Female employment and violence in the household: Evidence from Nicaragua

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Abstract

ABSTRACT: Mothers often work more in violent households, but their children fare relatively poorly. We consider a resource extraction motive which can explain observed relationships between female labour supply, household public goods provisions, and violence in the household. We first show that children in Latin America are more likely to die, and sometimes have worse height-for-age scores in violent households, after conditioning on observable parental characteristics. The 1971 census microdata from Nicaragua is then combined with the Demographic and Health Survey and Living Standards Measurement Study for 1998, to show that there is a positive impact of female employment on violence. A 10% rise in women's employment propensities is associated with an increase in violence of about 1-4%.

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1 Introduction

Violence in the home is associated with a wide range of negative consequences for both those who experience it and for those who are indirectly affected. Women who are abused by their partners suffer physical and emotional injuries, and children in violent households, even if they are not being abused, pay high costs in terms of their physical and emotional development. Such violence is widespread in households across the developing world, but its economic causes and implications have been little examined. This contrasts with the considerable attention given to understanding the role of violence outside of the home for economic development.[1] In this paper, we demonstrate how a resource extraction motive for violence can relate the stylised facts that women often work more in violent households, but their children's outcomes are worse. For Nicaragua, we combine the 1971 Integrated Public Use Microdata Series (IPUMS) with the 1998 Demographic and Health Survey (DHS) and 1998 Living Standards Monitoring Study (LSMS) to show that female employment has a positive causal impact on violence. Where women's legal or financial potential for exiting a violent partnership remains negligible, greater female financial autonomy may be accompanied by an increased probability that her partner becomes non-cooperative and violent.

Several stylised facts have emerged about household violence from the DHS, which have now included violence modules for more than 25 developing countries. First, levels are high in all countries. They range from a low of 18% of ever-married Cambodian women who have been beaten by a spouse, to 48% in Zambia. Second, infant mortality is higher among women who report having experienced violence from partners, and their children are less likely to be vaccinated on time. Third, women who have experienced violence in a partnership are more likely to work outside of the home (Kishor and Johnson (2004)). These statistical regularities across diverse cultures suggest that household violence may have some common causes and implications

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[1]See, for example, Bates (2000) and North, Wallis, and Weingast(2009).

around the world.

Why should it be that violence is associated both with women working more outside the home, and with worse child outcomes, when a large literature associates greater female incomes with healthier children?[2] This paper offers a theoretical and empirical study of the causes and effects of violence on female labour supply and public goods provision within the household. Public goods provision is proxied using two measures of the wellbeing of young children: height-for-age and child mortality. Data from the DHS surveys from five Latin American countries are used to provide empirical support for a model in which the motivation for domestic violence is primarily that of resource extraction. The census sample from the 1971 Nicaraguan IPUMS is combined with the 1998 DHS to measure changes in local labour male agricultural employment across 1971-1998. These changes plausibly proxy changes in the demand for women's labour over the period, and so are used to predict current employment propensities. It is shown that increases in women's employment cause increases in violence within the household, and that these results are unlikely to be attributable to local unobservables.

There is a substantial literature from other disciplines on the impacts of violence in the home on women and children. Psychological and sociological studies have shown that violence damages mental and physical health of women.[3] It has been demonstrated that children in violent households also experience negative effects on their physical and psychological health. Men who are violent towards their partners are also likely to physically abuse their children. However, the consequences of such violence on children are

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[2]For example, Thomas (1990) shows that (unearned) income controlled by women is associated with better child health outcomes, including anthropometry scores, even after controlling for other sources of income in Brazilian households. Duflo (2003) shows that, in three generation households in South Africa, exogenous increases in grandmother's unearned income impact children's anthropometric outcomes positively. Such increases in grandfather's income do not have such a strong effect.

[3]See, for example, Thompson et al. (2003), Romito et al. (2005), Fischbach and Herbert (1997), Loxton et al (2006), Fanslow et al (1998), Ellsberg et al. (1999), Ellsberg et al.(2001), and Kyriacou et al. (1999).

not limited to direct effects. Children in homes where mothers have experienced violence often score lower on height-for-age than children in homes with no spousal violence. Child mortality tends to be higher in these homes as well. A link between a woman's inability to make decisions for herself and her family, and violence has been found. This inability has been linked to an increased risk of malnutrition in children.[4] Violent households may underinvest in public goods because violence changes the optimal allocation of a woman's time, public goods provisions, and the private consumption levels of both spouses.

Evidence suggests that both legal settings and the characteristics of partnerships predict violence in the home. Tauchen and Witte (1995) show that police interventions in household violence situations impact the probability of reoccurrence. Studies conducted in the United States have shown that women with better outside options, such as access to divorce, shelters, and employment opportunities, experience less domestic violence than women who do not have these options.[5] Stephenson and Wolfers (2002) show that the introduction of no-fault divorce laws decreased spousal homicide in the US. Flake and Forste (2006) find that in Latin America, domestic violence is more prevalent in households amongst unmarried couples, where the woman's partner uses alcohol, where decision-making responsibilities are not shared, and where partners do not have similar education levels. Still, violence is widely present in households across socio-economic strata, in all countries for which data is available.[6] Eswaran and Malhotra (2011) show that the

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[4]See, for example, Ackerson and Subramanian (2008), Finkelstein and Yates (2001), Thormaehlen and Bass-Feld (1994), Straus and Gelles (1989), Yoshioka et al. (2003), Kishor and Johnson (2004), Asling-Monemi et al. (2003), Sethuraman et al. (2006), and Heaton and Forste (2008).

[5]See, for example, Farmer and Tiefenthaler (1996) and Farmer and Tiefenthaler (1997).

[6]In fact, there is some evidence that domestic violence is higher in non-poor households. See, for example, Gonzales-Brenes (2004) Kishor and Johnson (2004), Bates et al. (2004), and Naved and Persson (2005). Koenig et al. (2003) find that that community-specific characteristics, as well as household characteristics, are important correlates of violence in Bangladesh. Microcredit loan programs, for example, aim to increase a woman's earnings.

incidence of violence in India depends partly on the autonomy of the wife.

The paper proceeds as follows. A simple model is introduced in Section 2. Consistent with the rarity of divorce and separation in most developing countries, the alternative to cooperation in the household is considered to be non-cooperation, not divorce. Section 3 examines the fit of the model to summary statistics from the data, the Demographic and Health Surveys (DHS) from Latin America which contain information on violence in the household. In Section 4 the key implications of the model for child outcomes and female labour supply are tested, and a strong positive impact of female employment is identified for Nicaragua. Section 5 concludes.

2   Model

Our simple model is true to the spirit of Lundberg and Pollack's (1993) separate spheres bargaining model, but considers violence explicitly.[7] We assume that the husband has an outside option, the wife's alternative is the non-cooperative outcome with potential for threats and violence, and that the motive for these is instrumental. The husband does not derive utility from threats or violence but simply uses them as tools to enforce traditional gender roles.[8]

These programs may also cause the husband to become more violent in order to enforce the traditional gender roles that the loan programs are designed to break (Bates, Schuler, Islam and Islam, 2004).

[7]The majority of recent intrahousehold resource allocation models assume that household bargaining outcomes are Pareto optimal. See, for example Chiappori (1992) and Chiappori, Fortin and Lacroix (2002). However, given the negative effects that violence has on a range of outcomes, it is difficult to argue that no Pareto improvements are possible. Non-cooperative bargaining models of the household can more easily accommodate violence as an equilibrium outcome within the household.

[8]This is referred to as an instrumental motive to emphasize that violence is not considered to be directly utility-increasing for the perpetrator. This formulation has the benefit that it does not rely on untestable assumptions regarding the utility derived by men from violence. Tauchen, Witte and Long (1991) develop a non-cooperative model in which men

The husband and wife jointly produce household public goods (such as housekeeping, child care, health and education of children), to which she contributes time, l, and they both contribute a portion y_m and y_f, respectively, of their incomes. The time that the wife does not spend on the production of the public good is spent in the labour force earning an income, a part of which can be expropriated by the husband, and the rest spent on her contribution to public goods and on private goods for herself. Any income that the husband does not spend on the public good is used to purchase private goods for himself. For simplicity we treat the array of possible public goods as one composite good denoted by z. The private goods are also bundled into a single composite commodity denoted by x.

The DHS data suggest that threats and physical or sexual violence are similarly related to the outcomes of household members. Bobonis et al. (2009) find that exogenous increases in public transfers held by women under the *Oportunidades* program in Mexico increase threats but not violence in households. Bloch and Rao (2002) show that the threat of violence is used by husbands to extract more dowry from their in-laws. In our samples, only a small minority of women report threats without violence in the household, and threats are associated in the same way as actual violence with outcomes of interest.[9] Amongst children in Colombia and Nicaragua, households with threats but no violence have significantly worse height-for age scores than those in households without violence or threats. Women in households with threats are significantly more likely to have experienced child death. In Bolivia and Peru, women in households experiencing threats are also more likely to be employed than are women in households without threats or violence.[10]

may derive utility from violence.

[9]In Bolivia in 2008, 10% of women report threats without violence. In Colombia, 14% of women report threats but no violence. In Peru in 2000, 17% of women report threats but no violence, versus 2% in the Dominican Republic in 2002, and 3% in Nicaragua in 1998.

[10]For example in Bolivia in 2008, the female employment rate is 67% in households with threats but no violence, statistically different from the 64% in households with no threats

There may be some variation in the intrinsic tendency for threats and violence among husbands. For the same rate of expropriation, different households may have exogenously different intensities of threats and violence. These tendencies are denoted by γ_t, $0 \leq \gamma_t$ for threats and γ_v, $0 \leq \gamma_v$ for violence. The bargaining strength of the woman, s, is another exogenous parameter that may also vary between households.

