Intra-Household Allocations and Consumption Inequality under Cash Transfers and Violence*

José L. Casco†

The Bank of Mexico

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Abstract

In this paper, I study how different types of households determine adult members' allocations of time and consumption. Household types are characterized by the presence of partner violence and cash transfers. Using a collective intra-household decision making model, together with data from an experimental evaluation of a cash transfer program in Ecuador, I structurally estimate the parameters of the model. Then, I perform a poverty analysis at the individual level for the different types of households and find that women are substantially poorer than men, and that income distribution is more unequal for women than it is for men. I also find that the policy intervention generated welfare gains in terms of reducing overall and individual poverty. However, these welfare gains are heterogeneous among the different types of households. Particularly, I find that transfers are effective in reducing the gender poverty gap mainly in households where there is no violence. Finally, I estimate indifference scales for the different types of households to measure how much income an individual living alone needs to have in order to be as well off as when living as a couple. I find that men need a higher share of initial household resources compared to women, and that indifference scales for women decrease with violence and increase when the household is a beneficiary of the transfer. This work contributes to understanding how intra-household allocation of resources takes place among different types of households, the importance of gender difference in poverty and inequality, and the effectiveness of poverty policies when there are factors that generate inequality in consumption.

JEL Classification: D12, D13, D63, J12, J22.

Keywords: Collective Model, Poverty, Inequality, Violence, Transfers.

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†Economics Research Division, The Bank of Mexico, jose.casco@banxico.org.mx.

1 Introduction

Understanding how households allocate resources under different circumstances is crucial in order to correctly measure the well-being of individuals. Many countries and international institutions use adult equivalence scales to measure individual-level consumption and to derive measures of poverty and inequality. These measures are commonly used to assess the effectiveness of policy interventions in reducing poverty. Unfortunately, this methodology entirely ignores possible within-household inequalities. In particular, this procedure does not take into consideration factors that could lead to an asymmetric distribution of resources among individuals within a family. Heterogeneity among individual household members, and heterogeneity in household environments in which they might find themselves, could have important implications for the measurement of social welfare (see Lise and Seitz 2011; Dunbar et al. 2013).

I show that taking into account the process of intra-household resource allocation, together with important factors that affect the behavior of individuals within the household, allows one to better measure individual well-being and to analyze the effectiveness of policy interventions designed to reduce the gender gap in poverty and inequality.

The purpose of this paper is to estimate adult members' allocations of time and consumption inside different types of households and the associated welfare consequences. In my analysis, households are heterogeneous in the sense that they may or may not receive a cash transfer and that there may or may not be partner violence within the household. In this model violence is assumed to be exogenous but characterize the type of bargaining power and home production technology that household members face.[1] The goal of this study is to estimate individual shares of resources based on consumption, using a collective model of household decision-making. The structure of the model allows one to quantify the incidence of poverty and the level of inequality at the individual level (rather than at the household level) for adult members within these distinct types of households. It also allows one to evaluate the effectiveness of the policy intervention in reducing poverty. I find that there are overall important differences in poverty levels among men and women, and that these gaps vary across different types of households. Moreover, I show that the cash transfer policy generated welfare gains in terms of reducing overall and individual poverty. However, these welfare gains are heterogeneous across the different types of households. This work

[1] So, in the context of the model, when a household is formed, it immediately becomes either violent or non-violent and conditional on this reality, household members make decisions. This assumption is based in evidence that show that violent childhood experiences increased the risk of victimization or perpetration of intimate partner violence in adulthood, creating role models that perpetuate violence (Bancroft et al. 2011; Whitfield et al. 2003).

contributes to understanding how the intra-household allocation of resources takes place across different types of households, the extent of gender difference in poverty and inequality, and the effectiveness of poverty policies when there are factors that generate inequality in consumption.

Intimate partner violence is a perverse, widespread social problem that could have important consequences for the ways that resources are allocated within households. This allocative process is complex and becomes even more intricate when household behavior in poverty situations is considered. Poor individuals face particularly severe resource constraints and are more prone to domestic violence, as poverty can act as a fueling factor when there is disagreement in preferences. However, to mitigate the violent abuse of women and to improve child well-being, many countries run social protection programs seeking to promote gender empowerment among women.

A randomized evaluation of a program that provides transfers to families in Ecuador, implemented in 2011, provided an environment in which an exogenous transfer is targeted to women to grant them with a higher share of household resources. Taking advantage of the comprehensive dataset generated by this program, this paper examines how adult household members allocate time and consumption in the presence of transfers and violence. To do this, I use a collective model of household decision-making. In my model, transfers affect the relative power among household members and the non-labor income component of household resources, whereas violence affects the production technology of the domestically produced good as well as husbands' and wives' Pareto weights. In this model, adult members' preferences depend on their leisure, individual private consumption of market goods, and the consumption of a domestically produced good. Applying an estimation strategy based on a two-stage allocation representation of the collective model and using a flexible parametric specification, I structurally estimate the parameters of the model. (see Chiappori, 1988, 1992; Blundell et al., 2005; Cherchye et al., 2012)

The results reveal which factors influence the preferences of adult household members, home production and the Pareto weights. I use the estimated model to investigate whether there are patterns of within-household specialization by simulating changes in wages. This is relevant, because within-household specialization may have important consequences for the well-being of individuals. In my sample, households appear to be specialized, in the sense that there is a division of labor within the household, with husbands devoting more time to labor market activities, and wives assuming more responsibility for housework activities. I also analyze empirically whether higher wages for wives are more beneficial than higher wages for husbands for increasing the level of the home-produced good in an average household. Results suggest that higher wages for husbands have a stronger impact on the level of the

home-produced good, which is consistent with specialization within these households.

The main goal of the model is to provide a theoretical structure for an empirical analysis of intra-household welfare. In this context, I evaluate individual (as opposed to a household level) poverty and inequality using the estimated parameters from the structural model, which allows one to construct individual measures of consumption. I use three measures of consumption: a widely used measure that uses equivalence scales adjustment; a measure that assumes a linear consumption technology a la Barten, and a measure that accounts for the individual marginal willingness to pay for the home good. Significant discrepancies are found in the level of resources that husbands and wives control among different types of households. These gaps translate into heterogeneity in the incidence of poverty for men and women, both overall and also contingent on the type of household.

The results show that women are substantially poorer than men. Poverty is more than 23 percentage points higher for wives than for husbands. I also find that households where there is intimate partner violence exhibit larger gender poverty gaps (between 29 and 30 percentage points) compared to households where there is no violence (between 15 to 28 percentage points). Furthermore, transfers are more effective in mitigating this gender gap in households where there is no violence (around 13 percentage points gap reduction). This shows that cash transfer policies could be ineffective in reducing individual level poverty under certain household circumstances. In relation to inequality, results show that income inequality is the highest on households that do not receive transfers and have partner violence (an income Gini coefficient of 0.451). Results also show a higher level of income inequality for women relative to men in all types of households. However, households that receive the transfer exhibit lower levels of women's inequality. Finally, I use the model to calculate indifference scales following Browning et al. (2013) in order to define the income that each individual needs when living alone to be equally well off (in utility terms) as when they are living in his or her current household. Results show that husbands need a higher level of the initial household resources (between 80 and 89 percent) than women (between 71 to 78 percent) to be as well-off as in a couple. In addition, I find that indifference scales for women decrease with violence and increase when the household is a beneficiary of the transfer.

Related Literature

This paper is related to three lines of literature: (i) literature that studies cash transfers and household decisions, (ii) literature on targeted poverty transfer and bargaining power, and (iii) literature on collective intra-household models that allow one to estimate individuals' allocation of resources.

Regarding the first two branches of literature, in the last twenty years considerable amounts

of investment have been made seeking to boost women's empowerment. Social transfer programs have expanded across less developed countries and have gradually become an important component of anti-poverty budgets in many governments (Fiszbein et al., 2009). To promote desirable social outcomes such as better childhood education and health, productive activities for women and gender empowerment, several countries have designed programs specifically to place resources in the hands of women. This approach assumes that women care more about the household's children and other household public goods than men do.

The literature has shown that monetary incentives can have important effects on households' behavior (see, for example, Bobonis, 2009; Attanasio and Lechene, 2014; Angelucci and Garlick, 2016). In addition, empirical studies have provided evidence of the effect of these programs on children's school performance, health, and nutrition (see, for instance, Thomas, 1990; Duflo, 2003; Gertler, 2004; Behrman et al., 2005; Paxson and Schady, 2010; Duflo, 2011; Doepke and Tertilt, 2011). Many of these studies have examined the effect of the randomized treatment on the outcomes of interest. However, this is not informative about either the mechanism behind the intra-household choices or the identification of the actual control of resources. Regarding household allocation of consumption, Schady and Rosero (2008), Angelucci and Attanasio (2013) and Attanasio and Lechene (2014) show that cash transfer programs targeted at mothers are associated with constant or higher shares of household expenditure on food. In contrast, using a randomization of the gender of the recipient, Benhassine et al. (2015), Akresh et al. (2016) and Haushofer and Shapiro (2016) found no significant differences in program effects on household consumption, production and investment decisions. These diverse results suggest that a picture related to the mechanisms behind intra-household allocations is still far from clear. To better understand these mechanisms, it is advantageous to use models of household behavior to identify the redistribution and the control of household resources among individual members and to understand the potential effects of poverty policies on these intra-household allocations.

In terms of analyzing the role of violence within a household, Eswaran and Malhotra (2011) construct a non-cooperative household model where adult members' bargaining power is affected by violence. Empirically, an interesting result is obtained by Angelucci (2008), who found a non-monotonic relationship between transfer amounts and violence. Large transfers generate a tendency toward more violence, while small transfers are associated with a decrease in violence. Bobonis et al. (2013) showed that women beneficiaries of the program are less likely to be victims of physical abuse, but are more prone to be victims of emotional violence, and Hidrobo et al. (2016) showed that transfers induce a reduction in physical or sexual violence. In contrast, Hidrobo and Fernald (2013) found that conditional cash transfers did not appear to have an effect on physical violence, although, when a woman is

more educated than her partner, the program can increase emotional violence. To account for this, I include intimate partner violence in my model of household behavior as an important component of bargaining power and home good productivity.

Regarding the third branch of literature, this paper benefits from the recent developments in collective intra-household decision models. It is well known that the unitary approach fails to explain how resources are distributed within a household, which has important implications for poverty analysis. Many studies have developed non-unitary models that incorporate heterogeneous preferences of family members (Manser and Brown, 1980; McElroy and Horney, 1981; Lundberg and Pollak, 1994; Chen and Woolley, 2001). A relevant point of departure is the collective intra-household decision-making framework proposed by Chiappori (1988), Chiappori (1992) and Apps and Rees (1996). These types of models have become an important tool for analyzing household allocation decisions, since they provide an intuitive and manageable framework to study the distributional impacts of public policies.

Several subsequent studies have contributed to making this framework more tractable for empirical purposes (Browning et al., 1994; Blundell et al., 2005; Browning et al., 2013; Chiappori and Ekeland, 2006, 2009). The advantage of using this framework is the potential to identify—under reasonable conditions—the fundamentals such as household members' preferences and the household decision-making process (Chiappori and Ekeland, 2009). Another advantage is the small set of assumptions required—mainly the Pareto efficiency of the household allocation process—and the ability to derive strong testable restrictions.

In this context, other attempts to identify resource shares have relied on the assumption that single women and men have similar preferences to those of married women and men (Browning et al., 2013; Lewbel and Pendakur, 2008; Lise and Seitz, 2011; Bargain and Donni, 2009). However, Dunbar et al. (2013) proposed a framework that relaxed the assumptions related to similar preferences for different types of households. Similarly, the model developed in this paper does not rely on the restrictive assumption of similarity of preferences across different types of households, as the data from the intervention in Ecuador provide sufficient information at the individual level to identify all the necessary parameters.

To model household behavior with public goods, I follow the work of Blundell et al. (2005). They show that these types of models can be non-parametrically identified (up to a constant) by observing labor supplies and the demand for the public good. My model is closely related to that of Cherchye et al. (2012), who generalize the model of Blundell et al. (2005) by adding household production of public goods. Another key feature of this model is that it is appropriate for empirical implementation when data on individual consumption and time

use are available.[2] The richness of the data I use allows me to estimate the structural model and to study how different types of households allocate resources, the implications in terms of individual well-being and the effectiveness of poverty transfers in reducing poverty gaps.

