model is based on the premise that marriage is a non-market institution that can provide some degree of insurance against income risk. A key feature of our framework is that a male may or may not have a violent predisposition and that his female partner infers his type from his behavior. In equilibrium, a male with a violent predisposition can either reveal or conceal his type, and his incentives for doing so depend on each partners' *future* earnings prospects as determined by their idiosyncratic unemployment risks and potential wages.

2.1. A Signaling Model with Forward-Looking Males

We consider a dynamic game of incomplete information involving two intimate partners: a husband (h) and a wife (w). The precise timing of the game is as follows:

1. Nature draws a type for the husband from a set of two possible types $\theta \in \{N,V\}$. Type V has a violent predisposition, while type N has an aversion towards violence. The probability that $\theta = V$ is denoted $\phi \in (0,1)$.

2. The husband learns his type θ and chooses a behavioral effort from a binary set, $\varepsilon \in \{0,1\}$, which, along with his type, determines the probability that future conflictual interactions with his spouse escalate into violence. The probability of violence occurring is denoted by $\kappa(\theta,\varepsilon) \in [0,1]$. We assume that the behavioural effort $\varepsilon = 1$ reduces the risk of violence and that a husband of type N is less prone to violence than a husband of type V. Hence $\kappa(\theta,1) < \kappa(\theta,0)$ for each $\theta \in \{N,V\}$ and $\kappa(N,\varepsilon) < \kappa(V,\varepsilon)$ for each $\varepsilon \in \{0,1\}$. Making the effort $\varepsilon = 1$ costs the husband ξ (measured in utility units). Effort $\varepsilon = 1$ can therefore be interpreted as a costly action for the husband that reduces the likelihood of him "losing control" in a marital conflict situation. For example, he may voluntarily avoid criminogenic risk factors, such as excessive consumption of alcohol, or he may deliberately reduce his exposure to emotional cues (Card and Dahl, 2011).

3. The wife observes the husband's action ε (but not his type θ) and updates her beliefs about his type to $\hat{\phi}(\varepsilon)$. Given her updated beliefs, she then decides whether to remain *married* or whether to get *divorced*, a decision we denote by $\chi = \{m,d\}$. If the wife decides to terminate the relationship, each partner i suffers a divorce cost $\alpha_i \geqslant 0$ (which may be emotional).

4. Nature decides on employment outcomes. Each partner i ($i = h,w$) is employed or unemployed with probabilities $1-\pi_i$ and π_i, respectively. If employed, partner i earns income $y_i = \omega_i$. If unemployed, each individual has an income of $y_i = b$, which can be interpreted as an unemployment benefit.[4] We assume that $b < \omega_i$ for each partner i. If still married, the spouses benefit from consumption having a degree of publicness within the household. Formally, the consumption of partner i is

$$c_i^m = c(y_i,y_j) \equiv y_i + \lambda y_j, \tag{1}$$

where $\lambda \in (0,1]$ parameterizes the degree of publicness of household consumption and where y_j is the income level of the spouse. If divorced, each partner's consumption is simply his or her own income, $c_i^d = y_i$. Partner i obtains utility $u(c_i)$ from consumption, where $u(\cdot)$ is increasing and strictly concave.

[4]The benefit income could be gender-specific, but we ignore this for notational simplicity.

5. If still married, the couple encounters a conflict situation (e.g., heated disagreements) which escalates to violence with probability $\kappa(\theta,\varepsilon)$. The wife suffers additive disutility $\delta_w > 0$ if violence occurs. The husband's disutility from violence is type-dependent, $\delta_N > 0$ for a husband of type N and $\delta_V = 0$ for a husband of type V.

We solve the model for a pure strategy perfect Bayesian equilibrium. Throughout, $(\varepsilon', \varepsilon'')$ denotes that a husband of type V chooses ε' and a husband of type N chooses ε''. Similarly, (χ', χ'') indicates that the wife plays χ' following $\varepsilon = 0$ and χ'' following $\varepsilon = 1$.

2.2. Equilibrium

The wife rationally chooses whether or not to continue the marriage. Her expected payoff from getting divorced is given by:

$$D(\pi_w) = \mathbf{E}[u(c_w^d)|\pi_w] - \alpha_w, \tag{2}$$

where

$$\mathbf{E}[u(c_w^d)|\pi_w] = (1-\pi_w)u(\omega_w) + \pi_w u(b). \tag{3}$$

The expected value to the wife of remaining married depends not only on the wife's own unemployment risk, but also on the husband's unemployment probability and the perceived risk of domestic violence. Formally, the wife's expected payoff from remaining married is given by:

$$M(\pi_h, \pi_w, \varepsilon, \hat{\phi}(\varepsilon)) = \mathbf{E}[u(c_w^m)|(\pi_h, \pi_w)] - \delta_w \left[(1-\hat{\phi}(\varepsilon))\kappa(N,\varepsilon) + \hat{\phi}(\varepsilon)\kappa(V,\varepsilon)\right], \tag{4}$$

where

$$\begin{aligned}\mathbf{E}[u(c_w^m)|(\pi_h, \pi_w)] =& (1-\pi_h)(1-\pi_w)u(\omega_w + \lambda\omega_h)) + \pi_h\pi_w u(b(1+\lambda)) \\ &+ \pi_h(1-\pi_w)u(\omega_w + \lambda b) + \pi_w(1-\pi_h)u(b + \lambda\omega_h).\end{aligned} \tag{5}$$

Note that the wife's expected utility from remaining married is decreasing in her perceived probability that the husband has a violent predisposition, $\hat{\phi}(\varepsilon)$. The wife continues the partnership if and only if her expected value of remaining married exceeds the expected value of getting divorced. The key assumptions of the model are as follows (for expositional convenience, we suppress the arguments of the functions):

A 1. *$M < D$ when $\pi_w = 0$, $\pi_h = 1$, $\varepsilon = 0$ and $\hat{\phi} = 1$.*

A 2. *$M > D$ when $\pi_w = 1$, $\pi_h = 0$, $\varepsilon = 0$ and $\hat{\phi} = 1$.*

A 3. *For any $(\pi_h, \pi_w) \in [0,1]^2$ and $\varepsilon \in \{0,1\}$, $M > D$ when $\hat{\phi} = \phi$.*

The first two assumptions imply that the wife's tolerance of violence depends on her earnings prospects. To be more precise, suppose the wife observes the husband choosing $\varepsilon = 0$. Assumption A1 ("not-take-it-if-employed") then says that if the wife will be *employed with certainty* and the husband will be *unemployed with certainty*, and she knows that the husband has a violent predisposition, then she will choose to divorce the husband. This may be interpreted as implying that economically independent women leave their abusive partners. On the other hand, assumption A2 ("accept-it-if-unemployed") implies that if the wife will be *unemployed with certainty* and the husband will be *employed with certainty*, and she knows that he has a violent predisposition, then she will not leave him. This captures the idea that women who are economically dependent

on their abusers may be unable to leave them. Finally, assumption A3 ("stay-if-no-new-info") says that if the wife retains her prior beliefs, then she will continue the relationship irrespective of their unemployment probabilities and the husband's action. It is therefore consistent with wife accepting to be in a partnership with the husband in the first place.

In addition, we make the following two-part assumption:

A 4. *(i)* $[\kappa(N,0)-\kappa(N,1)]\delta_N > \xi$, *and (ii)* $\alpha_h > \kappa(N,0)\delta_N$.

Part (i) implies that a husband with an aversion towards violence values the reduction in violence associated with making the effort $\varepsilon = 1$ more than its cost. Part (ii) is a sufficient condition to ensure that continued marriage is preferable to divorce for each type of husband $\theta \in \{N,V\}$ at any effort level $\varepsilon \in \{0,1\}$. Thus, the husband has no incentive to choose his behavioral effort in a way that triggers a divorce.

Next we define $\hat{\pi}_w(\pi_h)$ as the unemployment probability for the wife at which she, conditional on having observed the husband choosing $\varepsilon = 0$ and knowing that the husband has a violent predisposition, is indifferent between continued marriage and divorce. Formally, $\hat{\pi}_w(\pi_h)$ is implicitly defined through:

$$M(\pi_h, \hat{\pi}_w(\pi_h), 0, 1) = D(\hat{\pi}_w(\pi_h)). \tag{6}$$

Equation (6) may fail to have a solution in the unit interval. However, the following lemma tells us that it will do so for *some* values of π_h.

Lemma 1. *There exist two values,* π_h' *and* π_h'', *satisfying* $0 \leq \pi_h' < \pi_h'' \leq 1$ *such that (6) has a solution* $\hat{\pi}_w(\pi_h) \in [0,1]$ *for every* $\pi_h \in [\pi_h', \pi_h'']$. *Moreover,* $\hat{\pi}_w(\pi_h)$ *is differentiable at any* $\pi_h \in (\pi_h', \pi_h'')$ *with* $\partial\hat{\pi}_w(\pi_h)/\partial\pi_h > 0$. *In addition,* $\partial\hat{\pi}_w(\pi_h)/\partial\omega_w > 0$ *and* $\partial\hat{\pi}_w(\pi_h)/\partial\omega_h < 0$.

Proof. See Appendix A. □

Figure 1 illustrates a case where $\pi' > 0$ and $\pi_h'' < 1$. The locus $\hat{\pi}_w(\pi_h)$ partitions the set of possible unemployment risk profiles, $(\pi_h, \pi_w) \in [0,1]^2$, into two non-empty subsets or "regimes":

$$R_0 \equiv \left\{(\pi_h,\pi_w)\,|\pi_h \geq \pi_h''\right\} \cup \left\{(\pi_h,\pi_w)\,|\pi_w \leqslant \hat{\pi}_w(\pi_h)\right\}, \tag{7}$$

$$R_1 \equiv \left\{(\pi_h,\pi_w)\,|\pi_h < \pi_h'\right\} \cup \left\{(\pi_h,\pi_w)\,|\pi_w > \hat{\pi}_w(\pi_h)\right\}. \tag{8}$$

An increase in the husband's wage ω_h expands regime R_1 by shifting the locus $\hat{\pi}_w(\pi_h)$ downwards. In contrast, an increase in the wife's wage ω_w expands regime R_0 by shifting the locus upwards.

The following proposition shows that the nature of the game's equilibrium depends on which regime the couple's unemployment risk profile (π_h, π_w) falls within. Since signaling games are prone to equilibrium multiplicity, we focus on pure strategy equilibria that satisfy the commonly used Cho-Kreps "intuitive criterion" (Cho and Kreps, 1987).

Proposition 1. *In each regime there is a unique pure strategy perfect Bayesian equilibrium that satisfies the "intuitive criterion":*

(a) If $(\pi_h, \pi_w) \in R_0$, *then*

$$[(\varepsilon', \varepsilon'') = (1,1), (\chi', \chi'') = (d,m), \hat{\phi}(0) = 1, \hat{\phi}(1) = \phi]$$

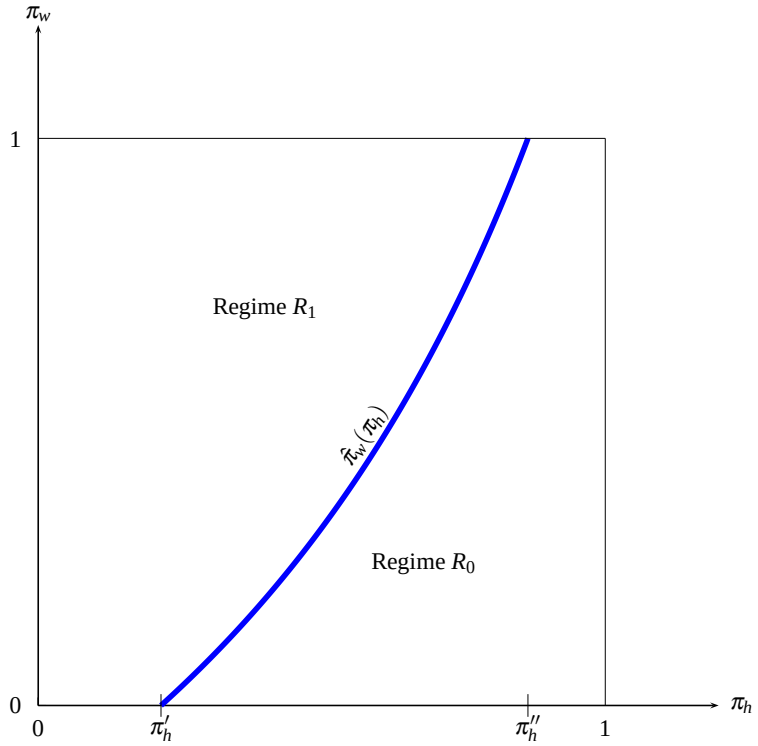


FIGURE 1
The Critical Locus $\hat{\pi}_w(\pi_h)$ Separating Regime R_1 and Regime R_0.

is a "pooling" equilibrium.

