Domestic violence and women's autonomy in developing countries: theory and evidence

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Abstract. This paper sets out a simple non-cooperative model of resource allocation within the household in developing countries that incorporates domestic violence as a vehicle for enhancing bargaining power. We demonstrate that the extent of domestic violence faced by women is not necessarily declining in their reservation utilities, or necessarily increasing in their spouses'. Using the National Family Health Survey data of India for 1998–99, we isolate the effect of domestic violence on female autonomy, taking into account the possible endogeneity of domestic violence through the choice of appropriate instruments. We provide some evidence for the evolutionary theory of domestic violence, which argues that such violence stems from the jealousy caused by paternity uncertainty in our evolutionary past. The findings have strong policy implications suggesting that it will take more than an improvement in women's employment options to address the problem of spousal violence. JEL classification: J16, D7

Violence conjugale et autonomie des femmes dans les pays en voie de développement : théorie et résultats. Ce mémoire met en place un modèle simple d'allocation de ressources sans collaboration à l'intérieur d'un ménage dans des pays en voie de développement où la violence conjugale est un véhicule utilisé pour accroître le pouvoir de marchandage. On montre que l'importance de la violence conjugale faite aux femmes ne décline pas nécessairement avec leurs exigences minimales, non plus qu'elle s'accroît avec les exigences minimales de leurs époux. A l'aide des résultats de l'Enquête nationale sur la santé des familles de l'Inde pour 1998–99, on précise l'effet de la violence conjugale sur l'autonomie des femmes, en tenant compte de l'endogénéité possible de la violence conjugale à l'aide d'instruments appropriés. On fournit un certain support à la théorie évolutionnaire de la

violence conjugale, laquelle suggère que cette violence émerge de la jalousie causée par l'incertitude de la paternité dans notre passé évolutionnaire. Les résultats ont de fortes implications pour la politique publique : ils suggèrent qu'il faudra beaucoup plus qu'une amélioration dans les opportunités d'emploi des femmes pour résoudre le problème de la violence conjugale.

1. Introduction

Domestic violence is a universal phenomenon.[1] Irrespective of whether a country is poor or rich, spousal violence is pervasive. However, it has not received as much research scrutiny in economics as it warrants.[2] This paper investigates how domestic violence in developing countries impinges on women's autonomy (that is, their independence in making decisions) within the household. We present a simple theoretical framework and then provide empirical evidence drawn from India.

Both feminist and evolutionary theories are in agreement that a pivotal aspect of gender relations is the need for men to control the sexuality of women. Feminist theory identifies patriarchy as the root cause of domestic violence, whereby males do whatever is needed to exercise control over women and keep them subservient (e.g., Dobash and Dobash 1979; Martin 1976; Yllo and Strauss 1990); using violence is one possibility. Evolutionary theory has it that domestic violence ultimately stems from paternity uncertainty (e.g., Wilson and Daly 1993, 1996). Because the paternity of children was never certain in our evolutionary past, natural selection would have favoured proprietary behaviour by males with regard to sexual access to their mates. Spousal violence, in this view, stems from the insecurity and jealousy that males feel when their partners are exposed to the possibility of sexual encounters with other males. Although feminist theory does not typically invoke evolutionary arguments, it is nevertheless true that the latter can augment feminist claims by providing some evolutionary underpinnings for patriarchy.

We pursue two goals in this paper. First, we seek to ascertain whether domestic violence impinges on female autonomy and, if so, the extent to which it does. To accomplish this goal empirically, however, we have to contend with the fact that autonomy itself may impinge on domestic violence. Therefore, to isolate the effect we are interested in we have to purge the latter effect. We do this through instrumental variable estimation.

That female autonomy can influence domestic violence is recognized in feminist literature. In feminist theory, domestic violence is viewed as an outcome that

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1 See, for example, World Health Organization's 2005 multi-country study of domestic violence.
2 Women who are abused – and it is largely women who suffer serious violence – are often not likely to report physical violence to the police because they may be too embarrassed to admit to having experienced such violence, too concerned with embarrassing their abusers, or too intimidated to expose them to public censure.

derives from the weak autonomy and bargaining power of women. The resource theory version of feminist theory predicts that women who have more autonomy (perhaps because they earn independent incomes) would experience less mate violence than women with less autonomy (Goode 1971). In a pioneering paper that brought out the importance of female autonomy in determining the demographics of India by region, Dyson and Moore (1982) showed a clear divide in the autonomy of women in north India and those in south India (the latter exhibiting greater autonomy).[3] Therefore, one would expect less domestic violence in the south of India. As was shown by Menon and Johnson (2007), using the NFHS data for India, and as we confirm here, this is patently false: women from the south appear to be beaten more frequently. We are able to provide an explanation for this very puzzling fact that women with more autonomy experience more spousal abuse. We show that there is no necessary theoretical relationship between a woman's reservation utility (or outside option) and the extent of the physical abuse she faces at home. In our framework, greater domestic violence may also be a rational male *response* to the greater autonomy of women. It is for this reason that, in our empirical attempt to isolate the effect of spousal violence on women's autonomy, we have to neutralize the reverse causality going from autonomy to domestic violence.

The second goal of this paper is to attempt to empirically assess the feminist and evolutionary theories of domestic violence. While both theories often make similar predictions, it is possible to separate them out in some scenarios. For example, the effect of women's earnings on domestic violence would elicit similar predictions from them, but evolutionary theory would go further and predict that women whose earnings come from working *outside* the home would experience greater domestic violence. This is because, in the perception of their husbands, there is greater danger that these women may have sexual contact with other men; paternity uncertainty would trigger more spousal jealousy and violence as a response. This claim can be tested, and we do so in this paper.

The framework that suggests itself when we seek to understand domestic violence is that of household bargaining. Most bargaining models tend to assume that bargaining is a cooperative endeavour and that the outcome is Pareto efficient. But this is a difficult assumption to justify in the context of spousal violence.[4] We concur with the theoretical literature on domestic violence that this phenomenon is best analyzed in a non-cooperative framework, as is done in Tauchen, Witte, and Long (1991), Farmer and Tiefenthaler (1996), and Bloch and Rao (2002). Violence is a means to obtaining the upper hand in bargaining situations. In developing countries, there are hardly any legal recourses to domestic violence; even when the laws are on the books, they will not be enforced

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3 But see Rahman and Rao (2004) for a contrary view.
4 It is possible to suggest a view that outcomes can still be ex ante Pareto efficient by invoking the assumption that information is asymmetric and incidents entailing spousal violence are much like strikes observed in union-management negotiations. But such an interpretation seems to us to be strained and untenable.

if society finds such violence culturally acceptable. In the developed countries, where the laws are enforced with less reluctance, the enforcers are hampered by the fact that charges of domestic violence are often dropped by the victims.[5]

In their pioneering theoretical work on the economics of domestic violence, Tauchen, Witte, and Long (1991) assume that spousal violence is used to control behaviour and is also a source of gratification for the abuser. They argue that an increase in the income of the abuser increases his violence and welfare, yielding no benefit to the victim if her reservation utility is binding. Increases in the victim's income generally increases her welfare. In high-income families where women supply most of the income, the authors argue that an increase in the victim's income may increase violence.[6]

Farmer and Tiefenthaler (1996) have argued that the laying of charges in domestic violence cases may be a signalling device. By communicating to their abusers that they have access to outside support and that they will leave should the violence continue, in effect they signal a higher reservation utility. The authors propose this as the reason why women often drop the charges they brought against their abusers; the use of services offered to battered wives offers a credible signalling mechanism as much as it offers a direct reprieve from battering.

In an interesting analysis using data from the Canadian Violence Against Women Survey, Bowlus and Seitz (2006) examined the effect of women's employment on the abuse they experience from their husbands. They find that employment is a deterrent as long as it is taken up before the abuse begins. Furthermore, they find that women who are abused and the men who abuse them are likely to have less education than women who are not abused and men who are not abusive, respectively.

Goode (1971) was an early proponent of the view that, in the absence of other factors such as education or income that may confer power within a relationship, men may resort to violence as a substitute to achieve their ends. Using data from three villages in a southern Indian state, Rao (1998) showed that women who faced greater domestic violence had less control over resource allocation within the household (as captured by children's nutrition levels). To our knowledge, this is the first paper to quantitatively establish a connection between domestic violence and decision-making power. Addressing the problem of dowry-related violence in India, Bloch and Rao (2002) propose a theoretical model of asymmetric information within a household bargaining framework. The husband uses violence to signal to his in-laws the degree of his satisfaction with his marriage and uses violence as a weapon of extortion. The authors show that women from wealthier families are more likely to be beaten in order to elicit greater transfers from their parents. They then provide some evidence for their theory using ethnographic data drawn from a southern Indian state. Panda and Agarwal (2005),

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5 But Farmer and Tiefenthaler (1996) emphasize the point that too much must not be read into this. In their view, the placing of charges is a signalling device that curtails abuse. See the discussion below.

6 But the authors acknowledge that the conditions under which this may happen are odd.

using data from the southern Indian state of Kerala, examine how women's ownership of property impinges on marital violence. They find evidence that ownership of immovable property by women reduces the risk of wife beating, which they attribute to higher bargaining power of these women.

In this paper, we provide a simple non-cooperative model of spousal violence in general. In our view, which is complementary to those of the authors whose papers are summarized above, spousal violence is intended to increase the abuser's bargaining power. We advance the view, in particular, that spousal violence is a means to ensuring that the victim (taken to be a woman) allocates resources more in line with the preferences of the abuser (taken to be her husband). In our model, domestic violence is a means to an end and does not arise from a 'taste' for violence. This is in accordance with the views of evolutionary psychologists, who argue that spousal violence is a means men utilize to ensure that women behave in their (the men's) reproductive interests; dominating women through violence facilitates the transmission of the genes of violent men.[7] This behaviour gets entrenched in male human nature – and this is the essence of the argument – because it is rewarded by the process of natural selection. The genesis of domestic violence, in this view, may well lie in the advantages it conferred on such behaviour in our evolutionary past, but in the contemporary context it is not just reproductive interest that is at stake. The important and more general point is that violence garners resources for its perpetrators.

In our model a woman's autonomy, as captured by the extent to which she can implement her preferences in household resource allocation, is determined among other things by the amount of spousal abuse she confronts. We demonstrate that an improvement in the wife's reservation utility would increase her autonomy in the non-cooperative equilibrium but this may be accompanied by an increase, not a decrease, of the spousal violence she experiences. Thus, increases in women's education levels, outside options, and the support groups available to women may incite more spousal violence. We also show that an increase in the husband's reservation utility may, in fact, lower the amount of violence he inflicts on his wife. We provide strong empirical support for these claims using the extensive National Family Health Survey data of India for the years 1998–99. This data set contains detailed socioeconomic information on a nation-wide sample of women and whether they were beaten by their husbands or by any family members (hers or his) and, if so, how frequently. The data set also provides some detailed information at the individual and household level.

After controlling for a whole host of factors, we find that working women face greater spousal violence and those working away from home even more. We argue in the paper that this is evidence in favour of the evolutionary theory of domestic violence because women working away from home have greater opportunity for illicit sexual encounters. With regard to how the autonomy of married women depends on domestic violence, there is, of course, an endogeneity issue

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7 See, for example, Wilson and Daly (1993, 1996) for an account of this line of argument.

here: greater female autonomy may impinge on domestic violence, and domestic violence may in turn affect female autonomy. This endogeneity is a serious issue that has been overlooked in the literature. Some of our empirical findings have been previously unearthed by Menon and Johnson (2007) in their interesting study of how personal and family characteristics affect domestic violence in India and how this varies by geographical region. However, they take autonomy as an explanatory variable, when, in fact, it is likely to be highly endogenous.[8] In contrast, we purge the effect of autonomy on domestic violence by suitable choice of instruments and isolate how spousal violence impinges on married women's autonomy. Though there are some regional variations in the importance of certain factors in exacerbating domestic violence, the broad thrust of our results is unambiguous: domestic violence seriously undermines women's autonomy. This offers persuasive evidence in favour of our model and that of Bloch and Rao (2002): domestic violence is a vehicle employed by males to enhance their bargaining power. It is not necessary to invoke additional assumptions on preferences (such as men obtaining satisfaction from spousal abuse) to explain the prevalence of domestic violence. Our paper has clear policy implications. For one, it suggests that improving the work options available to women may be an insufficient measure to enhance their well-being, for it may increase the spousal violence they experience. We must remark, however, that paucity of data on some pertinent variables (especially individual income and wealth) suggests that our findings must be treated as tentative.

