Household Decision Making with Violence: Implications for Conditional Cash Transfer Programs[*]

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Abstract

We develop and estimate a model of household decision making in which the weights of the husband and the wife in household utility are endogenously determined through violence. Only the male can inflict violence to increase his relative weight, but this comes at the cost of reducing female productivity. While the cost of violence does not depend on the type of transfers, the level of resources that the male can appropriate through violence are higher under cash. We use the model to analyze how intimate partner violence responds to transfers, and whether this response depends on the type of the transfer, in-kind rather versus cash. We estimate the model using data from a randomized intervention providing in-kind and cash transfers to poor families in Ecuador. In Ecuador, 35 out of every 100 women are victims intimate partner violence. Our results suggests that violence destroys up to 42% of female's productivity and reduces her weight in the household decisions by up to 50%. A cash transfer equivalent to 10% of the average household income would reduce violence from 35% to 28%. If the government gave the same transfer in-kind, however, violence would decline by an additional 5 percentage points, from 35% to 23%.

Keywords: Household Decision Making, Violence, In-kind versus Cash Transfers
JEL Classification: D13, I38, J12

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1   Introduction

Intimate partner violence is a pervasive phenomenon that occurs in all countries, irrespective of the social, economic, religious or cultural conditions. According to the World Health Organization, 1 out of every 3 women worldwide has been physically or sexually abused by an intimate partner.[1] In Europe, 1 out of 5 women has been victim of physical or sexual intimate partner violence.[2] In the United States, 24.3% of the women are physically abused by their partners.[3] In low and middle-income countries, this rate ranges from 24.6% to 37.7%.[4] Yet in regions such as central sub-Saharan Africa or rural Ethiopia the numbers can mount to 65%.[5] In Ecuador, the country under study, 35% of the women have been physically abused by an intimate partner.[6] Many of them, also experience psychological and sexual violence;[7] but still, the vast majority (90%) are married to their perpetrator.

Aside its human rights dimension, intimate partner violence comes at the cost of lowering women's well-being. Being a victim of intimate partner violence increases the risk of future ill-health and the likelihood of being a long-term user of health services. Relative to non-abused women, those who live with violent partners are twice as likely to suffer from depression, and are more likely to acquire HIV.[8] They also have more unwanted pregnancies and more induced abortions. Their children have lower at-birth-weight (Aizer, 2011) and are at higher risk of under-5 mortality (Asling-Monemi, Pena, Ellsberg, and Persson, 2003).

With the aim of fighting poverty and promoting gender empowerment, many countries have launched programs that provide Conditional Cash Transfers to women. These policies implicitly assume that women with more control over economic resources have higher bargaining power and can achieve better outcomes for themselves and their children. The empirical evidence suggests that these programs have been successful in improving outcomes such as school attendance, health, and child nutrition (Duflo, 2012; Doepke and Tertilt, 2011). However, little is known about the transmission channels leading to these effects, and in particular, it is not clear whether the improvement of woman's utility outside the marriage unambiguously enhances her relative position in the household. On the one hand, transfers make women less trapped in marriage by increasing their reservation utility. On the other hand, it is also possible that men react to threats to traditional gender roles by inflicting violence on their partners (Macmillan and Gartner, 1999).[9] As long as transfers induce changes in the household decision making process, their net effect depends on the underlying mechanisms.

In this paper, we acknowledge the existence violence as part of the household decision making process, and use the framework to analyze how the response of intimate partner violence to transfers varies when receiving in-kind rather than cash. To this end, we develop a model of household decision making in which the spouses bargain cooperatively, and the weights of the agents are endogenously determined through violence. Then we estimate the model structurally using data

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[1] UN World Health Organization (2014).

[2] European Union Agency for Fundamental Rights (2014).

[3] Breiding, Chen, and Black (2014).

[4] WHO Department of Reproductive Health and Research, London School of Hygiene and Tropical Medicine, and South African Medical Research Council (2013).

[5] See García-Moreno, Jansen, Ellsberg, Heise, and Watts (2005).

[6] Instituto Nacional de Estadística y Censos (2011).

[7] The rates of physiological and sexual intimate partner violence in Ecuador are 43.3% and 14.5%, respectively.

[8] WHO Department of Reproductive Health and Research, London School of Hygiene and Tropical Medicine, and South African Medical Research Council (2013).

[9] See Gelles (1980) for a review of violence within the family in the sociological literature.

from a randomized intervention providing in-kind and cash transfers to poor families in Ecuador.

In the model, households maximize a weighted sum of the utility of the female and the male. Only the male can inflict violence to increase his relative weight, but this comes at the cost of reducing female productivity. This problem is similar to the set-up in Basu (2006), where the household also maximizes a weighted sum of utilities, the weights are endogenous, and the outcomes are inefficient. However, in Basu (2006), even if agents' decisions affect the weights in the household utility function in the future, they do not acknowledge this endogeneity when taking decisions today. In our model, we focus on a static household problem where the agents fully internalize how their choices affect the relative weights.

A household is formed by a female and a male who derive utility from two public goods. One of the goods is a consumption good bought in the market, and the other is a home produced good which requires female time and market acquired inputs. Relative to males, females care more about the home good, and they would like to allocate to it more time and more income than what males would like them to. As a result, the spouses disagree on how to allocate (i) income between the market good and the market inputs, and (ii) female time between labor and home production. Households differ on the extent of the disagreement and the female relative wages. The larger the disagreement, the larger the incentives for the male to use violence to align household allocations with his preferences. The effect of female's relative wage is, however, ambiguous. On the one hand, when the female has a higher wage, violence sacrifices more female labor productivity and with it more female labor income. On the other hand, a female with a higher wage can make the household decisions more aligned with her preferences and, as a result, violence becomes more likely.

Now consider a situation where this household receives an in-kind transfer in the form of the home good. If this transfer exceeds what the male would like to consume of the home good when receiving the same transfer in cash, he has the incentive to use violence to shift the allocation of resources towards the market good. In a similar spirit to Attanasio and Lechene (2014), whenever the couple does not behave as a unitary household, any transfer is potentially extra-marginal,[10] and in-kind and cash transfers have different effects. The reason is that, while the cost of violence does not depend on the type of transfers, the utility gains the male can extract from the female are lower under in-kind than under cash. Even if the male would like to use violence to reduce level of the home good, an in-kind transfer sets a lower bound to the home production. Hence, with less resources to extract, violence is less productive as an appropriation device.

We estimate the model using data from randomized intervention of the World Food Program in Northern Ecuador: *Cash, Food, or Voucher*. The program was implemented in 2011 with the aim of reducing poverty and improving food security. Women of treated households received a 40 USD monthly transfer for 6 months, either in cash (*Cash*) or in-kind (*Food or Voucher*).[11] Hidrobo, Peterman, and Heise (2016) perform an impact evaluation of the effect of the program on intimate partner violence. According to their findings, transfers reduce physical or sexual violence from 16% to 10%, i.e. a 37% reduction.

We complement the findings of Hidrobo et al. (2016) in three ways: (i) we model a mechanism leading to different effects of in-kind versus cash transfer, (ii) we quantify the cost of violence in productivity terms, and (iii) we quantify how female relative weights respond to violence. Our

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[10]A transfer is extra-marginal if the equivalent in-kind transfer is above what would be consumed under a cash transfer. A transfer is infra-marginal if the equivalent in-kind transfer is below what would be consumed under a cash transfer.

[11]According to the *World Development Indicators*, the GDP per capital in Ecuador by 2011 was 5,200 USD. Therefore, a 40 USD monthly transfer would be equivalent to 10% of the average monthly household income.

results indicate that violence can destroy up to 42% of female productivity and can reduce female relative weight in the household decision making by up to 50%. Using the estimated distribution of disagreement in preferences and the empirical distribution of female relative wages, we find that 34.6% of women are victims of intimate partner violence,[12] and a program such as *Cash, Food, or Voucher* reduces violence by 30%.

As a policy counterfactual, we simulate how programs providing in-kind and cash transfers, exclusively, will affect violence. While a cash transfer equivalent to 10% of the average household income would decrease violence by 7 percentage points, an in-kind transfer would decrease violence by 12 percentage points. To put it differently, if 35 out of every 100 women are victims of intimate partner violence, a cash transfer would guarantee that 7 of these 35 women would no longer be abused. If the same transfers were given in-kind, at least 5 additional women would live in non-violent households. The order of magnitude of these results holds when we simulate a scale-up of the program at the national level, using data from the *National Survey on Family Relationships and Violence Against Women*. A national program giving poor families a cash transfer equivalent to 10% of the average household income would decrease violence by 7 percentage points, and the same transfer in-kind would decrease violence by 10 percentage points.

To the best of our knowledge, this is the first structural estimation of a model of household decision making that accounts for the fact that agents can destroy resources to improve their relative position in the overall household utility. Besides, our model provides a specific mechanism through which the type of transfers matters: whenever the transfer is extra-marginal a member of the household, in-kind transfers generate lower gains of violence than cash. From an empirical perspective, this paper also contributes to the usage of structural models to complement impact evaluations, perform policy experiments, and derive out-of-the-sample predictions. Once randomized control trials are combined with other methods which impose more structure, they can help to better understand what works and why it works (Deaton and Cartwright, 2016; Deaton, 2010; Heckman, 2010).

The rest of the paper is organized as follows. Section 2 presents the related literature. Section 3 presents the model. Section 4 describes the data used for the estimation. Section 5 presents the reduced-form evidence of the effect of the program on intimate partner violence. Section 6 states the assumptions under which the model is identified and how it is estimated. Section 7 presents the results. In Section 8 we perform some policy analysis. Section 9 scales up the program, and Section 10 concludes.

2   Related Literature

This paper is related to four lines of literature. First, it contributes to the empirical literature on the effect of Conditional Cash Transfers (CCT) on intimate partner violence. In the context of Oportunidades, Mexico's flagship poverty alleviation program,[13] Angelucci (2008) finds that small transfers can decrease violence, while large transfers can increase it in households where the husband has traditional views of gender roles. Also focusing on *Oportunidades*, Bobonis, Gonzalez-Brenes, and Castro (2013) find that women beneficiaries are 5 to 7 percentage points less likely to be victims of physical abuse, but are more likely to be victims of emotional violence. In Ecuador, Hidrobo and Fernald (2013) find that the national CCT program, *Bono de Desarrollo Humano*, has no effect

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[12]This number is very close to the prevalence of intimate partner violence in Ecuador.

[13]*Oportunidades* is considered the region's CCT gold standard in terms of randomization and evaluation.

on physical violence. Moreover, when the woman is relatively more educated than her partner, the program can increase emotional violence by 9 percentage points. Hidrobo, Peterman, and Heise (2016) evaluate *Cash, Food, or Voucher* program at Ecuador, the same program analyzed in this paper, and find that transfers reduce physical or sexual violence by 6 to 7 percentage points. Our results shows Cash, Food, or Voucher program at Ecuador reduced physical or sexual violence by 10 percentage points, an effect that is in line with the papers that find a reduction in violence due to CCTs.

There is also a theoretical literature on household decision making with violence. In this literature, violence is modeled either directly in the utility of the abuser, what is called expressive violence, or as a means to increase the bargaining power of the perpetrator, what is called instrumental violence. In this paper, violence is modeled as instrumental, as a mechanism that males can use to improve their decision power within the household. Farmer and Tiefenthaler (1997) and Card and Dahl (2011) are among the papers that model violence directly in the utility of the abuser. Anderberg and Rainer (2013), Bloch and Rao (2002) and Bobonis, Gonzalez-Brenes, and Castro (2013) build models with instrumental violence. When violence is purely expressive, Farmer and Tiefenthaler (1997) show that violence falls as female income increases.

Our paper is most related toEswaran and Malhotra (2011)who formulate a non-cooperative model of household where violence is a means through which the husband enhances his bargaining power, and not a psychopathology generating direct utility to the perpetrator.[14] Husband and wife decide on the consumption of public goods, autonomy, and violence. The husband decides how much violence to inflict and, after observing his decision, the wife chooses the bargaining power she would like to confer to herself, i.e. her autonomy. Even if autonomy is decreasing in violence, an increase in the reservation utility of the wife does not involve a monotonic decrease in violence. The reason is that the wife may rationally set a low autonomy to prevent violence, but can also accept more violence just to have more autonomy. In contract to Eswaran and Malhotra (2011), the model we build departs from the non-cooperative approach and adopts a setting where, in the absence of violence, the outcomes would be efficient.

This paper also builds upon the large literature on household decision making; see Browning, A., and Y (2014) and Chiappori and Mazzocco (2016) for excellent reviews. Within this literature our set-up is most related to Basu (2006) and Iyigun and Walsh (2007) where the household maximizes a weighted sum of the utilities, the weights are endogenous, and the outcomes can be inefficient. Basu (2006) studies how individual decisions on how much to work and earn today can affect the weights in household utility tomorrow. In Basu (2006) , however, even if decisions today affect bargaining power tomorrow, when taking current decisions, the agents are not fully aware of this endogeneity. In contrast, in our model the agents fully internalize how their choices affect the relative weights. In Iyigun and Walsh (2007) agents' income also improves their bargaining power, and, as in this paper, they internalize this connection. On the other hand, inIyigun and Walsh (2007) the inefficiency takes the form of an oversupply of goods, agents work more to improve their bargaining power, while in our model the inefficiency is captured by the destruction of resources.

Another key feature of our model is that the male faces a trade-off between his weight in household decisions and female labor productivity. On the one hand, since higher female relative wages make violence more costly, one can expect that reductions in female unemployment and in the gender wage gap reduce violence as in Anderberg, Rainer, Wadsworth, and Wilson (2015),

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[14]As early as in the seventies, the research in sociology stop understanding domestic violence as rare phenomena confined to mentally disturbed people. From then on, family violence is approached as an extensive phenomenon which could not be explained solely as a consequence of psychological factors (Gelles, 1980).