The rest of the paper is organized as follows. Section 2 presents key features of the data. Section 3 presents the collective intra-household bargaining model, including its identification strategy. Section 4 explains the empirical implementation of the model. Section 5 presents the estimation results. Section 6 shows the implications for the measurement of individual poverty, effectiveness of the poverty transfers, and for indifference scales. Section 7 concludes.

2 Data

2.1 Program Description

To study how households respond to poverty transfers under violence, I use data from a randomized evaluation of an intervention implemented by the World Food Programme in Ecuador called "Food, Cash, or Voucher". The program was carried out only in 2011. Beneficiaries received a monthly transfer of 40 U.S. dollars for 6 months.[3] The transfer was delivered in two different formats: as a cash transfer or as an in-kind transfer. The in-kind transfer could be either a food basket or a redeemable voucher.[4] The conditionality of the program was to attend a nutritional training program. The goal of the program was to promote better food consumption, empower women in terms of food consumption decisions, and mitigate the strained relations between Colombian refugees and Ecuadorian citizens. The program was implemented in two northern provinces of Ecuador: Carchi and Sucumbios (see Figure (A.1)). Within these provinces, seven urban centers[5] were selected and divided into 84 neighborhoods. From these 84 neighborhoods, 61 were randomly assigned to the treatment group and 19 were assigned to the control group. These neighborhoods were further divided into geographical units labeled clusters. Within the treated arm, 110 clusters in the

[2] Blundell et al. (2005) provide an estimation of this extended model with public goods production by exploiting detailed Dutch data.

[3] In terms of the household income this transfer represents around 10 percent of the average household monthly income.

[4] The food basket consisted of rice (24 kg), lentils (8kg), vegetable oil (4 l) and canned sardines (8 cans). The redeemable voucher transfer was under the female's head or female partner name, and could be used at local supermarkets to acquire a list of pre-approved goods such as the ones in the food basket. The cash transfer was delivered using banks automated teller machines (ATMs).

[5] These urban centers had more than 10 percent of Colombian refugees, more than 50 percent of people living in poverty, a local provider to implement food distribution, and financial institutions to distribute cash via ATMs.

61 treated neighborhoods were randomly assigned to the program.

The intervention sample consist of 2,357 households. Of these 2,357 household, 652 were assigned to the control group and the remaining 1,705 were treated households, who were divided into three almost equal parts to be assigned to receive the food basket, the cash transfer or the voucher. Only poor households and households with at least one Colombian member were eligible for the program. If any household member already participated in the Governmental cash transfer program, the household was ineligible for this program. Of the 2,357 households interviewed between March and April of 2011, 2,122 were resurveyed between October and November of 2011.

This dataset is particularly useful for the present analysis because the transfer incentives were exogenous and sufficient to have a real effect on households' behavior. In addition, the information available in the dataset is very comprehensive and includes variables necessary to empirically estimate the proposed structural model.

2.2 Data Description

In this study, I will concentrate on physical and sexual violence to be consistent with literature related to intimate partner violence (Garcia-Moreno et al. 2005). Physical violence is constructed using questions that ask the female whether she has been pushed, slapped, punched, kicked, strangled, and threatened or attacked with a weapon by her partner. Similarly, sexual violence is constructed using questions that ask the female whether her intimate partner forced her to have sex or to commit sexual acts she did not approve. In the descriptive statistics, I also provide a measure of emotional violence. Emotional violence is related to questions that ask the female whether she has been threatened with abandonment, threatened with being taken away from her children, threatened with being hurt, humiliated, or ignored by her partner in the last 6 months.

A woman suffering from physical or sexual violence with her partner as the perpetrator was considered as a victim of intimate partner. For the empirical analysis, I construct an index of violence that takes into consideration the physical and sexual dimension of violence and ranges from 0 to 1. This index captures the different forms of violence that the female experienced in the last 6 months by hands of her partner: pushed, slapped, punched, kicked, strangled, threatened with a weapon, attacked with a weapon, forced to perform sexual acts that she did not approve, forced to have sex and life-time violence. For instance, a female who reported being pushed, slapped and punched, but who did not suffer any of the other assaults listed, has an index of 3/10=0.3.

Table (A.1) presents selected descriptive statistics of household characteristics. All statistics are from the sample used for the analysis, differentiating among control and treatment

households. All the households in the analysis consisted of a couple. The average man in the sample was 39 years old, whereas the average woman was 35 years old. The average age difference within the sampled couples is 3.8 years.

Table A.1 also reveals differences in the allocation of time to different activities. Women allocate more hours to housework activities (around 6 more hours) than men. On the other hand, men allocate more hours to market work than women (around 1 more hour) and earn slightly higher wages per unit of labor. In addition, Table (A.1) shows average consumption patterns expressed in dollars per month. Private consumption of women is slightly higher than that of men. Expenditures on public goods, including on children, represent a large share (more than 80 percent) of household total consumption.

Around 42 percent of these couples are married. The remaining 58 percent are cohabiting. Men and women have similar years of education with 39 percent of the women and 38 percent of men having some secondary education or higher.

2.3 Some Reduce Form Relationships

In this section, I document the impact of the transfer on time allocation, as well as on household consumption. I estimate the following linear model[6]:

$$Y_{ij1} = \alpha + \beta T_i + \gamma Y_{ij0} + \delta P_{ij} + \theta_j + \varepsilon_{ij} \tag{1}$$

where Y_{ij1} represents the outcome of interest (allocation of time or consumption) for household i located in province j at the end of the intervention and Y_{ij0} is the outcome of interest at baseline. T_i is an indicator that equals one if household i is a program beneficiary and therefore β is the coefficient of interest, which represents the intent-to-treat estimator. P_{ij} is an indicator for the level of stratification or province and equals one if a household resides in Sucumbios at baseline.[7] Both θ_j and ε_{ij} are i.i.d errors across clusters and across households within clusters, respectively.

In Table (A.2), I show the influence of the transfer on household adult members' time allocation. Columns (1) to (6) present the estimates for women, and columns (7) to (12) display the estimates for men. For each category of time use, I estimate Equation (1) to assess the effect of the pooled treatment and then compare it to the estimates of the in-kind and cash treatment arms in the subsequent columns. The program has an effect over the

[6] In this regression, I take into account serial correlation by controlling for the value of the outcome variable at baseline (see similar approach in McKenzie, 2012).

[7] As it is observable Figure (A.1), the program was implemented in the two dark gray provinces Carchi and Sucumbios.

allocation of time of women, whereas for men the effect of the program is mostly statistically insignificant. Receiving the program increases women's time allocated to housework (by 0.72 hours per day) and reduces leisure activities (by 0.62 hours per day). There is no effect on time devoted to the labor market for either men or women. These effects are similar across the different treatment arms.

I also use the structure of Equation (1) to investigate the impact of transfers on intra-household allocation of consumption. Several studies in the literature claim that cash transfer programs increase the share of food in total consumption. A possible mechanism is that an exogenous source of income changes the intra-household bargaining power of women, which then influences the allocation of resources devoted to food (see Schady and Rosero, 2008; Bobonis, 2009; Angelucci and Attanasio, 2013; Attanasio and Lechene, 2014).

Table (A.3) shows the impact of the transfer on household consumption. As before, for each category of household consumption I estimate the effect of the pooled treatment and compare it to the estimates of the in-kind and cash treatment arms in the subsequent column. Receiving the program increases public consumption, whereas private consumption of men and women are not affected by the transfer. More specifically, the program increases public consumption (35.9 dollars per month) and the impact is similar across the different treatment arms. This relationship could be influenced by the mechanism explained in the literature but also by changes in individual preferences due to effect of the conditionality.

Finally, I analyze heterogeneity in changes in time allocation and consumption by different levels of intra-household violence. Figures (A.2) and (A.3) I document the impact of receiving the program on time allocation and the level of consumption, separately for different violence levels. Each curve is generated by calculating the reduced form effect of the program on time allocation and consumption by baseline intra-household violence. In Figure (A.2), the left axis is the change in hours per day of each adult member at follow-up (program recipients vs. non-recipients). Confidence bounds are not displayed to preserve readability. When the baseline level of intra-household violence is low, women in households that receive the transfer increase their home hours and decrease their work hours. This situation changes when there is a relative high level of violence; women in households that receive the transfer decrease home hours and increase work hours. For men, when the level of intra-household violence is low, the program leads to a slight increase in work hours, however, when there is a high level of intra-household violence, the program leads to an increase in both: home hours and work hours.

In Figure (A.3), the left axis represents the change in dollars per month allocated to consumption at follow-up. When the baseline level of intra-household violence is low, the program increases household public consumption; however, this positive effect decreases as the level of

violence increases. Private consumption of men and women are not affected by the program when there are low levels of violence, however when intra-household violence is relative high, the program increases the levels of men's and women's private consumption.

2.4 Decomposing Effects into Extensive and Intensive Margins

Treatment effects on outcomes such as the decisions to allocate time to the labor market and domestic activities as well as the decision to inflict violence can occur both at the extensive margin and at the intensive margin. This distinction is important, as intensive margin effects indicate that treatment is changing the patterns of specialization of the households or the overall household environment in the case of violence. I follow the approach proposed by Attanasio et al. (2011) and Carranza et al. (2019) to decompose labor market effects into extensive and intensive margins. The decomposition exposed in Equation (2) is for working hours, however the same procedure applies to the other the outcomes of interest. Using the law of iterated expectations and the fact that observed hours are zero for non-employed individuals, it is possible to write the average treatment effect on work hours as:

$$
\begin{aligned}
&\underbrace{\mathbb{E}\left[Hours \mid T=1\right] - \mathbb{E}\left[Hours \mid T=0\right]}_{ATE\ for\ hours} \\
&= \underbrace{\left(\mathbb{E}\left[Hours \mid T=1, Work=1\right] - \mathbb{E}\left[Hours \mid T=0, Work=1\right]\right)}_{ATE\ for\ hours \mid employment} \cdot \underbrace{Pr\left[Work=1 \mid T=1\right]}_{Treated\ employment\ rate} \\
&+ \underbrace{\mathbb{E}\left[Hours \mid T=0, Work=1\right]}_{Control\ earnings \mid employment} \cdot \underbrace{\left(Pr\left[Work=1 \mid T=1\right] - Pr\left[Work=1 \mid T=0\right]\right)}_{ATE\ for\ employment}
\end{aligned}
\tag{2}
$$

The first line on the right-hand side of Equation (2) is the intensive margin effect. If treatment only changes the employment rate but has no effect on hours for employed individuals, then this term is zero. The second line on the right-hand side of Equation (2) is the extensive margin effect. If treatment has no effect on the employment rate, then this expression is zero. Intuitively, the extensive margin effect on hours is the average treatment effect on employment multiplied by the mean hours for employed control group members. The intensive margin effect on hours is the average treatment effect on hours minus the extensive margin effect. In Equation (2), the only term that is not identified is the average treatment effect on hours conditional on employment. Therefore, this term can be consistently estimated using using the formula in Equation (2). The standard errors are computed by estimating all quantities as a system and using the Delta method.

Results of the decomposition exercise are presented in Table (A.4). The cash transfer affects primary women's housework activities and intimate partner violence. The effect on women's

housework activities is mainly driven by the intensive margin effect. On the other hand, the program shift intimate partner violence mostly at the extensive margin. There is also an effect of the program on men's housework activities at the extensive margin, however the overall effect is not statistically significant. Finally, there is no any statistically significant effect of the program at the intensive or extensive margin for men or women's time allocation to the labor market.

3 A Model of Intra-household Bargaining under Cash Transfers and Violence

The empirical results from the previous section reveal that transfers affect the intra-household allocation of time and consumption. They also indicate that there is some heterogeneity in these effects over levels of intimate partner violence. Although these empirical results are informative, they do not provide information on the mechanisms that operate behind the intra-household allocation of resources among different types of households. This section presents the collective intra-household bargaining model that I use to describe how households make decisions and allocate resources to each adult member within different types of households. Following Blundell et al. (2005), Cherchye et al. (2012) and Chiappori and Mazzocco (2017), I use a parsimonious collective household model with home production, which allows me to study the allocation of resources within the household and obtain measures of individual control of resources. This framework is useful for subsequently analyzing poverty and inequality at the individual level.