This paper is organized as follows. The next section presents our model and we derive some testable implications from it. In section 3, we describe the data, present the sample statistics, and outline our estimation strategy. Our econometric results are presented in section 4. We present our concluding thoughts in section 5.

2. The model

In this section, we propose a model that determines a married woman's autonomy endogenously when spousal violence is an option available to her husband.

We presume that the household consumes two goods, X and Y. For simplicity, we assume that these are household public goods, so that we do not have to separately determine the private consumptions of individuals. Denote the utility function of the wife by $U_W(x, y, v)$, where x and y denote the respective amounts of X and Y consumed and v denotes the amount of violence inflicted by the husband on her. We assume that $U_W(., ., .)$ is increasing and strictly quasiconcave in its first two arguments and decreasing and concave in the last. We denote the husband's utility function by $U_H(x, y, v)$, with monotonicity and curvature

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8 Menon and Johnson (2007) also use women's attitudes towards domestic violence as a regressor, possibly further biasing the results, owing to the endogeneity of this variable, too.

properties identical to those of the wife's utility function. In particular, we posit that the husband's utility also decreases with the amount of violence he inflicts on his wife because this leads to strained relations, loss of intimacy and trust, and so on. This loss is the opportunity cost he perceives to engaging in spousal violence. In this view, domestic violence is a means to an end for the husband, not an end in itself.

We presume that the wife's preferences over goods X and Y are different from those of the husband.[9] This difference is the point of contention within the household that makes bargaining power relevant. In the households of developing countries, the wife manages the running of the household and, since we use data from India in our empirical work, we presume that she oversees the allocation of household resources. In the spirit of Pahl (1995), however, there is a distinction to be made between management and control. The wife may manage the household, but we do not presume that she controls the resource allocation. In our model, it is to bring this allocation more in alignment with his own preferences that the husband potentially engages in domestic violence. Indeed, one may interpret the efforts of patriarchy in exercising control over women as attempts to bring women's behaviour more in accord with the interests of males. Here we take household management (resource allocation) as the nexus of women's struggle for autonomy.

For tractability, we assume that the wife's utility function is of the form:

$$U_W(x, y, v) = \alpha_1 \ln x + \beta_1 \ln y - \delta_1 v, \quad \alpha_1 > 0, \beta_1 > 0, \alpha_1 + \beta_1 = 1; \delta_1 > 0, \tag{1}$$

and the husband's is of the form:

$$U_H(x, y, v) = \alpha_2 \ln x + \beta_2 \ln y - \delta_2 v, \quad \alpha_2 > 0, \beta_2 > 0, \alpha_2 + \beta_2 = 1; \delta_2 > 0. \tag{2}$$

To ensure that difference in preferences over goods is a point of contention for the couple, we assume that $\alpha_1 \neq \alpha_2$. The normalizations $\alpha_1 + \beta_1 = 1$ and $\alpha_2 + \beta_2 = 1$ are innocuous and are invoked for convenience. As we shall see, the intuition for our results is robust; so we do not expect the functional form, assumed here for analytic tractability, to be seriously constraining.

Let $\overline{U}_W$ and $\overline{U}_H$, respectively, denote the wife's and husband's reservation utilities, that is, the utilities they need to be assured of for the marriage to be viable.[10] Suppose the family income, taken as exogenous here, is M and that the units of goods X and Y are chosen so that both their prices are normalized to

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9 For evidence drawn from the developed world on differences in the preferences of husbands and wives over expenditure patterns, see, for example, Lundberg, Pollak, and Wales (1997).

10 This sidesteps the issue of what is the relevant threat scenario in marriage. In the South Asian context (from where the data are drawn), divorce is rare – especially in rural areas – and it may be argued that non-cooperative behaviour within marriage is the likely threat outcome (e.g., Woolley 1988; Chen and Woolley 2001; Lundberg and Pollak 1993).

unity. We assume that the husband and wife pool their incomes. (We assume this, despite the fact that our model is a non-unitary one, because a posited difference in preferences over household public goods is sufficient for our purposes.)

As mentioned, the wife manages the household income and implements the allocation of resources. To what extent this allocation reflects her own preferences will depend, of course, on her bargaining power or autonomy. In the allocation of resources, suppose the wife puts a weight γ ($0 \leq \gamma \leq 1$) on her own preferences and $1 - \gamma$ on her husband's. We can interpret γ as the wife's autonomy (or bargaining power), one of the principal endogenous variables of interest here.

To begin with, let us consider how female autonomy is determined in the absence of domestic violence (which may be simulated by setting $\delta_1 = 0$ in (1)). Suppose in this case that γ_0 and $1 - \gamma_0$, respectively, are the weights the wife would put on her own preferences and on her husband's. We would expect that $\gamma_0 < 1$ because an allocation of resources tilted too much in favour of her own preferences is likely to generate a utility for her husband that falls short of his reservation utility. The wife has to ensure that her husband's utility in the allocation she chooses is at least equal to his reservation utility, $\overline{U}_H$. In other words, γ_0 and the associated allocation (x_0, y_0,) of the two goods must be the solution to the problem:

$$\max_{x,y,\gamma} \gamma \, U_W(x, y, 0) + (1 - \gamma)U_H(x, y, 0)$$
$$\text{s.t.} \quad x + y \leq M, \quad U_H(x, y, 0) \geq \overline{U}_H. \tag{3}$$

If the husband's reservation utility is very high, one might expect γ_0 to be close to 0. At the other extreme, if the husband's reservation utility is very low, the wife may well choose $\gamma_0 = 1$. It is possible that the husband reckons the allocation of household resources in this scenario is not sufficiently aligned with his preferences. In other words, he might deem that γ_0 is too high. To reduce his wife's exercise of independence and thereby bring the resource allocation more in line with his own preferences, he may choose the option of wife battering. As outlined in the introduction, evolutionary psychologists argue that spousal violence is a means to force women to serve the *reproductive* interests of men (see, e.g., Wilson and Daly 1993, 1996). But the use of spousal violence can be more general, and that is the view we adopt here. Our approach is consistent with that of Rao (1998), who found using data from three villages in the state of Karnataka, India, that domestic violence and intra-household allocation of resources were correlated, and also with that of Goode (1971).

In our model, the channel through which domestic violence impinges on women's autonomy is quite direct: women curtail their autonomy to reduce the amount of violence they experience. The determination of female autonomy as we model it involves two stages. In the first stage, the husband sets down the rule by which he decides how much violence he will inflict on his wife. We explicitly allow for the possibility that the exercise of autonomy by the wife may incite violence

by the husband. Suppose the husband commits to a frequency (or 'intensity') of battering, b, which inflicts violence on his wife in proportion to the autonomy she exercises, that is, the violence, v, that she suffers is given by $v = \gamma b$.[11] In the second stage, the wife decides how much weight to put on her own preferences (that is, how much autonomy to exercise) in the household resource allocation. The choice of modelling the husband as the first mover in this setting is motivated by the fact that patriarchy is an entrenched institution in developing countries. The fact that most brides leave their natal family and move to their husband's home and frequently live with his parents' extended family implies that married women can hardly aspire to being first movers.

Since the choices outlined above are made sequentially, we need to work backwards to solve for the equilibrium. Given that the violence she confronts is $v = \gamma b$, in the second stage the wife chooses the degree of autonomy to exercise and the household resource allocation to implement by solving

$$\max_{x,y,\gamma} \gamma\, U_W(x, y, \gamma b) + (1 - \gamma) U_H(x, y, \gamma b) \tag{4}$$
$$s.t. \quad x + y \leq M, \quad U_H(x, y, \gamma b) \geq \overline{U}_H.$$

In solving this problem, the wife makes her choices with full awareness of the battering this may subsequently entail. Denote the solution to this problem by $[x^*(b), y^*(b), \gamma^*(b)]$. (For brevity, we suppress the dependence of this solution on the husband's reservation utility.)

It can be verified that provided the following condition is satisfied,

$$\delta_2 + 2(\delta_1 - \delta_2)\gamma^*(b) > 0, \tag{5}$$

the degree of autonomy, $\gamma^*(b)$, the wife chooses to exercise in the second stage is strictly declining in b:

$$\frac{d\gamma^*(b)}{db} < 0, \tag{6}$$

that is, the greater the frequency of battering (all else constant) the lower is the autonomy the wife exercises. We assume that condition (5) is satisfied, for its violation is conceivable only when δ_2 is large compared with δ_1, that is, when the (constant) marginal disutility of violence is much greater for the husband than for the wife – a scenario where domestic violence is likely to be irrelevant.[12]

The husband is cognizant of his wife's optimal response to the potential spousal violence she faces. Therefore, in the first stage, in choosing the frequency of battering, b, the husband solves

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11 In the context of our static model, we use the terms 'frequency' and 'intensity' synonymously.
12 This presumes that the husband's reservation utility constraint in (4) is not binding. If it is, the comparative static derivative (6) is unconditionally true; for, in that case, an increase in b raises the cost to the wife of asserting her autonomy and so she will economize on it in delivering the husband's reservation utility, $\overline{U}_H$.

$$\max_b U_H(x^*(b), y^*(b), \gamma^*(b)b) \quad s.t. \quad U_W(x^*(b), y^*(b), \gamma^*(b)b) \geq \overline{U}_W. \quad (7)$$

Denote the solution to this problem by $b^\dagger$. The wife's endogenously chosen autonomy in the presence of domestic violence, then, is given by $\gamma^*(b^\dagger)$. The amount of spousal violence, $v^\dagger$, she encounters in the (subgame perfect Nash) equilibrium is given by $v^\dagger = \gamma^*(b^\dagger)b^\dagger$. In general, the endogenous bargaining power of the wife and the equilibrium level of spousal violence will depend on the reservation utilities. Our theory claims that $b^\dagger$ would be the equilibrium frequency of battering and $v^\dagger$ would be the observed level of spousal violence the woman experiences.

It should be noted that wife beating is not inevitable in this model. For one, if the wife's reservation utility is very high, naturally enough, the husband may not exercise the option of spousal violence. Even if there were scope for him to inflict violence, however, he may choose not to do so, since violence has an opportunity cost to him: if the marginal utility cost to the husband of lowering his wife's autonomy exceeds the marginal benefit of further aligning the household resource allocation with his preferences, it may well be that $b^\dagger = 0$. This is a more likely event when the husband's reservation utility is quite high, as we shall see.

Much of the intuition of our model can be garnered by examining the upper and lower panels of figure 1. On the horizontal axis of both panels is the frequency of wife battering, b. On the vertical axis of the upper panel is the husband's utility after the wife optimally chooses the autonomy she exercises, given b. The husband's utility (shown as $ABCD$) is inverted U-shaped as a function of b; for low levels of b, his utility is increasing because increases in wife battering induce her to align the household's resource allocation more in accord with his preferences. But at higher levels of b, the opportunity cost to him of inflicting violence on his partner overwhelms the additional benefit. The wife's utility (shown as LM in the lower panel), on the other hand, monotonically declines in b. This is because the increasing violence she faces for exercising autonomy induces her to choose resource allocations that increasingly deviate from her preferences and also because she is beaten with greater intensity. Both curves, $ABCD$ and LM, have been drawn without the consideration of the fact that the husband's utility cannot be lower than its reservation value, $\overline{U}_H$, shown as OE on the vertical axis of the upper panel. So, even if $b = 0$, the wife will curtail her bargaining power so that her husband's utility achieves the level indicated by OE instead of OA; as a result, her own utility falls from OL to ON on the vertical axis of the lower panel.