Aizer (2010), and Chin (2012). Aizer (2010), for example, finds that the reductions in the wage gap accounts for 9% of the decrease in domestic violence witnessed in California between 1990 and 2003. On the other hand, if female labor market participation imposes a significant reduction in the male's relative weight, female employment does not necessarily reduce violence (e.g., Bowlus and Seitz (2006) and Alonso-Borrego and Carrasco (2016)).[15] All in all, the fact that males react to treats to their bargaining power and they do so by destroying female productivity is consistent with theories of economic sabotage such as Anderberg, Rainer, Wadsworth, and Wilson (2015). It is also in line with the empirical evidence by Bertrand, Kamenica, and Pan (2015) that suggest that husbands might have an aversion for their wives earning more than they do.[16]

Finally, this paper is also contributes to the gender empowerment literature. As in Anderson and Genicot (2014), we provide a mechanism for why pro-woman redistribution policies can increase conflict within the family. Similar to Ashraf (2009), we show that the particular conditions for household decision making have effects on the household allocations. A key message that emerges from the current paper is that since the type of transfers matters, not all forms of empowerment are equally relevant for all women. Finally, in this papers are willing to sacrifice resources to be able to have mo say in the household. This relates to the findings of Almas, Armand, Attanasio, and Carneiro (2015), who study how a CCT in Macedonia influences woman's willingness to pay to have more control of resources within the household.

3 A Model of Household Decision Making with Violence

In this paper, we develop a static model of household decision making with an explicit role for violence. Here we present a general version of the model and apply it to the household. Then, we show how the model allows for a different response of violence to transfers in-kind and transfer in-cash. Finally, we impose the specific functional forms that we will use to bring the model to the data.

3.1 General Framework

Consider a household formed by 2 agents $s \in \{f, m\}$, female and male, who derive utility from a bundle of goods $\mathbf{x}$. Call $u^s(\mathbf{x})$ the utility of agent s. Assume $u^s(\mathbf{x})$ is $\mathcal{C}^2$, strictly increasing, and strictly concave. The household maximizes a weighted sum of the utilities,

$$\mu(\mathbf{v})u^f(\mathbf{x}) + (1 - \mu(\mathbf{v}))u^m(\mathbf{x}),$$

where the weights are endogenously determined by $\mathbf{v}$. The weight of the female, $\mu(\mathbf{v})$, is decreasing and strictly concave in $\mathbf{v}$.

Only the male m can use $\mathbf{v}$, and he use it to shift the household decision towards his most preferred $\mathbf{x}$, disregarding the utility of the female. Potentially he could choose a level of $\mathbf{v}$ such that $\mu(\mathbf{v}) = 0$; however, using $\mathbf{v}$ destroys resources. For a given level of $\mathbf{v}$, let $T(\mathbf{v})$ describe the set of bundles $\mathbf{x}$ from which the household can choose. The higher the level of $\mathbf{v}$, the higher his

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[15]For Canada, Bowlus and Seitz (2006) suggest that female employment deters abuse only if it occurs before the onset of violence. In Spain, Alonso-Borrego and Carrasco (2016) find that male unemployment increases the risk of violence, while female employment reduces the likelihood of violence only if the male is also employed.

[16]Bertrand, Kamenica, and Pan (2015) document the presence of aversion for the wife earning more than the husband. In couples where the wife's potential income is likely to exceed the income of the husband, she is less likely to be in the labor force and, even if she works, she earns less than her potential.

relative weight $(1 - \mu(\mathbf{v}))$, but the smaller the set of feasible bundles $\mathbf{x}$. Therefore, $T : \mathbf{V} \rightrightarrows \mathbf{X}$ is a correspondence such that, for every $\mathbf{v}, \mathbf{v}' \in \mathbf{V}$, if $\mathbf{v} < \mathbf{v}'$ then $T(\mathbf{v}') \subset T(\mathbf{v})$. One can interpret $T(\mathbf{v})$ as a *resource destruction correspondence.*

The problem of the household is to

$$\max_{\mathbf{v}, \mathbf{x} \in T(\mathbf{v})} \Omega(\mathbf{v}, \mathbf{x}) = \mu(\mathbf{v})u^f(\mathbf{x}) + (1 - \mu(\mathbf{v}))u^m(\mathbf{x}).$$

The strict concavity assumption guarantees that this problem has an interior solution. For a given $\mathbf{v} = \tilde{\mathbf{v}}$, $\Omega(\tilde{\mathbf{v}}, \mathbf{x})$ is also strictly concave in $\mathbf{x}$. Therefore, if $T(\tilde{\mathbf{v}})$ is convex, there exists an interior maximum of $\Omega(\tilde{\mathbf{v}}, \mathbf{x})$ called $x(\tilde{\mathbf{v}})$.

$$x(\tilde{\mathbf{v}}) = \arg\max_{x \in T(\tilde{\mathbf{v}})} \Omega(\tilde{\mathbf{v}}, \mathbf{x})$$

Because $\Omega(\mathbf{v}, x(\mathbf{v}))$ is also strictly concave, agents can solve for

$$\max_{\mathbf{v}} \Omega(\mathbf{v}, x(\mathbf{v})),$$

the solution of which is equivalent to:

$$\arg\max_{\mathbf{v}} \Omega(\mathbf{v}, x(\mathbf{v})) \equiv \arg\max_{\mathbf{v}, \mathbf{x}} \Omega(\mathbf{v}, \mathbf{x})$$

It is, as if, after the household achieves the Pareto-efficient allocation $x(\mathbf{v})$, the male can use $\mathbf{v}$ to boost his weight. The outcome would no longer Pareto-efficient as the agents could agree on the final weights without using violence, and no resources would be destroyed.

3.2   Household Problem

Consider now the following version of this framework. A household is formed by a female and a male, and maximizes a weighted sum of the utilities. Female f and male m derive utility from two public goods. One of the goods is a consumption good bought in the market (henceforth, market good), q. The other good, Q, is a home produced good (henceforth, home good), the production of which requires female time $(1 - l_f)$ and market inputs (d) according to

$$Q = F\left(d, (1 - l_f)\right).$$

Agents do not derive direct utility from the market inputs nor from leisure, i.e. d and l_f only enter utilities through Q.

While females split their time between the home production and the market, males devote their entire time endowment to labor. Each unit of time the male devotes to labor is paid at w_m. Each unit of time the female devotes for labor is paid at w_f.

The relative weight of each agent in the overall household utility depends on violence. Only the male uses violence and he does so to increase his relative weight in the overall household utility. Violence, however, reduces female productivity, both at home and in the labor market. The female is endowed with one unit of labor and a unit of labor productivity. If there is no violence, she can use her entire effective unit of labor. However, if there is violence the female productivity is reduced by $e^{\gamma(v)}$, with $e^{\gamma(v)} \in (0, 1]$, $\frac{\partial \gamma(v)}{\partial v} < 0$ and $e^{\gamma(0)} = 1$. Although violence does not destroy female

time, it is as if she had less effective units of labor available. Therefore, in the presence of violence, the home good production is characterized by

$$Q = e^{\gamma(v)} F\left(d, (1 - l_f)\right).$$

In a similar fashion, violence reduces female labor income to $e^{\gamma(v)} l_f w_f$

The government provides a transfer to the female, either in the form of the market input, i.e. in-kind (t_k), or in-cash (t). In-kind transfers cannot be sold and converted to cash. The female preserves the transfer even if the she leaves the household. This increases her outside option, which in turn improves her bargaining power. The bargaining power of the female depends on her potential relative income. We call this $\widetilde{\omega}_f = \frac{w_f + t_k + t}{w_m}$. Female relative weight (μ) is a function of both violence (v) and the potential earnings of the female outside the couple $(\widetilde{\omega}_f)$, $\mu\left(v, \widetilde{\omega}_f\right)$.

The household decides how to allocate female time between market (l_f) and home production $(1 - l_f)$, how to spend household's income $(e^{\gamma(v)} l_f w_f + w_m + t)$, and how much violence (v) the male can inflict. This optimization problem can be written as

$$\max_{q, l_f, d, v} \mu(v, \widetilde{\omega}_f) u^f(q, Q) + (1 - \mu(v, \widetilde{\omega}_f)) u^m(q, Q),$$

subject to

$$q + d = e^{\gamma(v)} l_f w_f + w_m + t,$$

and

$$Q = e^{\gamma(v)} F\left(d + t_k, (1 - l_f)\right).$$

We assume that the market food (q) and the market input (d) have the same price, that is normalized to 1.

The household decides how much market good and inputs for home production to buy, and how the female should allocate her time between the labor market and the home production. The household also decides on the level of violence. We assume that both q and Q are public goods within the household. As a result, the male will use violence only if there are differences in how female and male value q versus Q. If $u^f(q, Q)$ and $u^m(q, Q)$ put different weights on market and home goods, the male can use violence to shift the household's allocation towards his favored good. This, however, comes at a cost, as the productivity of the female reduces by $e^{\gamma(v)}$.

The optimality conditions with respect to d, $1 - l_f$, and v are given by

$$\frac{\partial Q}{\partial d} \left[\mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial Q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial Q} \right] = \mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial q}, \quad (1)$$

$$\frac{\partial Q}{\partial 1 - l_f} \left[\mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial Q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial Q} \right] = \left[\mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial q} \right] e^{\gamma(v)} w_f, \quad (2)$$

and

$$\frac{\partial \mu(v, \widetilde{\omega}_f)}{\partial v} \Delta u_f^m = \left[\mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial Q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial Q} \right] \frac{\partial Q}{\partial v} \quad (3)$$

$$+ \left[\mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial q} \right] \frac{\partial q}{\partial v},$$

where Δu_f^m is the level difference between the utility of the male and the utility of the female, i.e. $\Delta u_f^m = u^m(q, Q) - u^f(q, Q)$.

Equations 1 and 2 require that the benefit from devoting resources to the inputs of the home good (Q) equal the opportunity cost of not devoting those resource to the market good (q). One can also think about these equations in terms of the household marginal willingness to pay for good q and the home good Q. Rearranging the terms of equations 1 and 2, it can be seen that for any input of production $z_j \in \{d, 1 - l_f\}$, at the optimum, it must be the case that

$$\frac{\frac{\partial Q}{\partial z_j}}{\frac{\partial q}{\partial z_j}} = \frac{\mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial q}}{\mu(v, \widetilde{\omega}_f) \frac{\partial u^f}{\partial Q} + (1 - \mu(v, \widetilde{\omega}_f)) \frac{\partial u^m}{\partial Q}}, \tag{4}$$

where $\frac{\partial q}{\partial d} = 1$ by normalization, and $\frac{\partial q}{\partial 1 - l_f} = e^{\gamma(v)}$.

The LHS of Eq. (4) is the ratio between the marginal productivity of the input z_j $\left(\frac{\partial Q}{\partial z_j}\right)$ and its marginal cost $\left(\frac{\partial q}{\partial z_j}\right)$. The RHS is the ratio between the household marginal willingness to pay for good q and the household marginal willingness to pay for home good Q. Because the RHS of Eq. (4) does not depend on z_j, the equilibrium in the production of the household public good is independent of preferences and weights,

$$\frac{\frac{\partial Q}{\partial z_i}}{\frac{\partial Q}{\partial z_j}} = \frac{\frac{\partial q}{\partial z_i}}{\frac{\partial q}{\partial z_j}}. \tag{5}$$

The marginal rate of technical substitution between z_i and z_j equals their relative marginal cost. This optimality condition holds as long as the inputs of production of the home good do not generate direct utility.

Similarly, the optimality condition for violence (Eq. (3)) requires that the marginal benefit of violence equals its marginal cost. One can understand the marginal benefit from violence as the utility gains that the male can extract from the wife. As for the marginal cost of violence, one can think about it in terms of the resources that are destroyed instead of being allocated to the consumption of q and Q. The first term of the RHS of Eq. (3), is the marginal cost of violence in terms of the forgone home good. The second term of the RHS of Eq. (3), is the marginal cost of violence in terms of the forgone market good. The marginal benefit of violence (LHS of Eq. (3)) depends on two elements: 1) how much extra weight the husband can gain by inflicting violence $\left(\frac{\partial \mu(v, \widetilde{\omega}_f)}{\partial v}\right)$, and 2) the level of resources at stake (Δu_f^m). With more utility gains to appropriate, the stakes are higher, and the husband can allow himself to inflict more violence. Hence, if the marginal benefit of violence increases, violence increases as well.