Each household can be either cooperative or non-cooperative as in Lundberg and Pollack (1993). In the cooperative regime there are no violence or threats, and the household maximises a Nash product of their individual utilities where, similar to Manser and Brown (1980) or McElroy and Horney (1981), each partner controls their own budget based on their income and labour supply. However, this optimization is superseded by the husband's exogenously determined reservation utility, $\overline{U}_m$.[11] We suppose that if the husband's utility from this optimization falls below U_m, the household switches to non-cooperation.[12]

In the non-cooperative setting the two household members make choices to maximize their individual utilities, and this can include threats and violence if the husband has some tendency for either (if $\gamma_t \neq 0$ or $\gamma_v \neq 0$), although the latter provide only indirect benefit to the husband by allowing him to expropriate the wife's income. It is an absorbing state (once no cooperation sets in they do not revert back to cooperation) that is initiated when the choices under cooperation give the husband a lower utility that U_m.

We now investigate the household behaviour under each regime. Assume that the wife and husband have the same Cobb-Douglas utility function, with

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or violence. Similarly, in Peru in 2000, the employment rate of women in households with threats is 60%, versus 53% in households with no threats or violence. These results are not here presented in detail, but are available on request from the authors.

[11]We view this reservation utility as not only an indication of actual outside options for the husband and alsos some notion of his minimum acceptable standard of living. In contrast to Bonbonis et al, we suppose that the husband's option is known by both parties.

[12]This is a somewhat strong assumption that we make for simplicity. In reality if U_m is not satisfied, the wife may be willing to compromise a little along the utilities possibilities frontier. Analytically this gets messy but it would give qualitatively similar results.

x_f and x_m being the (numeraire) private goods of the wife and husband, respectively, and z the public good. Subscripts f and m denote the wife and husband, respectively. The technology for home production is multiplicative (also Cobb-Douglas). In order for a positive amount of public good to be produced, they need to have at least a small amount of each input. The wife earns wage rate, w, in the labour market, while the husband's income, I, is assumed fixed and exogenous.

First, consider the cooperative regime where a joint welfare function with $s, 0 < s < 1$, determining the bargaining strength of each party is maximized, constrained with individual control of resources. And the husband has an alternative utility U_m:

$$N = (x_f^\beta z^{1-\beta})^s (x_m^\beta z^{1-\beta})^{1-s} = x_f^{\beta s} x_m^{\beta(1-s)} z^{1-\beta}$$
$$\text{subject to } x_f + y_f = w(1-l); \quad I = x_m + y_m; \quad z = l(y_f + y_m)$$

If the husband's alternative utility does not bind, the first order conditions simplify to:

$$x_f = \frac{\beta s(w + y_m)}{\beta s + 2 - 2\beta}$$
$$y_f = \frac{(1-\beta)(w + y_m)}{\beta s + 2 - 2\beta} - y_m$$
$$l = \frac{(1-\beta)(w + y_m)}{w(\beta s + 2 - 2\beta)}$$
$$x_m = \frac{\beta(1-s)(I + y_f)}{\beta(1-s) + 1 - \beta}$$
$$y_m = \frac{(1-\beta)(I + y_f)}{\beta(1-s) + 1 - \beta} - y_f$$

We solve them to find that there are two cases depending on the relative level of the wife's income w. If she has a relatively high income then she will choose to make a monetary contribution to the public good. That is, if $w > \frac{1-\beta(1-s)}{1-\beta s} I$ then $y_f > 0$:

$$x_f^* = \frac{\beta s(I+w)}{2-\beta}$$

$$y_f^* = \frac{\beta(1-s)+1-\beta}{2-\beta}w - \frac{1-\beta(1-s)}{2-\beta}I$$

$$l^* = \frac{(1-\beta)(I+w)}{w(2-\beta)}$$

$$x_m^* = \frac{\beta(1-s)}{2-\beta}(I+w)$$

$$y_m^* = \frac{\beta s+2-2\beta}{2-\beta}I - \frac{\beta(1-s)w}{2-\beta}$$

$$y_m^* + y_f^* = \frac{(1-\beta)(I+w)}{2-\beta}$$

$$z^* = \frac{(1-\beta)^2(I+w)^2}{w(2-\beta)^2}$$

Notice that x_m^*, l^*, and $y_m^* + y_f^*$ all depend positively on w, in this case a higher wage, w, for the wife results in a higher utility for the husband, which reduces the likelihood that his reservation utility constraint binds.

If the wife's income is too low ($w \leq \frac{1-\beta(1-s)}{1-\beta s}I$) she will not make a monetary contribution, and then the solutions are:

$$x_f^* = \frac{\beta sw}{\beta s+1-\beta}$$

$$y_f^* = 0$$

$$l^* = \frac{1-\beta}{\beta s+1-\beta}$$

$$x_m^* = \frac{\beta(1-s)I}{1-\beta s}$$

$$y_m^* = \frac{1-\beta}{1-\beta s}I$$

$$z^* = \frac{(1-\beta)^2 I}{(\beta s+1-\beta)(1-\beta s)}$$

In contrast, if this case occurs a higher wage, w, (that does not bump us into the previous case) will have no effect on the husbands utility, and therefore have no impact on reducing the likelihood that the reservation utility will not be achieved.

In Figure 1a and 1b we depict the husband's reservation utility, compare it with the cooperative solution labelled U^*, and indicate the outcome, cooperative or not. We also indicate with arrows the direction of the movement of the cooperative solution with a small increase in the wife's wage. The direction of the movement is different as she have shown for relatively large initial wages as compared with small, resulting in the conclusion that in environments with low women's wages,we cannot conclude that small improvements in the wage make the cooperative outcome more likely. We also show how in reality the wife might be willing to make small compromises along the Utilities possibilities frontier to avoid non-cooperation as discussed in footnote 6. However as we indicated there, in the interest of simplicity of the model and because it would lead to qualitatively similar results we do not include this in our model.

Turning to the non-cooperative regime, each individual maximises their utility subject to their own budget constraint. It can be seen that in this case the wife never makes a monetary contribution to the public good.[13]

Two aspects of threats and violence are salient: (i) threats and violence should both reduce the wife's utility, and (ii) since both are economic instruments, at whichever propensity of violence (γ) with which the husband is characterized, he will choose higher levels of threats and violence the less of his wife's earnings he can appropriate. Let a denote the fraction of her earnings that the wife chooses to keep for herself. The wife maximises her utility

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[13]This can be seen in exactly the same manner as was shown for the cooperative case where w was low. So in the interest of simplicity we will not derive this result again for the noncooperative case.

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$$\max x_f^\beta z^{(1-\beta)} - a^\beta \gamma_t - aK(\gamma_v + \gamma_t) \quad \text{subject to} \quad w \cdot (1-l) \cdot a = x_f; z = ly$$

where a is the fraction of her earnings she keeps and $aK\gamma_t$ and $aK\gamma_v$ are the disutilites of threats and violence (and $K = I\beta^\beta(1-\beta)^{1-\beta}$ is a parameter that normalizes the distutility to ensure that generally a has an interior solution between 0 and 1). Thus, the more of her income she decides to keep, the higher the level of threats and violence and therefore her disutility from both. Substituting the constraints we have

$$\max_{l,a}[w \cdot (1-l) \cdot a]^\beta(l \cdot y)^{1-\beta} - aK\gamma_t - aK\gamma_v$$

This yields the following first-order conditions for choosing l and a

$$\beta w^\beta a^\beta(1-l)^{\beta-1}(ly_m)^{1-\beta} = (1-\beta)l^{-\beta}y^\beta[w(1-l)a]^\beta$$
$$\Rightarrow \tilde{l} = (1-\beta)$$

$$\text{and} \quad \beta a^{\beta-1}w^\beta(1-l)^\beta(ly)^{1-\beta} - I\beta^\beta(1-\beta)^{1-\beta}(\gamma_t+\gamma_v) = 0$$
$$a^{\beta-1} = \frac{I\beta^\beta(1-\beta)^{1-\beta}(\gamma_t+\gamma_v)}{\beta w^\beta \beta^\beta(1-\beta)^{1-\beta}y_m^{1-\beta}} = \frac{I(\gamma_t+\gamma_v)}{\beta w^\beta y_m^{1-\beta}}$$
$$\hat{a} = \left[\frac{\beta w^\beta y_m^{1-\beta}}{I(\gamma_t+\gamma_v)}\right]^{\frac{1}{1-\beta}}$$

The latter condition results in a corner solution of $\tilde{a} = 1$ if $\frac{I(\gamma_t+\gamma_v)}{\beta w^\beta y_m^{1-\beta}} > 1$, and otherwise the interior solution $\hat{a}$. Meanwhile, the husband maximises the following:

$$\max x_m^\beta z^{(1-\beta)} \quad \text{subject to} \quad x_m = I + (1-a)w(1-l) - y; z = ly_m.$$

Substituting the constraint and solving the first order conditions we find

$$\hat{x_m} = \beta[I + (1-a)w(1-l)] \quad \text{and} \quad \hat{y}_m = (1-\beta) \cdot [I + (1-a)w(1-l)].$$

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Notice that $\tilde{l}$ is the same as in the non-cooperative equilibrium independent of the level of violence or even without violence, and $\tilde{y}$ and $\tilde{x}_m$ can be higher if the husband is able to expropriate some of his wife's earnings.

Putting the two individual problems together we find the Nash equilibrium.