For values of b in the range $0 < b \leq \underline{b}$, the husband has no use for wife battering and so he will either set $b = 0$ or set b at a level that exceeds $\underline{b}$. Thus, wife battering is ruled out over the range $0 < b \leq \underline{b}$. From the lower panel of the figure we see that the wife's utility jumps discontinuously from ON to OR when the husband starts battering just past $b = \underline{b}$. If the husband were to acquire a more liberal view of spousal violence and find wife beating more reprehensible, we can capture this effect by an increase in the parameter δ_2 in (2). As a result, the
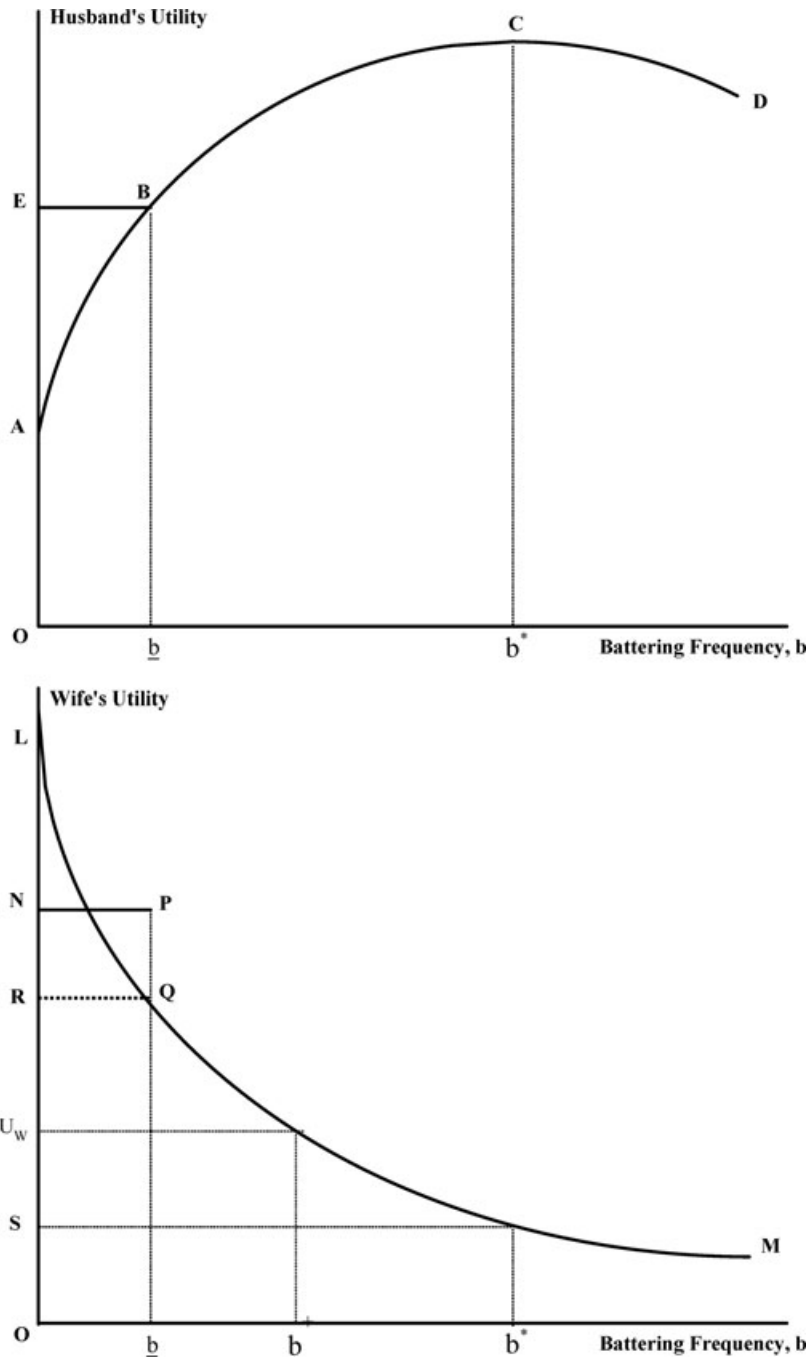
FIGURE 1 Determination of husband's battering frequency in equilibrium

schedule *ABCD* would shift down, and <u>*b*</u> would increase. In other words, such a husband would be less likely to engage in wife beating.

For future reference, we note that the distance *ON* on the lower panel of figure 1 is the utility level the wife can assure herself of in the event domestic violence is not a possibility (that is, when $b = 0$). This utility will depend on the husband's reservation utility, since she has to ensure that she delivers him at least the utility $\overline{U}_H$. If his reservation utility were higher, she would have to tilt resource allocation in his favour (that is, reduce γ), and so her own utility (*ON*) would be lower. Therefore, when the husband does not engage in spousal violence, a woman's utility within marriage declines with his reservation utility. This, as we shall see, is not so when he *does* engage in violence.

From the upper panel of figure 1 we see that the battering frequency that is globally optimal from the husband's point of view is b^*. Whether this is feasible or not depends on the wife's reservation utility, $\overline{U}_W$. If this utility is less than or equal to *OS* in the lower panel, the husband would choose to batter with a frequency b^*. This optimum is clearly independent of the husband's reservation utility, $\overline{U}_H$. If the wife's reservation utility rises to a level above *OS* in the lower panel, her reservation utility will become binding and the husband is constrained to set $b^\dagger < b^*$; he will set $b^\dagger$ as the largest value of b for which his wife will receive her reservation utility, $\overline{U}_W$. When $\overline{U}_W$ increases, $b^\dagger$ will have to decrease commensurately. Thus, for reservation utilities of the wife within the range $OS < \overline{U}_W \leq OR$ on the vertical axis of the lower panel, the equilibrium battering frequency, $b^\dagger$, will be declining in $\overline{U}_W$. Over the range $OR < \overline{U}_W \leq ON$, wife battering is infeasible because even the minimal battering frequency the husband deems to be in his self-interest (that is, <u>*b*</u>) pushes the wife below her reservation utility. For $\overline{U}_W > ON$, the marriage is infeasible even in the absence of wife battering because there is not enough surplus in the marital alliance to allow both partners to recover their reservation utilities.

It is easy to see that, generally, the equilibrium frequency of wife battering $b^\dagger$ will be weakly declining in the wife's reservation utility.[13] The above reasoning, along with the comparative static derivative in (6), shows that the relationship between the wife's reservation utility and her autonomy in equilibrium, $\gamma(b^\dagger)$, is of the form shown in figure 2. It is weakly increasing in her reservation utility

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13 We can see this formally as follows. When battering intensity increases, the woman will curtail her autonomy in accordance with (6) and the consumption component of her utility in (1) will clearly decline. The total amount of violence she faces will likely increase, but not inevitably, as we shall see subsequently. In any event, it cannot decline by so much that she actually becomes better off at the higher battering intensity. (For if it did, then, when the battering intensity was lower, she always could have chosen the lower autonomy of the latter scenario and she (and her husband, too) could have been better off with the reduced beating – implying that her earlier autonomy level could not have been optimal.) An exception occurs when she chooses to exercise no autonomy ($\gamma = 0$), in which case her utility is independent of battering intensity. Thus, it follows that $dU_W(x^*(b), y^*(b), \gamma^*(b)b)/db \leq 0$. The husband chooses the battering intensity, $b^\dagger$, so that he holds her at her reservation level: $U_W(x^*(b^\dagger), y^*(b^\dagger), \gamma^*(b^\dagger)b^\dagger) = \overline{U}_W$. Totally differentiating this with respect to $\overline{U}_W$, we obtain the desired result that $db^\dagger/d\overline{U}_W \leq 0$.
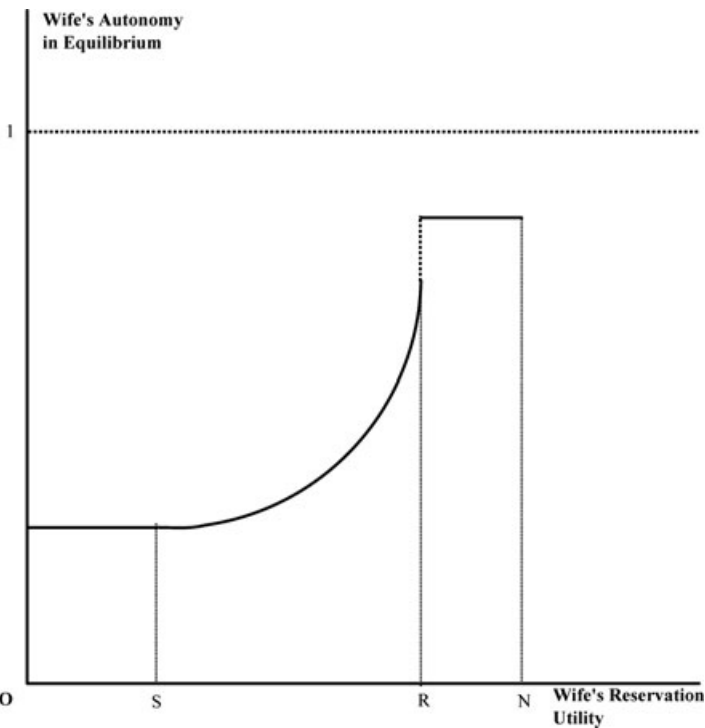
FIGURE 2 Wife's autonomy in equilibrium as a function of her reservation utility (for a given value of her husband's)

and discontinuously increases when her reservation utility reaches OR, at which point wife battering becomes infeasible.

It is very interesting to enquire how the equilibrium level of spousal violence the wife suffers changes with her reservation utility, $\overline{U}_W$. Recall that this equilibrium level of violence is given by $v^\dagger = \gamma^*(b^\dagger)b^\dagger$. When $\overline{U}_W$ increases, we have seen above that, when the wife's reservation utility binds in the equilibrium, $b^\dagger$ decreases and so, in view of the comparative static derivative in (6), $\gamma^*(b^\dagger)$ will increase. What happens to the equilibrium level of violence depends on how sensitive the wife's exercise of autonomy is to battering frequency. If the absolute value of the elasticity of $\gamma^*(b)$ with respect to b is greater than unity, an increase in the wife's reservation utility may result in *greater*, not less, violence in equilibrium.[14] The wife tolerates greater violence because the exercise of autonomy more than compensates for this.

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14 If this elasticity is denoted by $\epsilon(b)$, we readily see that $dv^\dagger/d\overline{U}_W = [1 + \epsilon(b^\dagger)]\gamma^*(b^\dagger)\,db^\dagger/d\overline{U}_W$. Since the derivative on the right-hand side is non-positive (from the negative slope of the schedule in the lower panel of figure 1), the result follows.
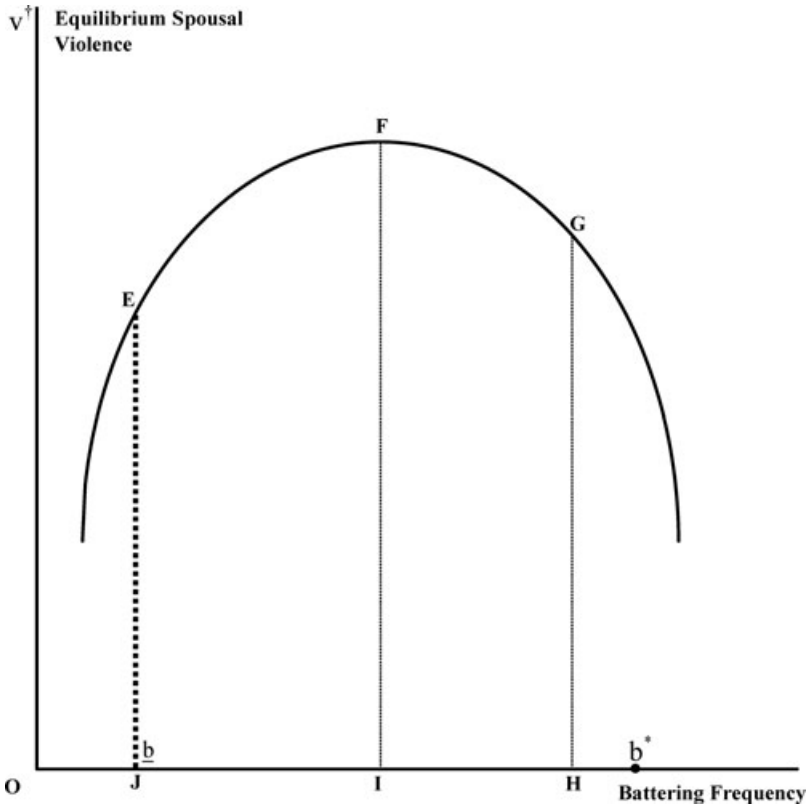
FIGURE 3 The equilibrium level of spousal violence as a function of the battering frequency

In figure 3, we plot the amount of domestic violence, $v = \gamma^*(b)b$, as a function of battering frequency, b, for the assumed functional form (1) for the wife's utility function. We see that the relationship is an inverted-U curve, displayed as *EFG* in figure 3. Suppose the wife's reservation utility is binding in equilibrium. The husband implements the equilibrium value $b^\dagger = OH$, say, and the associated level of spousal violence the wife suffers is GH. We have seen that, when her reservation utility increases, $b^\dagger$ decreases. Over the range $OI < b^\dagger < OH$, where the elasticity condition referred to above is satisfied, we see from the figure that the equilibrium level of violence increases when the wife's reservation utility rises. Further increases in her reservation utility, which push $b^\dagger$ below OI, result in decreases in the equilibrium violence. At a sufficiently high $\overline{U}_W$ we shall observe $b^\dagger = OJ$, the minimal battering frequency ($= \underline{b}$) the husband would ever find worthwhile to engage in wife battering. At higher levels of $\overline{U}_W$, $b^\dagger$ discontinuously falls to zero; the equilibrium level of violence, therefore, discontinuously falls from *EJ* in the figure to zero.