One can also think about Eq. (3) in terms of the responsiveness of female labor productivity and female relative weight to violence. To this end, let

$$\varepsilon_v^Q = \frac{\partial Q}{\partial v} \frac{v}{Q} \quad \text{and} \quad \varepsilon_v^q = \frac{\partial q}{\partial v} \frac{v}{q},$$

be the elasticities of the home good Q and the market good q with respect to violence. In a similar fashion, express

$$\frac{\partial \mu(v, \widetilde{\omega}_f)}{\partial v} \quad \text{as} \quad \mu(v, \widetilde{\omega}_f) \varepsilon_v^\mu.$$

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Then, Eq. (3) can be written as

$$
\mu(v,\widetilde{\omega}_f)\varepsilon_v^\mu \Delta u_f^m = \left[\mu(v,\widetilde{\omega}_f)\frac{\partial u^f}{\partial Q}\left(1-\mu(v,\widetilde{\omega}_f)\right)\frac{\partial u^m}{\partial Q}\right]Q\varepsilon_v^Q
$$
$$
+ \left[\mu(v,\widetilde{\omega}_f)\frac{\partial u^f}{\partial q}+\left(1-\mu(v,\widetilde{\omega}_f)\right)\frac{\partial u^m}{\partial q}\right]q\varepsilon_v^q.
$$

Moreover, the home good technology production and the budget constraint can be used to show that the elasticity of Q and q with respect to v depend on how sensitive female labor productivity is to violence, i.e.

$$
\varepsilon_v^Q = \gamma(v)\varepsilon_v^\gamma, \quad \text{and} \quad \varepsilon_v^q = \gamma(v)\frac{e^{\gamma(v)}l_f w_f}{q}\varepsilon_v^\gamma,
$$

where $\varepsilon_v^\gamma = \frac{\partial \gamma(v)}{\partial v}\frac{v}{\gamma(v)}$. As a result, the optimality condition for v reads as

$$
\mu(v,\widetilde{\omega}_f)\varepsilon_v^\mu \Delta u_f^m = \left[\mu(v,\widetilde{\omega}_f)\frac{\partial u^f}{\partial Q}+\left(1-\mu(v,\widetilde{\omega}_f)\right)\frac{\partial u^m}{\partial Q}\right]Q\gamma(v)\varepsilon_v^\gamma \tag{6}
$$
$$
+ \left[\mu(v,\widetilde{\omega}_f)\frac{\partial u^f}{\partial q}+\left(1-\mu(v,\widetilde{\omega}_f)\right)\frac{\partial u^m}{\partial q}\right]\gamma(v)e^{\gamma(v)}l_f w_f \varepsilon_v^\gamma.
$$

Eq. (6) shows that the higher the elasticity of female's weight, the higher the benefit from violence. As well, the higher the elasticity of the productivity cost of violence, the higher the cost of inflicting violence.

3.3 In-kind versus Cash Transfers

Whenever the couple does not behave as a unitary household, the demand systems should be defined at the individual rather than at the household level (Attanasio and Lechene, 2014). A natural extension of this argument is that, whether an in-kind transfer is above or below what would be consumed under a cash transfer, i.e. the transfer is extra-marginal or infra-marginal, should also be defined at the individual level. When the spouses disagree 0n how to allocate resources, any in-kind transfer has the potential of exceeding what the male would spend on that good when receiving the same transfer in cash. If this is the case, he has an incentive to use violence to align household allocations with his preferences. As a result, in-kind and cash transfers will affect differently the level of utility gains that the male can extract from the female.

When the transfer is in-kind, and provided that in-kind cannot be transformed into cash, at least part of the disagreement is mitigated. Even if the male would like to use violence to lower the demand of market input to his most preferred level, an in-kind transfer sets a minimal level of home good that must be produced. As a result, the utility gains that the male can extract from through violence are less than what he could appropriate under a cash transfer. One can see this argument using the optimality condition of violence in Eq. (3). Fix the marginal cost of violence (RHS). If the utility gains from violence, Δu_f^m, increases, for Eq. (3) to hold it must be the case that $\frac{\partial \mu(v,\widetilde{\omega}_f)}{\partial v}$ decreases. Since $\mu(v,\widetilde{\omega}_f)$ is concave in v, then v must increase.
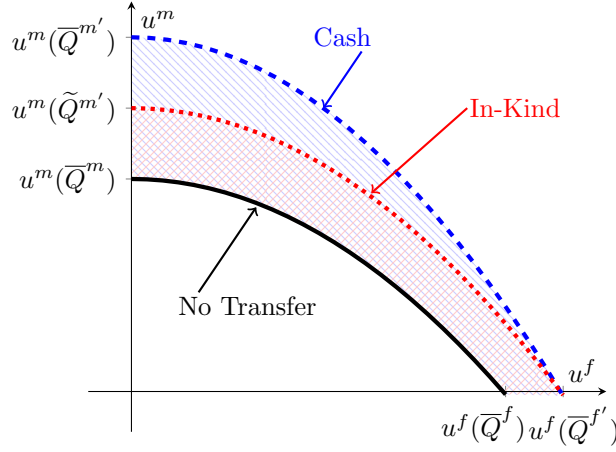
Figure 1: In-Kind versus Cash Transfers

Figure 1 graphically presents the argument. We plot the utility of the female on the x-axis and the utility of the male on the y-axis. For a spouse $s \in \{f, m\}$, define

$$u^s(\overline{Q}^s) \equiv \max_{q, l_f, d} u^s(q, Q)$$

subject to

$$w_f l_f + w_m = d + q, \quad \text{and} \quad Q = F(d, 1 - l_f).$$

$u^f(\overline{Q}^f)$ is the utility that the female would attain if she were the sole decision maker of the household, i.e. if $\mu(v, \widetilde{\omega}_f) = 1$. $u^m(\overline{Q}^m)$ is the utility that the male would attain if he were the sole decision maker, i.e. if $\mu(v, \widetilde{\omega}_f) = 0$. The black solid line depicts the utility possibility frontier of this household.

Now consider a transfer to the female, either in-kind or in-cash. Assume that the transfer is infra-marginal for the female and extra-marginal for the male. If the female had all the household income and received the transfer in cash, she would spend in d more than what the government transfers in-kind. In contrast, if the male had all the household income and received the transfer in cash, he would spend less than the equivalent transfer in-kind. The blue dashed line in Figure 1 depicts the household utility possibility frontier under a cash transfer and the red dotted line, under in-kind. Regardless of the type of transfer, the household's utility possibility frontier expands. Yet, the expansion is not symmetric between the different transfer regimes.

Since the transfer is infra-marginal for the female, she is indifferent between receiving the transfer in-kind or in-cash. This means that

$$\max_{q, l_f, d} u^f(q, Q),$$

subject to

$$w_f l_f + w_m + t = d + q, \quad \text{and} \quad Q = F(d, 1 - l_f);$$

is equivalent to

$$\max_{q, l_f, d} u^f(q, Q),$$

11

subject to

$$w_f l_f + w_m = d + q, \quad \text{and} \quad Q = F\left(d + t_k, 1 - l_f\right).$$

Call this utility $u^f(\overline{Q}^{f'})$.

As for the male, since the transfer is extra-marginal for him, if he were the sole decision maker he would devote less resources to the market input d than what the government transfers in-kind. Call the associate utility levels

$$u^m(\overline{Q}^{m'}) \equiv \max_{q, l_f, d} u^m(q, Q),$$

subject to

$$w_f l_f + w_m + t = d + q, \quad \text{and} \quad Q = F\left(d, 1 - l_f\right);$$

(under a cash), and

$$u^m(\widetilde{Q}^{m'}) \equiv \max_{q, l_f, d} u^m(q, Q),$$

subject to

$$w_f l_f + w_m = d + q, \quad \text{and} \quad Q = F\left(d + t_k, 1 - l_f\right).$$

(under in-kind). The above argument states that $u^m(\widetilde{Q}^{m'}) < u^m(\overline{Q}^{m'})$.

The area between the dashed line and the solid line represents the utility gains of the cash transfer. The area between the dotted line and the solid line represents the utility gains of the in-kind transfer. Because the male can use violence to appropriate part of these utility gains, when the transfer is in-kind there are less resources that the he can extract. This in turn makes violence less productive as an appropriation device. Thus, whenever the transfers exceed male's most preferred allocation towards the inputs of home production, in-kind transfers reduce the gains of violence relative to cash transfers.

3.4   Specific Functional Forms

To bring the model to the data, we assume that the home good is produced according a Cobb-Douglass technology with parameter θ,

$$Q = e^{\gamma(v)} \left(d + t_k\right)^{\theta} \left(1 - l_f\right)^{1-\theta}.$$

Then, Eq. (5) can be written as

$$\frac{\frac{\partial Q}{\partial 1 - l_f}}{\frac{\partial Q}{\partial d}} = \frac{\frac{\partial q}{\partial 1 - l_f}}{\frac{\partial q}{\partial d}}$$

or as

$$\frac{1 - \theta}{\theta} \frac{d + t_k}{(1 - l_f)} = w_f e^{\gamma(v)}, \tag{7}$$

where $\frac{\partial q}{\partial d} = 1$ by normalization, and $\frac{\partial q}{\partial 1 - l_f} = e^{\gamma(v)} w_f$.

We assume that the utilities of both female and male are logarithmic, i.e.,

$$u^f(q, Q) = \alpha_i^f \log(Q) + \log(q) \quad \text{and} \quad u^m(q, Q) = \log(Q) + \log(q).$$

Given that the female cares relatively more about the home good, we assume that $\alpha_i^f > 1$. While the male values the home good (Q) and the market acquired good (q) equally, the female has a higher valuation for the home good (Q). These functional forms reduces all the extent of the disagreement between female and male to α_i^f.

Given this functional forms, we rewrite the optimality condition for violence . The difference between the utility of the male and the female that appears in the LHS of Eq. (6) becomes

$$\Delta u_f^m = \left(1 - \alpha_i^f\right) \log(Q).$$

As a result, the first term in the RHS of Eq. (6), also simplifies to

$$\left[\mu(v, \widetilde{\omega}_f)\frac{\alpha_i^f}{Q} + (1 - \mu(v, \widetilde{\omega}_f))\frac{1}{Q}\right] Q\gamma(v)\varepsilon_v^\gamma = \left[\mu(v, \widetilde{\omega}_f)\alpha_i^f + (1 - \mu(v, \widetilde{\omega}_f))\right]\gamma(v)\varepsilon_v^\gamma.$$

Finally, since both female and male have the same valuation for the market good, the second term in the RHS of Eq. (6) reduces to

$$\frac{\partial u^m}{\partial q}\gamma(v)e^{\gamma(v)}l_f w_f \varepsilon_v^\gamma = \frac{e^{\gamma(v)}l_f w_f}{q}\gamma(v)\varepsilon_v^\gamma = \rho\gamma(v)\varepsilon_v^\gamma,$$

where ρ is the ratio between female's labor income and the value of the market acquired good. Putting the pieces together, Eq. (6) reads as

$$\mu(v, \widetilde{\omega}_f)\varepsilon_v^\mu \left(1 - \alpha_i^f\right)\log(Q) \quad = \quad \left[1 - \mu(v, \widetilde{\omega}_f)\left(1 - \alpha_i^f\right)\right]\gamma(v)\varepsilon_v^\gamma + \rho\gamma(v)\varepsilon_v^\gamma. \tag{8}$$

4 Data

4.1 *Cash, Food, or Voucher* Program

We estimate the model using data from a randomized intervention of the World Food Program in Ecuador: *Cash, Food, or Voucher*. This is a randomized control trial implemented in Northern Ecuador during 2011 with the aim of: 1) improving food consumption, 2) increasing the role of women in food consumption decisions, and 3) reducing tensions between Colombian refugees and Ecuadorians.[17] Beneficiaries of the program received a monthly transfer of 40 USD during 6 months. This transfer was equivalent to 10% of the average household monthly income. To receive the transfer, participants were required to attend to a nutritional training. The transfer could take the form of cash, distributed through ATMs; a food basket containing rice, lentils, vegetable oil and can-sardines with a 40 USD value; or a voucher for 40 USD value, endorsed to the woman and redeemable at local supermarkets. As the voucher was only exchangeable from goods of a

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[17]The civil conflict in Colombia has lead to high internal displacement. Many of the refugees also migrate to neighbor countries, such as Venezuela or Ecuador. *Cash, Food, or Voucher* was implement in the north of Ecuador where, by proximity, much of the Colombian refugees reside.

pre-approved list which mapped to the food basket, both *voucher* and *food* constitute an in-kind transfer.

Cash, Food, or Voucher was implemented in seven urban centers of the provinces of *Carchi* and *Sucumbíos*, two provinces located in the North of the country. The selected urban centers had more than 10% of refugees, more than 50% of people living in poverty, a local provider to implement food distribution, and financial institutions to distribute cash via ATMs. Within these centers, 84 neighborhoods were randomly assigned to treatment and control groups. Within the treated arm, 110 clusters were randomly assigned to cash, food or voucher. All the households with at least one Colombian member and the households considered as poor were enrolled in the program. Households receiving *Bono de Desarrollo Humano* were excluded.[18] The baseline sample consists of 2357 households, 652 of which were assigned to the control group. From the 1,705 treated households, one third received the transfers in cash, one third received it in food, and one third received it in voucher.

In March 2011 the 2357 households were interviewed. Out of them, 2122 were re-surveyed in October-November 2011. The final sample used for the estimation consist of 1,174 households where the female respondent of the intimate partner violence questionnaire was the head of household or the spouse of the head, she was between 15 and 70-years-old, married or at union at the beginning of the intervention, alone at the time of both interviews, and she provided complete information on violence (v), labor income ($e^{\gamma(v)}l_f w_f$ and w_m), food expenditure (d), hours worked (l_f) and hours devoted to household work ($1 - l_f$), both at baseline and follow-up.[19]

4.2   Definitions of Violence

Following World Health Organization's guidelines,[20] physical violence is defined as a dummy taking the value of 1 if the female reported she had been pushed, slapped, punched, kicked, strangled, or threaten or attacked with a weapon by her partner during the last 6 months. Emotional violence is coded as 1 if the female reported she has been threatened of abandonment, of being taken away from her children, or of being hurt; humiliated in private or in public; or ignored by her partner in the last 6 months. Sexual violence is coded as 1 if during the last 6 months the intimate partner had used physical strength to force the female to have sex or to commit sexual acts she did not approve. A woman suffering from physical, emotional or sexual violence with her partner as the perpetrator was considered as a victim of intimate partner violence (*any violence*).