(b) If $(\pi_h, \pi_w) \in R_1$, then

$$[(\varepsilon', \varepsilon'') = (0,1), (\chi', \chi'') = (m,m), \hat{\phi}(0) = 1, \hat{\phi}(1) = 0]$$

is a "separating" equilibrium.

Proof. See Appendix A. □

To see that this describes a perfect Bayesian equilibrium, consider each regime in turn, starting with R_0. Here a pooling equilibrium occurs where both types of husbands make the costly effort that reduces the risk of violence. A husband without a violent predisposition makes the effort since he values the reduction in the risk of violence that it generates more than the cost. A husband with a violent predisposition on the contrary makes the effort in order not to reveal his type as doing so would trigger a divorce. Central to the equilibrium are the wife's out-of-equilibrium beliefs and associated action: upon observing $\varepsilon = 0$, the wife would conclude that the husband has a violent predisposition and would choose divorce.

Consider then regime R_1. In this case the husband knows that the wife is economically vulnerable and would not leave him even if she were to believe that he has a violent predisposition.

A husband with a violent predisposition therefore has no incentives to make the costly effort that would reduce the risk of violence. A husband without a violent predisposition again values the reduction in the risk of violence more than the cost of making the effort. The wife's belief updating follows Bayes' rule and her continuing of the partnership with either type of husband is rational given her relatively weak earnings prospects.

2.3. Empirical Prediction

The above results form the basis of our empirical predictions: men with a violent predisposition may strategically mimic the behavior of non-violent men, thus concealing their type, when facing relatively weak earnings prospects (Regime R_0) in the form of relatively high unemployment risk and relatively low wages. In contrast, when men face relatively strong earnings prospects (Regime R_1) they will be less inclined to conceal any violent predisposition they may have. Noting that the difference in the equilibrium probability of violence between Regime R_1 and R_0 is $\phi\left[\kappa\left(V,0\right)-\kappa\left(V,1\right)\right]>0$ we arrive at the following central empirical prediction:

Prediction 1.

- *A higher risk of male unemployment and lower wages for men are associated with a lower risk of domestic violence.*
- *A higher risk of female unemployment and lower wages for women are associated with a higher risk of domestic violence.*

Thus, we will build our empirical approach on the theoretical prediction that a woman's risk of being abused depends on gender-specific unemployment risks. In particular, in the empirical analysis we relate a woman's risk of experiencing domestic abuse to the local unemployment rates for males and females in her own age group.[5]

3. Data and Descriptive Statistics

3.1. Domestic Abuse Data from the British Crime Survey

We use data on the incidence of domestic abuse from the British Crime Survey (BCS). The BCS is a nationally representative repeated cross-sectional survey of people aged 16 and over, living in England and Wales, which asks the respondents about their attitudes towards and experiences of crime. The BCS employs two different methods of data collection with respect to domestic abuse. The first method, available from the survey's inception in 1981, is based on face-to-face interviews. However, the unwillingness of respondents to reveal instances of abuse to interviewers implies that this method significantly underestimates the true extent of domestic violence. To overcome such non-disclosure, a self-completion module on interpersonal violence (IPV), which the respondents complete in private by answering questions on a laptop, was

[5]On a related note, Raphael and Winter-Ebmer (2001) find a negative association between female unemployment and state level rape rates which they suggest may be attributable to an increased number of encounters with potential perpetrators if an individual is working away from home. Rape perpetrated by a non-partner is, however, by definition not an outcome decided within a relationship, and therefore is not applicable to our theoretical framework.

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
Age	38.93	11.67	Qual: Degree or above	0.236	0.425
Ethnicity: White	0.928	0.258	Qual: High Ed < Degree	0.137	0.344
Ethnicity: Asian	0.028	0.165	Qual: A level	0.150	0.357
Ethnicity: Black	0.023	0.150	Qual: GCSE grades A-C	0.237	0.426
Ethnicity: Other	0.021	0.143	Qual: Other	0.096	0.295
Religion: None	0.216	0.412	Qual: None	0.143	0.350
Religion: Christian	0.740	0.439	Single	0.355	0.479
Religion: Muslim	0.017	0.128	Married	0.455	0.498
Religion: Hindu	0.009	0.092	Separated	0.046	0.209
Religion: Sikh	0.004	0.060	Divorced	0.125	0.331
Religion: Jewish	0.003	0.057	Widowed	0.019	0.136
Religion: Buddhist	0.005	0.069	Cohabiting	0.120	0.325
Religion: Other	0.008	0.087	Long-standing illness	0.179	0.383
Number of children	0.493	0.896	Poor health	0.031	0.174
Children younger than 5	0.110	0.313			
Number of Observations		86,898			

TABLE 1
Demographic Characteristics of the BCS Sample.

introduced.[6] We use BCS data for the survey years 2004/05 to 2010/11, covering interviews conducted between April 2004 and March 2011, and base our analysis on data on domestic violence from the self-completion IPV module.[7]

The BCS data has several key strengths as a source of data on domestic abuse. The IPV module in particular is unique in an international context, insofar that through self-completion the respondent does not need to provide answers directly to an interviewer. Furthermore, to reassure the respondent of privacy, the BCS randomly selects only one person per household who is exposed to the survey only once, implying that other household members including any partner will not know what questions the respondent has faced. In contrast the corresponding US survey, the National Crime Victimization Survey, administers the same set of questions to all household members every six months over a three year period, implying that the content of the questionnaire is common knowledge within the household.

Over our sample period, only 11 percent of those who report, in the IPV module, having been subjected to physical abuse by a partner also report being exposed to intrahousehold abuse in the general interviewer-based part of the BCS survey. Similarly, only 48 and 50 percent report having mentioned the abuse to a medical staff and to the police respectively. Hence compared to alternative data from interviewer-based surveys, or data derived from police reports or hospital episodes statistics, the BCS IPV data is likely to provide substantially more comprehensive data on the incidence of domestic abuse. Furthermore, while police reports and hospital episode data can be used to measure incidence of (severe) domestic violence, such data generally cannot distinguish between multiple victims versus multiple events for the same victim. Finally, using micro-level data obviously allows us to control for individual level characteristics.

[6]The IPV module was first introduced in 1996. In 2001 it was used for a second time and the use of laptops was introduced. Since the 2004/05 survey the IPV module has been included on an annual basis, with a comparable set of questions.

[7]In the 2010-11 BCS survey, half of the sample were, in a trial, asked the same abuse questions, but in a simplified sequential format. For consistency we include in our sample only those respondents who were asked the abuse questions in the format consistent with the previous years' surveys.

Table 2: Categories of Domestic Abuse.

Behavior	**Physical Abuse**	**Non-Physical Abuse**
Prevented from fair share of h-hold money		x
Stopped from seeing friends and relatives		x
Repeatedly belittled you		x
Frightened you, by threatening to hurt you		x
Pushed you, held you down or slapped you	x	
Kicked, bit, or hit you	x	
Choked or tried to strangle you	x	
Threatened you with a weapon	x	
Threatened to kill you	x	
Used a weapon against you	x	
Used other force against you	x	

The BCS IPV module is answered by respondents aged 16 to 59, and we focus our analysis on intimate partner violence experienced by women.[8] Table 1 presents descriptive statistics of our sample.

In the IPV module respondents are presented with a list of behaviors that constitute domestic abuse and are asked to indicate which, if any, they have experienced in the 12 months prior to the interview. Table 2 presents this list of behaviors from which we construct two binary indicators of abuse. The first, *physical abuse*, is a dummy variable indicating whether the respondent had any type of physical force used against them by a current or former intimate partner. The second, *non-physical abuse*, indicates whether the respondent was threatened, exposed to controlling behaviors or deprived of the means needed for independence by a current or former partner.

In our sample, 3.0% of women report episodes of physical abuse in the past 12 months and 4.4% declare having experienced non-physical abuse.[9] Figure 2 illustrates the extent to which the incidence of physical abuse in particular varies with the demographic characteristics of the respondents. In general, exposure to physical abuse declines with age and with academic qualifications acquired after compulsory education. It varies relatively little with religion and ethnicity, but increases with the number of children.[10] With respect to marital status, it should be noted that this refers to the respondent's formal status at the time of the interview, which is hence observed *after* the 12 month period to which the abuse questions refer. The high reported rate of abuse among separated and divorce women therefore suggests a "reverse causality". The high rate of incidence among singles also emphasizes the fact that "intimate partners" include current and past boyfriends.[11] Due to the highly endogenous nature of the respondent's current marital status we do not make use of this information except as a final sensitivity check on our

[8]While the IPV module is also completed by male respondents, abuse against men is less common, generally less violent, and with no apparent connection to labour market conditions.

[9]The fraction of women reporting at least one of the two types of abuse was 5.7%.

[10]The relationship between physical violence and ethnicity is somewhat unexpected given the data from the US where blacks are typically found to have a higher incidence (Aizer, 2010).

[11]For respondents who are not currently married we also use a cohabitation dummy to indicate that the respondent is currently living with a partner. The incidence of abuse among currently cohabiting respondents is about double that of currently married respondents.

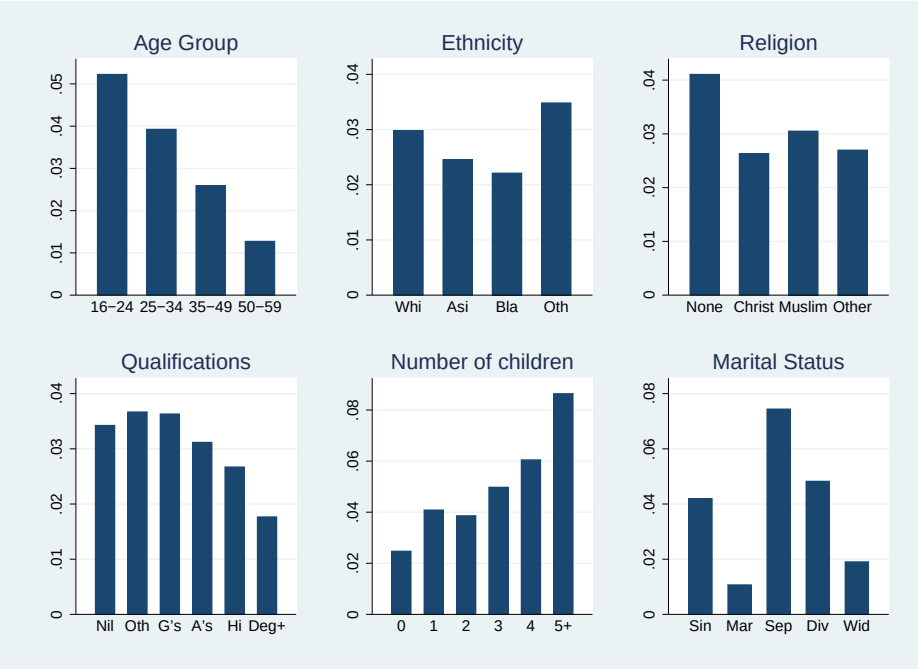


FIGURE 2
Incidence of Physical Abuse by Demographic Characteristics.

estimates.[12] Figure 3 shows the trends in physical and non-physical abuse which, if anything, suggests that the overall level of abuse is lower towards the end of our sample period than at the beginning. A corresponding decline has been observed over the same period in the most extreme form of violence against women: the rate of female homicide where the prime suspect is an intimate partner decreased by 6.3 percent between 2003-07 and 2007-11 (Smith et al., 2012).

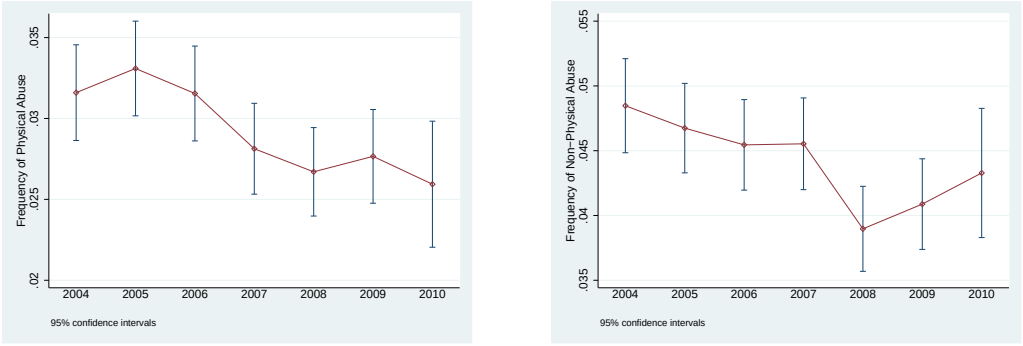
3.2. Labor Market Data from the Annual Population Survey

We merge our individual-level data from the BCS with labor market data from the Annual Population Survey (APS). The APS combines the UK Labour Force Survey (LFS) with the English, Welsh and Scottish LFS boosts. Datasets are produced quarterly, with each dataset containing 12 months of data. This means that we can, for each respondent in the BCS, match the period to which the IPV questions refer to a closely corresponding 12 month period in the APS.[13] Each respondent is matched to local labour market conditions corresponding to the Police Force Area (PFA) of residence, of which there are 42 in our data.[14] The APS data is available in a finer geography, and can hence be aggregated up to the PFA level.