Agents and Preferences

Consider a household formed by two agents $i \in \{♀, ♂\}$. I assume that all households are composed by one female (♀) and one male (♂) i.e. all men and women live in couple households, formed by one woman ('wife') and one man ('husband'). Each individual is endowed with one unit of time. In this model, men and women allocate their time endowment between home production (h^i), the labor market (m^i) and leisure (l^i).

Both agents derive utility from private consumption (c^i) , leisure, and a sub-utility u^Q that represent a public home produced good, the output of which is unobserved:

$$U^i\left(c^i, l^i, u^Q\right) \tag{3}$$

Home Production

Higher levels of u^Q require more home production, which is assumed to be done by combining the following inputs: a market acquired good and men's and women's time ($h^♀$ and $h^♂$):

$$u^Q = F(v)\ u^Q\left(c^Q, h^♀, h^♂; \mathbf{s}^Q\right) \tag{4}$$

The sub-utility function u^Q is assumed to be twice continuously differentiable, strictly increasing and strongly concave in all its arguments. Additionally, similar as in Cherchye et al. (2012), it is assumed that the sub-utility function u^Q is linearly homogeneous in its arguments, which implies that the household production technology is characterized by constant returns to scale.

More specifically, the domestic good u^Q can be understood as having a higher home quality including child-care and a livable house. I make the standard assumption that the domestic good is produced in an efficient (i.e., cost minimizing) manner. F represents the total factor productivity which could be influenced by violence. The vector $\mathbf{s}^Q$ in Equation (4) contains production shifters associated with the domestic good. I define a production shifter as a variable that affects individual utility only through the household production technology.[8]

Budget Constraint and Government Cash Transfer

There is a Hicksian composite good that can be consumed privately ($c^♀$ and $c^♂$) or used to buy inputs for the home production (c^Q). The price of the Hicksian good is normalized to one. Each member of the household can earn a labor income w^i for each unit of labor market work. In addition, the household has a non-labor income y and could also receive a transfer denoted by t. Therefore, the household budget constraint is:

$$c^♀ + c^♂ + c^Q = w^♀ m^♀ + w^♂ m^♂ + y + t \tag{5}$$

Couple Household's Optimization Problem

The problem of the household is to maximize the sum of female and male utilities.[9] As it is standard in the literature on collective models (Chiappori 1988, 1992), assume that the

[8]For instance, a production shifter could be the average age of the children in the household. It can be argued that this variable directly influences the household production technology (e.g., because younger children require more maternal care than older children, ceteris paribus).

[9]This is a Pareto maximization program with relative weights μ attached to the woman's and $1-\mu$ to the man's utility, where $0 \leq \mu \leq 1$

household makes Pareto-efficient decisions. Therefore, efficient allocations result from the following maximization problem:

$$\begin{aligned}\max_{l^{♀},l^{♂},h^{♀}h^{♂},c^{♀},c^{♂},c^{Q}} \quad & \mu\left(w^{♀},w^{♂},y,t,v,\mathbf{z}\right)U^{♂}\left(c^{♂},l^{♂},u^{Q}\right)+\left(1-\mu\left(w^{♀},w^{♂},y,t,v,\mathbf{z}\right)\right)U^{♀}\left(c^{♀},l^{♀},u^{Q}\right)\\ \text{subject to :}\quad & \\ & c^{♀}+c^{♂}+c^{Q}=w^{♀}m^{♀}+w^{♂}m^{♂}+y+t\\ & u^{Q}=F\left(v\right)\,u^{Q}\left(c^{Q},h^{♀},h^{♂};\mathbf{s}^{Q}\right)\\ & l^{i}+m^{i}+h^{i}=1\quad\left(i=♀,♂\right)\end{aligned} \tag{6}$$

The first constraint represents the household budget constraint, and the second is the production function for the home good. Note that the cash transfer enters directly into the budget constraint, providing the household more resources to allocate to private consumption or the home production input. The third constraint limits the total time allocated to the different activities to be no larger than the time endowment, which is normalized to 1. The Pareto weight represents the relative bargaining power of the man in the household. It is a function of individual wages ($w^{♀}$ and $w^{♂}$), non-labor income y, the cash transfer t, the level of violence v, and a vector of distribution factors $\mathbf{z}$. Distribution factors are defined as variables that affect the bargaining power without affecting preferences. In this model it is important to observe at least one distribution factor to identify the model.[10] Finally, household's optimal choices $(l^{♀},l^{♂},h^{♂},h^{♂},c^{♂},c^{♂},c^{Q})$ are observable functions of the adult members' wages $w^{♀}$ and $w^{♂}$, the household's non-labor income y, the cash transfer t, violence v, the distribution factors $\mathbf{z}$, and the production shifters in $\mathbf{s}$.

3.1 Identification of Parameters

Cherchye et al. (2012) argue that the model can be identified using a two-stage representation of the household decision process. Specifically, the solution to the maximization problem in Equation (6) can be decomposed into a two-stage process. In the first stage, household members decide on the level of the home good and a division of the remaining non-labor income between both members. This defines the conditional sharing rule for each member $\rho^{i}\left(i=♀,♂\right)$, which represents how much of the remaining non-labor income (after expenditures on the inputs that are needed for a given level of the home good) goes to member

[10]The literature has proposed many different types of the distribution factors, such as relative incomes, relative wages, the marriage market environment, and the targeting of social transfers (see Bourguignon et al. 2009).

i. These functions ρ^i, generalizes the sharing rule that Chiappori (1992) introduced for a setting with only private goods.[11]

The second stage deals with the individual trade-off between own leisure and own private consumption, conditional on the level of home good and the budget constraint that includes the sharing rule defined in stage one. Taking $\bar{u}^Q$ as given, the individual maximization problem for member i in the second stage is given by:

$$\begin{aligned} &\max_{l^i, c^i} && U^i\left(c^i, l^i, \bar{u}^Q\right) \\ &\text{subject to :} && \\ & && c^i + w^i l^i = w^i + \rho^i\left(w^{\text{♀}}, w^{\text{♂}}, y, t, v, \mathbf{z}\right) \quad (i = \text{♀}, \text{♂}) \end{aligned} \tag{7}$$

As proved by Blundell et al. (2005), identification of the model can be obtained using a distribution factor. Chiappori (1988) and Chiappori (1992) proved that the observability of both members individual labor supply functions allows one to recover the sharing rule up to a constant and the individual preferences up to a translation. The only difference between Chiappori's original setting and the Blundell et al. (2005) extension to household production is that the unidentified constant generally depends on $\bar{u}^Q$. As in Cherchye et al. (2012), I do not have such an unidentified constant in this model, which implies that the sharing rule and individual preferences are completely identified. The reason for this is that I observe $c^{\text{♀}}$ and $c^{\text{♂}}$ in the data set, which provides two boundary conditions for the individual integrability problems.

4 Empirical Implementation

This section presents the parametric structure that will be used to estimate the theoretical model described in the previous section. The estimation will be based on the two-stage allocation process. This two-stage process allows for the use of individual indirect utility functions, which simplifies the derivation of a flexible reduced form functional form for the observables.[12]

[11] It is important to clarify that in the model ρ^i could be either positive or negative.

[12] To avoid the restrictive assumption that leisure and individual consumption are separable from the unobserved output of the household production process, it is useful to specify individual indirect utility functions. Otherwise, it is very complicated to derive a flexible closed form specification for the observables based on a direct utility representation of the adult members' preferences.

Second Stage

To start, assume that in the second stage, individuals' preferences over leisure and private consumption are conditional on the level of domestic good produced and on the available resources defined in the first stage ($w^i + \rho^i$). This can be represented by a conditional indirect utility consistent with the Deaton and Muellbauer (1980) Almost Ideal Demand System (AIDS):

$$v^i\left(w^i, \rho^i, \bar{u}^Q\right) = \frac{\ln\left(w^i + \rho^i\right) - \ln a^i\left(w^i; \bar{u}^Q\right)}{\left(w^i\right)^{\beta^i}} \tag{8}$$

where the price index is $\ln a^i\left(w^i; \bar{u}^Q\right) = \left(\alpha_1^i\left(\mathbf{d}^i\right) + \alpha_2^i \ln \bar{u}^Q\right) \ln w^i$ and α_1^i is a function of preference shifters $\mathbf{d}^i$. It is important to note from the specification of Equation (8), that it is possible to empirically test for separability between unobserved output of the household production process and individual consumption and leisure by checking the significance of the parameter α_2^i.[13] Roy's identity, can be used to recover the conditional leisure and private consumption of each adult member:

$$\begin{aligned} l^i &= \left[\left(\alpha_1^i\left(\mathbf{d}^i\right) + \alpha_2^i \ln \bar{u}^Q\right) + \beta^i \ln\left(\frac{w^i + \rho^i}{a^i\left(w^i; \bar{u}^Q\right)}\right)\right] \frac{\left(w^i + \rho^i\right)}{w^i} \\ c^i &= \left[\left(1 - \alpha_1^i\left(\mathbf{d}^i\right) - \alpha_2^i \ln \bar{u}^Q\right) - \beta^i \ln\left(\frac{w^i + \rho^i}{a^i\left(w^i; \bar{u}^Q\right)}\right)\right] \frac{\left(w^i + \rho^i\right)}{w^i} \end{aligned} \tag{9}$$

First Stage

Turning to the first stage, the household decides the allocation of its non-labor income y and cash transfer t to (ρ^{φ}, ρ^{σ}, u^Q). First, specify the household production technology that transforms expenditures on public goods and the time men and women spend on home production into the domestic good u^Q. For simplicity, assume that this technology follows a constant elasticity of substitution form:

$$u^Q\left(c^Q, h^{\varphi}, h^{\sigma}; \mathbf{s}^Q\right) = F(v)\left(\gamma_1\left(c^Q\right)^{\epsilon\left(\mathbf{s}^Q\right)} + \gamma_2\left(h^{\varphi}\right)^{\epsilon\left(\mathbf{s}^Q\right)} + \gamma_3\left(h^{\sigma}\right)^{\epsilon\left(\mathbf{s}^Q\right)}\right)^{\frac{1}{\epsilon\left(\mathbf{s}^Q\right)}} \tag{10}$$

where total productivity is affected by violence $F(v) = e^{\kappa v}$ and $\epsilon\left(\mathbf{s}^Q\right)$ is assumed to depend on the production shifters in $\mathbf{s}^Q$.

[13] If parameter $\alpha_2^i = 0$, then separability holds.