The reasoning above demonstrates that, contrary to intuitive ideas one may entertain, an increase in the attractiveness of the outside options available to women need not be accompanied by an endogenous monotonic decline in wife beating. When the wife's reservation utility is very low, the mere possibility of violence may be sufficient to undermine her autonomy. When the battering frequency declines in response to higher reservation utilities, however, she may find it worthwhile to indulge her preferences so much that the incidence of domestic violence actually increases in equilibrium. Thus, for example, if higher earnings of the wife indicate higher reservation utility (as is reasonable), our model predicts that there may be *positive correlation* between women's earnings and the extent of spousal violence they endure in equilibrium. We record this insight for subsequent reference as the following proposition:

PROPOSITION 1. *The equilibrium level of spousal violence a woman endures may be non-monotonic in her reservation utility.*

We now enquire how the wife's bargaining power depends on her husband's reservation utility, $\overline{U}_H$. Suppose the wife's reservation utility is fixed at a level in the range $OS < \overline{U}_W \leq OR$ shown in the lower panel of figure 1. We have seen that the equilibrium battering frequency is then given by $b^\dagger < b^*$. When the husband's reservation utility is very low, he has a great deal to gain by engaging in spousal violence. As long as her utility in the absence of wife battering (that is, ON in the lower panel of the figure) is sufficiently high that $OR > \overline{U}_W$, when his reservation utility increases the husband will find it optimal to continue enforcing the same level of battering frequency as before. When his reservation utility continues to increase, the distance OR will decrease. This is because, all else constant, his wife's utility will decline in the absence of wife battering, since she has to ensure that he receives his reservation utility. A point will be reached when $OR = \overline{U}_W$. At that point, wife battering ceases to be feasible and, as we have seen, the husband discontinuously sets $b^\dagger = 0$.

We can now see that the wife's bargaining power in equilibrium as a function of her husband's reservation utility will be as shown in figure 4. Suppose that her reservation utility lies within the range $OS < \overline{U}_W < OR$; that is, her reservation utility is binding in equilibrium. When the husband's reservation utility is low (below OW in figure 4), he will maximize his utility by opting to enforce a battering frequency $b^\dagger < b^*$. As his reservation utility increases over the range O to OW, he will continue to implement the same frequency of wife battering. The wife's bargaining power and utility within marriage, as a result, are independent of her husband's reservation utility. Violence is a means the husband uses to make his reservation utility irrelevant. When his reservation utility reaches OW, however, the minimal amount of battering he would find worthwhile would reduce his wife's utility below its reservation level. In terms of figure 1, OR coincides with $\overline{U}_W$. At this point battering is unviable and the wife's bargaining power discretely increases, as shown in figure 4. For the husband's reservation utilities in the range $OW < \overline{U}_H \leq OV$ in the figure, wife battering is entirely out
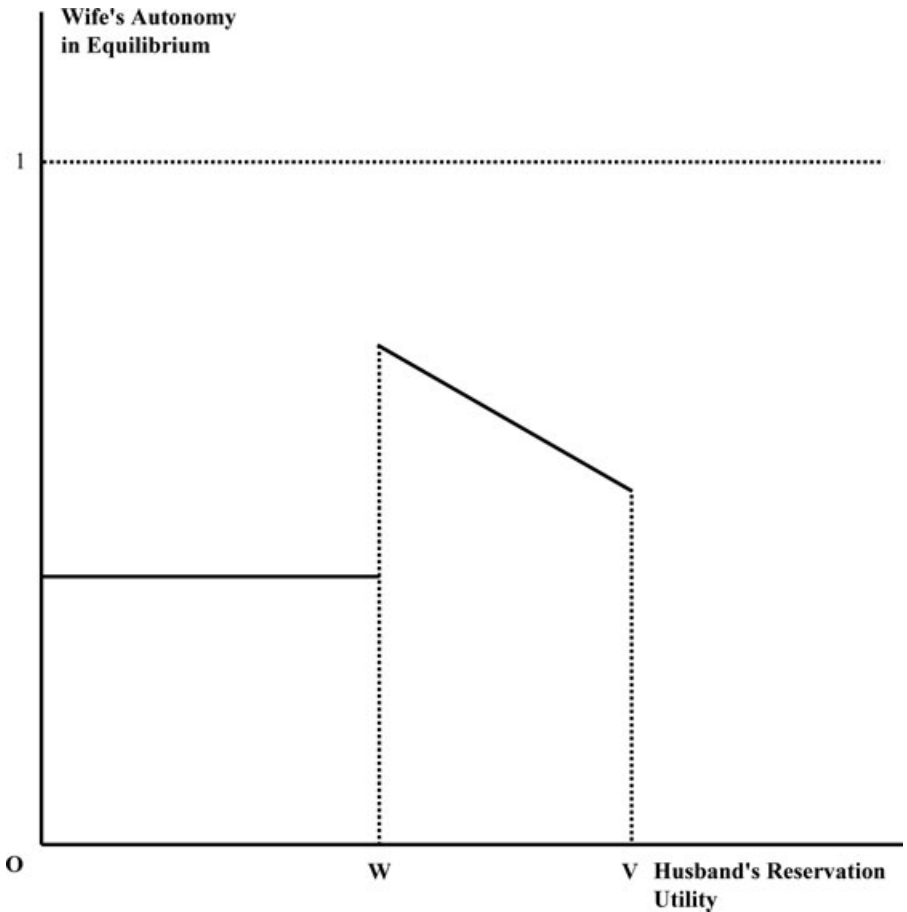
FIGURE 4 Wife's autonomy in equilibrium as a function of her husband's reservation utility (for a given value of her's)

of the question, and her bargaining power declines because she has to ensure that her husband receives his reservation utility. For $\overline{U}_H > OV$, there is not enough surplus in the marriage to ensure that both partners receive their reservation utilities. For $\overline{U}_H$ in the range 0 to OW, the wife is held at her reservation utility. When $\overline{U}_H$ is between OW and OV, the wife achieves a utility level *above* $\overline{U}_W$, since the minimal level of wife battering the husband would find profitable would push her below her reservation utility and is therefore not feasible.

   In our model, we see that women who experience domestic violence in equilibrium are held at their reservation utilities within marriage; women who experience no domestic violence are above their reservation utilities. Spousal violence in our framework is a vehicle that husbands employ for appropriating the entire surplus

within marriage. It is only when it becomes too expensive for husbands to employ this means that wives receive part of the surplus. From the point of view of the husband, violence is a substitute for his low reservation utility.

We see from figure 4 that the wife's bargaining power is *not* monotonically declining in the husband's reservation utility. Contrary to what we would expect from standard bargaining models without domestic violence, the wife's equilibrium utility here can increase when her husband's reservation utility increases. When $\overline{U}_H$ is sufficiently high, the resource allocation within the household is already strongly aligned with his preferences even in the absence of spousal violence. Since he perceives an opportunity cost to wife battering, he reckons it is not worth attempting to further narrow the gap between his preferences and the outcome his wife voluntarily implements. (This reticence on the husband's part would not arise, however, if his utility did not decrease in the amount of violence he inflicts on his wife.) We record these points for subsequent reference:

PROPOSITION 2. *(a) The extent of spousal violence the husband perpetrates in equilibrium may decline in his reservation utility. (b) The wife's autonomy in equilibrium is not monotonically declining in her husband's reservation utility.*

In our model, as $\overline{U}_H$ increases the husband suddenly relinquishes spousal violence and the wife's utility discretely jumps up from her reservation utility. One could conceive of other models that would deliver this outcome more gradually. The important point, however, is that, when the husband's reservation utility is low, he maintains his wife at her reservation utility through spousal violence. It is when the *husband's* reservation utility is sufficiently high that the wife's well-being strictly exceeds her reservation utility. This model also predicts that, all else held constant, domestic violence can be expected to *decline* when the husband's reservation utility increases. It is only husbands with poor outside options who will resort to spousal violence, an implication that is probably also valid in the developed world.

The analysis above enables us to predict the effects on domestic violence of various exogenous determinants. Naturally, the higher is the wife's education, dowry, earnings, and land ownership, the higher would her reservation utility be and, therefore, the higher her autonomy. Equilibrium spousal violence, however, is not necessarily monotonic in these factors, as we have seen. Furthermore, increases in the husband's reservation utility due to analogous factors may well decrease spousal violence.

We need to make a special point about the effects of the husband's education. An increase in his education can naturally be expected to increase his reservation utility. But this is not the only effect relevant here. Typically, educated men have more enlightened views on the appropriateness of spousal violence: they find it less acceptable. This would be tantamount to an increase in the parameter δ_2 in (2). As we have seen, this will make domestic violence less likely. So how would we expect an increase in the husband's education to impinge on his wife's autonomy? We have seen that, in the absence of domestic violence, both the wife's bargaining

power and her utility in marriage are decreasing in her husband's reservation utility (because she has to allocate resources more in line with his preferences). Thus, our model predicts that an increase in the husband's education will reduce wife beating as well as reduce her autonomy. There is some evidence drawn from Bangladesh of the negative effect of husband's education on domestic violence (Koenig et al. 2003).

One exogenous component of the environment that would be expected to substantially impinge on a woman's autonomy is the sort of family she lives in after marriage. If she lives in a nuclear family, her autonomy would be greater than when she lives with the husband's extended family, which usually includes his parents, his brothers and their sisters and wives (see Dyson and Moore 1983). In the latter scenario, one would expect the husband's reservation utility to be higher than when the family is nuclear, because he has the support of his parents and siblings. This increase in his reservation utility in going from a nuclear to an extended family may result in a *decline* in spousal violence, as argued above.

We would expect to observe less domestic violence when the couple resides with the wife's natal family.[15] This is because her parents and siblings are likely to be protective of her and curtail her husband's violence. We would also expect a woman's autonomy to be lower because it would be hard for her to break free from parental influence and exercise her independence. It is conceivable, though, that if her family members share her preferences over resource allocation, she may be able to exercise greater autonomy. In that case, the net effect of living with her natal family on a woman's autonomy would be an empirical matter.

Before we leave this theoretical section, we address one important issue. In the static model laid out above, domestic violence obtains as an equilibrium phenomenon. There is clearly an inefficiency in that a voluntary implementation of the equilibrium allocation without violence would be a Pareto improvement. The reason this does not transpire is that, in a one-shot game, the woman has no vehicle through which she could commit herself to this allocation; it would be in her self-interest to deviate. But it may be argued reasonably that marriage is best construed as a repeated game, in which Pareto efficient outcomes may be sustained through cooperation. One may ask why violence cannot be avoided altogether in the cooperative outcome by the threat of actual punishment in the event of deviation from the equilibrium allocation.[16] We are averse to arguing that domestic violence would be eliminated for three reasons. First, the repeated game rationale would be tantamount to setting out a cooperative model in a one-shot game in which Pareto inefficiency is ruled out per se by assumption. The *incontrovertible fact of domestic violence* is itself a stark reminder that outcomes within marriage are hardly Pareto efficient. And to attempt to do away with this

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15 Matrilocal residence is a frequent occurrence in the southern Indian state of Kerala, where a significant fraction of the population is organized along matriarchal lines, in sharp contrast to the rest of India, which is highly patriarchal and where, consequently, residence is patrilocal.