[12]The same applies to any information we have on the individual's current employment status. Hence we make no use of such information.

[13]For instance, any respondent interviewed in the first three months of 2005 is matched to the labour market data for the calendar year 2004, whereas a BCS responded interviewed between April and June in 2005 is matched to labour market data for the period April 2004 to March 2005 etc.

[14]There are 43 PFAs in England and Wales. However, the City of London PFA is a small police force which covers the "Square Mile" of the City of London. As this is a small area enclosed in the many times larger Metropolitan PFA



(a) Physical Abuse (b) Non-Physical Abuse

FIGURE 3
Trends in Domestic Abuse in England and Wales.

Our theory developed in the previous section stresses the role of male and female unemployment *risk* for the incidence of domestic violence. In the empirical analysis we will relate the incidence of domestic violence to the *observed* unemployment rates for the respondent's female and male peers, as defined by age group and geographical area. Hence we effectively interpret the observed unemployment rate not only as a measure of the direct incidence of unemployment, but also more broadly as an indicator for the perceived risk of unemployment. This interpretation is supported by the literature that documents workers' subjective unemployment expectations and relates it to the current level of unemployment. For instance for the US, Schmidt (1999) shows how workers' average beliefs about the likelihood of job loss in the next 12 months closely tracked the unemployment rate over the period 1977-96. The limited data that is available on unemployment expectations in the UK equally supports the notion that individual expectations of future unemployment risk are positively associated with the current unemployment rate. The British Social Attitudes (BSA) survey has, in selected years, asked respondents: (i) how "secure" they feel in their jobs, and (ii) whether they expect to see a change in the number of employees in their workplace. Both variables saw changes with the onset of the latest recession. In 2005, 78 percent of respondents reported feeling secure in their jobs; in 2009-2010, this figure had dropped to 73 percent. Similarly, while 16 percent of respondents reported expecting a reduction in the number of employees in the workplace in 2006-2007, this number had increased to 26 percent in 2009-2010.[15]

Table 3 presents basic descriptive statistics for local unemployment rates, broken down by gender and age group.[16] Figure 4 shows that the increase in the rate of unemployment (left-hand scale) associated with the latest recession was far from uniform across gender and age

we merge the two. This leaves us with 42 PFAs. They are Avon and Somerset, Bedfordshire, Cambridgeshire, Cheshire, Cleveland, Cumbria, Derbyshire, Devon and Cornwall, Dorset, Durham, Essex, Gloucestershire, Greater Manchester, Hampshire, Hertfordshire, Humberside, Kent, Lancashire, Leicestershire, Lincolnshire, City of London and Metropolitan Police District, Merseyside, Norfolk, Northamptonshire, Northumbria, North Yorkshire, Nottinghamshire, South Yorkshire, Staffordshire, Suffolk, Surrey, Sussex, Thames Valley, Warwickshire, West Mercia, West Midlands, West Yorkshire, Wiltshire, Dyfed-Powys, Gwent, North Wales and South Wales.

[15]Using data from the Skills Surveys, Campbell et al. (2007) document a similar fall in the average individual expectations of job loss between 1997 and 2001, a period of declining unemployment.

[16]The age grouping used in our analysis follows that conventionally used by the Office for National Statistics.

Table 3: Summary Statistics for Local Unemployment Rates.

Variable	Mean	Std. Dev.	Min	Max
Total unemployment	0.060	0.020	0.022	0.129
Unemployment by gender				
Male	0.064	0.023	0.022	0.149
Female	0.054	0.018	0.014	0.103
Unemployment by age group				
aged 16-24	0.150	0.045	0.0290	0.283
aged 25-34	0.055	0.021	0.009	0.136
aged 35-49	0.039	0.016	0.010	0.104
aged 50-64	0.035	0.014	0.004	0.086

NOTES.— The table provides averages over the time-interval January 2003-December 2010 based on data from the APS which is provided in overlapping 12 month periods: January-December, April-March, July-June, October-September. Reported standard deviations and minimum and maximum values are over 1,218 PFA-period observations.

groups. In particular, the impact of the recession is reflected more strongly in male than in female unemployment. As a consequence, we observe a widening of the male-female unemployment gap (right-hand scale) in the latter part of the sample period. In addition to local unemployment, we also use the APS to construct measures of mean hourly real wages.

Figure 5 contrasts the change over the sample period from 2004/05 to 2010/11 in the incidence of physical abuse with corresponding changes in male and female unemployment rates across the 42 PFAs. The figure highlights a substantial spatial variation in the change in unemployment over the sample period. Moreover, the local changes in female unemployment are not obviously correlated with the corresponding local changes in male unemployment.[17] Inspection of the figure further suggests that several PFAs in which men were relatively more affected by unemployment increases (e.g., the North-East) saw relative decreases in the incidence of physical abuse. Indeed, if anything, the figure suggests a more positive association between relative increases in female unemployment and relative increases in abuse.

4. Empirical Specification and Results

4.1. Baseline Specification

This section presents our main analysis where we relate a female respondent's experience of domestic violence to the local level of unemployment. We focus in particular on the rates of female and male unemployment within the respondent's own age-group as these are likely to be the most relevant for the respondent's own unemployment risk as well as that of her (potential) partners. As the APS data is released quarterly, with each dataset containing 12 months of data, we define a "period" variable, denoted t, where a given period contains the particular APS release

[17] Indeed, relevant to our identification strategy, less than forty percent of the variation in the gender unemployment gap is explained by area, period, and age group effects.

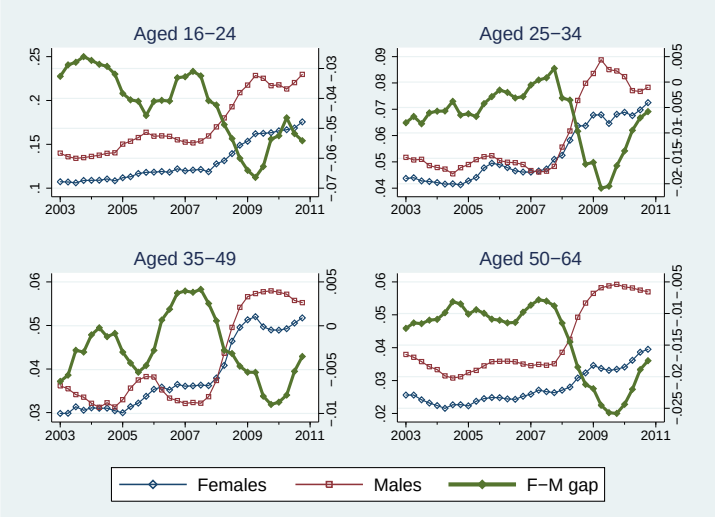


FIGURE 4
Gender-Specific Unemployment Rates and the Female-Male Unemployment Gap by Age Group in England and Wales, 2003 to 2011.

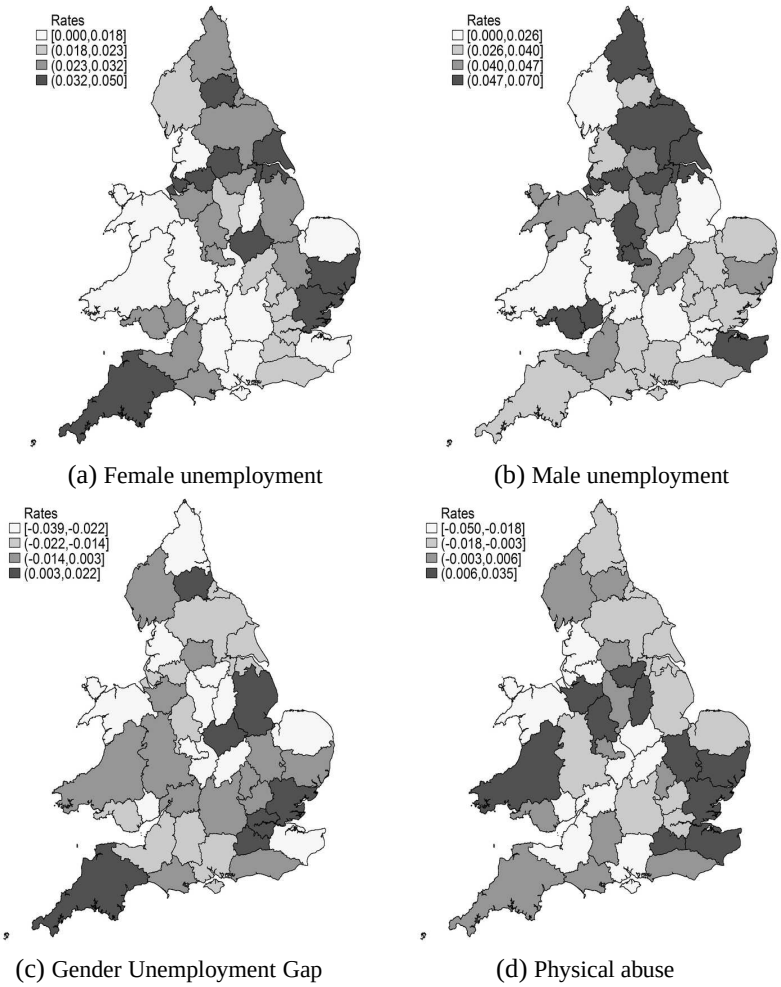
and BCS data from the following three months. Constructed in this way, our data stretches over 28 periods.

As the outcome variables in our analysis are binary indicators of abuse, we estimate probit models. In particular, the basic model for the latent propensity for abuse against individual i in PFA j in period t and within age group g is given by

$$y^*_{ijtg} = \beta X_{ijtg} + \gamma^f UNEMPL^f_{jtg} + \gamma^m UNEMPL^m_{jtg} + \lambda_t + \alpha_j + \varepsilon_{ijtg} \tag{9}$$

where X_{ijtg} includes demographic controls at the individual level, $UNEMPL^f_{jtg}$ and $UNEMPL^m_{jtg}$ are the female and male unemployment rate in i's own age-group in police-force area j during period t, and ε_{ijtg} is a normally distributed random term.[18] The parameters λ_t and α_j are fixed effects for time-periods and police force areas respectively, and thus control for the aggregate trend in the outcome variable and for factors affecting abuse that vary across areas but are fixed over time. Thus, our basic model identifies the impact of gender-specific unemployment on domestic abuse from variation in trends across PFAs.

[18] In Section 4.3 we further include area-level controls.



(a) Female unemployment (b) Male unemployment

(c) Gender Unemployment Gap (d) Physical abuse

FIGURE 5

Change in Female and Male Unemployment, in the Female-Male Unemployment Gap, and in Incidence of Physical Abuse across Police Force Areas in England and Wales, 2004 to 2011.

4.2. Baseline Results

Our basic results for the probability of being a victim of *physical abuse* are provided in Table 4.[19] Specification (1) gives the average marginal effect of the *total unemployment rate* within the own age group on the incidence of physical abuse. The estimated model includes basic individual-level controls, age measured in years and a set of dummies indicating ethnicity, as well as area- and time fixed-effects. We see that the marginal effect is small and insignificant.[20] This result parallels findings in previous studies (Aizer, 2010; Iyengar, 2009) suggesting near

[19]Estimates from linear probability models are very similar and are available on request from the corresponding author.

[20]A (non-reported) regression on aggregate unemployment - across genders *and* age groups - is also not significant, but also has less precision due to low local variation from the national trend.

Table 4: Impact of Unemployment on Physical Abuse - Main Specification.

Specification	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Unemployment in own-age group	-0.030 (0.018)						0.008 (0.019)
Female unemployment in own-age group		0.090** (0.027)	0.097** (0.027)	0.093** (0.027)	0.102** (0.028)	0.094** (0.027)	
Male unemployment in own-age group		-0.088** (0.021)	-0.090** (0.021)	-0.097** (0.022)	-0.081** (0.027)	-0.089** (0.021)	
Female unemployment in other age groups				-0.013 (0.065)			
Male unemployment in other age groups				-0.047 (0.055)			
Female real wage in own-age group					0.005 (0.009)		
Male real wage in own-age group					-0.001 (0.006)		
Female-Male unemployment gap in own age group							0.094** (0.022)
Area and time fixed effects	yes	yes	yes	yes	yes	yes	yes
Basic demographic controls	yes	yes	yes	yes	yes	yes	yes
Additional demographic controls	no	no	yes	yes	yes	yes	yes
Area-specific linear time trends	no	no	no	no	no	yes	no
Observations	86,877	86,877	86,731	86,731	86,731	86,731	86,731

NOTES.— Standard errors clustered on police force area and age group in parentheses. "Basic demographic controls" include age measured in years and dummies for ethnicity category. "Additional demographic controls" include dummies for type of qualifications and religious denomination, number of children, and a dummy to indicate the presence of at least one child under the age of five in the household. The complete set of estimated marginal effects is provided in Appendix C. ** Significant at 1%. * Significant at 5%.

zero effects of total unemployment on domestic violence. Specification (2) reports the estimated average marginal effect of each gender-specific unemployment rate within the own age group. The marginal effect of female unemployment in the own age group is positive and statistically significant. The magnitude of the coefficient suggests that a 1 percentage point increase in the own-age female unemployment rate causes an increase in the likelihood of the respondent being a victim of physical abuse by 0.091 percentage points or 3% of the sample mean. We also see that the estimated average marginal effect of male unemployment is negative and statistically significant. The magnitude of the coefficient indicates that a 1 percentage point increase in male unemployment in the respondent's own age group causes a decline in the risk of physical abuse by 0.089 percentage points – again about 3% of the sample mean.