Using the parametric indirect utility function that results from the second stage and the household production technology, the first-stage maximization problem is given by:

$$\begin{aligned} \max_{\rho^{\varsigma},\rho^{\sigma},u^{Q}} \quad & \mu\left(\cdot\right)\left(\frac{\ln\left(w^{\sigma}+\rho^{\sigma}\right)-\ln a^{\sigma}\left(w^{\sigma};\bar{u}^{Q}\right)}{\left(w^{\sigma}\right)^{\beta^{\sigma}}}\right)+\left(1-\mu\left(\cdot\right)\right)\left(\frac{\ln(w^{\varsigma}+\rho^{\varsigma})-\ln a^{\varsigma}\left(w^{\varsigma};\bar{u}^{Q}\right)}{(w^{\varsigma})^{\beta^{\varsigma}}}\right) \\ \text{subject to :} \quad & \rho^{\varsigma}+\rho^{\sigma}+g\left(w^{\varsigma},w^{\sigma}\right)\bar{u}^{Q}=y+t \end{aligned} \tag{11}$$

where $\mu\left(\cdot\right)=\mu\left(w^{\varsigma},w^{\sigma},y,t,v,\mathbf{z}\right)$ and $g\left(w^{\varsigma},w^{\sigma}\right)$ come from the expenditure minimization problem and is given by:

$$g\left(w^{\varsigma},w^{\sigma}\right)=\frac{1}{F\left(v\right)}\left(\left(\gamma_{1}\right)^{-\frac{1}{\epsilon\left(\mathbf{s}^{Q}\right)-1}}\left(w^{\sigma}\right)^{\frac{\epsilon\left(\mathbf{s}^{Q}\right)}{\epsilon\left(\mathbf{s}^{Q}\right)-1}}+\left(\gamma_{2}\right)^{-\frac{1}{\epsilon\left(\mathbf{s}^{Q}\right)-1}}\left(w^{\varsigma}\right)^{\frac{\epsilon\left(\mathbf{s}^{Q}\right)}{\epsilon\left(\mathbf{s}^{Q}\right)-1}}+\left(\gamma_{3}\right)^{-\frac{1}{\epsilon\left(\mathbf{s}^{Q}\right)-1}}\right)^{\frac{\epsilon\left(\mathbf{s}^{Q}\right)-1}{\epsilon\left(\mathbf{s}^{Q}\right)}} \tag{12}$$

Let λ be the Lagrange multiplier for the constraint in Equation (11). The first order conditions (assuming an interior solution) with respect to ρ^{ς}, ρ^{σ},u^{Q} and λ, can be described as follows:

$$\frac{\mu}{\left(w^{\sigma}\right)^{\beta^{\sigma}}}\frac{1}{\left(w^{\sigma}+\rho^{\sigma}\right)}=\lambda \tag{13}$$

$$\frac{\mu}{\left(w^{\varsigma}\right)^{\beta^{\varsigma}}}\frac{1}{\left(w^{\varsigma}+\rho^{\varsigma}\right)}=\lambda \tag{14}$$

$$-\frac{\mu}{\left(w^{\sigma}\right)^{\beta^{\sigma}}}\frac{\alpha_{2}^{\sigma}\ln w^{\sigma}}{\bar{u}^{Q}}-\frac{\left(1-\mu\right)}{\left(w^{\varsigma}\right)^{\beta^{\varsigma}}}\frac{\alpha_{2}^{\varsigma}\ln w^{\varsigma}}{\bar{u}^{Q}}=\lambda g\left(w^{\varsigma},w^{\sigma}\right) \tag{15}$$

$$\rho^{\varsigma}+\rho^{\sigma}+g\left(w^{\varsigma},w^{\sigma}\right)\bar{u}^{Q}=y+t \tag{16}$$

Equations (13), (14) and (15) can be rearranged as:

$$\left(w^{\sigma}+\rho^{\sigma}\right)=\frac{1}{\lambda}\frac{\mu}{\left(w^{\sigma}\right)^{\beta^{\sigma}}} \tag{17}$$

$$\left(w^{\varsigma}+\rho^{\varsigma}\right)=\frac{1}{\lambda}\frac{\mu}{\left(w^{\varsigma}\right)^{\beta^{\varsigma}}} \tag{18}$$

$$g\left(w^{\text{♀}},w^{\text{♂}}\right)\bar{u}^{Q}=\frac{1}{\lambda}\left[-\frac{\mu}{\left(w^{\text{♂}}\right)^{\beta^{\text{♂}}}}\alpha_{2}^{\text{♂}}\ln w^{\text{♂}}-\frac{(1-\mu)}{\left(w^{\text{♀}}\right)^{\beta^{\text{♀}}}}\alpha_{2}^{\text{♀}}\ln w^{\text{♀}}\right] \tag{19}$$

Summing Equations (17), (18) and (19), yields:

$$\begin{gathered}w^{\text{♂}}+w^{\text{♀}}+\underbrace{\rho^{\text{♂}}+\rho^{\text{♀}}+g\left(w^{\text{♀}},w^{\text{♂}}\right)\bar{u}^{Q}}_{y+t}=\\ \frac{1}{\lambda}\left[\frac{\mu}{\left(w^{\text{♂}}\right)^{\beta^{\text{♂}}}}+\frac{(1-\mu)}{\left(w^{\text{♀}}\right)^{\beta^{\text{♀}}}}-\frac{\mu}{\left(w^{\text{♂}}\right)^{\beta^{\text{♂}}}}\alpha_{2}^{\text{♂}}\ln w^{\text{♂}}-\frac{(1-\mu)}{\left(w^{\text{♀}}\right)^{\beta^{\text{♀}}}}\alpha_{2}^{\text{♀}}\ln w^{\text{♀}}\right]\end{gathered} \tag{20}$$

Using Equation (20) together with Equation (16), provides an expression for the Lagrangian multiplier:

$$\frac{1}{\lambda}=\frac{w^{\text{♂}}+w^{\text{♀}}+y+t}{X\left(w^{\text{♀}},w^{\text{♂}},\mu\right)} \tag{21}$$

Plugging Equation (21) into Equations (17), (18) and (19) yields expressions for the conditional sharing rules and the level of home good as a function of observables:

$$\rho^{\text{♂}}=\frac{w^{\text{♂}}+w^{\text{♀}}+y+t}{X\left(w^{\text{♀}},w^{\text{♂}},\mu\right)}\frac{\mu}{\left(w^{\text{♂}}\right)^{\beta^{\text{♂}}}}-w^{\text{♂}} \tag{22}$$

$$\rho^{\text{♀}}=\frac{w^{\text{♂}}+w^{\text{♀}}+y+t}{X\left(w^{\text{♀}},w^{\text{♂}},\mu\right)}\frac{\mu}{\left(w^{\text{♀}}\right)^{\beta^{\text{♀}}}}-w^{\text{♀}} \tag{23}$$

$$\bar{u}^{Q}=\frac{w^{\text{♂}}+w^{\text{♀}}+y+t}{X\left(w^{\text{♀}},w^{\text{♂}},\mu\right)}\frac{1}{g\left(w^{\text{♀}},w^{\text{♂}}\right)}\left[-\frac{\mu}{\left(w^{\text{♂}}\right)^{\beta^{\text{♂}}}}\alpha_{2}^{\text{♂}}\ln w^{\text{♂}}-\frac{(1-\mu)}{\left(w^{\text{♀}}\right)^{\beta^{\text{♀}}}}\alpha_{2}^{\text{♀}}\ln w^{\text{♀}}\right] \tag{24}$$

To obtain the final expressions for individual leisure and consumption as functions of observables, substitute Equations (22), (23) and (24) into the second stage Equation (9). Then, for $(i=\text{♀},\text{♂})$ we have:

$$\begin{aligned}l^{i}=&\left\{\left[\Theta^{i}+\beta^{i}\left[\ln\left(\frac{w^{\text{♂}}+w^{\text{♀}}+y+t}{X\left(w^{\text{♀}},w^{\text{♂}},\mu\right)}\frac{\mu^{i}}{\left(w^{\text{♂}}\right)^{\beta^{\text{♂}}}}\right)-\Theta^{i}\ln w^{\text{♂}}\right]+\beta^{i}\ln\left(\frac{w^{i}+\rho^{i}}{a^{i}\left(w^{i};\bar{u}^{Q}\right)}\right)\right]\right\}\times\\ &\left(\frac{w^{\text{♂}}+w^{\text{♀}}+y+t}{X\left(w^{\text{♀}},w^{\text{♂}},\mu\right)}\frac{\mu^{i}}{\left(w^{\text{♂}}\right)^{\beta^{\text{♂}}}}\right)\end{aligned}$$

$$c^i = \left\{ \left[\left(1-\Theta^i\right) + \beta^i \left[\ln\left(\frac{w^{\male}+w^{\female}+y+t}{X\left(w^{\female},w^{\male},\mu\right)} \frac{\mu^i}{\left(w^{\male}\right)^{\beta^{\male}}} \right) - \Theta^i \ln w^{\male} \right] + \beta^i \ln\left(\frac{w^i+\rho^i}{a^i\left(w^i;\bar{u}^Q\right)} \right) \right] \right\} \times \left(\frac{w^{\male}+w^{\female}+y+t}{X\left(w^{\female},w^{\male},\mu\right)} \frac{\mu^i}{\left(w^{\male}\right)^{\beta^{\male}}} \right) \tag{25}$$

where $\Theta^i = \left\{ \alpha_1^i\left(\mathbf{d}^i\right) + \alpha_2^i \ln\left[\frac{w^{\male}+w^{\female}+y+t}{X\left(w^{\female},w^{\male},\mu\right)} \frac{1}{g\left(w^{\female},w^{\male}\right)} \right] \left[-\frac{\mu}{\left(w^{\male}\right)^{\beta^{\male}}} \alpha_2^{\male} \ln w^{\male} - \frac{(1-\mu)}{\left(w^{\female}\right)^{\beta^{\female}}} \alpha_2^{\female} \ln w^{\female} \right] \right\}$,
$\mu = \mu\left(w^{\female},w^{\male},y,t,v,\mathbf{z}\right)$, $\mu^{\male} = \mu\left(w^{\female},w^{\male},y,t,v,\mathbf{z}\right)$ and $\mu^{\female} = 1-\mu\left(w^{\female},w^{\male},y,t,v,\mathbf{z}\right)$.
To recover the inputs of the home production process as functions of observables, use the cost/expenditure function $e\left(w^{\female},w^{\male},\bar{u}^Q\right) = g\left(w^{\female},w^{\male}\right)\bar{u}^Q$ and apply Shephard's lemma and plug in Equation (24), to obtain the following specification:

$$h^{\male} = \left(\frac{w^{\male}}{\gamma_1}\right)^{\frac{1}{\epsilon\left(\mathbf{s}^Q\right)-1}} \frac{w^{\male}+w^{\female}+y+t}{X\left(w^{\female},w^{\male},\mu\right)} \left[g\left(w^{\female},w^{\male}\right)\right]^{\frac{-\epsilon\left(\mathbf{s}^Q\right)}{\epsilon\left(\mathbf{s}^Q\right)-1}} \left[-\frac{\mu}{\left(w^{\male}\right)^{\beta^{\male}}} \alpha_2^{\male} \ln w^{\male} - \frac{(1-\mu)}{\left(w^{\female}\right)^{\beta^{\female}}} \alpha_2^{\female} \ln w^{\female} \right] \tag{26}$$

$$h^{\female} = \left(\frac{w^{\female}}{\gamma_2}\right)^{\frac{1}{\epsilon\left(\mathbf{s}^Q\right)-1}} \frac{w^{\male}+w^{\female}+y+t}{X\left(w^{\female},w^{\male},\mu\right)} \left[g\left(w^{\female},w^{\male}\right)\right]^{\frac{-\epsilon\left(\mathbf{s}^Q\right)}{\epsilon\left(\mathbf{s}^Q\right)-1}} \left[-\frac{\mu}{\left(w^{\male}\right)^{\beta^{\male}}} \alpha_2^{\male} \ln w^{\male} - \frac{(1-\mu)}{\left(w^{\female}\right)^{\beta^{\female}}} \alpha_2^{\female} \ln w^{\female} \right] \tag{27}$$

$$c^Q = \left(\gamma_3\right)^{-\frac{1}{\epsilon\left(\mathbf{s}^Q\right)-1}} \frac{w^{\male}+w^{\female}+y+t}{X\left(w^{\female},w^{\male},\mu\right)} \left[g\left(w^{\female},w^{\male}\right)\right]^{\frac{-\epsilon\left(\mathbf{s}^Q\right)}{\epsilon\left(\mathbf{s}^Q\right)-1}} \left[-\frac{\mu}{\left(w^{\male}\right)^{\beta^{\male}}} \alpha_2^{\male} \ln w^{\male} - \frac{(1-\mu)}{\left(w^{\female}\right)^{\beta^{\female}}} \alpha_2^{\female} \ln w^{\female} \right] \tag{28}$$

To take the parametric specification to the data, a functional form is needed for the bargaining power. In addition, preference shifters, production shifters, and distribution factors have to be defined. Following Browning et al. (2013) and Cherchye et al. (2012), I define a parametric structure for the bargaining power that uses a simple logistic form that assures that it lies between zero and one:

$$\mu\left(w^{\female},w^{\male},y,t,v,\mathbf{z}\right) = \frac{e^{\left(\Lambda_1+\Lambda_2\frac{w^{\male}}{w^{\female}}+\Lambda_3 y+\Lambda_4 v+\Lambda_5 t+\Lambda_6'\mathbf{z}\right)}}{1+e^{\left(\Lambda_1+\Lambda_2\frac{w^{\male}}{w^{\female}}+\Lambda_3 y+\Lambda_4 v+\Lambda_5 t+\Lambda_6'\mathbf{z}\right)}} \tag{29}$$

Then, the preference shifters are chosen to be a function of age only, and take the following form: $\alpha_1^i(\mathbf{d}^i) = \alpha_{10}^i + \alpha_{11}^i age^i$ for $(i = ♀, ♂)$. I use the number of children, children's average age, and violence as production shifters for the home good: $\epsilon\left(\mathbf{s}^Q\right) = \epsilon_0^Q + \epsilon_1^Q children + \epsilon_2^Q mean\ children\ age + \epsilon_3^Q violence$. Finally, I consider four distribution factors: difference in the ages of the spouses, probability of receiving the cash transfer, husband's share of household assets and violence.