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\begin{aligned}
\tilde{x}_f &= aw\beta \\
\tilde{y}_f &= 0 \\
\tilde{l} &= 1 - \beta \\
\tilde{x}_m &= \beta(I + (1 - a)w) \\
\tilde{y}_m &= (1 - \beta)(I + (1 - a)w) \\
\tilde{z} &= (1 - \beta)^2(I + (1 - a)w) \\
\text{where} \quad \tilde{a} &= min\{\hat{a}, 1\}
\end{aligned}
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We compare the outcomes under cooperation (when the husband's alternative utility does not bind) with the outcomes for non-cooperation:

Variable :	Cooperative outcome		Non − cooperative outcome
	$y_f > 0$	$y_f = 0$	
x_f	$\frac{\beta s(I+w)}{2-\beta}$	$\frac{\beta sw}{\beta s+1-\beta}$	$aw\beta$
l	$\frac{(1-\beta)(I+w)}{w(2-\beta)}$	$\frac{1-\beta}{\beta s+1-\beta}$	$1 - \beta$
$y = y_f + y_m$	$\frac{(1-\beta)(I+w)}{2-\beta}$	$\frac{1-\beta}{1-\beta s}I$	$(1 - \beta)(I + (1 - a)w)$
x_m	$\frac{\beta(1-s)}{2-\beta}(I + w)$	$\frac{\beta(1-s)I}{1-\beta s}$	$\beta(I + (1 - a)w)$
z	$\frac{(1-\beta)^2(I+w)^2}{w(2-\beta)^2}$	$\frac{(1-\beta)^2 I}{(\beta s+1-\beta)(1-\beta s)}$	$(1 - \beta)^2(I + (1 - a)w)$

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It can be easily seen that the wife's labour contribution to the public good, l is always higher under cooperation than under non-cooperation. We observe that in the cooperative setting a greater faction of the average earnings (and the husband's earnings) for the case $y_f > 0$ (and $y_f = 0$, respectively) is devoted to the public good. Consequently a smaller fraction is is devoted to his own personal consumption in the cooperative setting, and as he has access to less income in the cooperative setting, we can clearly conclude that his consumption will always be less. The comparison of some of the other variables is not as clear cut, because in the non-cooperative setting the husband has access to a greater amount of income. The effect not he husband's contribution to the public good is generally ambiguous. On the one hand he has access to potentially more income since he can expropriate, but counter acting that effect is that he invests a smaller fraction of his acessible income towards the public good. The implications for the amount of public good is similar to the total amount of money devoted to the public good, it might be higher under non-cooperation if the husband has access to a lot of the wife earnings.

Both parties are acting selfishly in the non-cooperative regime and with the wife withholding her labour contribution to the public good and the husband providing a low rate of contribution to the public good, as compared to the levels of contribution under the cooperative regime.[14] Also, the husband's private consumption x_m in the non-cooperative regime is always higher than it is under cooperation.

The higher the husband's reservation utility the more likely the outcome is non-cooperation. The wife switches to non-cooperation with the knowledge that her husband may become violent.

Most comparable to this interpretation of violence is the model of Eswaran and Malhotra (2011), though several important features differ. First, we

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[14]Our non-cooperative outcome is analogous to the Bergstrom et al. (1986), and Lundberg and Pollak (1993) outcomes: Where public goods are supplied voluntarily, they are undersupplied in the non-cooperative equilibrium.

include private and public goods in our model, and assume that only the wife spends time producing the public good. This introduces a cost to her labour market activities and ensures that she is essential to the production of public goods. Second, we allow for a cooperative regime, which becomes non-cooperative if the husband's reservation utility is very high. Third, we include a parameter in our model that measures the husband's propensity for violence.[15]

The three main predictions of this simple model are:

(1) in a non-cooperative marriage, l is lower; that is, the wife spends less time producing the public good than in a cooperative marriage;

(2) in a non-cooperative marriage, x_m is higher; that is, the husband consumes more of his private good than in a cooperative marriage; and

(3) in a non-cooperative marriage, z is very likely lower; the woman contributes less, and the man may appropriate some of her income but contributes at a lower rate, all of which is likely to result in less of the public good is being provided than in a cooperative marriage.

Thus, non-cooperation is more likely in environments where women's wages are low, and men's reservation utilities are high. Women work more outside the home when there is non-cooperation. Non-cooperation is often accompanied by threats and violence, and child outcomes are then worse because of reduced contributions to public goods in the household. In environments where women's wages, w, are relatively very low, small improvements int the wages do not reduce the likelihood of non-cooperative outcomes. However, substantially higher wages (where women are motivated to make monetary contributions to the public good), improvements in wages reduce the possibility of non-cooperative outcomes.

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[15]Eswaran and Malhotra seek to explain violence as an evolutionary reaction to paternity uncertainty. To support this interpretation, they show that the violence incidence is greater when women work outside the home than within. The intergenerational nature of violence in the home is discussed in Pollack (2005) and Bowlus and Seitz (2006), amongst others. Men who grew up in violent households are more likely to be violent. Women who grew up in violent homes are also more likely to experience violence in the home as adults.

In what follows, conclusions (1) and (3) are first examined, using child mortality, child anthropometry, and labour supply data from 6 Latin American countries. It is then shown that there is an important positive causal impact of female labour supply on violence in Nicaragua.

3   Data and Summary Statistics

We use twelve country-specific Demographic and Health Surveys (DHS) from Latin America. The data used are from Bolivia (2003 and 2008), Colombia (2000, 2005 and 2010), the Dominican Republic (2002 and 2007), Nicaragua (1998 and 2007), Honduras (2005) and Peru (2000 and 2004-08), and contain information on a variety of indicators important to our estimation, including the history and frequency of violence in the household, child health, infant and child mortality, and employment. The primary respondent in the DHS surveys is always a woman aged 15 through 49. The incidence of spousal violence is generally very high in Latin America, but varies from 13% in the Dominican Republic in 2002 to more than 45% in Bolivia in 2003, Colombia in 2000 and Peru in 2000.[16] Prior to this, however, we show that violence is commonly experienced amongst those with more and less bargaining power, as measured either by control over household decisionmaking or by educational attainment.

For each country, we restrict the sample to women who completed the violence questionnaire, are between age 20-49, and have a partner. Our sample of children is restricted to the children of these women. The information on child death comes from women's reports about whether or not they have born a child who died. Although slightly different questions regarding threats and violence were posed across surveys, as documented in Data Appendix A, we attempt to capture a consistent definition of violence across countries and over time. Nevertheless, differences in violence means for a country over

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[16]Questions regarding spousal violence vary slightly across the DHS surveys. These questions are described for each of these surveys individually in Data Appendix A.

time should not be interpreted as trends in violence levels, since questions posed differ across surveys for a given country.

3.1   Bargaining Power

The theoretical predictions of our model do not rely on assumptions about the distribution of power in the household, and evidence about the relationship between power and violence is mixed. Bargaining power within the household may, or may not, be an important determinant of violence. Kim and Sung (2000) find that violence is more prevalent when one partner controls decisionmaking, regardless of who makes the decisions. Aizer (2010), uses administrative records on hospital admissions to show that the long-run narrowing of the gender wage gap in California reduced domestic violence by about 9% between 1990 and 2003. However, Eswaran and Malhotra (2011) find that Indian women with better outside options experience more abuse than women with less.

For these 6 Latin American countries, comprising 12 surveys, interviewers collected information on who made decisions regarding key household outcomes. While the outcomes considered vary somewhat by country, they generally include: the purchase of day-to-day items, the purchase of expensive items, the daily meals to be served, and visits to friends or relatives. Women were asked if they alone made each decision, their husband alone made the decision, or the decision was jointly made by the partners or another. Appendix A details the bargaining power questions posed in each country.

The responses to these household decisionmaking questions are quantified in a bargaining power index, which takes a value in the range (-1,1). When a woman makes a particular decision alone, the index takes the value -1. If she makes the decision jointly with her partner, or another makes the decision, the index takes the value 0. If her partner makes the decision alone the index takes the value 1. Then, the average score across the range of bargaining power questions is calculated for each household. For example, if the woman makes all decisions alone, the household bargaining power index takes the

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value -1. If she has no say in any of the decisions considered, the index takes the value 1.

There is no clear relationship between the bargaining power index and violence in the household. Results are shown in Table 1. In a majority of the surveys, the bargaining power index takes the same mean value across violent and non-violent households. In Nicaragua in 1998, the index suggests more female decision-making (a more negative average value of the index) in violent households, but in Peru in 2000 and 2008 the relationship goes the other way. Simple probit analyses of the relationship between a quadratic term in bargaining power and violence (not shown) also do not consistently support the idea that violence is greater when one of the partners makes more of the decisions.

Education may be a better proxy for bargaining power, since it is unlikely to be a result of violence in the home, but is correlated with the earnings power of individuals. In all 6 countries, the incidence of violence is higher when women and their partners have not completed secondary education. Table 2 illustrates. In Colombia in 2000, and the Dominican Republic in 2002, the differences in violence propensities across education groups are highest. In the Dominican Republic in 2002, a woman who has completed at least secondary education is about 1/2 as likely as one who has not to experience violence. In other countries, there are less differences in violence by education levels of women or their partner, but overall levels of violence are consistently high. In Colombia in 2000, 57% of women without secondary education lived in violent households.