Specification (3) includes additional individual-level controls. These include variables that are not determined by birth, but can be expected to be pre-determined relative to the period referred to in the abuse question: qualifications, children and religious denomination. The estimated average marginal effects increase slightly in absolute size for both male and female unemployment in the own age group. Controls for male and female unemployment within age groups other than the own are added in specification (4). We find that male and female unemploy-

Table 5: Impact of Unemployment on Non-Physical Abuse - Main Specification.

Specification	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Unemployment	-0.024						0.021
in own-age group	(0.023)						(0.024)
Female unemployment		0.091*	0.102**	0.108**	0.110**	0.104**	
in own-age group		(0.038)	(0.037)	(0.038)	(0.038)	(0.037)	
Male unemployment		-0.083**	-0.081**	-0.074*	-0.061	-0.085**	
in own-age group		(0.029)	(0.030)	(0.032)	(0.037)	(0.031)	
Female unemployment				0.031			
in other age groups				(0.080)			
Male unemployment				0.035			
in other age groups				(0.068)			
Female real wage					-0.002		
in own-age group					(0.010)		
Male real wage					0.008		
in own-age group					(0.007)		
Female-Male unemployment							0.093**
gap in own age group							(0.032)
Area and time fixed effects	yes	yes	yes	yes	yes	yes	yes
Basic demographic controls	yes	yes	yes	yes	yes	yes	yes
Additional demographic controls	no	no	yes	yes	yes	yes	yes
Area-specific linear time trends	no	no	no	no	no	yes	no
Observations	86,877	86,877	86,731	86,731	86,731	86,731	86,731

NOTES.— See notes to Table 4. ** Significant at 1%. * Significant at 5%.

ment within the own age group still have opposite-signed effects on the risk of physical abuse while unemployment in age groups other than the own appears to have little impact. Our theory suggests that potential wages of men and women might also matter for the incidence of abuse. Therefore, we add measures of local female and male mean hourly real wage rates within the own age group in specification (5). Controlling for wage-effects in this way leaves the marginal effects for male and female unemployment largely unchanged. The estimated wage effects are small and insignificant.[21] Specification (6) shows that our estimates are robust to the introduction of area-specific linear time trends.

A striking feature of the results in Table 4 is that the estimated effects of female and male unemployment are of very similar absolute magnitude, but of opposite sign. This suggests that what matters for the incidence of abuse is not the overall level of unemployment but rather the unemployment gender gap. Hence, in specification (7), we report the estimated marginal effect of the linear difference between female and male unemployment rates within the own age group as well as that of the total unemployment rate in the own age group. The estimated effect of

[21] In fact, the coefficient have the "wrong" signs. In order to look further into this we obtained alternative measures of local wages from the Annual Survey of Hours and Earnings (ASHE) which is generally regarded as the best quality wage data in the UK. Using this alternative data source, the coefficient on wages have the expected sign, but remain statistically insignificant.

Table 6: Impact of Unemployment on Abuse - Alternative Age Specifications.

Specification	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	Physical Abuse				*Non-Physical Abuse*			
Female unemployment	0.097**	0.085**	0.104**	0.091**	0.102**	0.080*	0.095*	0.0876
in own-age group	(0.027)	(0.029)	(0.028)	(0.035)	(0.037)	(0.040)	(0.042)	(0.048)
Male unemployment	-0.090**	-0.095**	-0.067*	-0.085*	-0.081**	-0.090*	-0.066	-0.078
in own-age group	(0.021)	(0.028)	(0.029)	(0.037)	(0.030)	(0.039)	(0.039)	(0.048)
Linear Age Effect	yes	no	no	no	yes	no	no	no
Age Group Fixed Effects	no	yes	yes	yes	no	yes	yes	yes
Age group * Period FEs	no	no	yes	yes	no	no	yes	yes
Age group * Area FEs	no	no	no	yes	no	no	no	yes
Observations	86,731	86,731	86,731	86,731	86,731	86,731	86,731	86,731

NOTES.— See notes to Table 4. ** Significant at 1%. * Significant at 5%.

the unemployment gender gap is noticeably strong whereas the estimated effect of the overall unemployment rate is not statistically significant.

Table 5 presents corresponding results for *non-physical abuse*. The estimated marginal effects for this alternative outcome variable are strikingly similar to those for physical abuse.

In the regressions reported in Tables 4 and 5 we include age-in-years as a control variable; this has the advantage of allowing us to using the exact information on the respondent's age. In contrast, our labour market variables are measured at the age group level. In Table 6 we verify that our estimates are robust to how age is controlled for. Specification (1) repeats the estimates from our main specification (3) in Tables 4 and 5 for reference. In specification (2) we replace the linear age term with age group dummies, thus allowing for age-group fixed effects along with the area and period fixed-effects. In specification (3) we interact the age group dummies with the period dummies, thus allowing each age group to have a separate non-linear trend. In specification (4) we further interact the age group dummies with the area dummies, thus allowing each PFA to be associated with a separate fixed effect for each age group. While the precision of the estimates obviously reduce as more general age effect are included, the point estimates are largely unaffected.

Table 7 breaks the estimated effect of the gender unemployment gap down by population subgroup in three dimensions. The top panel shows that the relationship is strong for all age groups up to the age of 49. That nothing is found in the oldest age group is not entirely surprising given the low incidence of domestic violence in this age groups.

The lower left panel in Table 7 splits the respondents into those with "high" educational attainment (A-level or above) versus those with "low" attainment (GCSE level or below). One may argue that individuals' with lower qualifications are more at risk of unemployment and that, as a consequence, they may be more affected by gender unemployment gap in terms of the incidence of abuse.[22] While the point estimate is higher for low qualified women, the difference in the estimated effects is not statistically significant.

One may similarly argue that female unemployment is less relevant when the labour force participation (LFP) rate is relatively low. To consider this, we calculate the average female LFP

[22]However, noting that the earnings drop associated with unemployment tends to be larger among individuals with higher qualifications, the effect could in principle go in the either direction.

Table 7: Impact of Unemployment Gender Gap on Abuse by Population Subgroup.

Age Group			
16-24	25-34	35-49	50-59
0.082**	0.122**	0.128*	-0.047
(0.030)	(0.044)	(0.063)	(0.096)

Own Qualification Level		*Female LFP in Cell*	
"Low"	"High"	"Low"	"High"
0.114*	0.089**	0.075**	0.137**
(0.053)	(0.024)	(0.025)	(0.045)
Observations		86,731	

NOTES.— The table reports average marginal effects from three probit estimations using the preferred specification with basic and additional demographic controls (see notes to Table 4) of the impact of the unemployment gender gap on physical abuse. ** Significant at 1%. * Significant at 5%.

over the sample period for each PFA-age group cell and partition the cells into those with above versus below median female LFP rate. Estimates by subgroup is reported in the lower right panel of Table 7. Again, while not statistically significantly different, the point estimates suggest that the effect of the gender unemployment gap on the incidence abuse is, if anything, stronger when the female LFP is higher.

The observed relationship between the gender-profile of unemployment and intimate partner violence can be expected to be particular to this outcome and not hold for general victim experience of crime. To verify this we replace our main outcome variables with other reported crime outcomes. The BCS respondents are asked whether, over the past 12 months, they have experienced theft from their person or been a victim of a violent assault.[23] The results of this analysis are displayed in Table 8. For both theft and violence we find, in line with the literature (Raphael and Winter-Ebmer (2001) and Öster and Agell (2008)), that the probability of reporting having been a victim of crime increases with total unemployment. Moreover, unlike domestic abuse where there can be expected to be a direct power relationship between the perpetrator and the abuser, these outcomes if anything increase with both the male and the female rate of unemployment.

To summarize, we find no evidence to support the view that total unemployment increases

[23]In both outcomes the victim is present at the time of the crime, so gender is readily identifiable. In the case of theft, as this crime is mainly an opportunist event, the gender of either victim or perpetrator should however play only a minor role. In the case of violence, one might expect that in cases of affray the victim and assailant often share the same gender. The exact questions answered by the respondents were: "Was anything you were carrying stolen out of your hands or from your pockets or from a bag or case?" and "Has anyone, including people you know well, DELIBERATELY hit you with their fists or with a weapon of any sort or kicked you or used force or violence in any other way?".

Table 8: Impact of Unemployment on Experience of Crime.

Specification	Theft from Person	Theft from Person	Violence against Person	Violence against Person
Total unemployment	0.099**		0.036*	
in own-age group	(0.017)		(0.015)	
Female unemployment		0.042		0.039
in own-age group		(0.029)		(0.027)
Male unemployment		0.056**		0.003
in own-age group		(0.020)		(0.021)
Area and time fixed effects	yes	yes	yes	yes
Basic demographic controls	yes	yes	yes	yes
Additional demographic controls	yes	yes	yes	yes
Observations	86,725	86,725	86,726	86,726

NOTES.— Standard errors clustered on police force area and age group in parentheses. For details of "basic" and "additional" demographic controls, see notes to Table 4. ** Significant at 1%. * Significant at 5%.

domestic abuse. Instead, our results suggest that male and female unemployment have distinct impacts on the incidence of domestic abuse: increases in male unemployment are associated with declines in domestic abuse while increases in female unemployment have the opposite effect. This finding is consistent with economic theory. The magnitude of the estimated relationships imply (a) that a 3.7 percentage point increase in male unemployment, as observed in England and Wales between 2004 and 2011, causes a *decline* in the incidence of domestic abuse of between 10.1% and 12.1%, and (b) that the 3.0 percentage point increase in female unemployment over the sample period causes an *increase* in the incidence of domestic abuse of between 9.1% and 10.3%.

4.3. Extended Results: Area Level Controls

Our estimates in the previous section would be biased if there were omitted variables that are correlated with local unemployment and that affect the incidence of domestic abuse. For example, a positive effect of unemployment on crime in general may trigger a response by the criminal justice system, such as increased police efforts or higher incarceration rates. If the response by the criminal justice system reduces domestic abuse by increasing deterrence, omitting controls related to the general level of criminal activity and the criminal justice system biases the estimated effect of unemployment on domestic abuse. Similarly, assuming that the consumption of alcohol and drugs is correlated with unemployment and also affects domestic abuse, omitting these factors from the regression again biases the estimates.[24] Additionally, selective migration might confound our estimates. For example, employment-driven migration of low-skilled men from areas with high local unemployment to areas with low local unemployment creates a downward bias (due to "compositional effects") if low-skilled males have a higher propensity to abuse their partners than high-skilled males. To mitigate such omitted-variables bias, we now control extensively for observable institutional and demographic covariates at the police-force area-level.

The results for *physical abuse* are shown in panel (a) of Table 9. Specification (3) repeats our preferred specification from Table 4 for convenience. In specification (8), we add a set of controls

[24]The association between business cycles and alcohol consumption is not clear cut. For instance, Dee (2001) notes that average drinking is generally pro-cyclical, but finds that binge-drinking is counter-cyclical.

Table 9: Impact of Unemployment on Physical Abuse and Non-Physical Abuse - Additional Controls.

Specification	**(3)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
			(a) *Physical Abuse*				
Female unemployment in own-age group	0.097** (0.027)	0.096** (0.027)	0.102** (0.028)	0.087** (0.027)	0.097** (0.027)	0.107** (0.028)	0.092** (0.026)
Male unemployment in own-age group	-0.090** (0.021)	-0.088** (0.021)	-0.107** (0.021)	-0.086** (0.025)	-0.089** (0.021)	-0.069** (0.026)	-0.109** (0.021)
			(b) *Non-Physical Abuse*				
Female unemployment in own-age group	0.102** (0.037)	0.101** (0.038)	0.105** (0.038)	0.091* (0.039)	0.104** (0.037)	0.109** (0.039)	0.092* (0.037)
Male unemployment in own-age group	-0.081** (0.030)	-0.080** (0.031)	-0.090** (0.031)	-0.077* (0.034)	-0.083** (0.031)	-0.073* (0.037)	-0.104** (0.030)
Local area crime-related controls	no	yes	no	no	no	no	no
Local area drugs and alcohol	no	no	yes	no	no	no	no
Local area qualifications distribution	no	no	no	yes	no	no	no
Selective migration	no	no	no	no	yes	no	no
Unemployment in neighboring areas	no	no	no	no	no	yes	no
Health and marital status	no	no	no	no	no	no	yes
Observations	86,731	86,731	80,011	86,731	86,731	86,731	86,674

NOTES.— Standard errors clustered on police force area and age group in parentheses. All specifications include area and time fixed effects, basic demographic controls and additional demographic controls (see notes to Table 4). Local area crime related-controls include police force manpower per 10,000 capita, violent and non-violent crimes per 10,000 capita, and average time from charge to magistrate court appearance. Local area drugs and alcohol includes the number of arrests for drugs possession per 10,000 capita and the number of alcohol-related hospitalizations per 10,000 capita. Selective migration includes the number of in- and out-migrants as a percentage of the PFA population in the respondent's own-age and gender group. For a detailed description of controls used in this section, see Appendix B. ** Significant at 1%. * Significant at 5%.

that capture the general level of criminal activity and the potential response by the criminal justice system to it. In particular, we include per capita measures of violent and non-violent crimes. We include per capita measures of police force manpower and a proxy for the "efficiency" of the criminal justice system: the average time from charge to magistrate court appearance. Overall, the inclusion of these crime-related controls leaves our key estimates unchanged. This suggests that variation in overall crime rates and policing and criminal justice efforts do not confound our estimated effects of unemployment on domestic abuse.