In order to take into consideration the potential effect of the transfer on violence, I will re-estimate the model with an additional equation that characterizes violence as: $v = \delta_1 + \delta_2 t + \delta_3 v_0 + \delta_5 v_{neighborhood} + \delta_5 \frac{w^♂}{w^♀} + \delta_6 y$, where t is the probability of receiving the transfer, v_0 is the baseline level of violence and $v_{neighborhood}$ is the frequency of domestic violence in the neighborhood.[14]

Estimation Strategy

The model consists of a system of seven equations (Equations (9), (26), (27) and (28)) that characterize $\left(l^♂, c^♂, l^♀, c^♀, h^♂, h^♀, c^Q\right)$ as observable functions of $\left(w^♂, w^♀, y, t, v, \mathbf{z}, \mathbf{s}\right)$. To account for unobservable heterogeneity across households, I include additive error terms to the system of equations. The model is estimated via Feasible Generalized Non Linear Least Squares (FGNLS) estimator. It is assumed that errors are correlated across equations. In this context, the covariance matrix of the model is defined as:

$$\Omega = \Psi \otimes I \tag{30}$$

where Ψ is the 7×7 covariance matrix[15] of the nth observation. The covariance matrix Ψ is unknown and therefore it has to be estimated. Following Greene (2018), the procedure for estimating Ψ is as follows:

- First, I run the Non Linear Least Squares estimator (i.e. the weighting matrix of the sum of square errors is chosen to be the identity matrix I).
- Second, I use the resulting residuals to estimate an empirical covariance matrix S.
- Lastly, I minimize the weighted sum of squared errors, where the weight is given by S, which is a consistent estimate of Ψ.

[14] Results from this alternative specification are available in Appendix.

[15] In the case of the alternative specification, Ψ will be a 8×8 covariance matrix as there is an additional equation for violence.

As the set of equations that comprise the structural collective model is highly nonlinear, there is no closed-form solution for the gradient of the nonlinear conditional mean function with respect to the parameters (called pseudo-regressors), which appear in the first-order condition for minimizing the sum of squares. Consequently, I use a numerical solver to estimate the parameters. The solver was run with multiple random initial values.[16]

Following Cherchye et al. (2012), a sufficient condition for a theoretically consistent first-stage allocation is that the parameters α_2^i in the function $\ln a^i\left(w^i; \bar{u}^Q\right)$ for $(i = ♀, ♂)$ are negative. Therefore, during the numerical solving this condition is implemented by using $\alpha_2^i = -e^{\left(\tilde{\alpha}_2^i\right)}$, with $\tilde{\alpha}_2^i$ estimated. The remaining set of parameters are able to move freely within large bounds. The results from the best local optimum found are reported.[17]

Sample

For the model estimation, I use a sample of the randomized intervention database. The data are particularly suitable to estimate this colletive model because they contain expenditure information that allows me to generate both private consumption at the individual level and public consumption. This is important for the exact identification of the model. The sample for the estimation of the structural model includes households with two adult members (one man and one woman), with and without children. As wages are the only source of price variation, I select those couples for which both members are in the labor market, earn a positive wage, and where there is information about time allocation. For these households, I use a consumption-based measure of total non-labor income, i.e. non-labor income equals reported consumption expenditures (private and public expenses) minus total household earnings. This approach reduces measurement error and accounts for different sources of unobserved wealth that are important for individual decisions (see Blundell and Walker 1986; Blundell et al. 2007).[18] The final sample consist of 276 households. Although this is a relatively small sample, results suggest that it is sufficient to recover the underlying parameters of the model with a reasonable level of precision.

[16]The covariance matrix associated with FGNLS makes use of so-called pseudo-regressors that involve derivatives of the regression function with respect to the parameters. Applying the methodology of Goldfeldt and Quandt these derivatives were numerically calculated. There is possibility for approximation error given our the highly nonlinear nature of the system of equations in which the parameters appear simultaneously in different terms (see Greene, 2018).

[17]I selected the lowest local minimum found. I also performed several robustness checks with the parameter values from the other minima found. The obtained results show a picture that is qualitatively similar to the one reported here.

[18]In the calculation of non-labor income, I have also subtracted the transfer received from the program since this is an important variable in the present analysis and it is necessary to separate it from the other non-labor income.

5 Estimation Results

The estimated parameters of the structural model are displayed in Table (1). Despite the fact of having a relative small sample, most of the parameters are precisely estimated.[19] The majority of estimated coefficients display an expected sign. Leisure turns out to be a luxury good for both husband and wife given the positive estimated values for $\beta^{\male}$ and $\beta^{\female}$.

Table 1: Structural Estimation Results

	Parameter	Coefficient	S.E.
Preference Parameters	$\alpha_{10}^{\male}$	0.784***	(0.031)
	$\alpha_{11}^{\male}\left[age^{\male}/10\right]$	-0.018**	(0.007)
	$\alpha_{2}^{\male}\left[\bar{u}^{Q}\right]$	-1.369***	(0.058)
	$\beta^{\male}$	0.120***	(0.013)
	$\alpha_{10}^{\female}$	0.735**	(0.031)
	$\alpha_{11}^{\female}\left[age^{\female}/10\right]$	-0.010	(0.007)
	$\alpha_{2}^{\female}\left[\bar{u}^{Q}\right]$	-1.672***	(0.078)
	$\beta^{\female}$	0.100***	(0.023)
Home Production Parameters	κ	-0.379**	(0.125)
	γ_1	0.260***	(0.009)
	γ_2	0.449***	(0.015)
	γ_3	0.291***	(0.010)
	ϵ_0^Q	0.022***	(0.000)
	ϵ_1^Q[children]	0.063***	(0.000)
	ϵ_2^Q[mean children age]	-0.013***	(0.000)
	ϵ_3^Q[violence]	0.032***	(0.000)
Bargaining Power Parameters	Λ_1	-1.176***	(0.092)
	$\Lambda_2\left[w^{\male}/w^{\female}\right]$	1.000***	(0.041)
	$\Lambda_3\left[y\right]$	0.037***	(0.010)
	$\Lambda_4\left[age^{\male} - age^{\female}/10\right]$	0.336**	(0.162)
	Λ_5[violence]	1.063***	(0.115)
	Λ_6[probability of receiving transfer]	-0.100*	(0.051)
	Λ_7[husband's share of household assets]	0.000***	(0.000)

Notes: The table shows the estimated parameters obtained by the Feasible Generalized Non Linear Least Squares (FGNLS) estimator using the data from the random control trail transfer program. The expressions in brackets refer to the objects that are related to the respective parameters. Standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

From Table (1), we can also observe that the domestic good has a significant impact on

[19] With the exception of one parameter, the rest are all statistically significant at 10% 5% and 1% levels.

husbands and wives leisure and consumption since the estimates for $\alpha_2^{\male}$ and $\alpha_2^{\female}$ are both statistically significant. As expected, the signs of these coefficients is negative. This implies that for working couples participating in the transfer program implemented in Ecuador, the output of the household production process is non-separable from the individual trade-off between leisure and consumption. In terms of the home production technology, one extra time unit spent on home production by the mother is far more productive than one extra time unit spent on home production by the father (the parameter γ_2 is considerable larger than γ_1).

Model results also show that the number of children, the average age of children and the level of intra-household violence significantly affect the production of the domestic good u^Q. This is particularly important in the present framework as the identification strategy requires at least one statistically significant production shifter.

Finally, consider the parameters that influence the Pareto weight.[20] The results in Table (1) indicate that the bargaining power is significantly affected by the husband's relative wage, non-labor income of the household and the age difference between the husband and the wife. Further, the probability of receiving the transfer, the transfer share in non-labor income as well as the intra-household violence all have statistically significant effects on husband's bargaining weight.

These parameters have the expected signs and show that the probability of receiving the transfer reduces the husband's bargaining power whereas inflicting violence increases the husband's bargaining power. The significance of the parameters that influence the Pareto weight is useful for the identification strategy, which requires at least one statistically significant distribution factor. Therefore, the estimated model fulfills the necessary conditions for identification.Therefore, the estimated model fulfills the necessary conditions for identification. In Table (A.5), I present an alternative specification that takes into consideration the potential effect of the transfer on violence. The estimated parameters are similar to the initial specification. In terms of the additional estimated parameter, the results indicate that after controlling for the baseline level of violence, the probability of receiving the transfer significantly affects the level of violence. Also, the level of intimate partner violence is significantly affected by the husband's relative wage and non-labor income of the household. On the other hand, the frequency of domestic violence in the neighborhood does not affect the level of violence.

The estimated parameters of the structural model allow one to perform an analysis of individual level poverty and inequality, which is the main goal of this paper. However, before

[20]Recall that the Pareto weight (μ) in this model specification represents the husband's bargaining power

proceeding with this exercise, it is worth investigating whether there are some patterns of specialization in these households. When market wages differ between spouses, intra-household specialization could emerge. This will show the effects of changes in available household income on the allocation decisions of each adult member. Therefore, I perform a simulation together with a graphical analysis to show the impact of a change in each of the adult household members' wages on the optimal allocations of the household members' time and consumption.

5.1 Simulation: Patterns of Within-household Specialization

Within-household specialization implies that couples follow a cooperative household-level strategy in which they divide labor to maximize household well-being. In this context, each partner devotes more time in the activities in which he or she has a comparative advantage. This could have important effects on the well-being of individuals. To investigate whether the households under study tend to behave in this manner, I evaluate how the choice variables vary with changes in husbands' and wives' wages. In this exercise, I consider an average beneficiary household that experience average violence. I use a graphical analysis to explain the how these changes affect the choice variables of the intra-household model.[21] It is important to acknowledge that the outcomes of the different comparative static exercises will be the result of the interaction between individual preferences, the home production process, and the intra-household bargaining power.

Effects of a Change in Husband's Wages

To analyze the impact of a change in the husband's wage on the dependent variables, I select wage changes in a range from the first decile to the tenth decile of the husband's wage distribution. The remaining independent variables are fixed at their means (including the wife's wage). Figure (A.5) has two panels that portray husbands' and wives' time allocations to the labor market and to leisure activities. As the wage increases, husband's time spent on labor market activities increases. This suggests that the substitution effect dominates the income effect. At the same time, there is a decrease in the amount of time the husband allocates to leisure activities.On the other hand, turning to the wife's time allocation decisions to the same activities, as the husband's wage increase, her time spent in the labor market decreases and her time spent in leisure activities increases. The two panels of Figure (A.6) show the time allocation to housework activities, expenditures on the domestic good, and the

[21]The complex structure of the model does not allow me to straightforwardly interpret the magnitudes and effects of parametric changes.

production of the home good. The husband's time spent on housework activities decreases when his wage increases, while the wife's time spent in housework activities increases, as does the household's expenditures on the domestic good. The decrease in the husband's time spent on housework activities is compensated for by the rise in the wife's time spent on housework and expenditures on the domestic good, which leads to an overall increase in the production of home good.

In Figure (A.7), the two panels show the private consumption of each adult member as well as the distribution factors and the husband's bargaining power. It turns out that the husband's and wife's own private consumption experience an increase when the husband's wage rises, however, the increase in consumption for the husband is more pronounced than for the wife. These results exemplify the trade-off between own consumption, and at the same time leisure and the utility derived from the domestic good. Since husband supplies more hours to the labor market and the wife allocates more hours to housework and leisure activities, the couple follows a pattern of specialization. As the husband's wages start to increase, the opportunity cost of devoting time to housework activities increases. In this context, the husband's income begins to represent a larger fraction of family income. This translates in higher husband's bargaining power and allows for larger substitution of husband housework time with purchased market inputs as well as wife's housework time. As the husband work more hours there is a rise in income. Some of this income is spent on the inputs for the home produced good, while the residual is allocated to both adult members private consumption. Since the increase in husband's wage implies an increase in his bargaining power, the increase in private consumption benefits the husband more, a phenomenon that can also be seen from the behavior of distribution factors in panel (b) of Figure (A.7).