It does appear that women who have higher potential earnings, as proxied by their education, experience less violence. However, this may be due to factors other than their relatively great bargaining power in the household. Behavioral psychologist Stephen Pinker (2011) suggests that the decline of violence over human history might partly attributed to increases in cognitive skills associated with economic development. It is possible that there is less violence in more educated households because partners generally have better

non-violent communication skills, or value the provision of household public goods systematically differently. For these reasons, we control for the educational attainment of spouses in what follows, but do not focus on differences across education groups in the relationships between violence, public goods provisions, and labour supply.

3.2 Public goods and labour supply

Across the Latin American countries for which DHS violence surveys exist, common relationships are observed between household violence and variables reflecting resource allocation decisions. Female labour supply, young children's micronutrient intake, and infant mortality are often different in violent compared to non-violent households. This is shown in Table 3 for our 12 surveys.

Consistent with the model, labour supply of women in violent households is significantly higher in the Nicaragua 1998 and 2007 surveys, the Honduras 2005 survey, and the Peru 2000 and 2004-08 surveys (columns (1) and (2) of Table 3). In all other cases, mean employment levels are higher, although not significantly so, in violent households. Although these are simple correlations, these results nevertheless suggest that violence in the household is not strongly associated with a lack of female financial autonomy.

The probability that a woman has experienced the death of a child is significantly higher in violent households in the Bolivia 2003 and 2008 surveys, the Colombia 2000, 2005 and 2010 surveys, the Dominican Republic 2007 survey, the Nicaragua 1998 survey and the Peru 2000 and 2004-08 surveys (columns (3) and (4)). While the possibility that violence in the current partnership led directly to child death cannot be excluded, the findings are consistent with our prediction that there be less investment in public goods in violent households.

A comparison of children's stature in violent and non-violent households also generally concurs with the model's predictions (columns (5) and (6) of Table 3). The micronutrient intake and disease history of children under

age 5 is reflected in their height-for-age scores. This is considered a long-run measure of child health, since the effects of early periods of underfeeding and prolonged illness are observable for many years. The height-for-age score can be expressed in standard deviations or Z-scores below or above a reference mean.[17] Children who suffer from chronic malnutrition generally have lower height-for-age scores, and child malnutrition, in turn, is associated with a range of negative long-term outcomes, including lower enrolment in school.[18] Amongst our 6 countries, we find that height-for-age scores of children aged 6 through 59 months are often significantly lower in violent households. In Bolivia in 2003 and 2008, Colombia in 2000, 2005 and 2008, and Nicaragua in 1998, differences in stature of young children in violent and non-violent households are statistically significant at the 10% level.

We now examine how well the predictions of the model are supported in multivariate analyses, and identify the causal impact of female employment on violence for Nicaragua in 1998. To do this, a potentially exogenous component of variation in female employment across localities, that deriving from variations in female labour demand, is isolated. The 1971 IPUMS is used to measure heterogeneity in the 1971-1998 evolution of the share of male employment in agriculture across municipalities in Nicaragua. The growth of non-agricultural employment is is correlated with the availability of non-physical jobs in which women might have comparative advantages, but is plausibly unrelated to violence in the household *ceteris paribus*. The testable identifying assumption is that, conditional on observable aspects of the current male labour market and municipal and neighbourhood public goods provisions in 1998, the change in the fraction of males employed in agriculture since 1971 is exogenous to violence in the household.

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[17]The growth chart measure used by the DHS to construct these Z-scores is that of the World Health Organisation and the US Centers for Disease Control. See Kuczmarski et al. (2000) for details of these charts.

[18]See, for example, Alderman et al (2001) and Dufour (1997).

4 Estimation

4.1 Child outcomes

The two child outcomes examined are height-for-age and child mortality. First, the conditional assocation between height-for-age of children aged 6 to 59 months and the presence of violence in the child's household is estimated. Second the relationship between death of a woman's child, and whether or not her household is violent is examined. Since almost all women who report having experienced sexual violence from their partners also report having experienced physical violence, we examine the conditional association between violence, including threats, in general and outcomes. Samples of children are restricted to those whose mothers have completed the violence questionnaire.

Both OLS and nearest neighbour matching is employed, using identical covariates (Abadie and Imbens (2006)).[19] The average treatment effect on the treated (ATT), the conditional association between being in a violent household and the height-for-age of a child, is estimated. Clearly the measured impacts should not be interpreted as causal, but they may help in understanding the robustness of the unconditional correlations observed in Table 3.

4.2 Height-for-age

The control variables included in the specifications for height-for-age scores are: the sex of the child, birth order, the mother's age, whether or not the mother has completed secondary education, whether or not the mother's partner has completed secondary education, and the partners' age. In addition, all estimates include a rural-urban dummy, regional fixed effects (at the level given by the DHS surveys), and a full set of region times rural-urban interaction terms.

There is a robust and statistically significant, negative conditional asso-

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[19]The *n*nmatch procedure in STATA developed in Abadie et al. (2004) is employed.

ciation between violence and the height-for-age scores of children only for Colombia in 2010. Only in this survey do both OLS and nearest neighbour matching estimators show strong negative associations between violence and childrens' stature at a given age. Table 4 presents these results. The matching results are not always similar to the OLS results, so suggesting that the treatment of unobservables remains important. In fact, using nearest neighbour matching with 3 or 10 matches, the conditional association between height-for-age and violence is found to be positive and statistically significant at the 5% level in Peru in 2004-08. Using OLS estimation, however, no significant conditional association is observed for this survey. In a majority of surveys, no robust conditional association is observed.

4.3   Child death

We next examine the conditional association between violence and the probability that a woman aged 20-49 has had at least one child die. All estimates control for the following: a woman's age, educational attainment, her partner's age and educational attainment, an urban-rural dummy, regional fixed effects (at the level specified in the DHS surveys), and a full set of regional times urban interaction terms.

Violence is robustly conditionally associated with increases in the probability of a woman experiencing the death of a child in several of the Latin American countries for which data is available. Table 5 presents these results. In Bolivia in 2003 and 2008, Colombia in 2000, the Dominican Republic in 2002, Nicaragua in 1998, and Peru in 2004-08, living in a violent household is found to be associated with a statistically significant increase in the probability that a woman has had at least one child who died, after conditioning on observables of the woman and her current partner. In other surveys, coefficients are also generally positive although not statistically significant at the 10% level. In Nicaragua in 1998, violence was associated with a 4% greater probability that a woman had experienced the death of a child, *ceteris paribus*.

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4.4 Female employment

Our model predicts that the relationship between violence in the household and female labour supply is likely positive both because the incentive to switch to non-cooperation and then extract resources from the woman is higher when she earns more money. Clearly, however, violent behaviour by a spouse may cause a woman to work less in the home and more outside. For both of these reasons, a positive conditional correlation between the presence of violence in a woman's household and a woman's labour supply is expected. This positive association may, however, be muted if violence reduces a woman's ability to perform work outside the home, or leads her to stay in the household to avoid public viewing of her injuries.[20]

Women often have significantly higher employment propensities in violent households, even after conditioning on observable characteristics of the partners. Table 6 presents results of OLS regressions relating work propensities to violence. In Colombia in 2005, the Dominican Republic in 2002, Nicaragua in 1998 and 2007, and Peru in 2000, we find that women's employment is associated with more violence in the household, *ceteris paribus*. The incidence of violence is about 7% higher in Nicaragua in 1998, for women who are employed, after conditioning on observable characteristics and geographical fixed effects. The strength of the observed conditional association is perhaps surprising, given that violence might be expected to reduce women's self-esteem, work capacities, and desire to be seen in public. Indeed, this is one potential reason for the lack of statistical significances in the observed conditional correlations in some of the other surveys. For example, in the Bolivia 2003 data, 13% of respondents reported that they had had to miss work as a result of violence in the household. Although these OLS results relating employment to violence are far from confirming a universal positive conditional association between the two, they certainly do not suggest a negative association between financial autonomy and violence.

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[20]In the Colombia 2000 DHS, more than half of women in violent homes reported bruising and aching.

4.5 The causal impact of female employment on violence

Another reason why women may work more in violent households is that they are planning to leave their partners, and need to be able to cover their living expenses when they are single.[21] However, divorce rates in Nicaragua, as in much of Latin America, are very low, with only 1% of women above aged 40 reporting this as their marital status, and about 20% reporting being separated. Single women in the 1998 DHS survey were not asked to provide the cause of the dissolution of previous relationships, so we cannot gauge what fraction of our sample might be affected by this motive to increase market work. However, it is clear that separation or divorce is not an attractive option to a majority of Nicaraguan women: Whereas in the 1998 survey about 10% of women in partnerships reside in households with a car, only about 5% of separated or divorced women do so. Those who separate or divorce can be considered those with relatively good options outside of the marriage, so these means suggest that separation remains a low-value option for many women. In the 2007 Nicaragua Reproductive Health Survey, which is closely based on the DHS survey format, information on violence in previous relationships, and in the past year was collected. The fraction of women aged 20-25 in partnerships who report violence in the household in the year preceding the interview is the same (26%) as the fraction of women aged 40-45 who do so. Women do not appear to leave more violent men for less violent men. About about 21% of women aged 40-49 in the 2007 survey are divorced or separated, as are about 17% of women who have never experienced violence in the household. Nevertheless, amongst our 1998 DHS sample of women currently in partnerships, the potential endogeneity of female employment to violence can be accounted for in estimation.

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[21]This motive for greater female labour supply in violent households is modelled in Bowlus and Seitz (2006), for Canada, a context in which divorce rates are much higher, public goods provisions much more universal, and women's labour market opportunities much greater.