To ensure comparability with most of the surveys on violence against the woman, we focus on physical or sexual violence. For the estimation, we also define an index of physical or sexual violence ranging between 0 and 1. This index captures the different forms of physical or sexual violence that the female experienced in the last 6 months by hands of her partner: pushed, slapped, punched,

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[18]*Bono de Desarrollo Humano* is the main poverty alleviation program in Ecuador.

[19]The domestic violence questionnaire must have been answered by the same women at baseline and the follow-up.

[20]In Ellsberg and Heise (2005), the World Health Organization define intimate partner violence as any act or omission by a current or former intimate partner which negatively affects the well-being, physical or psychological integrity, freedom, or right to full development of a woman. Physical violence is the intentional use of physical force with the potential for causing death, injury, or harm. It includes scratching, pushing, shoving, throwing, grabbing, biting, choking, shaking, poking, hair pulling, slapping, punching, hitting, burning, the use of restraints or one's body size or strength against another person, and the use, or threat to use, a weapon (gun, knife, or object). Emotional violence is any act or omission that damages the self-esteem, identity, or development of the individual; including humiliation, threatening loss of custody of children, forced isolation from family or friends, threatening to harm the individual or someone they care about, repeated yelling or degradation, inducing fear through intimidating words or gestures, controlling behavior, and the destruction of possessions. See Ellsberg and Heise (2005).

kicked, strangled, threaten with a weapon, attacked with a weapon, forced to perform sexual acts that she did not approved, and forced to have sex. For instance, a female who reported being punched and threaten with a weapon, but who did not suffer any of the other assaults previously listed, will have an index of $\frac{2}{9} = 0.225$. We used this index for the estimation, and express all the results of our simulations in terms of a dummy capturing the extensive margin of violence.

4.3 Descriptive Statistics

Table 1 presents some descriptive statistics of the sample. We begin by presenting basic household demographics (Panel A, Table 1). A typical household is a family of 5 members. The head of the household is a 38-years-old working man and his spouse is a 35-years-old woman. They have one child under 5 years and another child under 14. Around 42% of these families are married. The remaining 58% live in cohabitation. Both female and male have on average 8 years of education; although 32% the women are more educated than their partners. Columns (5) and (6) of Table 1 presents the p-value of a battery of randomization tests. Except the number of household members and the number of children aged 6 to 15, none of the variables are statistically different between treatment and control group.[21] Comparing in-kind and cash, apart from the percentage of households that have a male as the head of household and the age difference, none of the variables is statistically different across treatment arms.[22]

Panel B of Table 1 presents the prevalence rates of intimate partner violence. At baseline, 1 out of every 3 women has been victim of a form of intimate partner violence in the last 6 months. In the same time period, 15% of the females have been physically abused by her partners. This means that in almost 60% of the cases of the cases of intimate partner violence, the abuse involved the intentional use of physical force with the potential of causing death, injury, or harm. The reports of sexual violence are scarce, and the prevalence physical or sexual violence exceeds the prevalence of physical violence (only) in one percentage point.

Panel C of Table 1, presents the main variables used for the estimation. Among those women who where physically or sexually abused by an intimate partner, the average index of violence (as previously described) is 0.25. That is to say, the average abused woman experience about two out of the nine possible forms of physical or sexual violence surveyed. The average household daily income amounts to 15 USD. From those 15 USD, 4 USD are devoted to daily food expenses (around 30%). A 40 USD transfer is equivalent to 10% of the average household monthly income. As for the labor market and time allocation variables, 32% of women work in the labor market for an average of 5 hours a day. In addition to these 5 hours, the average woman devotes 7 hours a day to take care of the children and other household chores. 97% of the partners of these women work, and do so for an average of 7 hours a day. While the average female earns 6.65 USD a day, the average male doubles her income; yet, only part of the gap is due to differences in the hours worked in the market.

4.4 Female Wages

In the data set, female labor income captures $e^{\gamma(v)} l_f w_f$. However, for the estimation of the model we need to disentangle w_f, $e^{\gamma(v)}$, and l_f. Since the model does not include leisure, for every household, we express the female time allocation relative to the sum of the time she devotes to household work

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[21]These variables are discrete in nature and the difference in the coefficients are not particularly large.

[22]Hidrobo, Hoddinott, Peterman, Margolies, and Moreira (2014) provide an in-dept validation of the randomization and attrition analysis.

Table 1: Descriptive Statistics

| | All | Control | Treatment | | p-values | |
| | | | In-Kind | Cash | Control vs. Treatment | In-kind vs. Cash |
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Demographics						
No. of household members	5.37	5.58	5.26	5.33	0.01	0.82
Male head of households	0.97	0.97	0.97	0.99	0.31	0.10
Married couple	0.42	0.43	0.43	0.40	0.95	0.68
No. children form 0 to 5	0.75	0.72	0.78	0.73	0.21	0.46
No. children from 6 to 14	0.92	1.03	0.86	0.91	0.04	0.70
Female age	34.64	35.39	34.26	34.53	0.18	0.79
Male age	38.50	39.34	38.37	37.74	0.17	0.50
Couple's age difference	3.36	3.45	3.60	2.77	0.81	0.08
Female education years	8.10	7.77	8.27	8.16	0.23	0.79
Male education years	8.04	7.74	8.21	8.04	0.26	0.68
Female more educated than male	0.32	0.30	0.31	0.35	0.35	0.18
Panel B. Intimate Partner Violence						
Any type of violence	0.29	0.28	0.31	0.27	0.73	0.24
Emotional violence	0.26	0.25	0.27	0.24	0.81	0.25
Physical violence	0.15	0.12	0.17	0.15	0.93	0.67
Sexual violence	0.03	0.02	0.04	0.04	0.71	0.84
Physical or sexual violence	0.16	0.13	0.18	0.16	0.88	0.61
Panel C. Variables for Estimation:						
Index of physical or sexual violence	0.25	0.26	0.25	0.23	0.33	0.36
Household daily expenses on food in USD	3.89	3.78	3.87	4.03	0.27	0.18
Household daily income in USD	14.18	14.97	13.73	14.14	0.24	0.41
Female employment	0.32	0.30	0.31	0.35	0.57	0.32
Female labor income a day in USD	6.65	7.39	6.24	6.63	0.07	0.68
Female hours of work a day	5.22	5.80	4.89	5.22	0.05	0.30
Female hours of household work a day	7.30	7.52	7.26	7.11	0.48	0.55
Male employment	0.97	0.96	0.97	0.98	0.12	0.31
Male labor income a day in USD	12.50	13.29	12.25	12.07	0.26	0.96
Male hours of work a day	6.93	7.08	6.77	7.08	0.77	0.53

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

and the time that she works in the labor market. For example, a female that works 8 hours a day in the labor market and works at home 4 hours ($l_f = 0.5$, $1 - l_f = 0.5$) is observationally equivalent to a female that works 4 hours a day, devotes 2 hours to household chores, and use the rest of her time for leisure ($l_f = 0.5$, $1 - l_f = 0.5$).

We interpret the female's per hour wage rate from the data as $e^{\gamma(v)} w_f$. In the absence of violence, w_f is directly observed. Thus, we use female's per hour wage rate in non-violent households to predict the wages in households where the female works and the male is violent. This strategy is implemented using a Heckman Two-Step procedure among the female-working households, As exclusion restrictions, we use the number of children aged between 0 and 5 and the cohabitation status of the couple. Both in the literature and in our data, these two variables are identified as risk factors for violence.[23] The demographics and the numbers of hours worked are the explanatory variables of the non-violent component of wages. Table 1 presents the results of this approach in the original sample.

We use the Heckman to predict female relative wages, $\widehat{w}_f$. The female wage variable used for

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[23]In our data, 20% of the women with children under 5 and 18% of the women living in cohabitation are abused. These rate decreases to 13% for women without young children, and to 14% for married women.

the estimation is, then,

$$w_f = \begin{cases} w_f & \text{if} \quad v = 0 \quad \text{and} \quad l_f > 0 \\ \widehat{w}_f & \text{if} \quad v = 1 \quad \text{and} \quad l_f > 0 \end{cases} \tag{9}$$

Figure 2, presents the predicted distribution of female's relative per hour wage rate, in logarithms. This distribution comes from a bootstrap in which, for each sample draw,[24] we estimate the Heckman Two-Step procedure just described. Then we split the predicted wages $(\log(w_f/w_m))$ in bins with equal number of observations. For each bin, we compute its median and its frequency. From a graphical inspection, relative wages follow a log-normal distribution and the average female earns 84% of what a male would earn.

Figure 2: Distribution of Female's Relative Wage
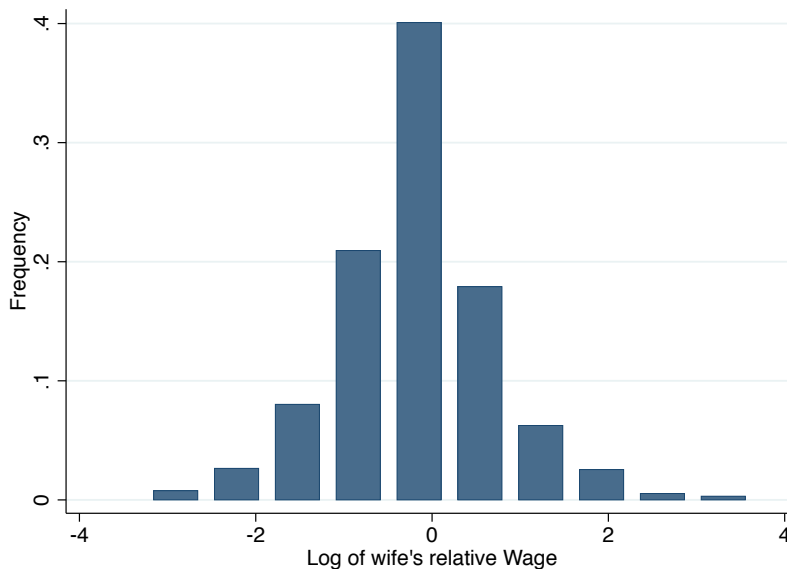
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

5   Reduced-Form Evidence

Hidrobo, Peterman, and Heise (2016) evaluate the effect of *Food, Cash or Voucher* on intimate partner violence. Their reduced-form estimates suggest that the overall treatment reduces violence in 6 to 7 percentage points, and the impacts do not seem to vary across the three modalities. This section, presents the reduced-form evidence of the effect of the program combining the *voucher* and *food* treatments in a unique in-kind treatment arm. Similar to Hidrobo, Peterman, and Heise (2016), we estimate the following linear probability model:

$$v_{ij1} \quad = \quad c + \beta_{\text{cash}} T_i^{\text{cash}} + \beta_{\text{in-kind}} T_i^{\text{in-kind}} + v_{ij0} + \phi_j + e_{ij} \tag{10}$$

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[24]Each bootstrap sample is a random draw of the clusters and households in the original data, with replacement, and within province and treatment arm (the strata).

The violence v that the woman of household i located in province j faces 6 months after the intervention began is a function of the type of transfer she receives, the violence she was facing at baseline, the province where she lives, and error term.[25] The coefficients of interest are β_{cash} and $\beta_{\text{in-kind}}$.[26]

Table 2: Impact of *Food, Cash or Voucher* on Domestic Violence

| | Effect on Physical or Sexual Violence | | | |
| | Mean at baseline =.16 | | | |
	(1)	(2)	(3)	(4)
Any transfer	-0.061*	-0.067**		
	(0.034)	(0.034)		
Cash			-0.060	-0.062*
			(0.037)	(0.036)
In-Kind			-0.062*	-0.069*
			(0.035)	(0.035)
p-value: In-Kind vs. Cash			0.19	0.14
Clusters	145	145	145	145
N	1,174	1,091	1,174	1,091

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). Clustered standard errors in parenthesis.

Table 2 presents the estimates of Eq. (10). Columns (1) and (2) presents the estimates for the pooled treatment without and with controls. Columns (3) and (4) compare the in-kind and cash treatment arms without and with controls. At baseline, 16% of the women have been victims of physical or sexual violence in the last 6 months. *Food, Cash or Voucher* reduces physical or sexual violence by 6.7 percentage points. This implies that a transfer to the woman equivalent to 10% of the household income, reduces intimate partner violence by 35%. The magnitude of the coefficients suggests the effect is concentrated among households that received the in-kind transfer. Yet the difference is only statistically significant at the 14% level.

If, as the reduced-form evidence suggest, in-kind transfers reduce violence to a larger extent than cash transfers; the model presented in Section 3 provides insights about the underlying mechanism leading to such outcome. Regardless of its type, a transfer increases female's outside option one might expect that violence decreases. However, since the male can also use violence to reduce the female's weight in the household decision making, violence can also increase. Which effect dominates depends on the sensitivity of the female relative weight to violence, and on the amount of resources destroyed by violence. For a given marginal cost of violence, the lower the resources at stake are, the lower the violence is.

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[25] A dummy for province is included in the regression as it was used for the stratification of the sample.

[26] Instead of doing a conventional difference-in-difference approach where the left-hand side variable would have also been time indexed, here we avoid serial correlation by controlling the violence at baseline. This approach is preferred over the conventional difference-in-difference approach when the correlation of outcomes is low (McKenzie, 2012).

6   Identification and Estimation

This section presents how we bring the model to the data. From the data, we observe violence (v), the household food expenditure in USD (d), female time allocation to the home production and to the labor market (l_f and $1 - l_f$), male labor income in USD (w_m), female labor income in USD ($e^{\gamma(v)} l_f w_f$), female per hour wage rate in USD (w_f), the ratio between female labor income and the value of the market acquired good (ρ), the cash transfer (t) in USD, and in-kind transfer (t_k) in USD. In this section, we first impose additional restrictions that will allow us to identity the remaining parameters θ, $\gamma(v)$, α_i^f and $\mu(v, \widetilde{\omega}_f)$. Then we explain how to estimate the model.