In order to complement the simulation results, I estimate labor supply elasticities defined at the sample median for husbands and wives. Table (A.7) shows that the husband's own wage elasticity is positive, whereas the wife's cross wage elasticity is negative. Finally, the husband's labor supply elasticity with respect to non-labor income is positive.

Effects of a Change in Wife's Wages

In Figure (A.8), results show that an increase in the wife's wage result in an increase of her leisure initially, followed by a slight decrease in the upper part of the wage distribution. An opposite pattern is observed when we look at the allocation of time in the labor market. When the wife's wage is low, the wife's time spent on the labor market declines as her wage rises from the low part of the wage distribution, after which it increases as her wage reaches the upper portion of the wage distribution. In this case the income effect dominates the

substitution effect in the lower part of the wage distribution, where the reverse effect takes place in the upper portion of the wage distribution. At the same time, there is an initial increase of husband's time spent on the labor market, followed by a slight decrease in the last part of the wage distribution. On the other hand, the effect of an increase in the wife's wage on the husband's allocation of time to leisure, is initially negative, followed by a slight increase in the higher portion of the wage distribution.

Figure (A.9) shows what happens to the inputs for home good production good as well as the level of home good from an increase in the wife's wage. The wife's time spent on housework activities decreases when her wage increases, while the husband's time spent on housework activities slightly increases, and the household's expenditures on the domestic good also increase. The decrease in the wife's time spent on housework activities is mainly compensated for by the increased expenditures on the domestic good, which leads to an overall increase in the production of the home good.

When the wife's wages are low, she needs to reduce leisure and allocate more hours to the labor market as well as to housework activities. When her wages start to rise, but are still in the low portion of the wage distribution, the couple household is specialized. Based on comparative advantage, the wife devotes more time to housework activities, and devotes less time to paid employment. As the wife's wages keep increasing, her opportunity cost of devoting time to housework activities or leisure rather than to the labor market starts to increase. This increment in the wife's wages therefore raise the couple's opportunity cost of the home good. This situation makes the wife willing to change her time allocation, so that she devotes less hours to housework activities and more hours to the labor market. The male time devoted to paid employment initially increases as well, and then slightly decreases. This is due to the availability of additional resources for the purchase of the market input of home production due to the fact that the wife is devoting more hours to the labor market, which allows the husband to substitute some labor for leisure.

The two panels of Figure (A.10) show the patterns of private consumption, as well as the distribution factors and husband's bargaining power over the wife's wage distribution. Panel (a) shows that a rise in the wife's wage implies an increase in both spouses' private consumption, however the slopes are different. When wife's wage is low, private consumption of the husband is higher than of the wife. As wife's wages start to rise, her private consumption overtakes the husband's private consumption and ends up being much more in favor of the wife in the upper portion of the wage distribution. Panel (b), shows how increases in the wife's wage translate into a decrease in the husband's bargaining power. This situation plays an important role in the increase in wife's private consumption, a situation that can also be seen from the behavior of sharing factors.

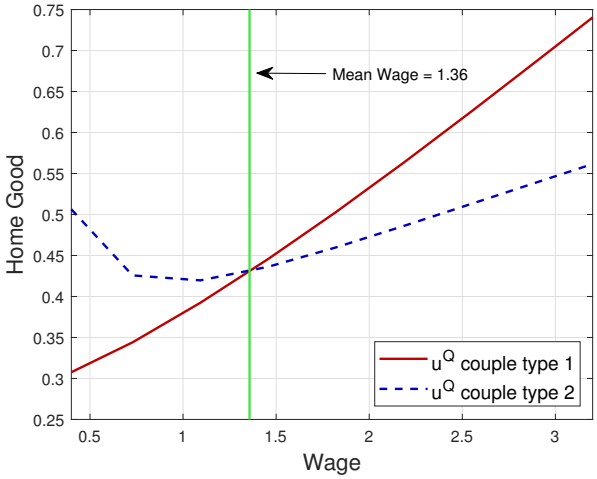
It is important to note that when the wife's wages are low, the husband will have more bargaining power and will influence more strongly the allocation of resources. As wife's wage start to increase, the household has more income and at the same time the wife has more bargaining power to influence the intra-household allocation of resources. Consequently, the model suggests that when wife's wages are low and start rising, higher opportunity costs become an important driver of the female time allocation decisions. In this context, the income effect is dominated by the substitution effect, and therefore the woman allocates less hours to housework activities. Again, to complement the simulation results, I estimate labor supply elasticities defined at the sample median. Table (A.7) shows that the wife's own wage elasticity and husband's cross wage elasticity are both positive. Finally, the wife's non-labor income elasticity is positive.

Comparing the Change in Wages on the Production of Home Good

To further examine household specialization, it is useful to compare whether is more beneficial for the production of home good increase in the wage of one of the adult member than an increase in the wage of the other. For the comparison, I consider an average household in which there is violence and is a beneficiary of the cash transfer. This exercise investigates whether better labor opportunities (in terms of better wages) for one adult member of the household are more likely to increase the production of the domestic good than better opportunities to the other member.

In Figure (1),the continuous red line displays a scenario of a couple where the wife's wage is fixed to the average wage and the wage of the husband moves over the distribution. Similarly, the blue dotted line represents a scenario in which the husband's wage is fixed to the average wage and the wage of the wife move over the wage distribution. Consider what happens in cases below the average wage. Starting at a point below the average wage (say 1 dollar), the first scenario (continuous red line) corresponds to situation in which the wage of the wife is fixed to the average wage (1.36 dollars) and the husband's wage is 1 dollar. The second scenario (dotted blue line) corresponds to a situation in which the wage of the husband is fixed to the average wage (1.36 dollars) and the wife's wage is 1 dollar. So, for each point the comparison concerns a situation in which one of the adult household members earns more than the other. Figure (1) suggests that home good production is higher in the second scenario. This implies that higher wages for husbands has a larger impact in terms of producing a higher amount of the home good. A similar conclusion holds when comparing couples where the husband has a higher than average wage with a couple where the wife has a higher than average wage. This corroborates the existence of patterns of specialization.

Figure 1: Comparison of Wage Changes



Notes: The figure shows a comparison of two scenarios. The first scenario (represented by the red continuous line) characterize a situation in which the wife's wage is fixed to the average wage of the overall sample and the husband wage move over the wage distribution. On the other hand, the second scenario (represented by the blue dotted line) characterize a situation in which the husband's wage is fixed to the average wage of the overall sample and the wife wage move over the wage distribution. The wage increments go from the first decile to the tenth decile of the overall wage distribution, while keeping the other explanatory variables constant at their corresponding means.

It is important to acknowledge that the overall effect of changes on wages of adult household members on the production of the home good is the result of the interplay between the intra-household bargaining power, adult member preferences, and the home production process. When there is a change in wages, the bargaining power increases in favor of the household member that experienced the wage increase. Since there is disagreement in preferences, an increase in the bargaining power induced by higher wages results in household choices that are more in line with the preferences of the member with higher bargaining power. Nevertheless, the effect will be contingent on the husband's and the wife's preferences and how they value the home good. There is a clear trade-off of inputs of production. A higher wage increases the opportunity cost of supplying hours to home production. This will shift the intra-household allocation of hours. At the same time, the household receives more income and can increase the expenditure on the market acquired input. Whether higher wages for husbands or wives has positive effect on the production of the home good is determined by the size and direction of the aforementioned mechanisms.

The Role of Violence and Transfers on the Production of Home Good

Recall that in the model transfers will affect the relative power among household members and the non-labor income component of household resources, whereas violence will affect the

home good production technology as well as the Pareto weight. Figure (A.11) shows that the level of home good is negatively affected by violence and positively affected by transfers and wages. An increase of 10 percent in the violence index could lead to a 3.3 percentage points reduction in the home good. On the other hand, receiving a transfer could increase the production of the home good by 1.7 percentage points.

5.2 Marginal Willingness to Pay for the Home Good

The previous section showed how the production of the home good crucially depends on the husband's and wife's preferences, as well as the available income. The estimation results indicate that spouses have different preferences. Therefore, it is interesting to know whether individual marginal willingness to pay for the home good differs among wives and husbands. Recall the first stage of the allocation process. From the first order conditions of this problem it is possible to obtain:

$$\frac{\partial v^{♂}/\partial \bar{u}^{Q}}{\partial v^{♂}/\partial \rho^{♂}} + \frac{\partial v^{♀}/\partial \bar{u}^{Q}}{\partial v^{♀}/\partial \rho^{♀}} = g\left(w^{♀}, w^{♂}\right) \tag{31}$$

this is a standard Bowen-Lindahl-Samuelson condition for the optimal provision of public good within the household. The left-hand side of Equation (31) is the sum of husband's and wife's marginal rates of substitution between the domestic good and the private good, while the right-hand side gives the price ratio for the two goods.[22] Equation (31) provides the expression for obtaining the individual marginal willingness to pay (MWP) for the public good. If we insert Equations (23) and (24) in Equation (25), the Bowen-Lindahl-Samuelson condition can be rewritten as:

$$\frac{-\alpha_2^{♂}\left(w^{♂} + \rho^{♂}\right)\ln w^{♂}}{\bar{u}^{Q}} + \frac{-\alpha_2^{♀}\left(w^{♀} + \rho^{♀}\right)\ln w^{♀}}{\bar{u}^{Q}} = g\left(w^{♀}, w^{♂}\right) \tag{32}$$

where the individual MWP for $(i = ♀, ♂)$ equals:

$$MWP^{i} = \frac{-\alpha_2^{i}\left(w^{i} + \rho^{i}\right)\ln w^{i}/\bar{u}^{Q}}{g\left(w^{♀}, w^{♂}\right)} \tag{33}$$

This represents the maximum amount each adult member would be willing to pay to acquire an additional unit of public good, if the amount was to be withdrawn from each individual consumption of the private good. Using the estimated parameters of the intra-household bargaining model, I calculate the husband's and wife's MWP for the home good. Table

[22] Recall that the price of the private good has been normalized to one.

(2) show the results of the average MWP for the home good for each adult member in the household.

Table 2: Husband and Wife Marginal Willingness to Pay (MWP)

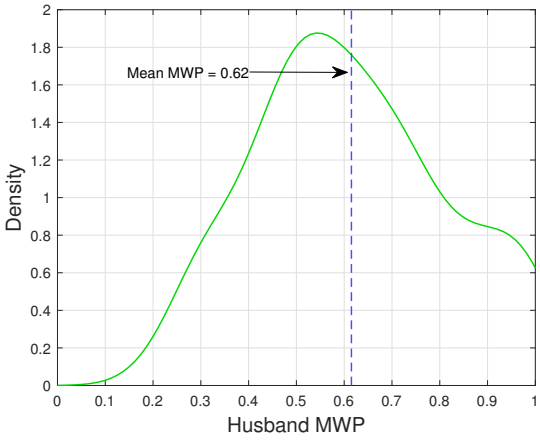
	$MWP^{\male}$	$MWP^{\female}$	Difference [p-value]
	0.615	0.385	0.230***
	(0.012)	(0.012)	[0.000]
Observations	276	276	552

Notes: The table presents the average marginal willingness to pay for the public good for each member of the couple as well as the difference between husband and wife. Standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

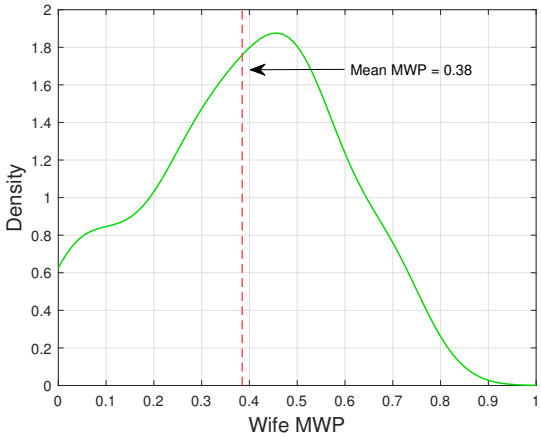
Table (2) shows the results of the calculations of individual average MWP for the home good. The average MWP is higher for men and the difference between men's and women's MWP is statistically different from zero at 1 percent level of significance. In Figure (2), I show the distribution of the husband's and wife's MWP. Clearly, the plot for women is a mirror graph of that of men. We can observe that there is variation in the individual MWP of women and men, with more mass to the left of 0.5 for husbands and correspondingly with more mass to the right of 0.5 for wives.