16 We thank an anonymous referee for suggesting that perhaps we could invoke informational asymmetries to justify violence even in a repeated game setting.

inefficiency is to trivialize the problem of domestic violence by invoking a paradigm that clearly fails in this realm. Secondly, if we presume that the household allocation of resources is cooperatively resolved in a repeated game, we would have to interpret episodes of domestic violence as breakdowns of cooperation. Since the non-cooperative outcome in bargaining models usually constitutes the threat outcome that determines the cooperative outcome, domestic violence retains its theoretical salience as being crucial to the endogenously determined autonomy of women in the cooperative couple. Finally, we emphasize that while our model is based on rationality to a large extent, we are not completely wedded to that approach here, especially since we are sympathetic to evolutionary arguments for domestic violence. Natural selection frequently uses inefficient means to achieve outcomes that promote biological fitness (as measured by the surviving offspring an organism leaves behind). If spousal violence enhanced the fitness of males in our evolutionary past, we shall observe it because it is hardwired at a visceral level in males and this is likely not easily superseded by rational considerations. We believe that our rendition of marriage as a one-shot game, despite its relative simplicity, does more justice to the phenomenon of domestic violence than would a more elaborate repeated game set-up.

3. Data and estimation strategy

We use the National Family Health Surveys (NFHS-2) data from India collected in 1998–99.[17] The cross-sectional data were collected on the basis of a multi-stage sample design. The survey information is nationally representative and was gathered from 91,196 households in 26 states through interviews with over 90,000 eligible women, ever-married women between the ages of 15–49 in these households. The survey had an excellent response rate, ranging from 89% to 100%, and in 24 out of the 26 states it was above 94%.[18] The survey provides state-level estimates of demographic and health statistics as well as data on various socioeconomic and programmatic information at the village, household, and individual levels. We narrow down our study to currently married women living in rural areas. This sub-sample comprises over 50,000 eligible women. We restrict our analysis to rural areas because we think this offers better scope to isolate the putative evolutionary forces that (in our view) may motivate men to curtail the movements of their wives. These effects are likely to appear in more pristine form in rural rather than in urban areas, which are typically under various modernizing influences.

17 The NFHS-2 survey was funded by the United States Agency for International Development (USAID) and UNICEF. The survey is the outcome of the collaborative efforts of many organizations: the International Institute for Population Sciences (IIPS); Government of India, New Delhi; thirteen reputed state field organizations; ORC Macro, Calverton, Maryland, USA; and the East-West Center, Honolulu, Hawaii, USA.
18 International Institute for Population Sciences (IIPS) and ORC Macro, 2000. National Family Health Survey (NFHS-2), 1998–99: India. Mumbai: IIPS.

The NFHS-2 survey covered a number of topics on gender issues relevant to this study, such as information on women's autonomy, domestic violence, and nutrition. The survey also collected anthropometric measures such as women's height and weight (which were obtained on site at the time of the interview).

3.1. *Outcome variables*

In order to test our theory, we need measures of women's autonomy and domestic violence (represented, respectively, by the parameter γ and the variable v in the theoretical section). We use a total of eight dichotomous variables to construct the outcome variables in our econometric study. Of these, one is domestic violence: violence perpetuated by a woman's husband in the past one year. The remaining seven, which reflect the woman's participation in household decision-making, are various components of our principal outcome variable for autonomy. (The survey questions from which we define these variables are listed in appendix A.)

- Domestic violence: whether the husband physically assaulted a woman during the year preceding the survey. Women are grouped as those not beaten by husbands in the preceding 12 months and those who were beaten. ('Yes' is coded as 1 and 'No' as 0.)
- Answers to the following questions yield the information we employ to define autonomy. Does the woman have *exclusive* say in decisions on (*i*) what she should cook (*ii*) whether she can access health care for herself, (*iii*) whether she should purchase jewellery, (*iv*) whether she can go to the market, (*v*) whether she should visit her natal family, (*vi*) whether she should stay with her natal family and siblings, and (*vii*) whether she can spend money. ('Yes' is coded as 1 and 'No' as 0.)

The use of dichotomous variables to represent aspects of autonomy is consistent with such usage in the literature (e.g., Anderson and Eswaran 2009). The questions from which we define these dichotomous variables are supplied in appendix A. In answering questions about her decision-making powers, she is offered several options: the decision is made (*i*) by herself, (*ii*) jointly with husband, (*iii*) jointly with others, (*iv*) by husband alone, or (*v*) by someone else. It is a basic assumption of this paper that the extent of 'say' a woman has in decision making is a measure whose utility is being maximized by the decision. It is probably the case that a woman truly exercises independence in these various realms only when she can exclusively decide on the matter at hand. In the South Asian context, an answer where a woman says she decides on these matters jointly with her husband or his relatives is usually not very indicative of autonomy, for it is likely camouflaged male dominance at work (see, e.g., Montgomery et al. 1996). So we do not count such women as having autonomy in these decisions. The women in our sample exhibit different levels of independence with regard to the seven decisions. We construct our autonomy variable by taking the *average*

TABLE 1
Summary statistics of outcome variables

Variable	Mean	Std. error	95% Confidence interval
Husband Has Beaten Wife (Ever)	**0.180**	**0.002**	**0.176–0.183**
Husband Has Beaten Wife (Past Year)	**0.105**	**0.001**	**0.102–0.108**
Autonomy	**0.232**	**0.001**	**0.229–0.233**
Decision About What to Cook	0.860	0.001	0.857–0.863
Decision to Access Health Care	0.499	0.002	0.495–0.503
Decision to Purchase Jewelry	0.523	0.002	0.519–0.527
Decision to Stay With Natal Family	0.477	0.002	0.472–0.481
Decision to Go to the Market	0.247	0.002	0.244–0.251
Decision to Visit Natal Family	0.200	0.002	0.196–0.203
Decision to Spend Money	0.150	0.002	0.147–0.153
Number of observations: 58,502			

of these seven binary variables. This variable, which lies between 0 and 1, is our empirical measure of the woman's bargaining power, γ, of our theory and is the primary left-hand-side variable of interest. An average of the binary variables, in our view, is a better indicator of the overall autonomy of a woman than is any binary variable in a specific sphere of her decision making.

As table 1 shows, a large proportion of the sample reports some form of subservience, as indicated by incidence of domestic violence and exclusion from having a say in family decisions. Roughly 18% of women in our sample of 58,500 have been beaten by their husbands at some time, and around 11% experienced such violence in the 12 months preceding the survey. There is always the possibility that there may a subjective element in answers to questions on sensitive issues such as spousal violence. To the extent that there is measurement error in our index of domestic violence, from an econometric point of view this variable would be deemed an endogenous regressor. We treat domestic violence as an endogenous variable anyway (for other reasons) in what follows and instrument for it. This should alleviate concerns about measurement error in this variable.

Table 1 shows that about 23% of the married women in our sample claim to have autonomy according to our comprehensive measure. There are substantial variations across the various components of their autonomy. Women exercise independence from a maximum of around 86% with regard to what they cook to a minimum of only 15% with regard to spending money.

3.2. Predictor variables

The survey also collected detailed economic and demographic data at the individual and household level. For our analysis we consider the following variables at the individual level: woman's and husband's educational attainment, length of their marriage, woman's age at her first marriage, woman's current age, woman's employment status, and aspects of woman's work (employed by a family member,

someone else, or self). From the question about the woman's ideal number of sons and information on total number of sons, we constructed the variable dubbed 'unmet desire for sons.' In India, where a woman is (erroneously) held responsible for the gender of the child and where families prefer sons over daughters, a woman might face more domestic violence and possess less autonomy if there is an unmet desire for sons.

In the social network module, the survey asked the woman if she discussed family planning with her mother and whether she went to her mother's house for delivery, as is the custom in most Indian households. We used this information to generate a variable for mother's support.[19] We expect that a woman might demand more autonomy and be less tolerant of physical abuse if she had support from her natal family. This variable might suffer from endogeneity issues, however, since a woman might contact her mother more frequently in case she needed to vent her anger or frustration with abuse or lack of autonomy. There can also be another reason for the association between domestic violence and mother's support, namely, the husband might inflict more violence on his wife if he believes she is influenced by outsiders, in this case her mother.

The survey also collected anthropometric measures such as the woman's height and weight; these were measured on site at the time of the interview by the surveyors. Since the average height of a woman varies significantly across different states in India, as an appropriate height index we used the deviation of her height from the mean for the state that she belongs to. We subsequently used this as an instrumental variable for domestic violence perpetrated by her husband, and this use is defended in what follows.[20] The ideal variables would be the difference in heights of husband and wife, but the survey did not collect this data for the husband. We also have information about whether the woman was currently pregnant or pregnant last year.

At the household level we consider the following variables: caste, religion, an asset-based standard of living index, and structure of the household (explained below). For the caste variable, we consider four groups: scheduled caste (a group that is socially segregated), scheduled tribe (a group identified on the basis of physical isolation), and other backward classes (officially identified as socially and educationally backward), and the upper caste (comprising Brahmins and other higher castes that are privileged). We consider four major religious groups: Hindus, Muslims, Sikhs, and Christians. The NFHS data does not contain information on individual or household incomes. But the survey asked a multitude of questions about the ownership of assets such as a car, television, property. The NFHS has used ownership of assets to create a standard of living index (*SLI*) with three categories: low, middle, and high. For the variable 'structure of the household,' we created three groups: nuclear family (with or without children),

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19 These questions were asked for only the last two children.
20 The woman's weight would also be correlated with the amount of domestic violence she faces, but we did not use this variable as an IV because it is more likely to be endogenous than height.

TABLE 2
Summary statistics for the sample of ever married women

Variable	Mean	Std. error	95% Confidence interval
Wife's Height (deviation from mean)	−0.024	0.026	−0.075–0.027
Wife's Height	151.648	0.053	151.54–151.75
Wife's Educ.: Illiterate	0.598	0.002	0.593–0.602
Wife's Educ. < Primary School	0.103	0.001	0.100–0.105
Wife's Educ. = Primary School	0.075	0.001	0.072–0.077
Wife's Educ. = Middle School	0.141	0.002	0.138–0.145
Wife's Educ. ≥ High School	0.083	0.001	0.081–0.086
Husband's Educ. : Illiterate	0.320	0.002	0.315–0.324
Husband's Educ. < Primary School	0.123	0.001	0.120–0.126
Husband's Educ. = Primary School	0.089	0.001	0.086–0.091
Husband's Educ. = Middle School	0.235	0.002	0.231–0.239
Husband's Educ. ≥ High School	0.234	0.002	0.230–0.237
Total Children Ever Born	3.229	0.010	3.210–3.248
Woman's Age at First Marriage	16.899	0.014	16.872–16.926
Unmet Desire for Sons	0.390	0.002	0.386–0.395
Current Age	31.069	0.039	30.993–31.146
Pregnant-Currently or Past Year	0.213	0.002	0.210–0.217
Support from Mother	0.071	0.002	0.068–0.075
Working	0.422	0.002	0.418–0.426
• Self-employed	0.046	0.001	0.045–0.048
• Work for family member	0.194	0.002	0.191–0.198
• Work for someone else	0.181	0.002	0.178–0.185
Nuclear Family	0.596	0.002	0.591–0.600
Living in Natal Joint Family	0.020	0.001	0.018–0.021
Living in Joint Family	0.385	0.002	0.380–0.389
Hindu	0.795	0.002	0.791–0.798
Muslim	0.101	0.001	0.099–0.104
Christian	0.054	0.001	0.052–0.056
Sikh	0.026	0.001	0.025–0.027
Low Social Economic Status	0.350	0.002	0.346–0.354
Medium Social Economic Status	0.500	0.002	0.495–0.504
High Social Economic Status	0.150	0.002	0.147–0.154
Schedule Caste (SC)	0.187	0.002	0.183–0.190
Schedule Tribe (ST)	0.151	0.002	0.147–0.154
Other Backward Classes (OBC)	0.345	0.006	0.333–0.356
Rest –other than SC, ST or OBC			
	Number of observations: 58,502		

joint family living with husband's parents, and joint family living with woman's natal family.[21] We created these using information about a woman's relationship with the household head and other members in the household.