6.1   Identification

At the optimal level of home production, the relative marginal productivity of the female time and the market input should equal to the relative price (see Eq. (5)). Using the Cobb-Douglass functional form and taking logarithms, a rearranged version of Eq. (7) is

$$\log\left(\frac{d + t_k}{(1 - l_f)\, w_f}\right) = \log\left(\frac{\theta}{1 - \theta}\right) + \gamma(v).$$

If there is a random error in the measurement of the inputs of household production, we can estimate

$$\log\left(\frac{d_{i\tau} + t_{k,\tau}}{(1 - l_{f,i\tau})\, w_{f,i\tau}}\right) = \log\left(\frac{\theta}{1 - \theta}\right) + \gamma(v_{i\tau}) + \epsilon_{i\tau}, \tag{11}$$

to recover θ and $\gamma(v)$. The sub-index i denotes a household, and τ denotes if the observation corresponds to baseline ($\tau = 0$) or to follow-up ($\tau = 1$). Since the transfers were only active at follow-up $t_0 = t_{k,0} = 0$.

The parameter θ is identified as a transformation of the constant term of Eq. (11). The function $\gamma(v)$ can be directly identified from the relation of the relative demand for the inputs of production and violence. The underlying assumption for identification is that the measurement error is uncorrelated with violence. If this is the case, θ and $\gamma(v)$ enable us to recover the home good (Q) using observations of the household food expenditure (d) and female time devoted to home production ($1 - l_f$).

To identify the effect of violence on the female weights ($\mu(v, \widetilde{\omega}_f)$), begin by applying the logarithmic transformation to Eq. (8):

$$\log(1 + \rho) = \log\left(\alpha_i^f - 1\right) + \log\left(\mu(v, \widetilde{\omega}_f)\right) + \log\left(-\log(Q)\frac{\varepsilon_v^\mu}{\varepsilon_v^\gamma \gamma(v)} - 1\right).$$

Even if classical measurement error was assumed, the estimation of

$$\log(1 + \rho_{i\tau}) = \log\left(\alpha_i^f - 1\right) + \log\left(\mu(v_{i\tau}, \widetilde{\omega}_{f,i\tau})\right) + \log\left(-\log(Q_{i\tau})\frac{\varepsilon_{v_{i\tau}}^\mu}{\varepsilon_{v_{i\tau}}^\gamma \gamma(v_{i\tau})} - 1\right) + \epsilon_{i\tau},$$

would not allow us to identify $\mu(v, \widetilde{\omega}_f)$ separately from ε_v^μ. To circumvent this issue, assume that $\frac{\varepsilon_v^\mu}{\varepsilon_v^\gamma \gamma(v)} = \delta$ is constant (with $\delta > 2$) and do a linear approximation of $\log(-\log(Q)\delta - 1)$ around δ,[27]

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[27]The linearization around δ is as if $Q \simeq \exp\left(-\frac{\delta + 1}{\delta}\right)$. Since $Q \in \left(e^{-\frac{3}{2}}, e^{-1}\right)$, it is as if $\log(-\log(Q)\delta - 1)$ was approximated around the level of the most violent household.

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to arrive at

$$\log\left(1+\rho\right) + \log(Q) + 1 \simeq \log\left(\alpha_i^f - 1\right) + \log\left(\mu(v,\widetilde{\omega}_f)\right) + \log(\delta - 1).$$

The only functional form of $\mu(v,\widetilde{\omega}_f)$ that satisfies $\frac{\varepsilon_v^\mu}{\varepsilon_v^\gamma \gamma(v)} = \delta$ is

$$\mu(v,\widetilde{\omega}_f) = \exp(\delta\gamma(v) + k(\widetilde{\omega}_f)) = \left[\exp(\gamma(v))\right]^\delta \exp(k(\widetilde{\omega}_f)).$$

Therefore, the response of female relative weights to violence is a power function of the productivity cost of violence. Moreover, when $v = 0$, $\mu(0) = \exp(k(\widetilde{\omega}_f))$, so that $\exp(k(\widetilde{\omega}_f))$ can be interpreted as the female weight in the absence of violence.[28] Under this additional assumption, the optimality condition of violence described in Eq. (3) reduces to

$$\log\left(1+\rho\right) + \log(Q) + 1 \simeq \log\left(\alpha_i^f - 1\right) + \delta\gamma(v) + k(\widetilde{\omega}_f) + \log\left(\delta - 1\right),$$

where δ is the new parameter to be identified.

In the presence of classical measurement error, δ and $\mu(v,\widetilde{\omega}_f)$ can be identified using the following equation,

$$\log\left(1+\rho_{i\tau}\right) + \left(\log(Q_{i\tau}) + 1\right) \simeq \log\left(\alpha_i^f - 1\right) + \delta\gamma(v_{i\tau}) + k(\widetilde{\omega}_f) + \log\left(\delta - 1\right) + \epsilon_{i\tau}. \qquad (12)$$

Given that there are two observations per household, the disagreement in preference parameter α_i^f is identified through a household fix effect. Once α_i^f and $\gamma(v)$ are identified, δ is non-linearly identified. We recover $\mu(v,\widetilde{\omega}_f) = \exp(\delta\gamma(v) + k(\widetilde{\omega}_f))$ using δ, $\gamma(v)$ and $k(\widetilde{\omega}_f)$. Although the transfer affects both v and $\widetilde{\omega}_f$ which in turn enter in $\mu(v,\widetilde{\omega}_f)$, *Food, Cash, and Voucher* give us an exogenous variation in the gains of violence that allows to separate the effect of violence on weights from the effect of higher relative wages. Both in-kind and cash transfers increase $\widetilde{\omega}_f$ in exactly the same manner. Yet, according to the model, the gains of violence under an in-kind transfer are lower than under cash.

6.2 Estimation

We implement the above identification strategy in three blocks. The first block uses the data on household food expenditure $(d_{i\tau})$, household labor supply $(l_{f,i\tau})$, and female relative wages $(w_{f,i\tau})$ to estimate the technology of the home production $(\widehat{\theta})$ and the productivity cost of violence $(\widehat{\gamma}(v_{i\tau}))$ through an OLS regression. The second block uses data of $\rho_{i\tau}$ (the ratio between the female labor income and the market acquired good) and the first block estimates to construct the LHS variable of Eq. (12), and estimate a household fix-effect regression to recover $\widehat{\alpha}_i^f$. The third block uses the residuals of the second block to estimate a non-linear least squares regression on violence $(v_{i\tau})$ to recover $\widehat{\delta}$ and compute $\widehat{\mu}(v_{i\tau},\widetilde{\omega}_{f,i\tau})$.

We begin by estimating Eq. (11) through an OLS regression of the relative demand for the inputs of home production, on a constant and a series of polynomials of violence.[29]

$$\log\left(\frac{d_{i\tau} + t_{k,\tau}}{(1 - l_{f,i\tau})\widetilde{\omega}_{f,i\tau}}\right) = \beta_0 + \beta_1 v_{i\tau}^1 + \beta_2 v_{i\tau}^2 + \beta_3 v_{i\tau}^3 + \ldots + \epsilon_{i\tau}. \qquad (13)$$

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[28]The concavity of $\mu(v,\widetilde{\omega}_f)$ is guaranteed as long as the productivity cost of violence is also concave, i.e. $\frac{\partial^2 \gamma(v)}{\partial^2 v} < 0$.

[29]This regression comes from the interior optimality conditions described by equations 2 and 3, hence we only estimate it in the set of households where the female works in the labor market.

The technology parameter θ is identified from the following transformation of the constant β_0 of Eq. (13),

$$\widehat{\theta} = \frac{\exp(\widehat{\beta}_0)}{1 + \exp(\widehat{\beta}_0)}.$$

Once $\widehat{\theta}$ is recovered, we can back-up $\widehat{\gamma}(v_{i\tau})$ by subtracting the constant $\widehat{\beta}_0$ from the linear prediction of Eq. (13). This difference is $\widehat{\gamma}(v_{i\tau})$. By construction, when there is no violence, $\widehat{\gamma}(v_{i\tau}) = 0$, so that $e^{\widehat{\gamma}(v_{i\tau})} = 1$.

Based on the estimated values of $\widehat{\theta}$ and $\widehat{\gamma}(v_{i\tau})$, and the data on $d_{i\tau}$ and $1 - l_{f,i\tau}$, we compute the predicted home good $\widehat{Q}_{i\tau}$. Now we can proceed to estimate the following regression based on Eq. (12):[30]

$$\log\left(1 + \rho_{i\tau}\right) + \left(\log(\widehat{Q}_{i\tau}) + 1\right) \simeq \log\left(\alpha_i^f - 1\right) + \delta\widehat{\gamma}(v_{i\tau}) + k(\widetilde{\omega}_f) + \log\left(\delta - 1\right) + \epsilon_{i\tau}. \qquad (14)$$

Given the non-linearity of δ, Eq. (14) is estimated in two-stages. The first-stage uses the panel structure of the data and run an OLS regression of the outcome variable against a household fix effect

$$\log\left(1 + \rho_{i\tau}\right) + \left(\log(\widehat{Q}_{i\tau}) + 1\right) = a_i + \eta_{i\tau}. \qquad (15)$$

The term $\eta_{i\tau}$ contains all of the arguments in the RHS the regression 14, except $\log(\alpha_i^f - 1)$. Under the classical measurement error assumption, $\eta_{i\tau}$ is uncorrelated with α_i^f, and this first-stage estimation described by Eq. (15) is unbiased. The parameter α_i^f is recovered from

$$\alpha_i^f = \exp(a_i) + 1.$$

Next, define $k(\widetilde{\omega}_f)$ as the maximum weight a female with relative potential earnings $\widetilde{\omega}_f$ can attain under no violence ($k(\widetilde{\omega}_f) = \exp(\mu_{max}(w_f))$). Set $\mu_{\max} = \exp(k) = 0.5$ for any $\widetilde{\omega}_f$, and use the difference between the residuals of the Eq. (15) ($\widehat{\eta}_{i\tau}$) and k as the outcome variable of the following regression on violence:

$$\hat{\eta}_{i\tau} - k = \delta\widehat{\gamma}(v_{i\tau}) + \log\left(\delta - 1\right) + \epsilon_{i\tau}. \qquad (16)$$

Eq. (16) is the second-step of Eq. (14), and is estimated through non-linear least squares. With it, we recover $\widehat{\delta}$. The weight function $\mu(v, \widetilde{\omega}_f)$ is recovered from a transformation of the constant k, the estimated parameter $\widehat{\delta}$, and the relation $\widehat{\gamma}(v_{i\tau})$:

$$\widehat{\mu}(v_{i\tau}, \widetilde{\omega}_{f,i\tau}) = \exp\left(\widehat{\delta}\,\widehat{\gamma}(v_{i\tau}) + k\right).$$

7   Results

This section presents the results of the empirical strategy described in Section 6. First, we present the parameter estimates for θ, $\gamma(v)$, δ and $\mu(v, \widetilde{\omega}_f)$, as well as the distribution of α_i^f. Then we present the prevalence of violence implied by the model.

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[30]This regression comes from the interior optimality condition described by Eq. (3), hence we only estimate it in the set of households where there is violence.

7.1   Parameter Estimates

Figure 3 plots the predicted productivity cost of violence derived from Eq. (13) and its bootstrapped standard errors.[24] The predicted functional form of $\gamma(v)$ is

$$\widehat{\gamma}(v_{i\tau}) = \widehat{\beta}v_{i\tau}^2,$$

where β represents the parameter β_2 in Eq. (13).[31] The parameter $\widehat{\beta}$ has mean -1.40 and standard error 1.96 (see Table 3). From the constant $\widehat{\beta_0}$ of Eq. (13), we recover the associated technology parameter $\widehat{\theta}$, which has mean 0.84 and standard error 0.05. The predicted technology of the home production is of the from

$$\widehat{Q}_{i\tau} = e^{-1.4v_{i\tau}^2} \left(d_{i\tau} + t_{k,i\tau}\right)^{0.84} \left(1 - l_{f,i\tau}\right)^{0.16}.$$

Figure 3 shows that at low levels of violence there is limited resource destruction. At the average intensity, violence destroys 6% of female productivity. Yet as it increases, it can destroy up to 42% of the female's productive time.

Figure 3: Productivity Cost of Violence
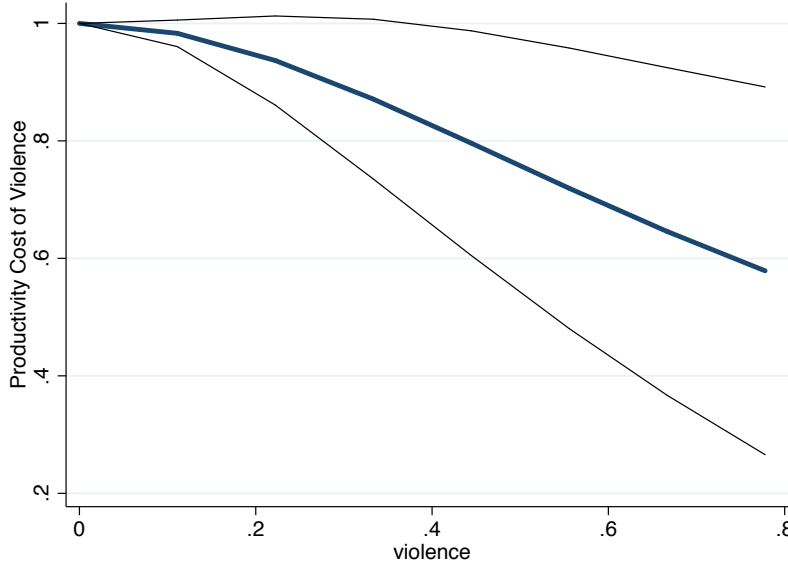
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

Figure 4 plots the estimated distribution of the disagreement in preference parameter $\widehat{\alpha}_i^f$.[32] As described in Section 6.1, we use the household's fix effect of Eq. (15) to recover $\widehat{\alpha}_i^f$. The

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[31]Several other degrees of the polynomial were considered. The final specification is the one with the highest adjusted R^2 preserving the concavity of $\gamma(v)$. See Tables 2 and 3, and Figure 1.