Figure 2: Individual Marginal Willingness to Pay for the Public Good

(a) Husband Marginal Willingness to Pay



(b) Wife Marginal Willingness to Pay



Notes: The figure shows the distribution of the marginal willingness to pay for husbands and wives.

Table (A.8) shows the average MWP for the home good disaggregated by type of household. There four types of household depending whether there is intimate partner violence and whether they receive the cash transfer. In all the cases, the average MWP is higher for

husbands, and all these differences are statistically significant. The results show that the highest difference in the MWP among adult members is in household where there are no transfers and there exists intimate partner violence.

Each adult member's marginal willingness to pay for the home good consists of a combination of parameters related to preferences, and to income and prices. Therefore, the difference in MWP between the husband and the wife can be disentangled in the contribution of preferences, on the one hand, and the contribution of elements related to income and prices on the other. This difference in MWP between the husband and the wife (scaled by the level of the home good) can be expressed as:

$$\Delta_{MWP} \times \bar{u}^{Q} = \Delta_{|\alpha_2^i|} \frac{\sum\limits_{i=\male,\female} (w^i + \rho^i) \ln w^i}{2 \times g\left(w^{\female}, w^{\male}\right)} + \Delta_{(w^i+\rho^i)\ln w^i} \frac{\sum\limits_{i=\male,\female} |\alpha_2^i|}{2 \times g\left(w^{\female}, w^{\male}\right)} \tag{34}$$

In equation (34), any Δ_y represents the difference between husband's and wife's elements and is given by $\Delta_y = y^{\male} - y^{\female}$. Using Equation (34), the magnitude of the contribution of the preferences, and income and prices to the difference in the adult member's MWP for the home good, can be obtained by taking the absolute value of the first and second term, respectively.

Table 3: Decomposition of the Contributions to the Marginal Willingness to Pay

	Preferences	Income and Prices
	0.399	0.601
	(0.013)	(0.013)
Observations	276	276

Notes: The table presents the decomposition of the marginal willingness to pay for the home good among preference component and income and prices component .

Table (3) provides the results from the decomposition calculations. On average, 40 percent of the difference in MWP for the home good among spouses is explained by the difference in the preference parameters, while 60 percent is explained by differences in income and prices.

6 Implications for Poverty and Inequality

Standard poverty measures in developing countries typically use per-capita calculations as an approximation to quantify poverty. This approach ignores the intra-household distribution of resources, the gains from joint consumption and the potential inequality among household members. In this section, I calculate the share of total resources allocated to each member of

the household resulting from the estimation of the intra-household collective model. These resource shares are used to compute individual poverty rates for adult household members, as well as indices of inequality.

6.1 Poverty

First, I calculate the poverty rate in the typical way, i.e. the poverty rate is defined as the percentage of population whose income falls below the poverty line, which is defined as 60 percent of the median full income in the sample of households used in this study. This approach ignores intra-household inequalities. This is a standard measure of relative poverty.[23] Also, the data set consists of couples where both spouses participate in the labor market, and so the poverty line will be higher than a line based on data that includes households containing an unemployed, retired or disabled spouse. In this framework, children are taken into consideration in the domestically produced good.[24] To make total household income comparable across approaches, it is assumed that each adult within the household amounts to one equivalent adult.

The second approach is based on a linear consumption technology a la Barten. This approach is commonly used in standard collective household models, which estimates economies of scales by a linear consumption technology (see Dunbar et al. 2013; Lewbel and Pendakur 2008). I evaluate individual income by assigning to each member half of the expenditures on the home-produced public good. This technology, together with Pareto efficiency assumption implies that both members have the same willingness to pay (shadow price) for the home-produced good. The implication in terms of calculation of incomes is that shared consumption of the home-produced good contributes the same to the individual income of both adult members.

The third approach allows individuals to have different willingness to pay for the home-produced good. This implies that each adult member values joint consumption differently. We can express each of the approaches as:

$$\begin{aligned} Y_1^i &= \frac{c^{\female} + c^{\male} + g\left(w^{\female}, w^{\male}\right) u^Q}{2} \\ Y_2^i &= c^i + 0.5 \times \left[g\left(w^{\female}, w^{\male}\right) u^Q\right] \\ Y_3^i &= c^i + MWP^i \times \left[g\left(w^{\female}, w^{\male}\right) u^Q\right] \end{aligned} \tag{35}$$

[23] This type of measure is used in the definition of OECD poverty rates.

[24] Children's welfare then acts as a public good, which is characterized as a domestic good that is produced by means of expenditures on children and parental time invested in children.

for ($i = ♀, ♂$). The distribution of income for husbands and wives using these three measures is displayed in Equation (A.12).Using these income measures, Table (4) presents the of incidence of poverty disaggregated for husbands and wives.

Table 4: Individual Poverty

	Equivalence scales	Equal prices	Individual prices
Global	0.326	0.322	0.428
Husband [♂]	0.326	0.329	0.308
Wife [♀]	0.326	0.315	0.547
Difference	-	0.014	0.239***
Husband Contribution (%)	50.00	51.12	36.02
Wife Contribution (%)	50.00	48.88	63.98
Observations	552	552	552

Notes: This table shows the incidence of poverty at the individual level. These indicators are constructed using the income definitions on Equation 35 and the model estimates obtained from the structural model. An individual is characterized as poor if her/his income share falls below the individual poverty line.

Using equivalence scales to measure poverty, by definition ignores within-household inequalities, and therefore there is no difference among husbands and wives in the level of poverty. Using the second approach (a la Barten), the level of poverty is 1.4 percentage points higher for husbands than for wives, however this difference is not statistically significant. This calculation is based on the assumption of equal marginal willingness to pay for the home good for the two adult members. Table (2) showed that MWP for the home good for husbands was higher than for wives.[25] In the last column of Table (4), I take into consideration this difference by applying individual prices when calculating the incidence of poverty. Results show that ignoring the marginal willingness to pay for the home good among adult household members could have important effects on the estimation of poverty. Accounting for the heterogeneity in the MWP shows that women are substantially poorer than men. Poverty is more than 23 percentage points higher for wives than for husbands under this approach..

Disaggregation of poverty rates by type of household is presented in Table (A.10). Results suggest important variability in the measures of poverty among the different types of households. Differences among wives and husband individual poverty are statistically significant in all types of households. The larger difference in poverty rates between men and women appear to be in households that do not receive the transfers and where there is violence.

[25]This means that men are more likely to exchange one unit of their own private consumption in order to produce and additional unit of home-produced public good. This respond to the fact that men face different shadow prices and have more income than women, and therefore they are able to consume more of the public good.

In this type of household, poverty is about 30 percentage points higher for wives than for husbands. I also find that households where there is intimate partner violence exhibit larger gender poverty gaps (between 29 and 30 percentage points) compared to households where there is no violence (between 15 to 28 percentage points). Furthermore, transfers are more effective in mitigating this gender gap on households where there is no violence (around 13 percentage points gap reduction).

These results suggest that the policy intervention generated welfare gains in terms of reducing overall and individual poverty. However, these welfare gains are heterogeneous among the different types of households. Particularly, Table (A.10) shows that transfers are effective in reducing the gender poverty gap mainly in households where there is no violence. Using the estimated parameter from the second specification that takes into consideration the potential effect of the transfer on violence provides similar results, however the magnitude of the effects are somewhat different (see Table (A.11)). The results are similar as in the baseline model–transfers are effective in reducing the gender poverty gap mainly in households where there is no violence, however, the magnitude of the reduction is around 10 percentage points in this case.

Clearly, the transfer increases the available resources within the household. Under a scenario with transfers and without violence, there is an increase in the bargaining power of the woman, allowing her to align household allocations with her preferences. Since there is no violence, the increase of the woman's consumption is larger than the increase in man's consumption. Therefore, households of this type experience a larger reduction on women's incidence of poverty and a reduction in the gender poverty gap compared to households with no violence and without transfers. On the other hand, in a scenario with transfers and with violence, there is an increase in the bargaining power of the man, allowing him to align household allocations with his preferences. This increase in the man's bargaining power could be partially offset by the transfer. Moreover, when there is violence the man could appropriate partially or fully the additional resources coming from the transfer. The results indicate that in households with transfers and violence, the increase in the woman's consumption is very small compared to the increase the man's consumption. Therefore, the man takes most of the additional resources. Consequently, households of this type do not experience a reduction in women's incidence of poverty and the reduction in the gender poverty gap is minimal (or even increases) compared to households with violence and without transfers.

Therefore, in terms of policy implications, governments aiming in improving the well-being of women should take into consideration the potential factors that could make these types of programs unsuccessful and complement the policy interventions with mechanisms that

Table 5: Measures of Income Inequality

	Equivalence scales	Equal prices	Individual prices
	0.367	0.368	0.454
Observations	552	552	552

Notes: This table shows the level of inequality measured by the Gini coefficient. These indicators are constructed using the income definitions on Equation 35 and the model estimates obtained from the structural model.

account for these perverse factors that reduce the effectiveness of the program. These could be done by introducing simple questions that reveal the presence of intimate partner violence in the surveys used to classify potential beneficiaries of the program.

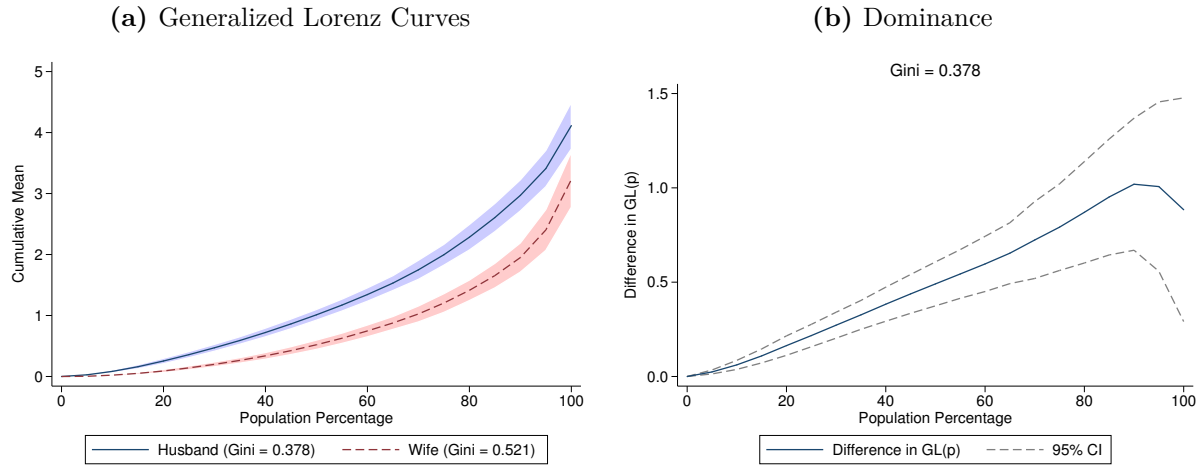
6.2 Inequality

The results in the previous section suggested differences in individual income among husbands and wives on the different types of households. This situation could have effects on the measurement of inequality. The level of income inequality is calculated using the Gini index and concentration curves.[26] Table (5) reports the Gini index for the sample of the model for the different income measures.

Taking into consideration differences in individual MWP in the measurement of income turns out to have an important effect on the level of income inequality. Comparing the three measures, income inequality is highest under the individual prices' methodology, with a Gini index of 0.454. This represents a difference of more than 8 points relative to the other methodologies.

[26] These are widely used tools for the analysis of economic inequality and redistribution.