In table 2 we provide the summary statistics of these individual and household predictor variables. We consider five educational categories: illiterate, literate but less than primary school, primary school completed, middle school completed, high school completed or higher. The sub-sample of rural population has

21 Menon and Johnson (2007) consider the first two but not the last.

extremely low levels of education and literacy rates, and women are far less educated than the husbands; about 60% of the women are illiterate whereas only 32% of the husbands are illiterate in our sub-sample; 23% of men have completed high school or more, compared with 8% of women. The mean age at first marriage is 16.9 years for women and their mean current age is 31 years. Only 6% of women in the sample have some support from their mother. The average number of children ever born is 3.2 and 39% of women still have an unmet desire for sons. On the work front, around 42% of women are currently working or have worked in the last 12 months: about 5% are self employed, 19% work for family members, and roughly 18% are employed by someone else.

A large proportion (60%) of the married women live with their husbands in a nuclear family and 40% live in a joint family (38% with wife's in-laws and only 2% with wife's parents). Approximately 80% of women belong to Hindu households, 10% to Muslim, 5% to Christian, and 3% to Sikh.[22] Around 18% of the women belong to the scheduled caste, 15% to scheduled tribes, 31% belong to other backward classes, and the remaining 36% to upper castes. By the standard of living index, around 35% of women belong to the group with the lowest standard of living index, 50% belong to the middle group, and 15% belong to the highest group.

3.3. Estimation strategy

Our theory purports that domestic violence is a vehicle for undermining the autonomy of married women, and our goal here is to isolate this effect. We do this by regressing autonomy as the dependent variable on domestic violence and controlling for other factors that could determine autonomy. However, we need to deal with the potential endogeneity of domestic violence. Autonomy itself may impinge on domestic violence, as we have seen in the theory section: women with greater autonomy might face a different degree of domestic violence than women with less autonomy. (We subsequently test for the possible exogeneity of domestic violence in determining autonomy and safely reject the possibility.)

To account for the potential endogeneity of domestic violence we use an index of the woman's height (H) as an instrumental variable. Our reason for choosing this as an IV is that a husband is more likely to engage in spousal violence if he feels he can physically overpower his wife. Also, the height of a woman is determined prior to marriage and is likely to be exogenous. Of course, there are a lot of other factors that might make even a physically strong woman acquiesce to spousal violence, such as like absence of other options (low reservation utility), which we control for. We still maintain that a woman's physical stature does play an important role in determining domestic violence, and we find empirical support for this claim in our sample. In order to identify the econometric model to follow, it is necessary that the instrumental variable and domestic violence be highly correlated. Table 3 reports the pairwise correlation coefficients between

22 The survey asked the following question: 'What is the religion of the head of the household?'

TABLE 3
Pair-wise correlation coefficients

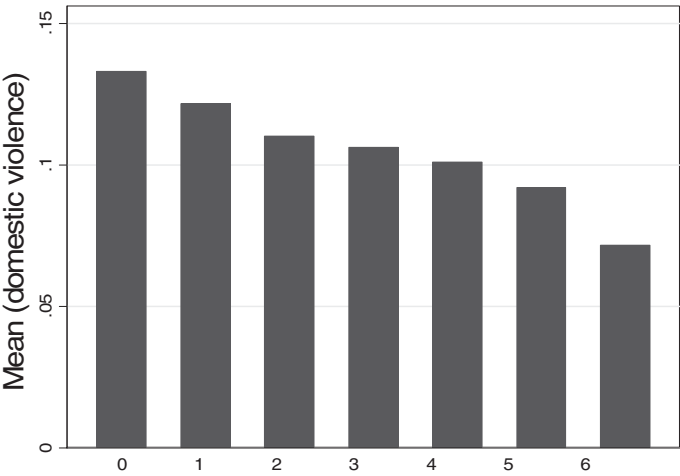|	Husband Has Beaten Wife (Past Year)	Wife Height-Deviation from Mean	Wife Height
Husband Has Beaten Wife (Past Year)	1		
Wife Height-Deviation from Mean	−0.0581*	1	
Wife Height	−0.0561*	0.9966*	1

*Denotes significance at 5%.

FIGURE 5 Domestic violence and height index. Domestic violence: Husband has beaten wife in last one year.
NOTE: Height index is divided into seven categories of equal frequency

the variables, and the significance level of the correlation coefficient. Height is seen to be significantly correlated (at 5%) with domestic violence. Figures 5 and 6 visually reveal these pairwise correlations. The first-stage regression shown in table B2 in appendix B (to be discussed later) also shows that height is strongly correlated with domestic violence.

The exclusion restriction in instrumental variable estimation requires that the relationship between the instrument (height) and autonomy be completely mediated by physical violence. There are a few objections that we can think of to the use of wife's height as an instrument for domestic violence, and we address these in our estimation. The first is the potential existence of third factors influencing both wife's height as well as autonomy. A woman's natal family income could be one such avenue of influence. It is possible that a low-income family is more likely to have daughters who are undernourished and so are shorter than daughters raised in high-income families. The latter, it could be

argued, may have higher levels of autonomy stemming from privilege. However, we may reasonably posit that there is assortative matching in the marriage market in the sense that women are married into a families with similar income levels (see, e.g., Deolalikar and Rao 1996 for evidence on this). We control for income level of the married woman's family by including a standard of living index (*SLI*). Thus, we are explicitly controlling for a direct effect of height on autonomy that may be working through the natal family's income.

It has been recently argued by Case and Paxson (2008) that there may be a correlation between height and cognitive ability, and the latter fetches higher returns in the labour market. Children raised in low-income families, they argue, would be undernourished and so would reach their genetic potential neither in height nor in cognitive ability. They provide some evidence for their hypothesis using data from the United Kingdom and the United States. Deaton and Raksha (2009) have made a similar argument. In view of this argument, how can we claim that there is no direct correlation between the height of women in our sample and their autonomy? Perhaps taller women earn higher incomes because of higher cognitive abilities and so are more autonomous? We believe this argument of a positive correlation between height and income (and hence autonomy) does not carry over to the context of rural India. The correlation coefficient between working and height for the women in our sample is *negative* (−0.0213, significant at 5%), contrary to what may be expected if the objection were valid. In rural India, working married women work mostly in agriculture, which employs mostly unskilled labour, and so differences in cognitive abilities are unlikely to be crucial. Physical strength may matter more for productivity, and this would be correlated with height. There is evidence of a positive correlation between height and agricultural productivity and, therefore, wages in developing countries (Haddad and Bouis 1991). What happens if taller women earn higher incomes when they do work?[23] Income is not observed in our data, unfortunately. As mentioned earlier, we control for income (to the extent possible) by our use of the family's standard of living index (*SLI*), a procedure that should be satisfactory given the evidence for assortative matching in the marriage market alluded to above.

Since we think physical violence is a major route through which height of a woman influences autonomy outcomes, another concern is that of selection bias. A man who intends to intimidate his wife through physical violence may be more likely to marry a woman with a smaller physical stature. However, in rural India most of the marriages are arranged by either the parents or other family elders or village elders. In most of these cases the groom and bride do not see each other before (and sometimes even during) the marriage ceremony.[24]

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23 If income is an omitted variable, it would then induce a correlation between our instrument (height) and the error term in the regression equation for autonomy – thereby rendering our instrument endogenous and the estimators inconsistent.

24 There is the possibility, though, that the groom's family members might choose a woman of a smaller frame, so that she would be easily intimidated by the groom.

We use the two-stage least squares (2SLS) regression in our analysis. Given that the National Family Health Survey used a multi-stage sample design, we incorporate the complex design factors (stratification, clustering, and post-survey weighting) into our analysis.[25] We estimate the following model:

$$V = \alpha_1 X + \alpha_2 H + \epsilon_1 \tag{8}$$

$$A = \beta_1 X + \beta_2 \widehat{V} + \epsilon_2, \tag{9}$$

where V is domestic violence as reported by the respondent, A is her decision-making autonomy, H (wife's height) is an instrumental variable for domestic violence, X denotes a vector of exogenous regressors, and ϵ_1, ϵ_2 are error terms. The height variable, H, we define more precisely as the deviation of the woman's height from the average for the relevant state. In the first stage, we regress domestic violence on all the predictor variables on the right-hand side of equation (8) using a linear probability model (OLS). We then use the predicted values of this regression, $\widehat{V}$, as the instrumental variable in the second-stage ordinary least squares regression equation (9) of the autonomy variable A. Since it is constructed as an average of several binary variables, we treat A as an approximately continuous variable defined over the range 0 and 1.

The vector X contains exogenous regressors that determine the reservation utilities of the woman and her husband, and we include the variables listed in table 2. We expect education of husband and wife to have negative impacts on domestic violence, whereas the former would have a negative effect on the wife's autonomy and the latter a positive effect. Higher socioeconomic status should reduce the likelihood of domestic violence because of less financial stress. Wife's age at first marriage should decrease domestic violence and increase autonomy; a young girl is easier to intimidate and, as the saying goes, easier to mould into a family's norms and traditions. We expect a woman to have less autonomy in a joint family than in a nuclear family. Working should increase a woman's bargaining power, and thus we expect a positive correlation between working and autonomy outcomes. However, working might or might not reduce the physical abuse she faces – our theory suggested that better outside options for the woman may increase wife beating. The husband might use violence to undermine a woman's bargaining power or to challenge her higher status as a working member. Parents in India are known to have a strong preference for sons over daughters. Given this, it may be argued that women with sons may command greater autonomy and also face less spousal violence. We therefore include a variable representing the woman's unmet desire for sons in our regressions. It may also be argued that

25 The survey design was uniform for all the states, with a two-stage selection procedure in the rural areas and a three-stage one in the urban areas. In both cases, households were randomly selected in the last stage. (See the survey's final report for details of sample design, including sampling frame and sample implementation; IIPS 2000).

women may prefer fewer children than men do (since the former have to bear a greater proportion of the costs of upbringing). If this is true, women with low autonomy would have more children and so we control for the total number of children in our regressions. We also include dummy indicators for the 26 states to control for state fixed effects.

4. Results

4.1. Domestic violence

In table 4 we report results from the regressions for domestic violence; domestic violence is the dependent variable and we include all variables of interest that have been listed earlier as the explanatory variables. Note that this is *not* the first-stage regression of the 2SLS estimation. In the first stage of the 2SLS model we do not include the work variables, for they are likely to be endogenously determined by the woman's autonomy. (The first-stage regression for the 2SLS is reported in table B1, which is relegated to appendix B.) In table 4, column 2 reports the results for a linear probability model (OLS regression) and column 3 reports the odds ratio from a logit estimation.[26]

Domestic violence is negatively correlated with wife's height. This result is significant (at the 1% level) even after wealth (socio-economic status), education, working status, and other explanators are controlled for. Education (both for men and women) significantly decreases the incidence of domestic violence (illiteracy is the left-out category). This is consistent with what we might expect. This relation, however, is seen to be non-linear; it is significant only if the woman and her husband have completed at least primary school. A literate woman with less than primary schooling is as likely to be beaten by her husband as an illiterate woman. Similarly, a literate husband who has completed less than primary schooling is likely to be as abusive as an illiterate husband. The odds of violence decreases with the woman's age at first marriage. Wife's current age is negatively correlated with domestic violence. We find evidence of a positive relation between domestic violence and total number of children born. We don't find any correlation between domestic violence and woman's unmet desire for sons. There is no correlation between being pregnant last year and domestic violence during the period. We find a significantly positive correlation between support from woman's mother and domestic violence. Either men are more likely to be violent with wives who are close to their mothers or wives who are abused tend to seek more support from their mothers – we cannot say which.