[32]Figure 2 plots the distribution of α_i^f in the original sample.

distribution of $\widehat{\alpha}_i^f$ comes from a bootstrap in which, for each sample draw we:[24] (i) estimate the household fix-effect and recover $\widehat{\alpha}_i^f$, (ii) generate bins of equal size of $\widehat{\alpha}_i^f$, and (iii) for each bin, compute its median and its frequency. In the average household, the female prefers the home good over the market good 10 times more than the male. There are households with low disagreement where the female cares about the home good only twice as much as the male. In other households, female's valuation for the home good can be as high as 50 times the valuation of the male. Most of the households are concentrated to the left of the distribution. These relative preferences for the home good are, on average, uncorrelated with female relative wages.[33]

Figure 4: Distribution of Disagreement in Preference Parameter
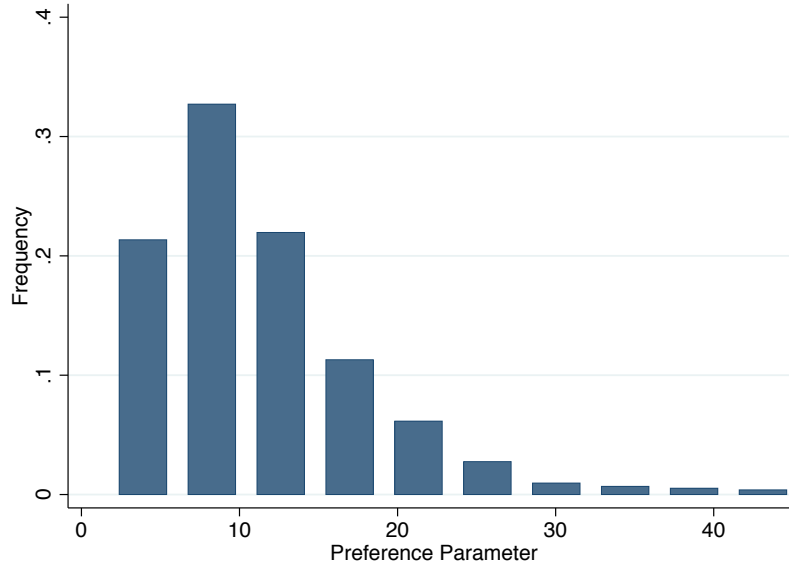
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

Figure 5 presents the predicted relationship between violence and female weight in the joint utility. Given the identification assumptions described in Section 6.1, the response of female's relative weight to violence has the functional form of: $\mu(v, \widetilde{\omega}_f) = \exp(\delta\gamma(v) + k)$. The estimation result of Eq. (14) suggests the parameter $\widehat{\delta}$ has mean 2.99 and standard error of 0.41 (see Table 3). By normalization, in the absence of violence, the female has the same say as the male ($\mu_{\max} = \exp(k(\widetilde{\omega}_f)) = 0.5$ for every $\widetilde{\omega}_f$). As violence increases, it can reduce her relative weight in the household decision making to less than half ($\mu_{\min} = 0.19$).

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[33]The average correlation is 0.39.

Figure 5: Violence and Balance of Power
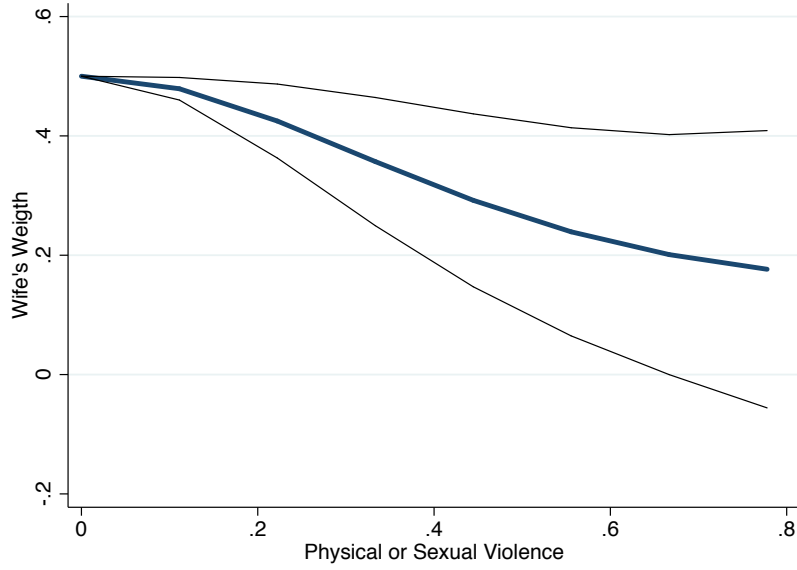
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

Table 3: Estimated Parameters

Parameter	Estimates
θ	0.84
	(0.05)
β	-1.36
	(1.90)
δ	2.98
	(0.48)
Order of the polynomial	2

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). Bootstrapped standard errors in parenthesis.[24]

7.2 Simulations

We use the above estimated parameters (see Table 3 and Figure 4) to simulate the model described in Section 3. As a comparative statics exercise, figures 6 to 9 present the graphical representation of how the choice variables (violence v, female labor supply l_f, and demand for market input d), the consumption of public goods (home good Q, and market good q), and utilities (u^f, u^m and u) vary with the female relative preferences over Q, fixing the female wages at the average level ($w_f = 0.84$). Later on, when computing the prevalence of violence and performing counterfactual

analysis, we will use the entire distribution of female relative wages depicted in Figure 2.

Figures 6 to 9 plot how the choice variables (violence v, female labor supply l_f, and demand for the market input d) change with the extent of disagreement (α_i^f). In each figure, the black solid line depicts a situation under no transfers, the blue dashed line represents the outcome under a cash transfer equivalent to 10% of the male income, and the red dotted line represents the equivalent in-kind transfer. In the x-axis we plot the disagreement in preference parameter, α_i^f, ranging from 2 to 50, as in the estimated distribution of α_i^fs (see Figure 4).

In Figure 6, we observe how, when female's preference for the home good (Q) is relatively similar to that of the male, violence is not profitable as there are limited utility gains that he can appropriate. As her relative preference for the home good increases, there is more disagreement. From the male's perspective, without violence the household would devote too many resources to the home good production. Thus, he inflicts violence to align the household resource allocation with his preferences.
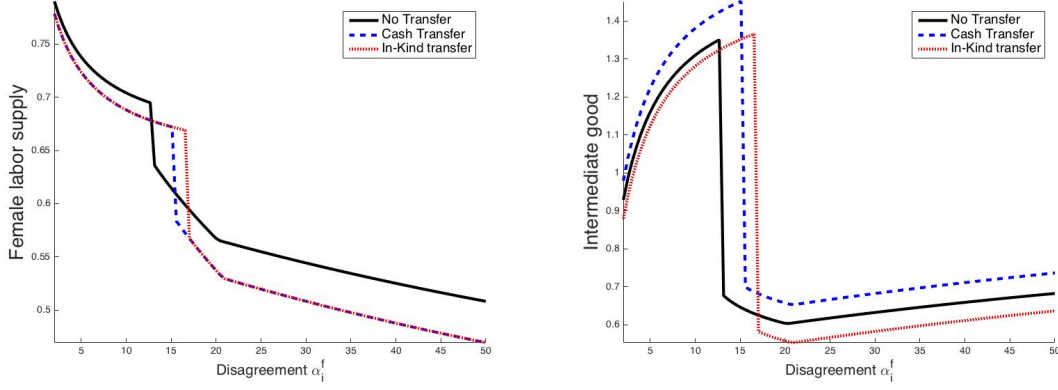
Figure 6: Effect of Cash versus In-kind Transfers on Violence
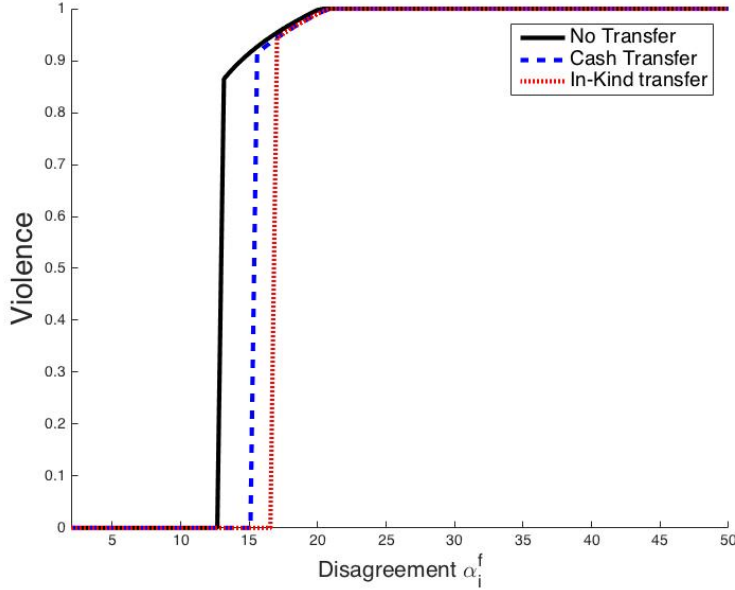
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). The black solid line represents the no transfer scenario, the blue dashed line represents a cash transfer, and the red dotted line represents an in-kind transfer. Transfers are equivalent to 10% of the household income. Relative wages and no-violence female's relative weight set to $w_f = 0.84$ and $\mu(0, 0.84) = 0.5$, respectively.

Transfers alleviate part of the tension in the family by increasing the resources available. With less disagreement, there is a larger range of α_i^fs for which there is no violence. There is also a range of α_i^fs for which in-kind transfers decreases violence while cash transfers do not. The reason is that, although there is disagreement, by making the transfer in-kind rather than in-cash, the government resolved part of the tension.

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Figure 7: Effect of Cash versus In-kind Transfers in the Inputs of Home Production

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). The black solid line represents the no transfer scenario, the blue dashed line represents a cash transfer, and the red dotted line represents an in-kind transfer. The left panel depicts the effect of cash versus in-kind in the female labor supply. The right panel depicts the effect of cash versus in-kind in the market inputs demand. Transfers are equivalent to 10% of the household income. Relative wages and no-violence female's relative weight set to $w_f = 0.84$ and $\mu(0, 0.84) = 0.5$, respectively.

Figure 7 plots how female labor supply changes with female's relative preferences for the home good. As female preference for Q increase, her opportunity cost of devoting her time to the labor market rather than to the home good production increases. Consequently, she is less willing to allocate her time to the labor market and female labor supply falls. Males does not like this shift as the reduction of female labor supply reduces the lessens her labor income, which the household could use to buy his preferred good (q). Although violence dampens female's productivity, by inflicting it, the male can enforce a larger allocation of resources towards the market good. This effect compensates the productivity loss. Besides, as female labor supply decreases with α_i^f, the resource destruction effect of violence concentrates on the good the male cares relatively less (Q), so that from his perspective, violence is less costly.

The demand for market input d, depicted in Figure 7, reflects such non-monotonicity. When disagreement is low, higher preferences for the home good lead to higher demand for the market input. Yet, once there is violence, the resource destruction lowers the marginal productivity of the market input, which in turn lessens its demand.

Figure 8 plots how the above effects translate into the home good production and the demand for the market good. Up to the threshold where violence starts being profitable, the home good increases with female's preference for it. Yet, once there is violence, the home good production falls. Relative to households with less disagreement, the resources liberated from the home good production are devoted to the market good, which is relatively more preferred by the male (see Figure 8). This transfer of utilities from the female to the male occurs as violence dampens female's weight in the joint utility.

Finally, Figure 9 plots how the above mentioned changes with disagreement in preferences map to utilities. At low levels of disagreement in preferences, the fact that the female cares more about the home good improves everyone's well-being. Yet, once violence is used, as disagreement increases,

Figure 8: Effect of Cash versus In-kind Transfers on the Home Good and the market Good
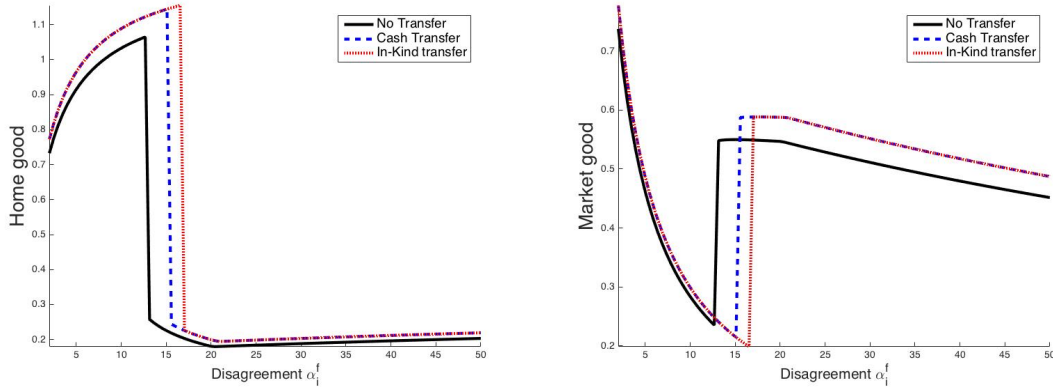
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). The black solid line represents the no transfer scenario, the blue dashed line represents a cash transfer, and the red dotted line represents an in-kind transfer. The left panel depicts the effect of cash versus in-kind tin the home good. The right panel depicts the effect of cash versus in-kind in the market good. Transfers are equivalent to 10% of the household income. Relative wages and no-violence female's relative weight set to $w_f = 0.84$ and $\mu(0, 0.84) = 0.5$, respectively.