The IPUMS Nicaragua 1971 census contains a 10% random sample of the population, and can be combined with the DHS 1998 data and 1998 LSMS data to help identify the impact of increases in female employment on violence propensities.[22] Changes agricultural employment levels of males during 1971-1998 in a municipality are used to predict current female employment propensities in a DHS sampling cluster, which we refer to as a neighbourhood. The greater the reduction in the fraction of men working in agriculture over the period, the more nonagricultural and non-physical jobs are available in a small geographic area.

Another potential predictor of current local female employment is the 1971 labour force participation rate of women 20-55. In what follows, both of these instruments will be employed to predict female employment rates in a neighbourhood. The testable exclusion restriction is that, conditional on the current mean male earnings, the unemployment rate of men in a municipality, and the extent of neighbourhood and municipal public goods provisions, neither 1971-1998 changes in male agricultural employment nor 1971 female employment in a municipality directly predict current household violence levels in a neighbourhood.

The Nicaragua 1998 DHS contains municipal codes, which can be matched to the 1998 LSMS. Neighbourhoods of municipalities can be distinguished by cluster codes, but not by name. The IPUMS microcensus samples contain both municipality and county codes. Although it is not possible to measure the neighbourhood-level change male employment in agriculture over 1971-1998 by combining IPUMS and DHS data, it is possible to come quite close.

Let m refer to the municipality, and n to the neighbourhood. Let A denote the fraction of male employment in agriculture in a year. The DHS collects information on men's occupations only as spouses or common-law partners of respondents, so we restrict these IPUMS means similarly. The measure of

changes in male agricultural employment is $\Delta A_{1998-1971} = A_{n,1998} - A_{m,1971}$.

Nicaragua in 1971 was extremely rural, poor, and unindustrialised. Across Nicaragua, 70% of male employment was in agriculture, but county-level means varied from 15% in Managua county to 87% in Río San Juan. Although the 70 municipalities distinguished in the 1971 IPUMS data do not correspond to DHS localities, it is still possible to gauge the extent of 1971 heterogeneity in male agricultural employment rates, across municipalities within counties, and across counties.[23] In 1971, the largest heterogeneity amongst municipalities in male agricultural employment rates was in the county of Granada, where they ranged from 0.22 within the town of Granada (a municipality) to 0.71 in rural municipalities of Granada county. Within a majority of counties, this variation was much less extreme. For example, in the county of Matagalpa, male agricultural employment rates varied only from 0.70 in Sebaco to 0.86 in Cuidad Darío.

Following the 1971 census, Nicaragua was convulsed first by a massive earthquake which destroyed much of Managua City, and then by the Sandinista revolution and civil war. Although by international standards little development occurred during 1971-1998, it turns out that there is substantial heterogeneity in the extent to which male agricultural employment rates in 1998 differed from their 1971 municipal means. This heterogeneity, which we use to proxy 1998 female labour demand, then allows us to predict 1998 female employment levels within a neighbourhood. As the extent of male employment in agriculture declines, opportunities for non-physical work emerge. Women may have comparative advantages in some of these new occupations, and so demand for their skills may also increase.[24] Male labour supply is

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[23]In the IPUMS samples, municipalities containing 20 000 people or less are grouped into residual categories. For this reason, although there were more than 133 municipal groupings in Nicaragua, the IPUMS data contain only 70 distinct municipal groupings. In 1971, the most populous county was Managua with 482 600 inhabitants, the least populous Río San Juan with 20 250 inhabitants, and the total population of the country was 1 894 690. Where municipal populations were below 20 000, municipalities were grouped within counties.

[24]Goldin (1995) presents international historical evidence that female labour supply first

very inelastic, and changes in the male occupation distribution in a neighbourhood *per se* should not be causes of changes in household violence levels. Agricultural employment for men can be considered the low-productivity default occupation, so that the movement of males out of agriculture reflects improvements in their labour market options. It is also possible that differences in the distribution of husband's jobs across localities reflects wealth differentials across municipalities, and that this wealth difference is in turn correlated with violence. However, in the 1998 data, the simple correlation coefficient between the DHS wealth index of assets, averaged at the neighbourhood level, and local violence indices is relatively low, $\rho = 0.048$. This suggests that violence is not strongly related to the wealth level of households in a neighbourhood. In what follows, we do not control directly for household wealth, since this is potentially endogenous to female employment.

Estimation employs cluster-level means with reweighting of the sample to capture both the size of neighbourhoods and the original individual-level sample weights. Standard errors are clustered at the municipality level, since this reflects the degree of heterogeneity in 1971 male agricultural employment rates. The estimation of effects using neighbourhood means also reduces the potential impact of household level unobservables on estimates. While unmeasurable aspects of a marriage may be correlated both with violence levels and female labour supply decisions, such heterogeneity in marriage types should be less strong across localities than across couples. Clearly, however, unobservable differences across neighbourhoods and municipalities could still be joint determinants of both violence levels and employment.

There is a positive measured impact of employment on violence. Panel A of Table 7 presents OLS results, while Panels B-D present IV specifications. Four different specifications are included: (*i.*) Neighbourhood level regressions with controls only for ages of women, age of partners, the fraction of women

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decreases and then increases with modernisation, following a U shape. One potential reason why an initial decrease in participation does not appear to have taken place in Nicaragua is that the move out of agriculture did not raise male wages enough for negative household wealth effects on women's labour supply to become important.

with completed secondary education, and the fraction of their partners with completed secondary (*ii.*) Neighbourhood-level regressions with these controls plus additional controls for male unemployment rates in the municipality, the mean monthly earnings of men in the municipality, the fraction of neighbourhood households attached to the municipal sewage system, and mean distances to the nearest school and health center, (*iii.*) Neighbourhood-level regressions with these controls plus county fixed effects, a rural-urban dummy, and a full set of rural-county interactions. Data Appendix B provides first stage regression results, including F-statistics and partial R^2 values for the the instrument.[25]

The OLS and IV results both suggest positive causal impacts of female employment on violence. The IV estimates produce larger coefficients, so suggesting that unobservables may be biasing OLS results downwards. The measured causal effects differ little between the three IV specifications. This robustness is important because of the concern that the 1971-1998 change in male agricultural employment might reflect general modernisation factors correlated with violence in the household. For example, changes in male agricultural employment might induce male unemployment or income reductions, which could then induce violence. However, the inclusion of controls for male unemployment and earnings does not very much alter the estimated impact of female employment on the incidence of violence in the household (compare columns (1) and (2)), so we can be relatively confident that our instrument is operating primarily by impacting female employment propensities.

The second instrument used to predict current female employment in neighbourhood n is the 1971 female employment rate in the municipality. Results are presented in Panel C of Table 7. Standard errors are clustered at the municipality level. Results are very similar to those of Panel B, and suggest larger causal impacts of employment on violence than do OLS spec-

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[25]The data set of neighbourhood means which was used in these specifications is available at `http://www.economics.uoguelph.ca/lgrogan/nicaragua98employmentviolence.zip`

ifications. However, it turns out that the 1971 female employment rate in a municipality is a relatively weak instrument, with F-statistics below 10 in all 3 cases, so estimates of the employment coefficient must be treated with caution. Finally, in Panel D, both instruments are used to predict 1998 female employment in a neighbourhood. This is the preferred specification, given the relative weakness of the instruments. The IV results are similar to those in Panels B and C, and J-tests for overidentification easily accept the joint validity of the instruments in all three specifications. This suggests that unobservables related to our instruments are unlikely to be driving our results. Neither controlling for observable mean characteristics of women and their partners, nor for county fixed effects with a full set of rural-county interactions, alters this general conclusion.

These findings for Nicaragua suggest that, even with general improvements in women's and children's status associated with greater female employment, the change induced in relationships between spouses may sometimes alter intrahousehold resource allocation in negative ways. Our results suggest that at 10% increase in female employment increases the rate of household violence in a locality by 1-4%, after conditioning on regional fixed effects, municipal and neighbourhood public goods, male earnings and unemployment, and the education and ages of women and their partners.

Even if we prefer to think of the two labour market instruments as directly driving violence, the results are striking. Although the instruments pass the overidentification tests, there may still be reason to believe that municipalities and neighbourhoods which are more modernised are more violent. Interpreted in this way, the fact that greater movement out of agriculture since 1971, and female employment levels in a province predict the incidence of violence within the household suggests that not all factors in economic development work towards increasing individual security.

The finding that increased participation may cause violence to increase corroborates with Eswaran and Malhotra (2011), and with the evidence from South Asia that microcredit programs aimed at empowering women may

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increase violence (Bates, Schuler, Islam and Islam, 2004). In none of the 6 countries in our sample is violence in the home associated with women working less. Thus, the stylised facts do not support a view of violence in the household as resulting principally from a deficit of female financial autonomy, which then leads to reduced provision for children because their mothers cannot control resources. Violence will not necessarily decline as women's reservation utilities rise if non-cooperation, rather than divorce, remains the real alternative to cooperative public goods provision in the household. Our model does predict, however, that greater female earnings possibilities will decrease the probability of a move to non-cooperation and potential violence.

5   Conclusion

This paper explains why the incidence of violence in the household might initially increase with the demand for female labour. A simple model of household violence is presented in which the primary motivation for both threats and violence is that of controlling female resources. In our model, non-cooperation is the alternative to a cooperative household. The model fits empirical regularities for the 6 countries in Latin America where existing DHS surveys include violence modules. Women in violent households often work significantly more, outside the home, *ceteris paribus*. In none of the surveys do we find that female employment is associated with less violence in the home. Children are more likely to die, and often less healthy, in violent households.