Specification (9) includes a measure of the hospitalization rate for alcohol-related conditions as well as a per capita measure of drugs possession.[25] Adjusting for the cyclical consumption of criminogenic commodities in this way does not alter our main finding that male and female unemployment have opposite-signed effects on the incidence of physical abuse. In specification (10), we account for the possibility of skill-selective migration by including the qualification distribution in the respondent's own-age group. Specification (11) controls directly for area-level migration by including the number of in- and out-migrants as a percentage of the PFA population in the respondent's own-age group. In each case, the estimated marginal effects of

[25]Information on hospitalization rates for alcohol-related conditions in particular is only available for England. This accounts for the drop in the number of observations in this particular specification.

gender-specific unemployment remain largely unaffected.

The two remaining specifications provide additional robustness checks. Specification (12) shows that our results are robust to the introduction of controls for the average own-age group female and male unemployment rates in neighboring police-force areas. Specification (13) shows that our main findings remain intact also when we include controls that capture a respondent's marital and health status (measured at the time of the interview and hence after the period to which the abuse information pertains).

Panel (b) of Table 9 provides the corresponding extended results for *non-physical abuse*. Again, the general conclusion is that the estimated effects of unemployment by gender are robust to the inclusion of further controls. The results presented in this section thus suggest that our initial finding that female unemployment increases domestic abuse while male unemployment reduces it is robust to including a wide variety of observable institutional and demographic covariates at the PFA level.

4.4. Instrumental Variables Estimation

The analysis so far has treated the local unemployment variables as exogenous regressors. Concerns about potential omitted variables motivated our use of additional regressors in Section 4.3. However, this may not have entirely solved the potential issue of omitted variables and would not address any potential problem of simultaneity. Solving these problems requires constructing measures of local labor market conditions that do not reflect characteristics of female and male workers, which could be affected by violence itself, or unobservables that might be correlated with violence. Hence as a final robustness check, we also consider an instrumental variables approach. Building on the work of Bartik (1991) and Blanchard and Katz (1992), we interact the initial local industry composition of employment with the corresponding national industry-specific trends in unemployment.

Specifically, we use APS data on local PFA industry composition by gender and age group at baseline, defined as the calendar year 2003, which we combine with APS data on industry unemployment rates by gender and age group at the national level over the sample period.[26] For each PFA, gender, age-group and time period we construct an industry-predicted unemployment rate as follows,

$$\widehat{UNEMPL}^{h}_{jtg} = \sum_{k} \psi^{h}_{jgk} UNEMPL^{h}_{ktg}, \tag{10}$$

where ψ^{h}_{jgk} is the share of industry k among employed individuals of gender h and age group g in PFA j at baseline, and where $UNEMPL^{h}_{ktg}$ is the unemployment rate, at the national level, in industry k among individuals of gender h and age group g in time period t. Hence (10) is a weighted average of the national industry-specific unemployment rates where the weights reflect the baseline local industry composition in the relevant gender and age group. The weights are thus fixed over time and do not reflect local sorting into industries over the sample period.

[26] Eight industries are used in the analysis based on a condensed version of the UK Standard Industrial Classification of Economic Activities, SIC(2007):"Agriculture, forestry, fishing, mining, energy and water supply", "Manufacturing", "Construction", "Wholesale, retail & repair of motor vehicles, accommodation and food services", "Transport and storage, Information and communication", "Financial and insurance activities, Real estate activities, Professional, scientific & technical activities, Administrative & support services", "Public admin and defence, social security, education, human health & social work activities", "Other services". The "industry unemployment rate" is defined as the unemployed by industry of last job as percentage of economically active by industry.

Table 10: Impact of Unemployment on Physical Abuse - Instrumental Variables Estimation.

Specification	**(1a)** Probit	**(1b)** IV Probit	**(2a)** Probit	**(2b)** IV Probit	**(3a)** Probit	**(3b)** IV Probit
	(a) *Gender Unemployment Gap in Own Age Group*					
Predicted unemployment gender gap in own age group		1.761** (0.104)		1.733** (0.106)		1.723** (0.102)
	(b) *Physical Abuse*					
Gender unemployment gap in own age group	0.088** (0.021)	0.104* (0.046)	0.090** (0.021)	0.104* (0.049)	0.089** (0.021)	0.105* (0.049)
	(c) *Non-Physical Abuse*					
Gender Unemployment gap in own age group	0.083** (0.030)	0.101 (0.060)	0.081** (0.031)	0.083 (0.062)	0.084** (0.031)	0.081 (0.063)
Area and time fixed effects	yes	yes	yes	yes	yes	yes
Basic demographic controls	yes	yes	yes	yes	yes	yes
Additional demographic controls	no	no	yes	yes	yes	yes
Area-specific linear time trends	no	no	no	no	yes	yes
Observations	86,877	86,877	86,731	86,731	86,731	86,731

NOTES.— Standard errors clustered on police force area and age group in parentheses. For details of "basic" and "additional" demographic controls, see notes to Table 4. ** Significant at 1%. * Significant at 5%.

Our approach draws on recent work by Albanesi and Sahin (2013) who, using US data, show how the gender gap in unemployment tends to vary over the business cycle. In particular, they find that unemployment rises more for men than for women during recessions, and also decreases more for men in subsequent recoveries. The authors also explore the role played by gender differences in industry structure. Specifically with respect to the recession in the late 2000s, Albanesi and Sahin show how gender differences in industry composition explain around half of the difference in the observed unemployment growth. Based on this observation, and on our previous finding that unemployment appears to matter for the incidence of domestic abuse only in the form of the unemployment gender gap, our IV analysis will be focused on estimating models where the incidence of domestic violence is related to the gender unemployment gap, defined as

$$UNEMPL_{jtg}^{gap} \equiv UNEMPL_{jtg}^{f} - UNEMPL_{jtg}^{m}. \tag{11}$$

We instrument for the actual gender gap using the corresponding industry-predicted gender gap in unemployment.

Table 10 presents the results for three different specifications, each estimated using both basic probit and IV probit models. Specification (1) in Table 10 includes the same controls as in specification (2) in Table 4. Hence the difference is that here we include the unemployment rates in the own age group in the form of the gender gap rather than in levels. Specification (2) includes the same controls as in specification (3) in Table 4, while specification (3) includes the

same controls as specification (6) in Table 4. The probit estimated average marginal effects of the gender unemployment gap on physical and non-physical abuse reported in columns (1a), (2a), and (3a) are naturally in line with the corresponding estimates in Tables 4 and 5.

Turning to the IV probit estimates, panel (a) of Table 10 confirms that our instrument is indeed a strong and relevant predictor of the gender unemployment gap in the own age group. More precisely, the estimates show that the actual variation in gender unemployment gap trends across PFAs and age groups is strongly positively related to the corresponding variation in the unemployment gap trends predicted using local variation in industry structure at baseline.

The IV probit estimated average marginal effects of the gender unemployment gap on the incidence of domestic abuse are reported in columns (1b), (2b), and (3b). For physical abuse we find that, for all three specifications, the IV estimated marginal effects are slightly larger than, but not statistically significantly different from, the corresponding probit estimated effects. Each estimated marginal effect is also statistically significant. For non-physical abuse, the IV probit estimated average marginal effects of the gender unemployment gap are also very similar to the basic probit estimated effects. However, due to lower precision, they are not statistically significant. Overall, we view our IV estimates as evidence that our basic probit estimates do not exaggerate the impact of unemployment on domestic abuse.

5. Concluding Comments

This paper has examined the effect of unemployment in England and Wales on partner abuse against women. The geographical variation in unemployment in these countries induced by the Great Recession provides an interesting context in which to look at domestic abuse. Our empirical approach was motivated by a theoretical model in which partnership provides insurance against unemployment risk through the pooling of resources. The key theoretical result is that an increased risk of male unemployment lowers the incidence of intimate partner violence, while an increased risk of female unemployment leads to a higher rate of domestic abuse. We have demonstrated that this prediction accords well with evidence from the British Crime Survey matched to geographically disaggregated labor market data. In particular, our empirical results suggest that a 1 percentage point increase in the male unemployment rate causes a *decline* in the incidence of physical abuse against women of around 3 percent, while a corresponding increase in the female unemployment rate has the opposite effect. Moreover, our results also rationalize findings in previous studies of near zero effects of the *overall* rate of unemployment on domestic violence.

Overall, our theoretical model and empirical results contrast the conventional wisdom that male unemployment in particular is a key determinant of domestic violence. Quite the contrary, latent abusive males who are in fear of losing their jobs or who have lost their jobs may rationally abstain from abusive behaviors, as they have an economic incentive to avoid divorce and the associated loss of spousal insurance. However, when women are at a high risk of unemployment, their economic dependency on their spouses may prevent them from leaving their partners. This in turn might prompt male partners with a predisposition for violence to reveal their abusive tendencies. Thus, high female unemployment leads to an elevated risk of intimate partner violence. From a policy perspective, it is therefore conceivable that policies designed to enhance women's employment security could prove an important contributor to domestic violence reduction.

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Appendix A: Proofs

Proof of Lemma 1. We start by noting that, due to the functional form, $M(\pi_h, \pi_w, \varepsilon, \hat{\phi})$ is a continuously differentiable function of $(\pi_h, \pi_w, \hat{\phi})$ and $D(\pi_w)$ is a continuously differentiable function of π_w. Differentiating yields that $\partial M/\partial \pi_h < 0$, $\partial D/\partial \pi_h = 0$, $\partial M/\partial \pi_w < 0$, and $\partial D/\partial \pi_w < 0$, and, importantly, due to the concavity of $u(\cdot)$,

$$\frac{\partial (M-D)}{\partial \pi_h} < 0 \quad \text{and} \quad \frac{\partial (M-D)}{\partial \pi_w} > 0, \tag{A1}$$

where the latter inequality follows from concavity of $u(\cdot)$. Hence an increase in the wife's unemployment risk makes marriage more attractive to her, as the loss in earnings associated with unemployment has a larger negative impact on her utility when she does not have access to her partner's income.

Next we define

$$\pi_h' \equiv \begin{cases} 0 & \text{if } M(0,0,0,1) \leq D(0) \\ \sup\{\pi_h \in [0,1] \,|\, M(\pi_h,0,0,1) \geq D(0)\} & \text{if } M(0,0,0,1) > D(0) \end{cases} \tag{A2}$$

and

$$\pi_h'' \equiv \begin{cases} 1 & \text{if } M(1,1,0,1) \geq D(1) \\ \inf\{\pi_h \in [0,1] \,|\, M(\pi_h,1,0,1) \leq D(1)\} & \text{if } M(1,1,0,1) < D(1) \end{cases} \tag{A3}$$

Consider the case where $M(0,0,0,1) > D(0)$, the second case in (A2). By assumption A1, $M(1,0,0,1) < D(0)$. Hence it follows that $\pi_h' \in (0,1)$ and is the unique critical value for π_h at which $M = D$ given $\pi_w = 0$ (and $\varepsilon = 0$ and $\hat{\phi} = 1$). Similarly, consider the case where $M(1,1,0,1) < D(1)$, the second case in (A3). By assumption A2, $M(0,1,0,1) > D(1)$. Hence it follows that $\pi_h'' \in (0,1)$ and is the unique critical value for π_h at which $M = D$ given $\pi_w = 1$ (and $\varepsilon = 0$ and $\hat{\phi} = 1$). Next we verify that $\pi_h' < \pi_h''$. This follows trivially if $\pi_h' = 0$ and/or $\pi_h'' = 1$. Hence consider the case where $\pi_h' > 0$ and $\pi_h'' < 1$ (as in Figure 1). Note that since, per definition of π_h', $M(\pi_h', 0, 0, 1) = D(0)$, and using (A1) it follows that $M(\pi_h', 1, 0, 1) > D(1)$ and hence that $\pi_h'' > \pi_h'$.