Consistent with our theory, work status of a woman does not reduce the domestic violence that she faces. In fact, the correlation is positive and significant

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26 The main difference between the two regressions is that the linear probability model assumes marginal effects to be constant, whereas the logit model allows marginal effects to change. Close to the average values of the regressors, the linear probability model is a good estimator.

TABLE 4
Determinants of domestic violence

DV: Husband Has Beaten Wife (Past Year))	OLS	Logit odds ratio
Wife's Height (deviation from mean)	−0.0009**	0.9914**
	(0.0003)	(0.0030)
Wife's Educ. < Primary School	0.0046	1.0615
	(0.0063)	(0.0653)
Wife's Educ. = Primary School	−0.0200**	0.8087**
	(0.0061)	(0.0594)
Wife's Educ. = Middle School	−0.0199**	0.7772**
	(0.0055)	(0.0546)
Wife's Educ. ≥ High School	−0.0237**	0.6644**
	(0.0070)	(0.0741)
Husband's Educ. < Primary School	−0.0019	1.0155
	(0.0068)	(0.0596)
Husband's Educ. = Primary School	−0.0191**	0.8566*
	(0.0070)	(0.0566)
Husband's Educ. = Middle School	−0.0140**	0.9064*
	(0.0051)	(0.0423)
Husband's Educ. ≥ High School	−0.0314**	0.7317**
	(0.0053)	(0.0420)
Total Children Ever Born	0.0041**	1.0415**
	(0.0011)	(0.0109)
Wife's Age at First Marriage	−0.0012	0.9866+
	(0.0007)	(0.0080)
Unmet Desire for Sons	0.0013	1.0109
	(0.0040)	(0.0397)
Current Age	−0.0023**	0.9773**
	(0.0003)	(0.0030)
Pregnant-Currently or Past Year	−0.0030	0.9644
	(0.0047)	(0.0421)
Support from Mother	0.0200**	1.2091**
	(0.0068)	(0.0735)
Working: Self-employed	0.0345**	1.3698**
	(0.0100)	(0.1185)
Working for family member	0.0276**	1.3084**
	(0.0055)	(0.0728)
Working for someone else	0.0433**	1.4485**
	(0.0063)	(0.0786)
Living in Natal Joint Family	−0.0444**	0.6514**
	(0.0113)	(0.0858)
Living in Joint Family	−0.0334**	0.7207**
	(0.0038)	(0.0280)
Muslim	0.0124	1.1430
	(0.0085)	(0.0933)
Christian	0.0106	1.0983
	(0.0154)	(0.1711)
Sikh	0.0192*	1.3256*
	(0.0091)	(0.1861)
Medium Social Economic Status	−0.0248**	0.8228**
	(0.0044)	(0.0327)
High Social Economic Status	−0.0410**	0.5136**
	(0.0057)	(0.0449)

(Continued)

TABLE 4
(*Continued*)

DV: Husband Has Beaten Wife (Past Year))	OLS	Logit odds ratio
Schedule Caste	0.0203**	1.1969**
	(0.0058)	(0.0676)
Schedule Tribe	0.0023	1.0596
	(0.0075)	(0.0785)
Other Backward Classes	−0.0039	0.9945
	(0.0049)	(0.0560)
Observations	49118	49118

NOTES: OLS-R-squared= 0.05; standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%; constant and regional dummies are not reported.

TABLE 5
Domestic violence and type of work

Adjusted Wald Test	Work_else - Work_family $= 0$		
	Coefficient	F-stat	Prob > F
OLS	(0.0433) − (0.0276)	5.34	0.0217

(at the 1% level). Gonzalez-Bernes (2004), using data from East Africa, also concludes that female labour force participation is not associated with lower levels of violence. The coefficients on all the categories of work are positive and significant in our estimated equations, although the magnitudes vary with her relationship to the employer. In particular, women who work for someone else are more likely to face domestic violence than those who work for a family member. The difference is statistically significant (at the 5% level), as can be seen from the Wald test performed in table 5. This result that wives working for unrelated employers are more likely to be beaten is strong confirmation of the evolutionary basis of domestic violence espoused by Wilson and Daly (1993, 1996).

In order to better understand the incidence of domestic violence by type of women's employment, in figure 6 we report the proportion of women who face domestic violence in the different sub-groups defined by relationship to employer. Of women who work for someone other than family members 16% report incidence of wife beating in the past one year, compared with 9% of women who are either self-employed or working for family members. Of course, these proportions do not account for other covariates. In the Wald test reported in table 5, we control for other socio-demographic determinants (using the regression results from table 4) and we still find evidence of a significantly greater incidence of domestic violence among women employed by non-family members than among those working for family members.
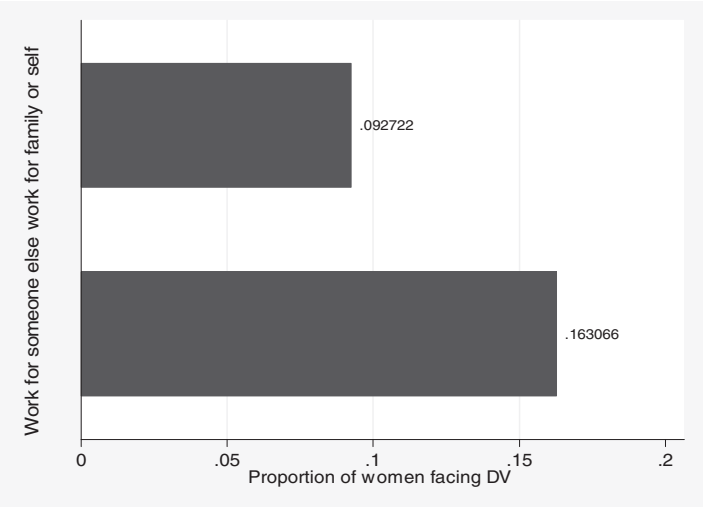
FIGURE 6 Work status and domestic violence

Returning to table 4, we see that the incidence of domestic violence is signifi-cantly lower for couples that reside in joint families, both with wife's natal family and with husband's parents' family (the left-out category being the nuclear fam-ily). When the couple resides with the husband's family, his reservation utility increases. As a result, there is less need for the husband to resort to violence to boost his own well-being. This finding, which Menon and Johnson (2007) also find using NFHS data, is consistent with our theory. In addition, we find that a woman is less vulnerable to domestic violence when the couple resides with her natal family. We see that women belonging to Sikh and Muslim households face significantly higher incidence of domestic violence (compared with Hindu households, the left-out category). Women belonging to groups with medium and higher standard of living index (*SLI*) face significantly lower incidence of domes-tic violence, compared with the group with the lowest *SLI* (the left-out category). Using a similar measure of wealth index Gonzalez-Bernes (2004), in contrast, does not find a significant relation between wealth and domestic violence for East Africa.

4.2. Women's autonomy

4.2.1. Effect of domestic violence

In table 6 we report the results from the second stage (the estimation of women's autonomy) of the 2SLS procedure. The first stage of the 2SLS regression is reported in table B1, as mentioned earlier. In this first stage, we note that the wife's height is negatively correlated with domestic violence at the 1% level of

TABLE 6
Women's autonomy – involved in decision making (instrument: height)

	Autonomy
Husband Has Beaten Wife (Last Year)	−0.8831*
	(0.3612)
Wife's Educ. < Primary School	0.0069
	(0.0069)
Wife's Educ. = Primary School	−0.0101
	(0.0110)
Wife's Educ. = Middle School	−0.0121
	(0.0115)
Wife's Educ. ≥ High School	0.0123
	(0.0121)
Husband's Educ. < Primary School	−0.0041
	(0.0074)
Husband's Educ. = Primary School	−0.0235*
	(0.0110)
Husband's Educ. = Middle School	−0.0234**
	(0.0084)
Husband's Educ. ≥ High School	−0.0367*
	(0.0142)
Total Children Ever Born	0.0040+
	(0.0021)
Wife's Age at First Marriage	−0.0025*
	(0.0010)
Unmet Desire for Sons	−0.0011
	(0.0044)
Current Age	0.0029**
	(0.0009)
Pregnant-Currently or Past Year	−0.0125*
	(0.0059)
Support from Mother	0.0092
	(0.0102)
Living in Natal Joint Family	−0.0653**
	(0.0214)
Living in Joint Family	−0.1061**
	(0.0134)
Muslim	0.0005
	(0.0087)
Christian	0.0205
	(0.0176)
Sikh	0.0058
	(0.0149)
Medium Social Economic Status	−0.0455**
	(0.0117)
High Social Economic Status	−0.0780**
	(0.0195)
Schedule Caste	0.0327**
	(0.0113)
Schedule Tribe	0.0332**
	(0.0088)

(Continued)

TABLE 6
(*Continued*)

	Autonomy
Other Backward Classes	0.0048
	(0.0061)
Observations	49118

NOTES: Tests of endogeneity of: hbeat_yr; Durbin-Wu-Hausman chi-sq test: 18.51642; p-value = 0.00002; standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%; constant and regional dummies are not reported.

significance. This assures us that height is not a weak instrument for domestic violence.

At the bottom of table 6 we report the results of the Durbin-Wu-Hausmann test for the exogeneity of domestic violence in the determination of women's autonomy. The extremely low prob value of 0.00002 indicates that any presumption of exogeneity can be firmly rejected, and so a 2SLS procedure is appropriate.

We see from table 6 that domestic violence reduces women's autonomy (at the 5% level of significance). We also see that, once we account for the endogeneity of domestic violence (using IVs), the coefficient is not only statistically significant but also much larger in magnitude than the OLS estimate shown in table 7 for comparison. This comparison brings out the importance of accounting for the endogeneity of domestic violence. In the light of our theory, we can see why the OLS estimate is insignificant (and of the wrong sign). On the one hand, domestic violence would induce women to curtail their autonomy to avoid the pain and humiliation of being beaten. On the other hand, as we saw in our theoretical model, there is a reverse causality going from autonomy to domestic violence: women with greater autonomy may elicit greater violence from their husbands. The OLS estimation does not account for this reverse causality and, in essence, merely captures the 'net' correlation between domestic violence and women's autonomy – and this may be of either sign. Once we purge the reverse causality with our 2SLS estimation using an instrumental variable, we isolate the negative effect of domestic violence on autonomy. So strong is this effect that a fully independent woman (with autonomy $= 1$, by definition) will see her autonomy collapse to around 0.12 if she is subjected to spousal violence.

To get some intuitive assurance of the validity of our instrumental variable, we follow the suggestion of Murray (2006) and check the coefficient of the IV in the reduced-form estimation. If we substitute for V from equation (8) into (9), the coefficient of our instrument H in the reduced form would be $\alpha_2 \beta_2$. Since we expect $\alpha_2 < 0$ and $\beta_2 < 0$, the reduced-form OLS estimate of the coefficient of H should be positive and significant. Our estimation of the reduced form (table B2 in appendix B) yields a positive coefficient that is significant at the 1% level. This

TABLE 7
Women's autonomy involved in decision making (OLS – second stage)

	Autonomy
Husband Has Beaten Wife (Last Year)	0.0053
	(0.0037)
Wife's Educ. < Primary School	0.0054
	(0.0040)
Wife's Educ. = Primary School	0.0116*
	(0.0047)
Wife's Educ. = Middle School	0.0101**
	(0.0037)
Wife's Educ. ≥ High School	0.0361**
	(0.0045)
Husband's Educ. < Primary School	−0.0015
	(0.0040)
Husband's Educ. = Primary School	−0.0042
	(0.0039)
Husband's Educ. = Middle School	−0.0074*
	(0.0033)
Husband's Educ. ≥ High School	−0.0039
	(0.0031)
Total Children Ever Born	0.0003
	(0.0008)
Wife's Age at First Marriage	−0.0012*
	(0.0005)
Unmet Desire for Sons	−0.0027
	(0.0024)
Current Age	0.0049**
	(0.0002)
Pregnant-Currently or Past Year	−0.0074**
	(0.0027)
Support from Mother	−0.0089*
	(0.0037)
Living in Natal Joint Family	−0.0238**
	(0.0090)
Living in Joint Family	−0.0754**
	(0.0023)
Muslim	−0.0055
	(0.0046)
Christian	0.0097
	(0.0105)
Sikh	−0.0099
	(0.0090)
Medium Social Economic Status	−0.0191**
	(0.0027)
High Social Economic Status	−0.0350**
	(0.0044)
Schedule Caste	0.0103**
	(0.0033)
Schedule Tribe	0.0261**
	(0.0050)
Other Backward Classes	0.0065[+]
	(0.0038)
Observations	49118

NOTES: R-squared = 0.19; Standard errors in parentheses + significant at 10%; * significant at 5%; ** significant at 1%; Constant and regional dummies are not reported.