For Nicaragua, the relationship between female labour force participation and violence is suggested to be causal. Nicaraguan census data from 1971 is combined with municipal means from the 1998 DHS and LSMS to construct a plausibly exogenous source of variation in female employment propensities. Changes in the fraction of male employment in agriculture over 1971-1998 strongly predict current female employment propensities, after conditioning on current male incomes and unemployment rates, local public goods

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provisions, and the ages and educational attainment of women and their partners. The development of non-agricultural labour markets creates employment opportunities which demand non-physical skills in which women have comparative advantages. As female labour force participation rates in a neighbourhood rise 10%, violence is found to increase 1-4%.

The finding that female employment may increase violence in the home has important policy implications. Female employment may involve the breaking of an implicit contract in marriage that women provide time and men provide money for public goods. Where non-cooperative partnerships, not divorce, are the outside option, the prospect of violence may act as an implicit tax on female labour supply and so lower participation rates at a given wage. The benefits to children of their mother's increased incomes may be partially offset by less household public goods provision. If increased financial autonomy leads to greater physical vulnerability in the household, there may be even greater need for preventive measures as women's labour market prospects begin to improve. The greater women's earning prospects become, however, the more feasibile it will become for them to commit financial resources to public goods. When wage employment possibilities improve sufficiently, reductions in time spent in home production are less likely to lead to non-cooperation, and so to violence.

Table 1: A comparison of the bargaining power index levels in violent and non-violent households.

	No violence	Violence
Bolivia 2003		
	0.2840	0.3375
	(0.007)	(0.006)
P-value, │ t │-test equality		0.000
Bolivia 2008		
	0.1979	0.1845
	(0.006)	(0.009)
P-value, │ t │-test equality		0.291
Colombia 2000		
	0.3368	0.3376
	(0.014)	(0.012)
P-value, │ t │-test equality		0.968
Colombia 2005		
	0.3667	0.3882
	(0.006)	(0.008)
P-value, │ t │-test equality		0.121
Colombia 2010		
	0.3753	0.3881
	(0.005)	(0.008)
P-value, │ t │-test equality		0.311
Dominican Republic 2002	–	–
Dominican Republic 2007		
	0.0897	0.1102
	(0.009)	(0.016)
P-value, │ t │-test equality		0.428
Honduras 2005		
	0.0079	-0.0049
	(0.006)	(0.015)
P-value, │ t │-test equality		0.484
Nicaragua 1998		
	-0.0942	-0.1570
	(0.006)	(0.010)
P-value, │ t │-test equality		0.000
Nicaragua 2006/07	–	–
Peru 2000		
	0.2812	0.3189
	(0.007)	(0.007)
P-value, │ t │-test equality		0.002
Peru 2004-08		
	0.2507	0.3320
	(0.006)	(0.007)
P-value, │ t │-test equality		0.000

Notes: Bargaining power data was not collected in the Dominican Republic's 2002 DHS survey or the Nicaragua 2006/07 survey. Sample weights are employed. The components of the bargaining power indices vary slightly across countries. These components are described in detail in Data Appendix A. The bargaining power index taxes the value -1 if the woman reports that she herself decides on a particular outcome, 0 if she and her partner or others together decide, and 1 if her partner decides alone. The samples consist of women aged 20-49, with common-law partners, living in two-generational households, who were posed the domestic violence questions.

Table 2: A comparison of the incidence of violence across households, by education of women and their spouses

	By education of woman:		By education of partner:	
	Complete Secondary	No Complete Secondary	Complete Secondary	No Complete Secondary
Bolivia 2003				
	0.5912	0.5035	0.5876	0.5364
	(0.008)	(0.015)	(0.008)	(0.013)
P-value, | t |-test equality		0.000		0.011
Bolivia 2008				
	0.3957	0.3314	0.4179	0.3090
	(0.009)	(0.014)	(0.010)	(0.012)
P-value, | t |-test equality		0.002		0.000
Colombia 2000				
	0.5740	0.4357	0.5519	0.4807
	(0.013)	(0.020)	(0.013)	(0.021)
P-value, | t |-test equality		0.000		0.008
Colombia 2005				
	0.4411	0.3502	0.4376	0.3416
	(0.008)	(0.010)	(0.008)	(0.010)
P-value, | t |-test equality		0.000		0.000
Colombia 2010				
	0.3441	0.2337	0.3047	0.2540
	(0.007)	(0.007)	(0.006)	(0.009)
P-value, | t |-test equality		0.000		0.000
Dominican Republic 2002		-		
	0.1466	0.0674	0.1469	0.0643
	(0.008)	(0.015)	(0.008)	(0.015)
P-value, | t |-test equality		0.000		0.000
Dominican Republic 2007				
	0.2972	0.1845	0.3081	0.1885
	(0.011)	(0.020)	(0.012)	(0.017)
P-value, | t |-test equality		0.001		0.000
Honduras 2005				
	0.1576	0.1397	0.1564	0.1483
	(0.006)	(0.016)	(0.005)	(0.017)
P-value, | t |-test equality		0.375		0.711
Nicaragua 1998				
	0.3445	0.2992	0.3465	0.2444
	(0.007)	(0.010)	(0.007)	(0.014)
P-value, | t |-test equality		0.001		0.000
Nicaragua 2006/07				
	0.2540	0.2311	0.2547	0.2319
	(0.006)	(0.009)	(0.006)	(0.008)
P-value, | t |-test equality		0.081		0.074
Peru 2000				
	0.5199	0.4603	0.5161	0.4803
	(0.007)	(0.011)	(0.008)	(0.009)
P-value, | t |-test equality		0.001		0.022
Peru 2004-08				
	0.4256	0.4384	0.4254	0.4360
	(0.007)	(0.009)	(0.008)	(0.008)
P-value, | t |-test equality		0.427		0.486

Notes: Sample weights are employed. The samples consist of women aged 20-49, with common-law partners, living in two-generational households, who were posed the domestic violence questions. Sample sizes are: Bolivia 2003, 3376; Colombia 2000, 1853; Dominican Republic 2002, 1886; Nicaragua 1998, 7648; and Peru 2000, 6016.

Table 3: Household violence, female labour supply, and child outcomes in Latin America

	Pr(Employed)		Pr(Child died)		Height-for-age	
	No violence	Violence	No violence	Violence	No violence	Violence
Bolivia 2003						
	0.5893	0.6068	0.2747	0.3507	-1.2525	-1.3522
	(0.010)	(0.009)	(0.010)	(0.009)	(0.029)	(0.023)
P-value, | t |-test equality		0.316		0.000		0.007
Bolivia 2008						
	0.6395	0.6605	0.2211	0.2708	-1.1100	-1.2750
	(0.014)	(0.019)	(0.008)	(0.011)	(0.024)	(0.028)
P-value, | t |-test equality		0.464		0.003		0.000
Colombia 2000						
	0.4079	0.4147	0.0617	0.1161	-0.7264	-0.9021
	(0.016)	(0.016)	(0.008)	(0.010)	(0.036)	(0.036)
P-value, | t |-test equality		0.777		0.000		0.001
Colombia 2005						
	0.4429	0.4689	0.0744	0.0925	-0.7181	-0.8448
	(0.008)	(0.010)	(0.004)	(0.006)	(0.019)	(0.022)
P-value, | t |-test equality		0.156		0.048		0.000
Colombia 2010						
	0.4663	0.4674	0.0642	0.0825	-0.6218	-0.7332
	(0.007)	(0.010)	(0.003)	(0.006)	(0.015)	(0.022)
P-value, | t |-test equality		0.949		0.025		0.000
Dominican Republic 2002		-				
	0.3404	0.3577	0.1180	0.1623	-0.3682	-0.3970
	(0.012)	(0.030)	(0.008)	(0.023)	(0.028)	(0.077)
P-value, | t |-test equality		0.708		0.206		0.706
Dominican Republic 2007						
	0.3535	0.3724	0.0921	0.1365	-0.2158	-0.2350
	(0.012)	(0.020)	(0.007)	(0.014)	(0.035)	(0.055)
P-value, | t |-test equality		0.612		0.074		0.767
Honduras 2005						
	0.3371	0.3778	0.1478	0.1627	-1.1973	-1.1659
	(0.007)	(0.018)	(0.006)	(0.014)	(0.021)	(0.047)
P-value, | t |-test equality		0.076		0.337		0.542
Nicaragua 1998						
	0.3657	0.4445	0.1840	0.2334	-1.2176	-1.3024
	(0.007)	(0.011)	(0.006)	(0.009)	(0.026)	(0.035)
P-value, | t |-test equality		0.000		0.000		0.057
Nicaragua 2006/07						
	0.4123	0.4982	0.1907	0.1855	-0.9836	-1.0333
	(0.006)	(0.011)	(0.005)	(0.009)	(0.021)	(0.036)
P-value, | t |-test equality		0.000		0.680		0.233
Peru 2000						
	0.5297	0.5959	0.2039	0.2426	-1.3275	-1.3418
	(0.009)	(0.008)	(0.007)	(0.007)	(0.023)	(0.021)
P-value, | t |-test equality		0.000		0.001		0.647
Peru 2004-08						
	0.6405	0.6711	0.1255	0.1617	-1.3413	-1.2280
	(0.007)	(0.008)	(0.005)	(0.006)	(0.048)	(0.050)
P-value, | t |-test equality		0.051		0.000		0.102

Notes: The respective probabilities of employment, of having at least one child who died are calculated amongst women aged 20-49, who completed the violence questionnaire, and have spouses. The violence questions differ slightly across DHS surveys, and are described in detail in Appendix A. Height-for-age Z-scores are calculated amongst children aged 6 through 59 months, whose mothers answered the violence survey questions. Children of women who are currently in a legal or common-law partnership are included. The P-values refer to t-tests of equality of means in households with and without violence, within a country. Height-for-age scores are considered missing if the calculated Z-score is less than -5 standard deviations below, or more than 5 standard deviations above the mean.