Figure 9: Effect of Cash versus In-kind Transfers on the Utility of the Female and the Male
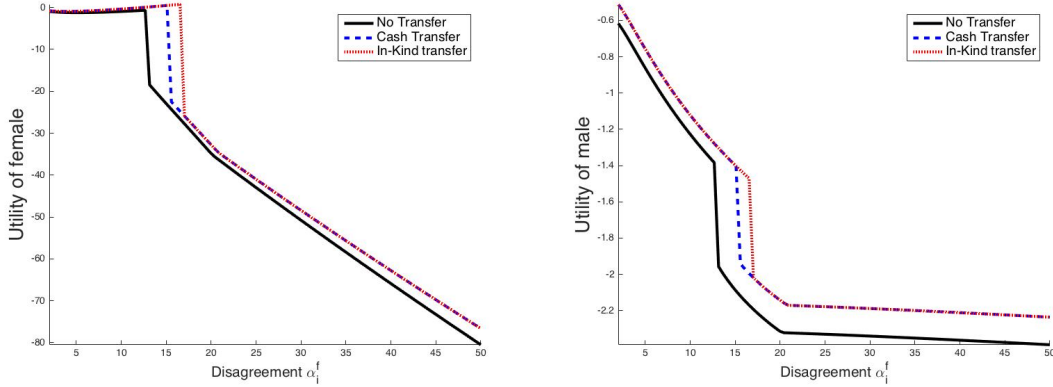
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). The left panel depicts the effect of cash versus in-kind transfers on the utility of the female. The right panel depicts the effect of cash versus in-kind on the utility of the male. Transfers are equivalent to 10% of the household income. Relative wages and no-violence female's relative weight set to $w_f = 0.84$ and $\mu(0, 0.84) = 0.5$, respectively.

the utility of both the female and the male fall because more resources are destroyed.

7.3 Prevalence of Violence

We use the estimated distribution of α_i^fs depicted in Figure 4 and the empirical distribution of female relative wage presented in Figure 2 to compute the prevalence of violence. In the absence of transfers, 34.6% of the households in this economy would exhibit some violence. A program such as *Food, Cash or Voucher*, which randomly allocates one third of the transfers in-cash and two thirds in-kind (*Food* and *Voucher* treatment arms combined), would reduce violence by 10 percentage points.[34]

Table 4: Prevalence of Violence

Transfer Regime	Prevalence of Violence
No transfers	34.6%
Food, Cash or Voucher	24.6%

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

At baseline, 16% of the females beneficiaries of *Food, Cash or Voucher* were victims of physical or sexual abuse. Although the estimated prevalence of violence in the model is above the baseline data, the point estimate is consistent with the prevalence of violence at the national level in Ecuador. According to the Instituto Nacional de Estadística y Censos (2011), 35% of the women in Ecuador have experience a form of physical violence by an intimate partner. Moreover, both these estimates and the impact evaluation of the program done by Hidrobo, Peterman, and Heise (2016) coincide in that *Food, Cash or Voucher* reduces the prevalence of violence by at least 30%.

8 Policy Experiments: In-Kind versus Cash

This section presents a policy experiment trying to quantify the differential effect that in-kind and cash transfers have on violence. Similar to Section 7, we use the estimated distribution of α_i^fs depicted in Figure 4 and the empirical distribution of female relative wage presented in Figure 2 to compute the rate of violence under different transfer regimes.

In the absence of transfers, 34.6% of the households experience intimate partner violence. If the government implements a program of transfers to the women, where the beneficiary households receive a cash transfer equivalent to 10% of the average household income; the rate of violence would decrease to 27.6%. This 7 percentage point reduction violence is consistent with the point estimates of other impact evaluations addressing the effect of CCTs on violence.[35]

We also use this framework to analyze what would be the reduction in violence if the same transfers were given in-kind rather than in-cash. According to the simulations, if the transfers were given in-cash violence would reduce by 20%. However, if the transfer were exclusively in-kind, violence would reduce by 33%. To put it differently, 35 out of every 100 women in Ecuador are victims of intimate partner violence. With a cash transfer program, the government would guarantee that 7 of these 35 women would live in non-violent households. Yet, if the same transfers were given in-kind, additional 5 women would no longer be abused.

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[34]Prevalence at the extensive margin, not at the intensity level.

[35]In Mexico, Bobonis et al. (2013) find that *Oportunidades* reduces physical abuse by 5 to 7 percentage points.

Table 5: Predicted Rates of Violence under Different Transfer Regimes

Transfer Regime	Prevalence of Violence
No transfers	34.6%
Cash transfers (only)	27.6%
In-kind transfers (only)	23.0%

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

A policy relevant question is to how to valuate the fact in-kind transfers would allow for 5 additional women to live in non-violent households. In a first attempt to quantify this difference, one can use the productivity cost of violence to generate a market value of preventing one woman from being abused. Consider the average beneficiary of *Food, Cash, or Voucher*. This female earns 2 USD for each hour of fully productive work. Suppose that her intimate partner inflicts violence to the average index level (see Table 1). According the results presented in Section 7, such violence destroys 6% of her labor productivity. This means that instead of earning 2 USD an hour, she would earn 1.87 USD. For a female working 5 hours a day and a household earning 400 USD a month, violence would cost 12 USD.[36]

In addition to the transfer itself, to provide an in-kind transfer, the government must incur into the additional cost of looking for local providers and paying the transportation cost of bringing the transfer to the beneficiaries. Hence, the next question is how this 12 USD compare to the additional implementation cost of an in-kind transfer. For *Food, Cash, and Voucher*, Hidrobo et al. (2014) suggest that the cost of providing a food transfer, a cash transfer, and a voucher transfer are 11.46 USD, 2.99 USD, and 3.27 USD per household, respectively. Therefore, it seems to be the case that if the 8.47 USD difference in the implementation are offset by the 12 USD monthly reduction of income associated to violence.

9   Scaling-up the Program

One of the advantages of using structural estimation is that it improves the external validity of the reduced-form estimates, and allows to perform policy experiments such as scaling-up the program. This section combines the results of *Food, Cash, and Voucher* with a national level data set, to make out-of-the-sample predictions relevant for Ecuador's anti-poverty CCT program, *Bono de Desarollo Humano*.[37] Similarly to *Food, Cash, or Voucher*, *Bono de Desarollo Humano* provides around 50 USD monthly cash transfer to poor families. Thus, we use the estimates of *Food, Cash, or Voucher* to simulate the effect that *Bono de Desarollo Humano* has on violence and the effect of transforming the program into an in-kind transfer.

9.1   Predicting Disagreement in Preferences at the National Level

To replicate the exercise described in Section 6 at the national level, we would require a data set with repeated observations per household, containing information on violence, time allocation,

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[36]If the husband inflicted violence to its full intensity, he will destroy 42% of the female's productivity, which will amount for one forth of the household monthly income (105 USD).

[37]According to the International Labor Organization, *Bono de Desarollo Humano* covers 1.2 million households in Ecuador.

wages, and food consumption. However, this type of data is rare as, to preserve the integrity of the respondents, the surveys that collect information on violence against women abstain from making multiple visits to the same household. To circumvent this issue, we take advantage of the similarities between *Food, Cash, or Voucher* and *Bono de Desarollo Humano*, and use the estimates presented in Section 7 to draw conclusions about a *Bono de Desarrollo Humano*, using a cross-sectional national representative data base.

We use data from the *National Survey on Family Relationships and Violence Against Women*.[38] This is a nationally survey representative of all women aged 15 or more, living in urban and rural areas of Ecuador. The survey was implemented in 2011 by the National Institute of Statistics and Census (INEC, by its acronym in Spanish),[39] and collects information on family history, marital status, violence, time allocation, and labor market participation. To ensure comparability with the families beneficiaries of *Food, Cash or Voucher*, we restrict the sample to the households where the respondent was a female head of household or the spouse of the head, she is aged between 15 and 70, and she was married or at union. Because we are interested in drawing results relevant for *Bono de Desarollo Humano*, we concentrate in the households that report being beneficiaries of the program.

Table 6 presents some descriptive statistics of the sample. Similarly to the beneficiaries of *Food, Cash, or Voucher*, a typical household is a family of 5 members. The head of the household is a 45-years-old working man. His spouse is a 44-years-old woman, and they have one child aged under 5 and another child under 14. 64% of these families are married. The remaining 36% live in cohabitation. Both female and male have, on average, 4 years of education. Yet 22% of the women are more educated than their partners. Around 32% of women work in the labor market for an average of 8.5 hours a day. More than 90% of the partners of these women are employed, and they also work for 8.5 hours a day. Figure 10 plots the empirical distribution of female relative per hour wage rate in logarithms. The average female earns 60% of what a male would earn.

Regarding violence, almost 4 out of every 10 women (37%) have been victims of a form of physical violence by an intimate partner in the last 12 months. During this time period, none of these women reported an episode of sexual intimate partner violence. Even if this is a sub-sample of the universe of observations and we do not use the expansion factors of the survey, the rate of violence in the sample is close to the 35% national prevalence of physical abuse (Instituto Nacional de Estadística y Censos, 2011).

As inputs for simulating the model for an economy with the characteristics described in Table 6, we use the estimated technology of home production ($\widehat{\theta}$), the productivity cost of violence ($\widehat{\gamma}(v)$), and the response of female's relative weights to violence ($\widehat{\mu}(v, \widetilde{\omega}_f)$) presented is Table 3, and in Figures 4 and 5. However, a key element of the simulation is still missing: the disagreement in preferences parameter (α_i^f). The disagreement between female and male is observable for the household, but not for the econometrician, nor for the government. To overcome this issue, first, among the beneficiaries of *Food, Cash, or Voucher*, we run a regression of the unobserved heterogeneity term, $\widehat{\alpha}_i^f$, on household observable characteristics. Then, we use these coefficients to produce the predicted disagreement parameters in the national data set.

Table 7 presents the results of the first step.[40] Each point estimate comes from a bootstrap, where for every sample draw of the beneficiaries of *Food, Cash, or Voucher*, we:[24] (i) recover the

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[38]Encuesta Nacional sobre Relaciones Familiares y Violencia de Gènero contra las Mujeres.

[39]Instituto Naconal de Estadística y Censos, Ecuador.

[40]Table 5 presents the regression of the disagreement in preference parameter on household observable characteristics, in the original sample.

α_i^fs for every household (as explained in Section 6.1), and (ii) run a regression of α_i^fs on some of the household observable characteristics presented in the descriptive statics of Table 1.

Households with more members tend to have more disagreement, but the presence of a child between 6 to 14 reduces disagreement. When the head of the household is a male rather than a female, households also seem to disagree more. Female education reduces disagreement, yet if she's more educated than the male, the protective effect can vanish. Females with higher of income as well as females working more hours also have higher tensions at home. Nevertheless, if the male is also employed, the tensions reduce.

We proceed by using these coefficients to predict the disagreement in preferences that would exhibit the beneficiaries of *Bono de Desarrollo Humano*. For each of the households in the sub-sample of the described in Table 6, we predict a predicted parameter α_i^f using the household characteristics and the coefficients in Table 7. Figure 11 plots the predicted distribution of α_i^f.

Figure 10: Distribution of Female Relative Wage
Bono de Desarollo Humano
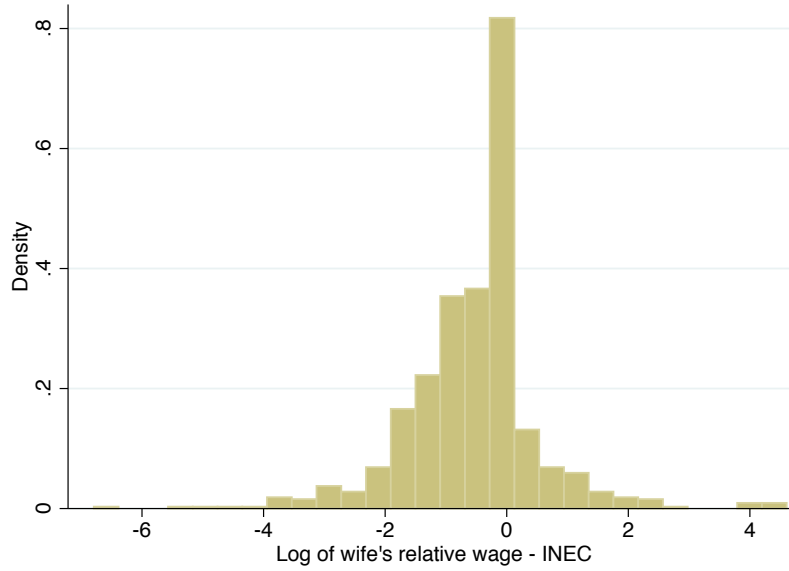
Notes: Own calculations based on data from *National Survey on Family Relationships and Violence Against Women* (INEC).