TABLE 8
Weak instrument conditional tests and confidence intervals
LIML estimate of β[Husband Has Beaten Wife (Last Year)] $= -0.2880429$

Test	Confidence Set	p-value
Conditional Likelihood Ratio	[−0.5252, −0.1028546]	0.002
Anderson-Rubin	[−0.5252, −0.1028546]	0.002
Score (Lagrange Multiplier)	[−0.5252, −0.1028546]	0.002

NOTES: Coverage-corrected confidence sets and p-values for Ho: β[Husband Has Beaten Wife (Last Year)] $= 0$.

is somewhat comforting, since the sign of the coefficient of the IV is consistent with its intuition.

We address the possibility that our instrument may be deemed weak. An F-test on the exclusion of the instrument from the first stage yields an F-statistic of 9 (which is the square of the t-statistic associated with H in table B1 in appendix B). This falls somewhat shy of the rule-of-thumb value of 10, which Stock and Yugo (2005) suggest as the minimal value of the F-statistic for which weakness of an instrument is not an issue.[27] If the instrument is weak, the IV estimate would be biased and the standard errors would be incorrect – thereby leading to erroneous inferences because the t-statistics are unreliable. To ensure that our inferences are not vulnerable to this potential problem we use the limited information maximum likelihood (LIML) estimator, which is robust with regard to whether or not the IV is weak.[28] The LIML estimate, the conditional likelihood ratio (CLR) confidence regions, and the p-value are reported in table 8 (which also presents the Anderson-Rubin and Lagrange multiplier tests). As can be seen, the LIML estimate of the coefficient of domestic violence is −0.2880429 and the entire CLR confidence region lies below zero; the p-value is 0.002. This demonstrates that our results regarding the effect of domestic violence on women's autonomy are not an artefact of a weak instrument.[29]

4.2.2. Other determinants
Higher education would be expected to increase reservation utilities. Higher levels of education do not affect the wife's autonomy once we account for the endogeneity of domestic violence. A husband's educational attainments significantly reduce women's autonomy, provided he has completed at least primary school. If

27 This, however, is based on the arbitrary criterion that the IV estimator has a bias that is less that 10% of the OLS bias. Had the rule-of-thumb been based on the proportional bias being less that 20% rather than 10%, our F-statistic would have not been deemed problematic.
28 The implementation of this procedure in STATA 11 is by Mikusheva and Poi (2001), and the associated command is *condivreg*.
29 While we have opted to run all our regressions using STATA's *svy:reg* command to account for survey design, as is appropriate for our data, the *condivreg* estimation (table 8) does not permit the use of *svy* or *weights*.

a husband's educational attainment is low, it is seen to have no effect on women's autonomy after we control for domestic violence. As our theory predicts, these men with low reservation utilities would try to assert control through domestic violence.

The regression in table 6 shows that, if the couple lives in a joint family (the husband's parents' family), the woman's autonomy is lower.[30] This is consistent with our theory. Patrilocal residence reduces the woman's freedom to decide, from her decision about buying jewellery to staying with her natal family. In essence, a woman is more restrained if she is living with her husband's parents and siblings rather than just with her husband in a nuclear family. The joint family structure in India usually clearly delineates a wife's role and, in addition, other family members are able to monitor and control her life more closely. Furthermore, the joint family also raises her husband's reservation utility. Our results also show that if the couple stays with the wife's natal family, then too her autonomy is reduced. As argued earlier, this may be because it is difficult for a woman to exercise autonomy in the presence of her parents. The negative coefficient of pregnancy in table 6 may strike on as odd but actually is not so in the Indian context. Pregnant women in rural India are often sequestered and prevented by their families from doing anything strenuous. This well-intentioned behaviour would naturally result in a decline in pregnant women's autonomy.

In line with our expectations about a positive influence of women's age at first marriage, we find a significant relation between this and women's autonomy. We find that the total number of children born and wife's current age correlate positively (but barely significantly) with women's autonomy. We do not find mother's support to be a significant determinant of women's autonomy. We do not find much difference in women's autonomy across different religious households (the left-out category is Hindu). Turning to caste, where the left-out category in the table is Upper castes, we see that women belonging to the Schedule Caste and Schedule Tribe castes have more control over decisions in their lives than those in the other castes. Women who are higher in the caste hierarchy exercise less autonomy. This is consistent with the fact that the higher castes in India demand greater 'purity' of their womenfolk, and this is usually accomplished by curtailing their independence.

We observe a negative correlation between women's autonomy and the standard of living index (*SLI*). Women belonging to more affluent families have less bargaining power than those belonging to poorer families. As alluded to above, it is possible that more affluent families are more particular about their so-called family honor, which is invariably tied to controlling women's actions and mobility. So, paradoxically, the autonomy of women in well-off families is lower than that of women in poorer families. Note that, since *SLI* is not exclusively capturing women's wealth only but rather refers to the *family's* wealth, this finding does not contradict other empirical findings that show that women's autonomy

30 Menon and Johnson (2007) also find this.

in developing countries increases in their unearned wealth (e.g., Anderson and Eswaran 2009; Thomas 1990).

5. Conclusions

In this paper we have provided a non-cooperative model of the household in the South Asian context, in which husbands use domestic violence as a vehicle to undermine their wives' autonomy and ensure an allocation of household resources that is more aligned with their own preferences. We showed that, although the autonomy of married women is (weakly) increasing in their reservation utility, it is not necessarily (weakly) declining in that of their husbands. Furthermore, the amount of spousal violence women experience can be non-monotonic in their own reservation utility. Better outside options for women, we showed, may invite more spousal violence – especially when their husbands have low reservation utilities, since violence is their last resort. The framework we offered here also suggested a way to investigate whether it is patriarchy or jealousy hardwired in our evolutionary past by concerns of paternity uncertainty that is responsible for spousal violence against women. In the latter case, women who earn income by working away from home should face greater domestic violence.

We tested the theory with data on married women from the NFHS (1998–99) from India. Our analysis takes care to account for the possible endogeneity of domestic violence. With the choice of a suitable instrument, we find compelling evidence to suggest that domestic violence drastically reduces women's autonomy. The regrettable efficacy of domestic violence in undermining women's autonomy may go a long way towards explaining why natural selection may have hardwired the proclivity for mate violence in males, judging from the pervasiveness of this type of violence across the world. We also find that women who work away from home are seen to confront more spousal violence, after controlling for a host of explanatory variables. This provides some tentative evidence in favour of the view from evolutionary psychology on the ultimate cause of spousal violence. Furthermore, we find that the extent of the violence can be increasing in the outside options of women.

This last finding has important policy implications. It suggests that empowering women through better employment opportunities – which can be very helpful in terms of improving their well-being on balance – may be accompanied by more wife battering. More shelters for battered women and better enforcement of the law may be necessary accompaniments of better employment opportunities if spousal violence is to be controlled. Also, as Bowlus and Seitz (2006) argue, re-socializing men who have a history of abuse can be an important policy measure for reducing domestic violence. These various avenues are *complements* to, not substitutes for, policies that improve women's employment opportunities. Recognition of this is all the more essential if, as our analysis suggests, spousal violence

has evolutionary origins and so needs to be countered with greater vigilance via an appropriate design of institutions.

Appendix A: NFHS survey questions related to decision making in the the household and to domestic violence

Who makes the following decisions in your household?

- What items to cook
- Obtaining health care for yourself
- Purchasing jewellery or other major household items
- Your going and staying with parents or siblings

    Options given for these answers:
    1) Respondent 2) Husband 3) Jointly with husband 4) Others in household 5) Jointly with others in household

Who mainly decides how you can spend the money you earn?
    Options given for the answer:
    1) Respondent 2) Husband 3) Jointly with husband 4) Others in household
    5) Jointly with others in household

Do you need permission to:

- Go the market?
- Visit relatives or friends?

    Options given for the answers:
    1) Yes 2) No 3) Not allowed to go

Since you completed 15 years of age, have you been beaten or mistreated physically by any person?
    Options given for the answers:
    1) Yes 2) No

If yes: Who has beaten you or mistreated you physically?
    There are 21 options, and one option is 'Husband'

If yes: How often have you been beaten or mistreated physically in the last 12 months:
    Options for the answer:
    1) Once 2) A few times 3) Many times 4) Not beaten

Appendix B

TABLE B1
First-stage regression of the 2SLS (ordinary least squares)

DV: Husband Has Beaten Wife (Last Year)

Wife Height-Deviation from Mean	−0.0009**
	(0.0003)
Wife's Educ. < Primary School	0.0018
	(0.0063)
Wife's Educ. = Primary School	−0.0244**
	(0.0061)
Wife's Educ. = Middle School	−0.0248**
	(0.0054)
Wife's Educ. ≥ High School	−0.0264**
	(0.0069)
Husband's Educ. < Primary School	−0.0030
	(0.0068)
Husband's Educ. = Primary School	−0.0219**
	(0.0070)
Husband's Educ. = Middle School	−0.0179**
	(0.0050)
Husband's Educ. ≥ High School	−0.0365**
	(0.0052)
Total Children Ever Born	0.0042**
	(0.0011)
Wife's Age at First Marriage	−0.0014^{+}
	(0.0007)
Unmet Desire for Sons	0.0016
	(0.0040)
Current Age	−0.0023**
	(0.0003)
Pregnant-Currently or Past Year	−0.0059
	(0.0047)
Support from Mother	0.0205**
	(0.0068)
Living in Natal Joint Family	−0.0466**
	(0.0114)
Living in Joint Family	−0.0347**
	(0.0038)
Muslim	0.0073
	(0.0084)
Christian	0.0126
	(0.0154)
Sikh	0.0185*
	(0.0090)
Medium Social Economic Status	−0.0291**
	(0.0044)
High Social Economic Status	−0.0470**
	(0.0055)
Schedule Caste	0.0242**
	(0.0060)
Schedule Tribe	0.0075
	(0.0075)
Other Backward Classes	−0.0025
	(0.0049)
Observations	49118

R-squared = 0.04; Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%. Constant and regional dummies are not reported.

TABLE B2
Reduced-form OLS

	Autonomy
Wife's Height (deviation from mean)	0.0008**
	(0.0002)
Wife's Educ. < Primary School	0.0053
	(0.0040)
Wife's Educ. = Primary School	0.0114*
	(0.0047)
Wife's Educ. = Middle School	0.0098**
	(0.0037)
Wife's Educ. ≥ High School	0.0357**
	(0.0045)
Husband's Educ. < Primary	−0.0014
	(0.0040)
Husband's Educ. = Primary School	−0.0042
	(0.0039)
Husband's Educ. = Middle School	−0.0076*
	(0.0032)
Husband's Educ. ≥ High School	−0.0045
	(0.0031)
Total Children ever born	0.0003
	(0.0008)
Woman's Age at First Marriage	−0.0012*
	(0.0005)
Unmet Desire for Sons	−0.0025
	(0.0024)
Current Age	0.0049**
	(0.0002)
Pregnant-Currently or Past Year	−0.0073**
	(0.0027)
Support from Mother	−0.0089*
	(0.0038)
Living in Natal Joint	−0.0241**
	(0.0090)
Living in Joint	−0.0755**
	(0.0023)
Muslim	−0.0059
	(0.0046)
Christian	0.0093
	(0.0105)
Sikh	−0.0106
	(0.0090)
Medium Social Economic Status	−0.0198**
	(0.0027)
High Social Economic Status	−0.0365**
	(0.0045)
Schedule Caste	0.0113**
	(0.0033)
Schedule Tribe	0.0266**
	(0.0050)
Other Backward Classes	0.0070+
	(0.0038)
Observations	49118
R−squared	0.19

NOTES: Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%.

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