Next we verify that (6) has a solution in the unit interval if and only if $\pi_h \in [\pi_h', \pi_h'']$. Consider the case where $\pi_h' > 0$. Then, $M(\pi_h, \pi_w, 0, 1) > D(\pi_w)$ at any $(\pi_h, \pi_w) \in [0, \pi_h') \times [0,1]$, implying that (6) does not have a solution in the unit interval. Similarly, consider the case where $\pi_h'' < 1$. Then, $M(\pi_h, \pi_w, 0, 1) < D(\pi_w)$ for any $(\pi_h, \pi_w) \in (\pi_h'', 1] \times [0,1]$, implying that (6) does not have a solution in the unit interval. Thus (6) can have a solution in the unit interval only if $\pi_h \in [\pi_h', \pi_h'']$. Consider then some $\pi_h \in (\pi_h', \pi_h'')$. By definition of π_h' and π_h'' if follows that $M(\pi_h, 0, 0, 1) < D(0)$ and $M(\pi_h, 1, 0, 1) > D(1)$. It then follows from continuity of the value functions and (A1) that (6) has a unique solution we denote by $\hat{\pi}_w(\pi_h) \in (0,1)$.

Implicitly differentiating (6) yields that

$$\frac{\partial \hat{\pi}_w}{\partial \pi_h} = -\frac{\partial (M-D)/\partial \pi_h}{\partial (M-D)/\partial \pi_w} > 0, \tag{A4}$$

where the sign follows from (A1).

The sign of the derivatives of $\hat{\pi}_w(\pi_h)$ with respect to the partners' wages follow in a similar

way from the observation that

$$\frac{\partial (M-D)}{\partial \omega_h} > 0 \quad \text{and} \quad \frac{\partial (M-D)}{\partial \omega_w} < 0, \tag{A5}$$

where the latter inequality follows due to concavity of $u(\cdot)$. □

Proof of Proposition 1. We start by defining the husband's expected utility in the case of divorce,

$$D(\pi_h, \varepsilon) \equiv \mathbf{E}\left[u\left(c_h^d\right)|\pi_h\right] - \alpha_h - \xi\varepsilon, \tag{A6}$$

where $\mathbf{E}\left[u\left(c_h^d\right)|\pi_h\right]$ is defined analogously to (3). The husband's expected utility from continued marriage on the other hand is type-dependent,

$$M(\pi_h, \pi_w, \varepsilon; \theta) = \mathbf{E}\left[u\left(c_h^m\right)|(\pi_h, \pi_w)\right] - \delta_\theta \kappa(\theta, \varepsilon) - \xi\varepsilon, \tag{A7}$$

where $\mathbf{E}\left[u\left(c_h^m\right)|(\pi_h, \pi_w)\right]$ is defined analogously to (5). In particular, we obtain that a husband of type N ranks the possible outcomes with respect to marriage and behavioral effort in the following way:

$$M(\pi_h, \pi_w, 1; N) > M(\pi_h, \pi_w, 0; N) > D(\pi_h, 0) > D(\pi_h, 1). \tag{A8}$$

To see this, note that the first inequality follows from part (i) of assumption A4, the second inequality follows from part (ii) of assumption A4, and the third inequality is trivial. In contrast, a husband of type V ranks the possible outcomes in the following way:

$$M(\pi_h, \pi_w, 0; V) > M(\pi_h, \pi_w, 1; V) > D(\pi_h, 0) > D(\pi_h, 1). \tag{A9}$$

The first inequality follows from the assumption that $\delta_V = 0$. The second inequality follows from the fact that $\alpha_h > \xi$ which is implied by the combination of parts (i) and (ii) of assumption A4.

The key difference between (A8) and (A9) is that a husband of type V does not value the reduction in the risk of violence associated with the effort $\varepsilon = 1$ whereas a husband of type N values it more than its cost.

There are four possible pure strategy profiles that the husband can adopt:

- **Strategy profile (1):** separation with $(\varepsilon', \varepsilon'') = (0, 1)$;
- **Strategy profile (2):** separation with $(\varepsilon', \varepsilon'') = (1, 0)$;
- **Strategy profile (3):** pooling with $(\varepsilon', \varepsilon'') = (1, 1)$;
- **Strategy profile (4):** separation with $(\varepsilon', \varepsilon'') = (0, 0)$.

We will consider each possible pure strategy profile within each regime.

Regime R_1

Given that $(\pi_h, \pi_w) \in R_1$, the wife obtains a higher expected payoff from marriage than from divorce with any husband of type θ and any effort choice ε by the husband. We will now consider the four possible pure strategy profiles in turn:

Strategy profile (1). Bayesian updating implies that $\hat{\phi}(0) = 1$ and $\hat{\phi}(1) = 0$, and the wife rationally chooses to remain married at either choice of ε, $\chi' = \chi'' = m$. According to (A8) and (A9) each type of husband obtains his most preferred outcome and hence has no incentive to deviate, confirming that this is a PBE.
Strategy profile (2). Bayesian updating implies that $\hat{\phi}(0) = 0$ and $\hat{\phi}(1) = 1$, and the wife rationally chooses to remain married at either choice of ε, $\chi' = \chi'' = m$. In this case neither type of husband obtains his most preferred outcome and, since the wife responds to either choice of ε by continuing the marriage, each type of husband would have an incentive to deviate.
Strategy profile (3). Bayesian updating implies that $\hat{\phi}(1) = \phi$, while $\hat{\phi}(0)$ is not determined by Bayesian updating. Irrespective of how the wife updates her beliefs at $\varepsilon = 0$, she rationally chooses to remain married at either choice of ε, $\chi' = \chi'' = m$. Given this, a husband of type V would be better off deviating to $\varepsilon = 0$.
Strategy profile (4). Bayesian updating implies that $\hat{\phi}(0) = \phi$, while $\hat{\phi}(1)$ is not determined by Bayesian updating. Irrespective of how the wife updates her beliefs at $\varepsilon = 1$, she rationally chooses to remain married at either choice of ε, $\chi' = \chi'' = m$. Given this, a husband of type N would be better of deviating to $\varepsilon = 1$.

Regime R_0

In this regime, the wife's decision whether or not to remain married depends on her beliefs and on the husband's observed effort.
Strategy profile (1). Bayesian updating implies that $\hat{\phi}(0) = 1$ and $\hat{\phi}(1) = 0$. The wife then (by assumptions A1 and A3) continues the marriage if and only if the husband makes the effort $\varepsilon = 1$, that is $\chi'' = m$ and $\chi' = d$. A type V would then be better of deviating to $\varepsilon = 1$ as by doing so he would avoid triggering divorce.
Strategy profile (2). Bayesian updating implies that $\hat{\phi}(0) = 0$ and $\hat{\phi}(1) = 1$. Given these updated beliefs, the wife rationally responds (by Assumption 3) to $\varepsilon = 0$ by continuing the marriage, that is $\chi' = m$. This then cannot be an equilibrium since a type V husband could then deviate to $\varepsilon = 0$ and obtain is his most preferred outcome.
Strategy profile (3). Bayesian updating implies that $\hat{\phi}(1) = \phi$ and, by assumption A3, the wife rationally responds to $\varepsilon = 1$ by continuing the marriage, $\chi'' = m$. Note that $\hat{\phi}(0)$ is not determined by Bayesian updating. Suppose that the wife, at $\varepsilon = 0$, believes that the husband is of type V, that is $\hat{\phi}(0) = 1$. She would then rationally respond to $\varepsilon = 0$ by choosing divorce, $\chi' = d$. Given this, and given the preference orderings in (A8) and (A9), neither husband type has any incentive to deviate. Note also that the out-of-equilibrium belief $\hat{\phi}(0) = 1$ satisfies the Choo-Kreps "intuitive criterion". For a husband of type N, $\varepsilon = 0$ is equilibrium dominated as this type, by choosing $\varepsilon = 1$, obtains his most preferred outcome in equilibrium. In contrast, a husband of type V would benefit if the wife were to respond to $\varepsilon = 0$ by continuing the marriage.
Strategy profile (4). Bayesian updating implies that $\hat{\phi}(0) = \phi$ but does not determine $\hat{\phi}(1)$. Given this, and by assumption A3, the wife rationally continues the marriage upon observing $\varepsilon = 0$, that is $\chi' = m$. Next, note that by (A8) for a husband of type N in particular to prefer to choose $\varepsilon = 0$ it must be that the wife responds to $\varepsilon = 1$ by divorcing, that is $\chi'' = d$. Hence for this to be a PBE, $\hat{\phi}(1)$ must be such that the wife prefers divorce upon observing $\varepsilon = 1$. In particular, from Assumption 3 it must be that $\hat{\phi}(1) > \phi$. Such a PBE however does not satisfy the "intuitive criterion". For a husband of type V, $\varepsilon = 1$ is equilibrium dominated as this type, by choosing $\varepsilon = 0$, obtains his most preferred outcome in equilibrium. In contrast, a husband of type N would benefit from deviating if the wife were to respond to $\varepsilon = 1$ by continuing the marriage. Hence,

by the intuitive criterion, the wife's out-of-equilibrium beliefs must be $\hat{\phi}(1) = 0$, contradicting that she would choose $\chi'' = d$. □

Appendix B: Variable Descriptions

The following variables are used in Section 4.3 ("Extended Results"):

1. **Magistrate court timeliness:** This is a measure of the duration from first listing of an offence to completion, for defendants in indictable cases in magistrates courts, and hence captures the "efficiency" of the criminal justice system, post arrest. The data is released on an annual basis from the Ministry of Justice, and is at the Local Justice Area (LJA) geography which coincides with the PFAs we use in the analysis.

2. **Police force manpower:** This variable refers to overall police manpower per 10,000 capita at PFA level. It is comprised of the number of (full-time equivalent) police officers, police community support officers, and police staff. This data is released annually by the Home Office.

3. **Violent crime rate:** This is the number of recorded violent crimes per 10,000 capita at PFA level. The data is from the Home Office.

4. **Non-violent crime rate:** This is the number of recorded non-violent crimes per 10,000 capita at PFA level. The data is from the Home Office.

5. **Alcohol hospitalizations:** This is the number of alcohol hospitalisations per 10,000 capita at PFA level. This is from the Local Alcohol Profiles for England datasets, available from the North West Public Health Observatory data, which is part of Public Health England. Note that this data is not available for the 4 welsh PFAs. We aggregated the data up to PFA level from Local Authority level.

6. **Internal migration:** These are number of in- and out-migrants as a percentage of the PFA population in each age/gender group. The statistics are compiled using the data series "Internal Migration by Local Authorities in England and Wales" which are released annually by the Office for National Statistics (ONS) to coincide with the mid-year population estimates. The data has received the "National Statistics" accreditation, and are understood to be the best official source of information on internal migration in England and Wales. The data is available by gender and in 5 year age groups at Local Authority level. Here we aggregated up to PFA level and using the APS defined age grouping.

7. **Drugs possession:** This is the number of arrests for possession per 10,000 capita at PFA level. This data is from the quarterly Home Office Offences tables.

The data in (1)-(6) come from annual tables, so has been interpolated to produce data at the period frequency.

Appendix C: Complete Set of Estimated Marginal Effects

Table 11: Impact of Unemployment on Physical Abuse - Full Set of Results from Main Specification.

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Unemployment	-0.030						0.008
in own age group	(0.018)						(0.019)
Female unemployment		0.090**	0.097**	0.093**	0.102**	0.094**	
in own age group		(0.027)	(0.027)	(0.027)	(0.028)	(0.027)	
Male unemployment		-0.088**	-0.090**	-0.097**	-0.081**	-0.089**	
in own age group		(0.021)	(0.021)	(0.022)	(0.027)	(0.021)	
Female unemployment				-0.013			
in other age groups				(0.065)			
Male unemployment				-0.047			
in other age groups				(0.055)			
Female real wage					0.005		
in own age group					(0.009)		
Male real wage					-0.001		
in own age group					(0.006)		
Female-Male unemployment							0.094**
gap in own age group							(0.022)
Age in years	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ethnicity: White	-0.002	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Ethnicity: Asian	-0.011*	-0.011*	-0.007	-0.007	-0.007	-0.007	-0.007
	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Ethnicity: Black	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Qualifications:			-0.001	-0.001	-0.001	-0.001	-0.001
Other			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Qualifications:			-0.003	-0.003	-0.003	-0.003	-0.003
GCSE grades A-C			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Qualifications:			-0.009**	-0.009**	-0.009**	-0.009**	-0.009**
A Level			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Qualifications:			-0.008**	-0.008**	-0.008**	-0.008**	-0.008**
Higher educ, below degree			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Qualifications:			-0.020**	-0.020**	-0.020**	-0.020**	-0.020**
Degree or above			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Religion: Christian			-0.008**	-0.008**	-0.008**	-0.008**	-0.008**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Religion: Muslim			-0.009	-0.009	-0.009	-0.009	-0.009
			(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Religion: Hindu			-0.015	-0.015	-0.015	-0.015	-0.015
			(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Religion: Sikh			-0.011	-0.011	-0.011	-0.011	-0.011
			(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Religion: Jewish			-0.037*	-0.037*	-0.037*	-0.037*	-0.037*
			(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Religion: Buddhist			0.008	0.008	0.008	0.008	0.008
			(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Religion: Other			0.009	0.009	0.009	0.009	0.009
			(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Number of children			0.005**	0.005**	0.004**	0.005**	0.005**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Child under age			0.005*	0.005*	0.005*	0.005*	0.005*
five in h-hold			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Area and time fixed effects	yes	yes	yes	yes	yes	yes	yes
Basic demographic controls	yes	yes	yes	yes	yes	yes	yes
Additional demographic controls	no	no	yes	yes	yes	yes	yes
Area-specific linear time trends	no	no	no	no	no	yes	no
Observations	86,877	86,877	86,731	86,731	86,731	86,731	86,731

NOTES.— See Table 4. ** Significant at 1%. * Significant at 5%.