Table 4: Violence and height-for-age of children 6-59 months in Latin America

	Bolivia 2003	Bolivia 2008	Colombia 2000	Colombia 2005	Colombia 2010	Dom Rep 2002	Dom Rep 2007	Honduras 2005	Nicaragua 1998	Nicaragua 2006/07	Peru 2000	Peru 2004-08
OLS:												
violence	-0.0750*	-0.1026**	0.0658	0.0362	-0.0883*	-0.0277	-0.0270	0.0322	-0.0998*	-0.0848*	-0.0309	0.0612
	(0.042)	(0.041)	(0.080)	(0.102)	(0.053)	(0.037)	(0.034)	(0.057)	(0.056)	(0.051)	(0.034)	(0.081)
adjusted-R^2	0.19	0.21	0.10	0.04	0.11	0.13	0.08	0.19	0.10	0.12	0.24	0.30
No. obs.	4664	4361	2510	1916	1746	5206	6944	4310	3072	3479	7217	1070
Nearest neighbour matching with 3 nearest neighbours:												
SATT	-0.0168	-0.0365	-0.1110*	-0.0240	-0.0844*	-0.0214	-0.0500	0.0505	-0.0605	-0.0758	-0.0888*	0.1209**
	(0.052)	(0.053)	(0.067)	(0.049)	(0.047)	(0.094)	(0.135)	(0.075)	(0.078)	(0.063)	(0.046)	(0.056)
No. obs. N	4664	4361	1746	5206	6944	2510	1916	4311	3072	3479	7217	5022
Nearest neighbour matching with 10 nearest neighbours:												
SATT	-0.0168	-0.0365	-0.1110*	-0.0240	-0.0844*	0.0156	-0.0500	0.0505	-0.0605	-0.0818	-0.0888*	0.1209**
	(0.052)	(0.053)	(0.067)	(0.049)	(0.047)	(0.084)	(0.135)	(0.075)	(0.078)	(0.056)	(0.046)	(0.056)
No. obs. N	4664	4361	1746	5206	6944	2510	1916	4311	3072	3479	7217	5022

OLS regressions and nearest neighbour regressions with sample weights and robust standard errors.
All specifications control for: age of woman, a dummy for completed secondary school, partner's age,
a dummy for his completion of secondary school, plus regional and rural-urban dummies with a full set of interactions.
*** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

Table 5: Violence and probability of experiencing child death in Latin America

	Bolivia 2003	Bolivia 2008	Colombia 2000	Colombia 2005	Colombia 2010	Dom Rep 2002	Dom Rep 2007	Honduras 2005	Nicaragua 1998	Nicaragua 2006/07	Peru 2000	Peru 2004-08
OLS:												
violence	0.0615***	0.0516***	0.0480***	0.0112	0.0175**	0.0448*	0.0344	0.0100	0.0396***	0.0030	0.0269**	0.0255***
	(0.015)	(0.016)	(0.013)	(0.009)	(0.008)	(0.026)	(0.025)	(0.015)	(0.012)	(0.013)	(0.011)	(0.009)
adjusted-R^2	0.17	0.17	0.07	0.05	0.05	0.08	0.03	0.10	0.11	0.09	0.17	0.11
No. obs.	5131	3834	1935	6062	7777	1943	2130	4804	6254	6373	6708	8065
Nearest neighbour matching with 3 nearest neighbours:												
SATT	0.0403**	0.0520**	0.0381**	-0.0001	0.0139	0.0571**	-0.0063	0.0388*	0.0426***	-0.0046	0.0168	0.0328**
	(0.019)	(0.021)	(0.018)	(0.013)	(0.011)	(0.027)	(0.035)	(0.020)	(0.015)	(0.015)	(0.016)	(0.013)
No. obs.												
N	5131	3834	1935	6062	7777	1943	2130	4804	6254	6373	6708	8065
Nearest neighbour matching with 10 nearest neighbours:												
SATT	0.0403**	0.0520**	0.0381**	-0.0001	0.0139	0.0451*	-0.0063	0.0388*	0.0426***	0.0016	0.0168	0.0328**
	(0.019)	(0.021)	(0.018)	(0.013)	(0.011)	(0.026)	(0.035)	(0.020)	(0.015)	(0.014)	(0.016)	(0.013)
No. obs.												
N	5131	3834	1935	6062	7777	1943	2130	4804	6254	6373	6708	8065

All specifications control for: age of woman, a dummy for completed secondary school, partner's age, a dummy for his completion of secondary school,
plus regional and rural-urban dummies with a full set of interactions.

OLS regressions with sample weights and robust standard errors.

*** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

Table 6: Female employment and the probability of experiencing violence in the household, Latin America

	Bolivia 2003	Bolivia 2008	Colombia 2000	Colombia 2005	Colombia 2010	Dom Rep 2002	Dom Rep 2007	Honduras 2005	Nicaragua 1998	Nicaragua 2006/07	Peru 2000	Peru 2004-08
OLS:												
employed	0.0194	0.0197	-0.0033	0.0422**	0.0213	0.0303*	0.0422	0.0112	0.0742***	0.0535***	0.0778***	0.0185
	(0.019)	(0.013)	(0.025)	(0.018)	(0.014)	(0.018)	(0.033)	(0.014)	(0.015)	(0.015)	(0.017)	(0.017)
age	0.0058***	-0.0063***	-0.0000	-0.0012	-0.0055***	-0.0015	0.0014	0.0012	0.0026***	-0.0017	0.0026	0.0055***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
female secondary	-0.1028***	0.0421	-0.1781***	-0.0846***	-0.1237***	-0.0510**	-0.0796**	-0.0476*	-0.0608***	-0.0626***	-0.1110***	-0.0110
	(0.027)	(0.027)	(0.032)	(0.023)	(0.015)	(0.021)	(0.041)	(0.025)	(0.022)	(0.017)	(0.022)	(0.022)
partner secondary	-0.0306	-0.1543***	-0.0218	-0.0743***	-0.0361**	-0.0519**	-0.0996***	-0.0120	-0.1162***	-0.0046	-0.0411**	-0.0230
	(0.025)	(0.025)	(0.032)	(0.024)	(0.014)	(0.021)	(0.037)	(0.026)	(0.022)	(0.004)	(0.020)	(0.020)
partner age	-0.0031*	0.0001	-0.0015	-0.0024*	-0.0000	-0.0026**	-0.0026	0.0002	-0.0009	-0.0006	-0.0033***	-0.0008
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
adjusted-R^2	0.02	0.02	0.04	0.02	0.03	0.02	0.01	0.01	0.03	0.02	0.04	0.03
No. obs.	5129	3834	1935	6062	7777	1923	2130	4802	6247	6373	6704	7639

OLS regressions with sample weights and robust standard errors.
All specifications control for: age of woman, a dummy for completed secondary school, partner's age, a dummy for his completion of secondary school, plus regional and rural-urban dummies with a full set of interactions.
*** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

Table 7: The causal effect of female employment on household violence in
Nicaragua, 1998

Dependent variable: Mean incidence of violence in household			
Panel A: OLS			
female employment mean	0.1642**	0.1373**	0.0957**
	(0.032)	(0.040)	(0.040)
male labour market	no	yes	yes
public goods	no	yes	yes
county+rural+interactions	no	no	yes
R^2	0.04	0.05	0.16
No. obs.	592	592	592
county+rural+interactions	no	no	yes
Panel B: IV Estimates. Instrument is change in fraction of males employed in agriculture 1971-1998			
female employment mean	0.3981**	0.3747**	0.3936*
	(0.121)	(0.124)	(0.238)
Wald χ^2	28.13	50.47	4432.33
No. obs.	592	592	592
county+rural+interactions	no	no	yes
Panel C: IV Estimates. Instrument is 1971 female employment rate in county			
female employment mean	0.5094**	0.4775*	0.3514
	(0.162)	(0.267)	(0.414)
Wald χ^2	25.77	49.95	4575.91
No. obs.	592	592	592
county+rural+interactions	no	no	yes
Panel D: IV Estimates. Both instruments with overidentification test			
female employment mean	0.4412**	0.4011**	0.3809*
	(0.094)	(0.112)	(0.201)
male labour market	no	yes	yes
public goods	no	yes	yes
county+rural+interactions	no	no	yes
Wald χ^2	43.51	73.83	4330.50
No. obs.	592	592	592
county+rural+interactions	no	no	yes

Notes: Nicaragua 1998 DHS data. Standard errors are clustered at the municipal level. Sample weights
account for neighbourhood (DHS cluster) size, as well as for the original DHS sample stratification.
Column (1) reports neighbourhood level regressions with controls only for ages of women, age of
partners, the fraction of women with completed secondary education, and the fraction of their partners
with completed secondary, column (2) reports neighbourhood-level regressions with these controls
plus additional controls for male unemployment rates in the municipality, the mean monthly earnings
of men in the municipality, the fraction of neighbourhood households attached to the municipal
sewage system, and mean distances to the nearest school and health center, and column (3) reports
neighbourhood-level regressions with these controls plus county fixed effects, a rural-urban dummy,
and a full set of rural-county interactions. First stage regressions and overidentification tests are pre-
sented in Data Appendix B. *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

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Appendix A. NOT INTENDED FOR PUBLICATION
Definitions of violence used

The definition of violence varies slightly across surveys, because each survey was administered by national statistical authorities. However, because the questions are similar, we are able to define violence relatively consistently across countries. We focus on violence between current partners. Our samples refer to women who currently have some possibility of experiencing violence from their spouses, and we exclude women who previously experienced a violent relationship but are no longer in that partnership. In most countries, only women currently in partnerships are interviewed in the violence survey.