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Table 6: Descriptive Statistics
Bono de Desarollo Humano

| Variable	Mean
No. of household members	4.91
	(2.05)
Male head of household	0.97
	(0.17)
Married couple	0.64
	(0.48)
No. children form 0 to 5	0.73
	(0.90)
No. children from 6 to 14	1.37
	(1.30)
Female's age	40.97
	(13.42)
Couple's age difference	3.78
	(8.19)
Male's education years	4.23
	(2.19)
Female's education years	4.08
	(2.26)
Female more educated than male	0.22
	(0.41)
Female employed	0.32
	(0.47)
Female's labor income a day	5.12
	(17.82)
Female's hours of work a day	8.50
	(3.05)
Female's hours of household work a day	8.51
	(3.05)
Male employed	0.91
	(0.29)
Male's labor income a day	8.34
	(7.56)
Male's hours of work a day	8.49
	(3.04)
Physical Violence	0.37

Notes: Own calculations based on data from *National Survey on Family Relationships and Violence Against Women* (INEC).

Table 7: Household Observable Characteristics Predicting Disagreement in Preferences

Observable Characteristic	α_i^f
No. of household members	0.85
	(0.91)
Male head of household	3.01
	(5.82)
Married couple	0.10
	(1.34)
No. children form 0 to 5	0.03
	(0.86)
No. children from 6 to 14	-0.84
	(1.11)
Female's age	0.09
	(0.08)
Couple's age difference	0.09
	(0.11)
Male's education years	0.70
	(1.64)
Female's education years	-0.53
	(1.43)
Female more educated than male	1.40
	(1.48)
Female employed	0.09
	(1.73)
Female's labor income a day	0.33
	(0.28)
Female's hours of work a day	0.25
	(0.35)
Female's hours of household work a day	0.05
	(0.18)
Male employed	-3.37
	(8.43)
Male's labor income a day	0.08
	(0.11)
Male's hours of work a day	0.07
	(0.25)

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

Figure 11: Distribution of Predicted Disagreement in Preferences
Bono de Desarollo Humano
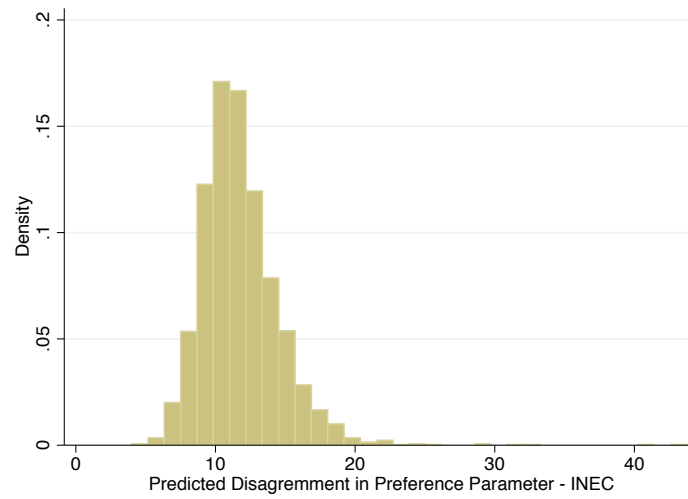
Notes: Own calculations based on data from *National Survey on Family Relationships and Violence Against Women* (INEC).

9.2　In-Kind versus Cash at the National Level

We use the predicted distribution of α_i^fs depicted in Figure 11, and the empirical distribution of female relative wage depicted in Figure 10 to compute the prevalence of violence without transfers and with a cash transfer corresponding to 10% of the average household income. This is equivalent to simulate the effect of *Bono de Desarrollo Humano* on intimate partner violence.

According to the simulation, 45% of the households in the economy experience a from of physical violence. The cash transfer program, is would be able to transform 7 of these 45 households into non-violent households. Hence, it is as if *Bono de Desarrollo Humano* reduces physical intimate partner violence by 15%. This result differs from the impact evaluation of the program done by Hidrobo and Fernald (2013) according to which *Bono de Desarrollo Humano* has no effect on physical violence. However, the authors suggest the program has an effect in controlling behaviors, and the order of magnitude of the coefficient resembles the magnitudes of our simulations.[41]

Table 8: Predicted Rates of Violence under Different Transfer Regimes
National Level

Transfer Regime	Prevalence of Violence
No transfers	45.6%
Cash transfers (only)	38.8%
In-kind transfers (only)	35.8%

Notes: Own calculations based on data from *National Survey on Family Relationships and Violence Against Women* (INEC).

Finally, we also use the model to consider the additional reduction in violence that a program such as *Bono de Desarrollo Humano* could attain if the transfers were given in-kind. As described in Table 8, if the transfer of *Bono de Desarollo Humano* were in-kind, the violence rate would decline from 45.6% to 35.8%. That means that the differential effect on violence of in-kind versus cash amounts for 3 additional women living in non-violent households.

10　Conclusions

Conditional Cash Transfer programs are a popular anti-poverty and pro-gender policy in developing countries. In this paper we address the issue of how intimate partner violence responds to transfers whenever the male can use violence to boost his bargaining power. With this research question in mind, we construct and estimate a model of household with an explicit role of violence. We understand the household as a space of cooperation where there is also room for disagreement and conflict. If there were no violence, the household would attain efficient outcomes. Yet, given that there is disagreement, the male has incentives to inflict violence to enhance his relative position in the household decision making, at the expense of making his partner less productive.

Under this setting, both the identity and the type of the transfer matter. The reasons is that different type of transfers generate different gains of violence. Although both in-kind and cash transfers to the woman improve her outside option, in-kind transfer have an additional margin as they mitigate part of the disagreement and make violence less profitable as an appropriation device.

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[41]According to Hidrobo and Fernald (2013), in 56% of the households, the male had controlling behaviors over the female, and *Bono de Desarrollo Humano* reduces the prevalence of such behaviors by 6 percentage points.

We estimate the model using data from *Food, Cash or Voucher*. With it, we identify the productivity cost of violence and the effect of violence on the utility weights. Our identification relies on three assumptions: (i) the inputs of the production of the home production do not generate direct utility, (ii) the entire disagreement of the household can be captured by a single parameter, and (iii) the response of female relative weight to violence is a power function of the productivity cost of violence.

According to the estimations, violence can destroy up to 42% of female productivity, and reduce her relative weight in the household decision making by more than half. We also find that 34.6% of the women are victims of violence and a program such as *Food, Cash or Voucher* reduces violence by 10 percentage points. Using data from the *National Survey on Family Relationships and Violence Against Women* in Ecuador, we extent the model to a much larger program such as *Bono de Desarrollo Humano*. The simulations suggests that the program reduces physical intimate partner violence by 15%, and additional improvements could be achieved if in-kind transfers were considered for the intervention.

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A Estimation in the Original Sample

Table 1: Female Wages

	Log Wages	Selection on Violence
No. children from 6 to 14	-0.0375	-0.0206
	(0.0413)	(0.0539)
Age	0.0436**	0.0049
	(0.0214)	(0.0272)
Age, squared	-0.0004	0.0001
	(0.0003)	(0.0003)
Female with secondary education or more	0.2532***	0.0161
	(0.0726)	(0.1005)
Female's hours of work a day	0.0414	0.4753***
	(0.1696)	(0.0445)
Female's hours of work a day, squared	-0.0120	-0.0313***
	(0.0116)	(0.0039)
Afro-Ecuadorian Female	-0.1548	-0.2151
	(0.2262)	(0.3167)
Afro-Ecuadorian Male	-0.1528	-0.1139
	(0.2136)	(0.3276)
Carchi	-0.1981**	-0.0007
	(0.0881)	(0.1141)
Married couple		0.1885*
		(0.1087)
No. children form 0 to 5		-0.0920
		(0.0873)
Constant	-0.8840	-0.7465
	(0.9663)	(0.5417)
Lambda	1.21	
Clusters	141	
N	913	

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). Bootstrapped standard errors in parenthesis.[24] Heckman Two-Step procedure. Estimation on the sample of females working in the labor market. Selection on violence. Exclusion restrictions: marital status and number of children from 0 to 5.

Table 2: Polynomials of v for $\gamma(v)$

| Polynomial (p) | Adjusted R^2 | | R^2 | |
	$v, \ldots, v^p$	v^p	$v, \ldots, v^p$	v^p
1	0.0094	0.0094	0.0105	0.0105
2	0.0097	0.0049	0.0120	0.0061
3	0.0088	0.0021	0.0124	0.0033
4	0.0086	0.0006	0.0133	0.0018
5	0.0074	-0.0001	0.0133	0.0011
6	0.0072	-0.0005	0.0144	0.0007
7	0.0065	-0.0007	0.0148	0.0005
8	0.0065	-0.0009	0.0148	0.0003
9	0.0065	-0.0010	0.0148	0.0002
10	0.0065	-0.0010	0.0148	0.0002

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). Selection of the polynomial of v to estimate $\gamma(v)$ through Eq. (13).The polynomial of order 2 has the highest adjusted R^2.

Table 3: Productivity Cost of Violence

| | LHS Equation 13 | |
	(1)	(2)
v	-1.670**	
	(0.733)	
v^2	1.376	-1.138**
	(1.267)	(0.554)
β_0	1.772***	1.737***
	(0.053)	(0.049)
Adjusted R^2	0.0097	0.0049
Clusters	139	139
N	836	836

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). Clustered standard errors in parenthesis. Estimation of Eq. (13), according to the best-fit polynomial in Table 2.

Table 4: Effect of Violence on Female Weight

|	LHS Equation 16
δ	3.228***
	(0.101)
Clusters	119
N	383

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). Clustered standard errors in parenthesis. Estimation of Eq. (16).

Figure 1: Productivity Cost of Violence
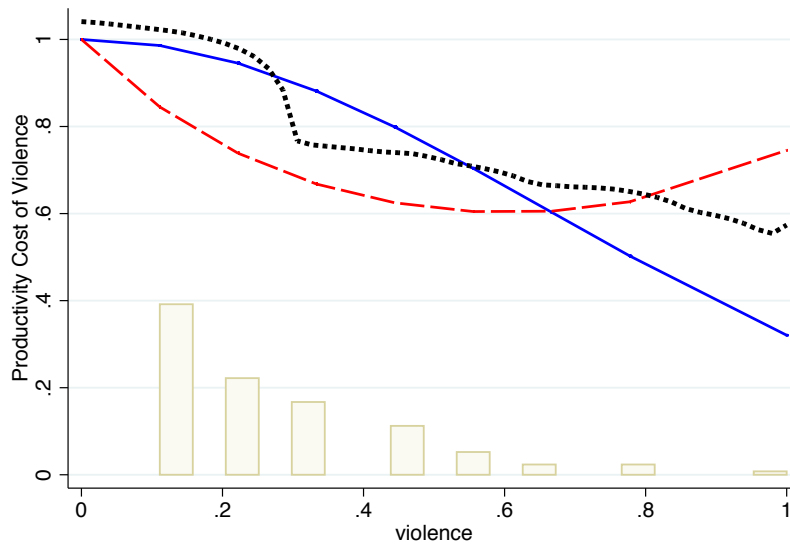
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). The bars represent a histogram of the intensity of violence, among the violent households. The black dotted line corresponds to a local polynomial regression of the LHS of Eq. (13) on violence. The red dashed line depicts the predicted $\widehat{\gamma}(v)$ from column (1) in Table 3. The blue solid line depicts the predicted $\widehat{\gamma}(v)$ from column (2) in Table 3. Since the concavity of $\gamma(v)$ is required for the existence of interior solutions (see Section 3), column (2) in Table 3 is the most preferred specification.

Figure 2: Disagreement in Preference Parameter
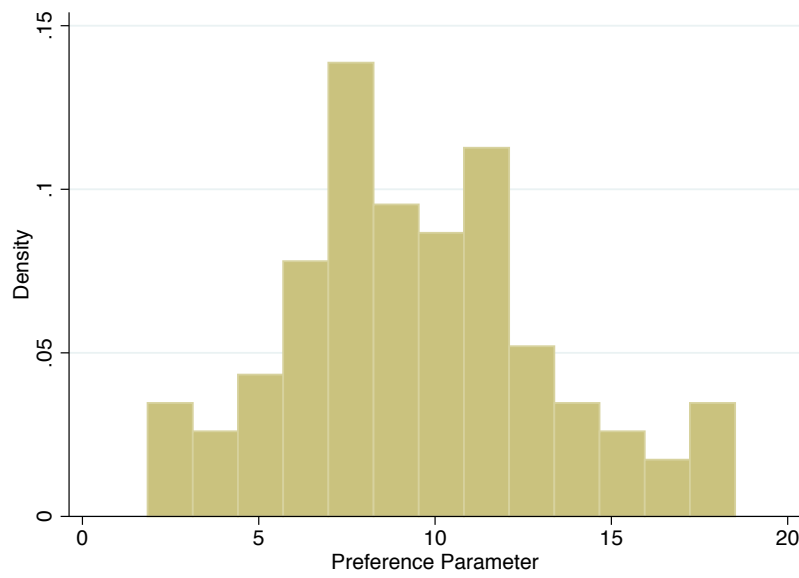
Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme).

Table 5: Household Observable Characteristics Predicting Disagreement in Preferences

Observables	α_i^f
No. of household members	1.097***
	(0.259)
Male head of household	2.342*
	(1.235)
Married couple	-0.050
	(0.782)
No. children form 0 to 5	-0.398
	(0.507)
No. children from 6 to 14	-0.705
	(0.451)
Female's age	-0.000
	(0.033)
Couple's age difference	0.102
	(0.062)
Male's education years	0.068
	(0.147)
Female's education years	-0.220
	(0.153)
Female more educated than male	1.789*
	(1.014)
Female employed	-0.714
	(1.215)
Female's labor income a day	0.231
	(0.142)
Female's hours of work a day	0.064
	(0.129)
Female's hours of household work a day	-0.137
	(0.090)
Male employed	1.223
	(2.044)
Male's labor income a day	0.033
	(0.050)
Male's hours of work a day	0.277
	(0.185)

Notes: Own calculations based on data from *Food, Cash or Voucher* (World Food Programme). Clustered standard errors in parenthesis.