Table 12: Impact of Unemployment on Non-Physical Abuse - Full Set of Results from Main Specification.

Specification	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Unemployment	-0.024						0.021
in own age group	(0.023)						(0.024)
Female unemployment		0.091*	0.102**	0.108**	0.110**	0.104**	
in own age group		(0.038)	(0.037)	(0.038)	(0.038)	(0.037)	
Male unemployment		-0.083**	-0.081**	-0.074*	-0.061	-0.085**	
in own age group		(0.029)	(0.030)	(0.032)	(0.037)	(0.031)	
Female unemployment				0.031			
in other age groups				(0.080)			
Male unemployment				0.035			
in other age groups				(0.068)			
Female real wage					-0.002		
in own age group					(0.010)		
Male real wage					0.008		
in own age group					(0.007)		
Female-Male unemployment							0.093**
gap in own age group							(0.032)
Age in years	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ethnicity: White	0.007	0.007	0.005	0.005	0.005	0.005	0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Ethnicity: Asian	-0.008	-0.008	-0.011	-0.011	-0.011	-0.011	-0.011
	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Ethnicity: Black	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Qualifications:			0.000	0.000	-0.000	- 0.000	0.000
Other			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Qualifications:			-0.003	-0.003	-0.003	-0.003	-0.003
GCSE grades A-C			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Qualifications:			-0.009**	-0.009**	-0.010**	-0.009**	-0.009**
A Level			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Qualifications:			-0.008**	-0.008**	-0.009**	-0.008**	-0.008**
Higher educ, below degree			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Qualifications:			-0.024**	-0.024**	-0.024**	-0.023**	-0.024**
Degree or above			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Religion: Christian			-0.008**	-0.008**	-0.008**	-0.008**	-0.008**
			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Religion: Muslim			-0.013	-0.012	-0.013	-0.013	-0.013
			(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Religion: Hindu			0.002	0.002	0.002	0.002	0.002
			(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Religion: Sikh			0.017	0.017	0.017	0.017	0.017
			(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Religion: Jewish			-0.021	-0.021	-0.021	-0.022	-0.021
			(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Religion: Buddhist			0.004	0.004	0.004	0.004	0.004
			(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Religion: Other			0.006	0.006	0.006	0.006	0.006
			(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Number of children			0.007**	0.007**	0.007**	0.007**	0.007**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Child under age			0.004	0.004	0.004	0.004	0.004
five in h-hold			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Area and time fixed effects	yes	yes	yes	yes	yes	yes	yes
Basic demographic controls	yes	yes	yes	yes	yes	yes	yes
Additional demographic controls	no	no	yes	yes	yes	yes	yes
Area-specific linear time trends	no	no	no	no	no	yes	no
Observations	86,877	86,877	86,731	86,731	86,731	86,731	86,731

NOTES.— See Table 4. ** Significant at 1%. * Significant at 5%.

Appendix D: A Simple Model of Household Bargaining Under Uncertainty (Not for Publication)

In this appendix, we present a bargaining model of domestic violence. The model extends the Nash bargaining approach presented by Aizer (2010) to allow for income uncertainty. In order to simplify the analysis we assume additively separable preferences. When incomes are uncertain, the couple has an incentive to bargain at the ex-ante stage, before their incomes are realized, and we assume that the outcome of their ex-ante negotiations is binding.

As one would expect, a key feature of ex-ante bargaining is risk sharing. Hence the couple's ex-ante bargained allocation will smooth consumption as far as possible given the uncertainty they face regarding total household income. However, by direct analogy, the couple also have an incentive to "smooth violence" across states of nature. As there is no uncertainty regarding the available choices of violence, the ex-ante bargained allocation features equilibrium violence that is independent of the income realization. However, it is not independent of the partners' income *prospects*. Generalizing the theoretical prediction from Aizer (2010), we show that a shifting of the income probability distribution which reduces the husband's expected income and increases the wife's expected income while leaving the probability distribution over household income unchanged reduces the ex-ante bargained level of violence.

This conclusion holds for two possible consequences of failing to agree in the ex-ante bargaining. It holds if a failure to agree ex-ante implies that the couple will not engage in any further negotiations but instead behave non-cooperatively or divorce, and it also holds if failure to agree ex-ante leads to ex-post bargaining once all uncertainty is resolved.

5.1. Setup

Consider a couple consisting of a husband h and a wife w. Let the preferences of the spouses be defined over private consumption (c_i) and violence (v), with the husband's utility increasing in violence and the wife's decreasing in violence. For simplicity, suppose that the utility functions of the spouses are additively separable and given by

$$U_h(c_h,v) = u_h(c_h) + \varphi_h(v) \quad \text{and} \quad U_w(c_w,v) = u_w(c_w) + \varphi_w(1-v), \tag{A10}$$

where $c_i \in R_+$ and $v \in [0,1]$, and where each sub-utility function is twice continuously differentiable, strictly increasing and strictly concave, with $u_i(c_i) \to -\infty$ as $c_i \to 0^+$.

Each partner faces income uncertainty, with y_h and y_w being independent draws from two distributions $F_h(y_h)$ and $F_w(y_w)$ defined on a common discrete support denoted $Y \equiv \{y_1, y_2, ..., y_N\}$, ordered increasingly. The associated probability density functions are denoted by $f_h(y_h)$ and $f_w(y_w)$, respectively. Hence the set of possible *states of the world* is $Y \times Y = Y^2$ with a typical element (y_h, y_w). The probability distributions are known to the couple who bargain ex-ante, before uncertainty is resolved, over which allocation to choose. An *allocation* is defined as a mapping $\{c_h(y_h,y_w), c_w(y_h,y_w), v(y_h,y_w)\}$ detailing the couple's consumption profile and violence choice in each state of the world $(y_h,y_w) \in Y^2$. The consumption profile (c_h,c_w) chosen at the state (y_h,y_w) must satisfy being non-negative in both components and $c_h + c_w \leq y_h + y_w$.

5.2. Ex-Ante Bargaining: Consumption and Violence Smoothing

When bargaining ex-ante, the fallback is either to bargain ex-post or not to bargain at all. If the fallback is not to bargain at all, then each partner j will have a fallback expected utility which depends only on his or her own income distribution F_j. If the fallback is to bargain ex-post—i.e.,

once all uncertainty has been resolved—then each partner's fallback expected utility depends on both F_h and F_w. Both cases will be considered below. We will highlight here some properties of ex-ante bargaining which are *independent* of the nature of the fallback. Hence we adopt the general notation $U_i^0(F)$ for the fallback expected utility of partner i, where $F \equiv \{F_h, F_w\}$.

Given an equilibrium-negotiated allocation $\{c_h(y_h,y_w), c_w(y_h,y_w), v(y_h,y_w)\}$, the gain in expected utility to the husband is

$$\Delta_h = U_h^* - U_h^0(F) = \sum_{y_h \in Y} \sum_{y_w \in Y} f_h(y_h) f_w(y_w) [u_h(c_h(y_h,y_w)) + \varphi_h(v(y_h,y_w))] - U_h^0(F), \quad \text{(A11)}$$

while the corresponding gain in expected utility to the wife is

$$\Delta_w = U_w^* - U_w^0(F) = \sum_{y_h \in Y} \sum_{y_w \in Y} f_h(y_h) f_w(y_w) [u_w(c_w(y_h,y_w)) + \varphi_w(1 - v(y_h,y_w))] - U_w^0(F), \quad \text{(A12)}$$

where U_h^* and U_w^* are the equilibrium expected utilities of the husband and the wife respectively.

The ex-ante Nash bargained agreement maximizes $\Delta_h \Delta_w$. Consider first the first order conditions with respect to the partners' consumption levels in state (y_h,y_w). These reduce to:

$$\frac{u_h'(c_h(y_h,y_w))}{u_w'(c_w(y_h,y_w))} = \Delta_r, \quad \text{(A13)}$$

where

$$\Delta_r \equiv \frac{\Delta_h}{\Delta_w}, \quad \text{(A14)}$$

denotes the relative expected utility gain of the husband. Noting that the right hand side of (A13) is independent of the state of the world, it follows that the same is true of the left hand side. Hence, as the bargained outcome is ex-ante efficient it features *complete consumption insurance* in the standard sense that the ratio of the partners' marginal utilities of consumption is constant across states of the world (see e.g. Cochrane, 1991). It does *not* imply complete consumption smoothing in the sense that each partner has an consumption that is independent of the state of the world: this is since the couple face uncertainty regarding total household income, $y_h + y_w$, which per construction is not constant across states of the world.

Considering violence, the first order condition for the bargained level of violence $v(y_h,y_w)$ reduces to

$$\frac{\varphi_h'(v(y_h,y_w))}{\varphi_w'(1 - v(y_h,y_w))} = \Delta_r. \quad \text{(A15)}$$

Noting again that the right hand side is constant across states of the world, it follows that the same is true for the left hand side. In contrast to consumption, this implies that $v(y_h,y_w)$ *is* constant across states of the world. The analogy to consumption is clear: in both cases, concavity of each partner's utility function implies a benefit from smoothing. In the case of consumption, the possibility for smoothing is limited due to the uncertainty about total household income. There is no such uncertainty regarding the available choices of violence, and thus violence is perfectly smoothed across states of the world. Hence the following conclusion holds irrespective of the specification of the fallback utilities.

Lemma 2. *Ex-ante Nash bargaining by the couple leads to:*

(a) Complete consumption insurance: the partners' relative marginal utilities are constant

across states of the worlds [see eq. (A13)];

(b) Complete violence smoothing: the chosen violence level is constant across states of the world [see eq. (A15)].

Moreover, as can be seen from (A13) and (A15), the bargained outcome is effectively summarized by Δ_r. Of particular interest to us is to note that:

Lemma 3. *The ex-ante bargained state-independent level of violence $v^* = v(y_h, y_w)$ is strictly decreasing in Δ_r.*

In general, the ex-ante bargained allocation "discriminates" against the partner whose expected utility gain from implementing it exceeds that of the other partner. Thus, as the relative expected utility gain of the husband (Δ_r) increases, he has to "compensate" his spouse by agreeing to a lower level of equilibrium violence.

In order to conduct comparative statics on the bargained outcome, it is useful to rephrase the bargaining problem as the general problem of choosing expected utilities U_h^* and U_w^* for the two partners in order to maximize

$$\left(U_h^* - U_h^0(F)\right)\left(U_w^* - U_w^0(F)\right), \tag{A16}$$

subject to $\left(U_h^*, U_w^*\right)$ being in a feasible set. In order to define the feasible set of expected utilities we first formally define the set of feasible allocations.