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http://www.economics.uoguelph.ca/lgrogan/nicos_violence_DataAppendixA.
zip
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Data Appendix B

Table 8: The causal effect of female employment on household violence in Nicaragua, 1998

First stage regressions predicting female employment			
Panel B: IV Estimates. Instrument is change in fraction of males employed in agriculture 1971-1998			
female employment rate 1971	0.5678***	0.4077***	0.3238**
	(0.123)	(0.147)	(0.140)
R²	0.34	0.37	0.50
No. obs.	592	592	592
F-stat	26.8982	33.8845	10.7918
Partial R² First stage	0.0844	0.0811	0.0260
Panel C: IV Estimates. Instrument is 1971 female employment rate in municipality			
1971-1998 change male agri. emp.	-0.1974***	-0.1892***	-0.1252***
	(0.038)	(0.032)	(0.038)
R²	0.37	0.41	0.50
No. obs.	592	592	592
F-stat	21.3237	7.6538	5.31614
Partial R² First stage	0.0459	0.0180	0.0078
Panel D: IV Estimates. Both instruments with overidentification test			
1971-1998 Δ male agri. emp.	-0.2707***	-0.2688***	-0.1851***
	(0.047)	(0.044)	(0.039)
female emp. rate 1971	0.9022***	0.9038***	0.6838***
	(0.131)	(0.134)	(0.155)
R²	0.44	0.46	0.52
No. obs.	592	592	592
F-stat	26.2722	26.4447	14.6218
Partial R² First stage	0.1887	0.1552	0.0550
P-value OVERID	0.6729	0.7804	0.9506

Notes: Nicaragua 1998 DHS and LSMS data combined with 1971 census microsample from IPUMS. Dependent variable in main regression is incidence of violence in the DHS cluster (neighbourhood of a municipality). Standard errors are clustered at the municipal level. The instrumental variable in Panel B is the deviation between the 1971 and 1998 fraction of males employed in agriculture at the municipal level, as calculated from the 1971 census and 1998 DHS, respectively. The instrumental variable in Panel C is the municipal-level female employment rate in 1971, calculated amongst women aged 20-55. Column (1) reports neighbourhood level first stage regressions with controls only for ages of women, age of partners, the fraction of women with completed secondary education, and the fraction of their partners with completed secondary, column (2) reports neighbourhood-level regressions with these controls plus additional controls for male unemployment rates in the municipality, the mean monthly earnings of men in the municipality, the fraction of neighbourhood households attached to the municipal sewage system, and mean distances to the nearest school and health center, and column (3) reports neighbourhood-level regressions with these controls plus county fixed effects, a rural-urban dummy, and a full set of rural-county interactions. Sample weights account for DHS cluster size, as well as for the original DHS sample stratification. *** significant at 1% level, ** significant at 5% level, * significant at 10% level.
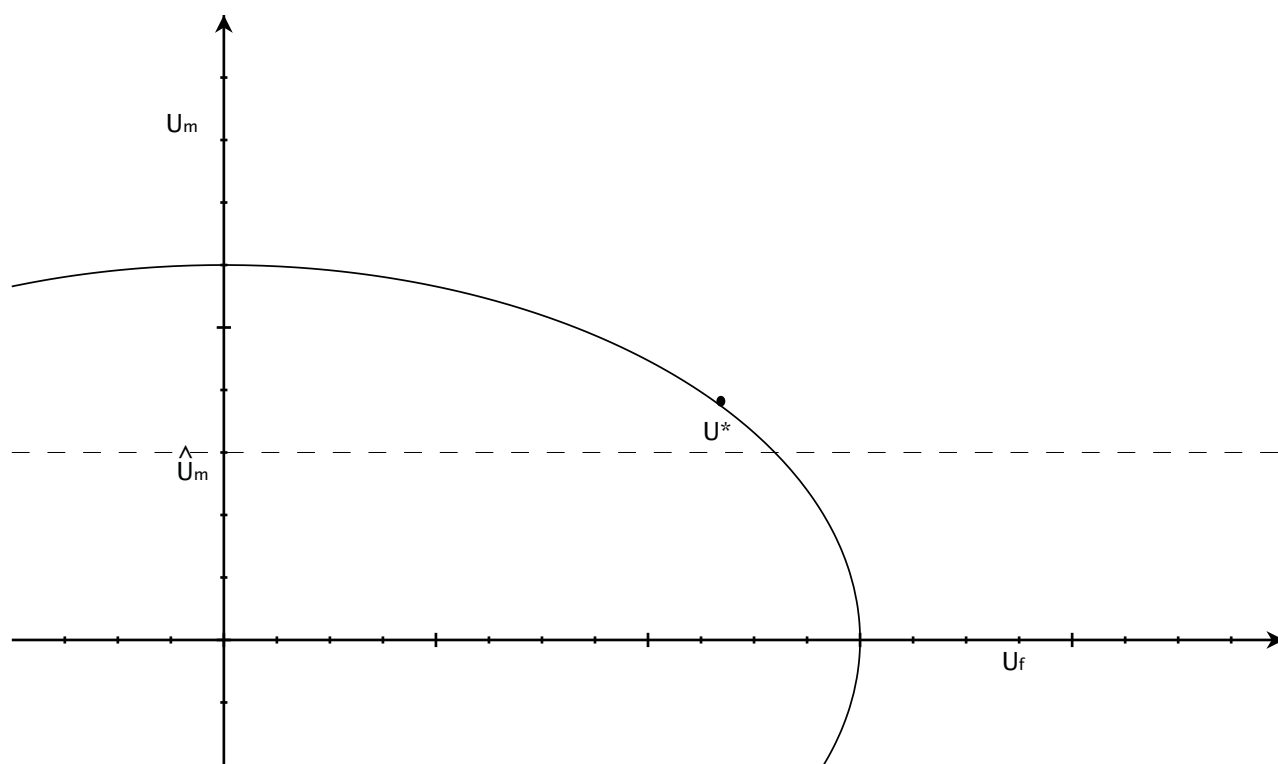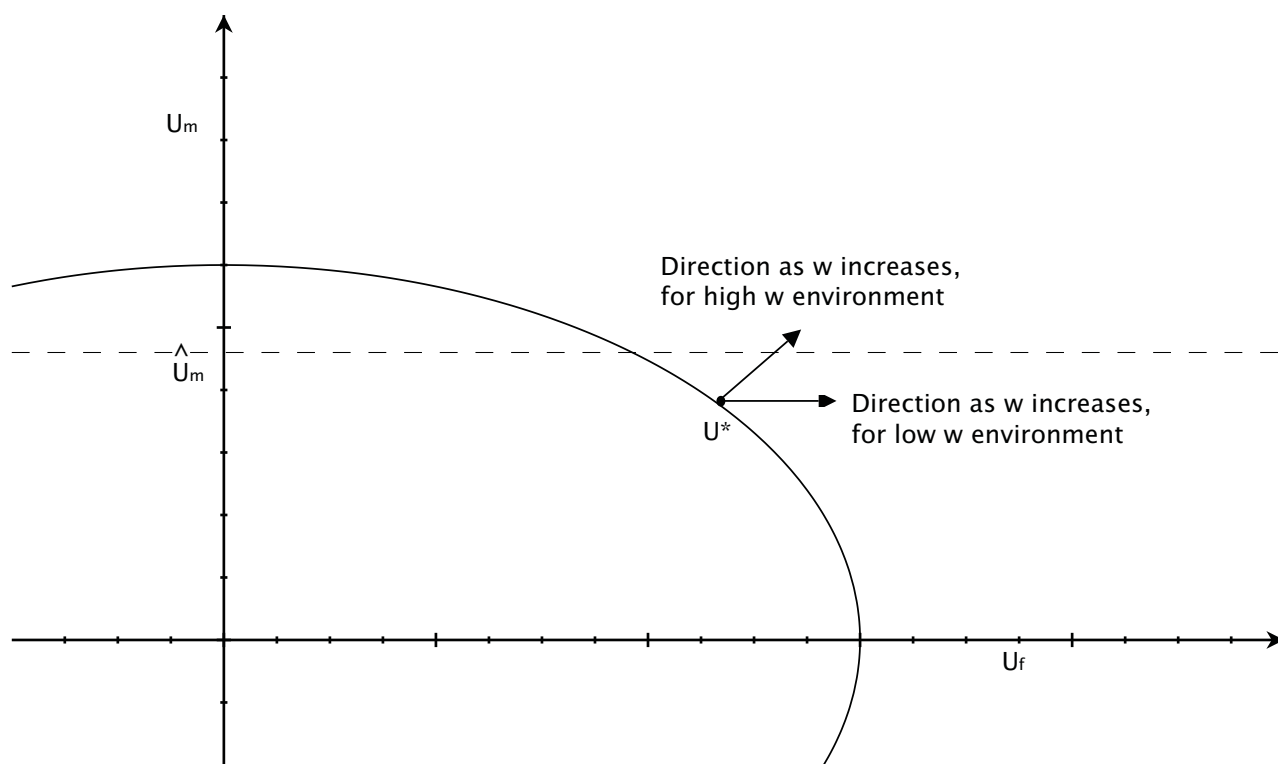
Figure 1a: Cooperative outcome

Figure 1b: Non-Cooperative outcome