Definition 1. *An allocation $\{c_h(y_h,y_w), c_w(y_h,y_w), v(y_h,y_w)\}$ is said to be feasible if for all states of the world $(y_h,y_w) \in Y^2$ and for each $i \in \{h,w\}$: $c_i(y_h,y_w) \in [0, y_h + y_w]$, $c_h(y_h,y_w) + c_w(y_h,y_w) \leq y_h + y_w$, and $v(y_h,y_w) \in [0,1]$.*

We can now define a feasible expected utility profile

Definition 2. *The expected utility profile (U_h, U_w) is said to be feasible if there exists a feasible allocation $\{c_h(y_h,y_w), c_w(y_h,y_w), v(y_h,y_w)\}$ such that for each state of the world $(y_h,y_w) \in Y^2$:*

$$U_h = \sum_{y_h \in Y} \sum_{y_w \in Y} f_h(y_h) f_w(y_w) \left[u_h(c_h(y_h,y_w)) + \varphi_h(v(y_h,y_w))\right],$$

and

$$U_w = \sum_{y_h \in Y} \sum_{y_w \in Y} f_h(y_h) f_w(y_w) \left[u_w(c_w(y_h,y_w)) + \varphi_w(1 - v(y_h,y_w))\right].$$

The set of feasible expected utility profiles is denoted T. We want to demonstrate that T is a convex set. Let $\left(U_h^0, U_w^0\right)$ and $\left(U_h^1, U_w^1\right)$ be two elements in T. We then need to verify that, for any $\alpha \in (0,1)$

$$\left(U_h^2, U_w^2\right) \equiv \left(\alpha U_h^0 + (1-\alpha) U_h^1, \alpha U_w^0 + (1-\alpha) U_w^1\right), \tag{A17}$$

is also in the set T. Let $\left\{c_h^k(y_h,y_w), c_w^k(y_h,y_w), v^k(y_h,y_w)\right\}$ denote a feasible allocation that supports the expected utility profile (U_h^k, U_w^k) for each $k = 0,1$. Consider then the convex combination of the two supporting allocations: at each node (y_h,y_w) define

$$\hat{c}_i(y_h,y_w) = \alpha c_i^0(y_h,y_w) + (1-\alpha) c_i^1(y_h,y_w), \tag{A18}$$

for $i = h, w$, and

$$\hat{v}(y_h, y_w) = \alpha v^0(y_h, y_w) + (1-\alpha) v^1(y_h, y_w), \tag{A19}$$

and note that this is a feasible allocation. Consider then the expected utility profile generated by this allocation. For the husband we obtain the expected utility,

$$\hat{U}_h = \sum_{y_h \in Y} \sum_{y_w \in Y} f_h(y_h) f_w(y_w) \left[u_h(\hat{c}_h(y_h, y_w)) + \varphi_h(\hat{v}(y_h, y_w)) \right]. \tag{A20}$$

Due to concavity of $u_h(\cdot)$ and $\varphi_h(\cdot)$ it follows that, in each state of the world:

$$u_h(\hat{c}_h(y_h, y_w)) > \alpha u_h\left(c_i^0(y_h, y_w)\right) + (1-\alpha)\alpha u_h\left(c_i^1(y_h, y_w)\right), \tag{A21}$$

and

$$\varphi_h(\hat{v}(y_h, y_w)) > \alpha \varphi_h\left(v^0(y_h, y_w)\right) + (1-\alpha)\varphi_h\left(v^1(y_h, y_w)\right), \tag{A22}$$

and hence it follows that $\hat{U}_h > U_h^2$. An identical argument shows that, for the wife, $\hat{U}_w > U_w^2$. Since it is always possible to reduce the expected utility of either (or both partners) by reducing consumption at some arbitrary node, it follows that $\left(U_h^2, U_w^2\right) \in T$. Moreover, the argument above makes clear that if even if $\left(U_h^0, U_w^0\right)$ and $\left(U_h^1, U_w^1\right)$ are both boundary points of T, $\left(U_h^2, U_w^2\right)$ is not a boundary point. Hence we have that:

Lemma 4. *The feasible set of expected utilities T is strictly convex.*

We also take it as given that the set T is compact. For simplicity we further assume that the Pareto frontier—i.e., the downward sloping part of the boundary of T—is twice differentiable. Letting $U_w(U_h)$ denote the Pareto frontier, it thus follows that $U_w'(U_h) < 0$ and $U_w''(U_h) < 0$.

The solution to the ex ante bargaining problem (A16) satisfies the general first order condition

$$\Delta_r \equiv \frac{\left(U_h^* - U_h^0(F)\right)}{\left(U_w^* - U_w^0(F)\right)} = -\frac{1}{U_w'\left(U_h^*\right)}, \tag{A23}$$

where $U_w^* = U_w\left(U_h^*\right)$. This feature will be key to the comparative statics below.

5.3. Comparative Statics with Autarky ("Divorce") as the Threat Point

In order to conduct a comparative statics analysis, we specify the fallback to be autarky. Ex-post bargaining as a fallback (see e.g. Riddell, 1981) will be considered below. Hence we define the fallback utilities to be:

$$U_h^0(F_h) = \sum_{y_h \in Y} f_h(y_h) \left[u_h(y_h) + \varphi_h(0) \right] \quad \text{and} \quad U_w^0(F_w) = \sum_{y_w \in Y} f_w(y_w) \left[u_w(y_w) + \varphi_w(1) \right], \tag{A24}$$

for the husband and the wife respectively. Thus, when living in autarky each spouse consumes his or her own income and there is no violence.

Having assumed that the two partners have income distributions with the same support, we can now consider a simple comparative static exercise. Consider two income levels $\underline{y}$ and $\overline{y}$ in Y with $\overline{y} > \underline{y}$ and a small constant $\Delta > 0$. Then consider the following shifting of probability:

$$\Delta f_h\left(\underline{y}\right) = \Delta, \Delta f_h(\overline{y}) = -\Delta, \ \Delta f_w\left(\underline{y}\right) = -\Delta, \Delta f_w(\overline{y}) = \Delta. \tag{A25}$$

Hence there is a shifting of probability mass Δ for each partner. For the husband, this shifting involves decreasing the probability of the higher income level $\overline{y}$ and increasing the probability of the lower income level $\underline{y}$. For the wife, the shifting goes in the opposite direction.

In interpreting the model, we can think of the lower income level $\underline{y}$ as unemployment and the higher level $\overline{y}$ as employment. The perturbation thus increases the husband's probability of unemployment while increasing the wife's probability of employment. We will show that the shifting of probability leads to a reduction in the ex-ante bargained level of violence.

Note in particular that, per construction, the income shift in (A25) does not affect the distribution of household income. Hence the perturbation leaves the feasible set of expected utilities T unchanged.[27] Next we note that the perturbation decreases the fallback/autarky value for the husband but increases it for the wife,

$$\Delta U_h^0(F_h) = \Delta\left[u_h\left(\underline{y}\right) - u_h\left(\overline{y}\right)\right] < 0 \text{ and } \Delta U_w^0(F_w) = -\Delta\left[u_w\left(\underline{y}\right) - u_w\left(\overline{y}\right)\right] > 0. \tag{A26}$$

Consider then the impact of the reform on the bargaining outcome, in particular on (A23). As the reform has not affected the set of feasible expected utility profiles, it has not changed the Pareto frontier $U_w(U_h)$. From inspecting (A23) we obtain the following key result:

Lemma 5. *The shifting of probability in eq. (A25) leads to:*

(a) A decrease in the husband's equilibrium expected utility U_h^*;

(b) An increase in the wife's equilibrium expected utility U_w^*;

(c) An increase in the relative expected utility gain of the husband $\Delta_r = \frac{U_h^* - U_h^0(F_h)}{U_w^* - U_w^0(F_w)}$.

The first two parts are intuitive results. The third part, which is central for our purposes, says that, as the husband's probability of unemployment increases, he has more to gain in expected utility terms than his spouse from striking an ex-ante agreement. As a consequence, his relative bargaining position weakens. Combining Lemmas (3) and (5) we obtain the main result:

Proposition 2. *Suppose that the relevant threat point in the ex-ante bargaining process is autarky ("divorce"). Then the shifting of probability in eq. (A25) leads to a decrease in the ex-ante bargained state-independent equilibrium level of violence $v^* = v(y_h, y_w)$.*

5.4. Comparative Statics with Ex-Post Bargaining as the Threat Point

The assumption of divorce in the case of failure to agree in ex-ante negotiations may be overly strong. If the couple cannot agree on an allocation at the ex-ante stage, they can still bargain ex-post once all uncertainty is resolved.[28] We show here that Proposition 2 also holds in this case. In order to demonstrate that result we need to start by characterizing the outcome of ex-post Nash bargaining over consumption levels and violence.

[27] In principle, the argument for this requires the definition of a feasible allocation to be generalized to allow for randomization at any given state of the world. This means that if the couple behave differently at the two nodes $\left(\underline{y},\overline{y}\right)$ and $\left(\overline{y},\underline{y}\right)$, then after the shift in probability they can still "replicate" the same probability distribution over outcomes by adopting the behavior associated with node $\left(\underline{y},\overline{y}\right)$ at node $\left(\overline{y},\underline{y}\right)$ with probability Δ.

[28] See Riddell (1981) for a seminal contribution here.

5.4.1. Ex-Post Bargaining

Suppose that the state of the world (y_h, y_w) has been realized without any ex-ante agreement having been reached. The couple can then bargain over the allocation of consumption ex post. The fallback position here is "no trade" (or divorce). Hence in absence of an agreement the partners' utilities are

$$U_h^0 = u_h(y_h) + \varphi_h(0) \text{ and } U_w^0 = u_w(y_w) + \varphi_w(1), \tag{A27}$$

respectively. Ex-post Nash bargaining solves $\max \Delta_h^* \Delta_w^*$ where

$$\Delta_h^* = U_h - U_h^0 = u_h(c_h) + \varphi_h(v) - U_h^0, \tag{A28}$$

and

$$\Delta_w^* = U_w - U_w^0 = u_w(c_w) + \varphi_w(v) - U_w^0,$$

and subject to feasibility, $c_h + c_w \leq y_h + y_w$ and $v \in [0,1]$. The first order conditions with respect to consumption and violence imply

$$\frac{u_h'(c_h)}{u_w'(c_w)} = \frac{\Delta_h}{\Delta_w}, \tag{A29}$$

and

$$\frac{\varphi_h'(v)}{\varphi_w'(1-v)} = \frac{\Delta_h}{\Delta_w}, \tag{A30}$$

Note that the bargained outcome is *ex-post efficient* in the sense that the partners' marginal rates of substitution are equalized:

$$\frac{\varphi_w'(1-v)}{u_w'(c_w)} = \frac{\varphi_h'(v)}{u_h'(c_h)}. \tag{A31}$$

This relation summarizes the "ex-post contract curve" which is defined for a particular level of household income. Moreover, it is easy to see that the contract curve is monotonic: the higher is the husband's utility, the higher is c_h and v.

In any realized state of the world, there will thus be an ex-post bargained utility for each partner, which we denote by $\widetilde{U}_h(y_h, y_w)$ and $\widetilde{U}_w(y_h, y_w)$, along with actions $\widetilde{c}_i(y_h, y_w)$ and $\widetilde{v}(y_h, y_w)$. In a similar fashion each partner would associate each state of the world with a particular bargained indirect utility and actions.

For our comparative statics purposes we want to compare the outcome at two different states of the world that have the same total household income. Hence consider two states of the world $(\underline{y}, \overline{y})$ and $(\overline{y}, \underline{y})$ where $\overline{y} > \underline{y}$. Since total household income is the same at the two nodes, the utility possibility set is the same at the two nodes. However, comparative statics along the lines used above (or, noting that the shift from $(\underline{y}, \overline{y})$ to $(\overline{y}, \underline{y})$ is equivalent to an income redistribution) yields that

Lemma 6. *(Aizer, 2010) Consider two states of the world, $(\underline{y}, \overline{y})$ and $(\overline{y}, \underline{y})$ where $\overline{y} > \underline{y}$. Ex-post bargaining then implies that $\widetilde{U}_h(\underline{y}, \overline{y}) < \widetilde{U}_h(\overline{y}, \underline{y})$ and $\widetilde{U}_w(\underline{y}, \overline{y}) > \widetilde{U}_w(\overline{y}, \underline{y})$. Moreover, the ex-post negotiated violence level satisfies $\widetilde{v}(\underline{y}, \overline{y}) < \widetilde{v}(\overline{y}, \underline{y})$.*

We can now consider ex-ante bargaining with ex-post negotiations—i.e., bargaining once all uncertainty is resolved—as the fallback position.

5.4.2. The Ex-Ante Problem

Note that the resource allocation that the spouses would obtain through ex-post bargaining, $\{\widetilde{c}_h(y_h,y_w),\widetilde{c}_w(y_h,y_w),\widetilde{v}(y_h,y_w)\}$, is a feasible allocation according to Definition 1. Hence ex-post bargaining would generate an ex-ante expected utility for partner i

$$\widetilde{U}_i(F)=\sum_{y_h\in Y}\sum_{y_w\in Y}f_h(y_h)\,f_w(y_w)\,\widetilde{U}_i(y_h,y_w). \tag{A32}$$

Moreover, the expected utility profile $(\widetilde{U}_h(F),\widetilde{U}_w(F))$ is in the set T. However, noting that an allocation that would arise through ex-post bargaining is not ex-ante efficient, the expected utility profile $(\widetilde{U}_h(F),\widetilde{U}_w(F))$ is not a boundary element of T and hence it is Pareto dominated by some other element in T. Thus, both partners have an incentive to bargain for an ex-ante agreement, in this case with $\widetilde{U}_h(F)$ and $\widetilde{U}_w(F)$ as their respective fallback utilities.

In order to establish the result of interest, we need to verify that the husband's expected utility from ex-post bargaining is reduced from the shifting of probability defined in (A25) while that of the wife is increased. But this follows directly from Lemma 6. Hence by an analogous argument to the case with autarky as the threat point we obtain:

Proposition 3. *Suppose that the relevant threat point in the ex-ante bargaining process is ex-post bargaining. Then the shifting of probability in eq. (A25) leads to an decrease in the ex-ante bargained state-independent equilibrium level of violence* $v^*=v(y_h,y_w)$.

Appendix References

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