Figure 3: Generalized Lorenz Curves by Adult Household Members



Notes: The figure shows generalized Lorenz curves for husbands and wives for the measures of individual income that takes into consideration individual prices (different MWP).

Next, I analyze inequality using the income definition under the third methodology (individual prices). Using this measure, I compare inequality between husbands and wives. Figure (3) shows the generalized Lorenz curves for wives and husbands using the third measure of income. These curves represent the relationship between the cumulative individual income and the proportion of population, where individuals are ordered in ascending order of income. I observe that the generalized Lorenz curve of husbands under equal prices is always above the curve for wives. To evaluate welfare ordering, it is useful to analyze generalized Lorenz dominance. In the panel (b) of Figure (3), I evaluate whether one distribution dominates the other. It is very clear from the plot, that the income distribution of husbands generalized Lorenz dominates the income distribution of wives.

I have also calculated measure of inequality for the different types of households. Results in Table (A.12) suggest that, under individual prices, households that do not receive the transfer and have partner violence exhibit the highest overall income inequality (an income Gini coefficient of 0.469).[27] Finally, in Figure (A.13), I plot generalized Lorenz curves for husbands and wives in the different households. In all cases the generalized Lorenz curve of husbands (under individual prices) is above the curve for wives. This implies that in all the different types of households women's income inequality is higher compared to men's income inequality. Moreover, Figure (A.13) suggest that: (i) households that receive the transfer exhibit lower levels of women's inequality, (ii) households that receive the transfers and have violence show higher levels of women inequality compared to the households that receive the

[27]Using the other measures of income shows a similar result, although with different magnitudes (Gini index of 0.388 and 0.389, respectively).

transfer and have no violence, and (iii) households that do not receive the transfer and have no violence exhibit almost the same levels of women inequality compared to the households that do not receive the transfer and have violence.

6.3 Indifference Scales

Indifference scales measure how much income an individual living alone needs to have in order to be as well off as when living with a couple with some given household income. Since the utility level of the same individual is compared for two different living arrangements, indifference scales are not affected by the particular cardinal representation of the individual preferences. Thus, they do not involve any interpersonal utility comparisons. Naturally, one needs to assume that individual preferences do not change when moving from one living arrangement to another.

The first type of indifference scales follows Browning et al. (2013) and Cherchye et al. (2012). In the calculation of this type of indifference scale, it is assumed that home production technology is the same in the two living arrangements, time inputs of the partner become zero when living alone and there is no restriction on the level of the home-produced good in the new state. Then, indifference scales are given by:

$$is^{♂}_{type1} = \frac{\min_{c^{♂*},c^{Q*},l^{♂*},h^{♂*}} \left(\begin{array}{c} c^{♂*} + c^{Q*} + w^{♂}\left(l^{♂*} + h^{♂*}\right) \\ s.t. \quad u^{♂}\left(c^{♂*}, l^{♂*}, u^{Q}\left(c^{Q*}, h^{♂*}, 0\right)\right) = u^{♂}\left(c^{♂}, l^{♂}, u^{Q}\left(c^{Q}, h^{♂}, h^{♀}\right)\right) \end{array} \right)}{w^{♀} + w^{♂} + y + t} \tag{36}$$

$$is^{♀}_{type1} = \frac{\min_{c^{♀*},c^{Q*},l^{♀*},h^{♀*}} \left(\begin{array}{c} c^{♀*} + c^{Q*} + w^{♀}\left(l^{♀*} + h^{♀*}\right) \\ s.t. \quad u^{♀}\left(c^{♀*}, l^{♀*}, u^{Q}\left(c^{Q*}, 0, h^{♀*}\right)\right) = u^{♀}\left(c^{♀}, l^{♀}, u^{Q}\left(c^{Q}, h^{♂}, h^{♀}\right)\right) \end{array} \right)}{w^{♀} + w^{♂} + y + t} \tag{37}$$

The numerators of Equations (36) and (37) represents the minimum expenditures needed for member ($i = ♀, ♂$) living alone to reach the same indifference curve as when they would live in a couple with the initial commodity bundle $(c^i, c^Q, l^i, h^{♂}, h^{♀})$, respectively. The denominator is equal to the couple's full income in the initial household situation. Table (6) shows numerically estimated indifference scales for different types of households.

It is important to clarify that some indifference scales are not defined. This is related to the time restriction and the dependence of individual utilities on the home-produced good that

is produced within the household. In a situation in which one partner leaves the household, the limited time that is available to the individual is not enough to produce the same level of utility—which includes the home-produced good—as in the initial scenario when the individual is within a couple. Living together allows for economies of scale, which is related to the public home good that each adult member consumes. If the economies of scale are very high the individual in the new scenario (living alone) could experience an important utility loss in any circumstance.

Table (6) shows that husband's indifference scales oscillate around 0.57 and 0.7, whereas wife's indifference scales oscillate around 0.58 and 0.68. Therefore, using this type of indifference scales, the husband would need at least about 57 percent of the initial household resources to be as well off when living alone, and the wife would need at least about 58 percent of the initial household resources to be as well off when living alone. In Table (6), it is noticeable that indifference scales increase (decrease) for wives (husbands) when a household is a beneficiary of the transfer and decreases for both adult members when there is an increase in the level of violence. This could be explained by the fact that transfers and violence shift the bargaining power of the husband and wife, which produce a reallocation in the control of resources. This together with the inherent destruction of home good, due to violence, and the fact that the transfer provides additional resources explains this heterogeneous results . Finally, it is noticeable that indifference scales increase with the household's level of full income.

Table 6: Approach 1: Indifference Scales

		No Violence		Mean Violence		3Q Violence	
		Husband [♂]	Wife [♀]	Husband [♂]	Wife [♀]	Husband [♂]	Wife [♀]
	Full Income						
	1Q	0.606	0.655	0.598	0.625	0.583	0.583
No Transfer	Median	0.619	0.669	0.610	0.634	0.592	0.592
	3Q	0.636	0.684	0.625	0.648	0.602	0.603
	1Q	0.587	–	0.580	0.682	0.566	0.602
With Transfer	Median	0.700	–	0.592	0.678	0.575	0.609
	3Q	0.656	–	0.608	0.679	0.586	0.620

Notes: Indifference scales were numerically calculated. In this case, the calculation keep the spouses' utility constant across both living arrangements. The empty cells reveal that the scale cannot be calculated without violating an individual time constraint.

The second type of indifference scales accounts for the effects of public consumption in case a couple dissolves. The calculation in this case impose some restrictions: the single spouse's

time spent on home work stays the same as in the initial situation, and a share of the initial time spent on home work by the now absent partner remains available in the new regime. Then, u^Q is maintained at the same level as in the initial situation by increasing the expenditures on the domestic goods, to compensate for the decreased time inputs of the absent partner. Assuming that production technologies are the same in the two living arrangements, indifference scales is given by:

$$is^{♂}_{type2} = \frac{\min\limits_{c^{♂*},l^{♂*}} \left(\begin{array}{cc} & c^{♂*} + c^{Q}_{u^Q} + w^{♂}\left(l^{♂*} + h^{♂}\right) + w^{♀}\left(\tau h^{♀}\right) \\ s.t. & v^{♂}\left(w^{♂}, \rho^{♂*}, u^Q\right) = v^{♂}\left(w^{♂}, \rho^{♂}, u^Q\right) \end{array} \right)}{w^{♀} + w^{♂} + y + t} \tag{38}$$

$$is^{♀}_{type2} = \frac{\min\limits_{c^{♀*},l^{♀*}} \left(\begin{array}{cc} & c^{♀*} + c^{Q}_{u^Q} + w^{♀}\left(l^{♀*} + h^{♀}\right) + w^{♂}\left(\tau h^{♂}\right) \\ s.t. & v^{♀}\left(w^{♀}, \rho^{♀*}, u^Q\right) = v^{♀}\left(w^{♀}, \rho^{♀}, u^Q\right) \end{array} \right)}{w^{♀} + w^{♂} + y + t} \tag{39}$$

In Equations (38) and (39), $c^{Q}_{u^Q}$ represents the necessary level of expenditures on the domestic goods in order to keep u^Q at the same level as in the initial situation and τ is the share of partner's time that is taken over in the new situation. Table (7) show the results of the estimates of the second type of indifference scales for the same type of households considered before.

Table 7: Approach 2: Indifference Scales

		No Violence		Mean Violence		3Q Violence	
		Husband [♂]	Wife [♀]	Husband [♂]	Wife [♀]	Husband [♂]	Wife [♀]
	Full Income						
	1Q	0.812	0.735	0.820	0.725	0.836	0.708
No Transfer	Median	0.839	0.753	0.846	0.743	0.861	0.725
	3Q	0.872	0.776	0.878	0.765	0.889	0.746
	1Q	0.796	0.749	0.804	0.739	0.820	0.722
With Transfer	Median	0.849	0.745	0.830	0.757	0.845	0.738
	3Q	0.881	0.769	0.862	0.778	0.874	0.759

Notes: : Indifference scales were numerically calculated. In this case, the calculation keep the spouses' utility as well as the output of the domestic goods constant across both living arrangements.

Recall that this type of indifference scale does not have the time constraint problem since it has been assumed a level of time spent on the domestic goods by the absent spouse. Results show that the husband needs between 80 and 89 percent of the initial household resources to be as well off as in a couple. On the other hand, women require between 71 and 78 percent

of the initial household resources to be as well off as in a couple. These numbers are larger than the numbers obtained using the first type of indifference scale. The explanation is that we here impose a constant level of the domestic goods.Results indicate that partner violence have different effects on the amount of necessary resources that husbands and wives need when leaving the partnership to be as well off as in a couple.

The intuition behind this result is that violence increases the husband's bargaining power and shifts the household allocation towards the husband's preferred allocation. At the same time, violence generates a reduction in the level of the domestic good due to the effect in the total factor productivity of the home production technology. Specifically, we observe that indifference scales for husbands (wives) increase (decrease) with violence. Receiving a transfer also has different effects on the amount of resources that husbands and wives require when leaving the partnership to be as well off as in a couple. In this case, the intuition is that transfers increase the wife's bargaining power and shift the household allocation towards the wife's preferred allocation. Simultaneously, transfers increase the amount of available resources for private and public consumption. Specifically, indifference scales increase (decrease) for wives (husbands) when the household receives a transfer. Finally, as before, indifference scales increase when there is higher household income.

7 Conclusion

In the present paper, I study how different types of households determine adult members' allocations of time and consumption. Using a collective intra-household decision making model and data from a randomized control trial intervention that provided cash transfers to families in Ecuador in 2011, I estimate the parameters of the model. My estimates show that spouses' preferences, to a large degree, depend on the consumption of the home-produced good. I also find that adult members' bargaining power is significantly influenced by individual wages, non-labor income, the probability of receiving a cash transfer, and presence of violence in the household. Further, my estimates allow me to calculate the amount of resources controlled by each individual within the household. I use three measures of income: the widely used equivalence scales measure; a measure that assumes a linear consumption technology a la Barten, and a measure that accounts for the individual marginal willingness to pay for the home good. Using this information, I provide two policy insights.

First, I conduct a poverty analysis at the individual level, and show that there is a significant difference in the level of resources that husbands and wives control among the different types of households. This translates into heterogeneity in the incidence of poverty for men and

women contingent on the type of household. The results show that women are substantially poorer than men, that households characterized by violence exhibit larger gender poverty gaps and that transfers partially reduce this gender gap. These results suggest that the policy intervention generated welfare gains in terms of reducing overall and individual poverty. However, these welfare gains are heterogeneous among the different types of households. In terms of inequality, the results indicate that income distribution is more unequal for women than for men. However, households that receive the transfer exhibit lower levels of women's inequality

Second, I estimate indifference scales for the different types of households as proposed by Browning et al. (2013). Results reveal that husbands need a higher level of resources when living alone to be as well-off as when living as a couple. This suggests that husbands had a larger share of benefit than wives when living with their wives. Moreover, the type of household affects the level of income that each partner needs when living alone. For example, I find that indifference scales for women decrease with violence and increase when the household is a beneficiary of the transfer.

Finally, further research should take into consideration two possible extensions. One will be to endogenize violence and try to understand the negative externalities in terms of utility shifts that these phenomena could cause. The other is to try to integrate non-participation in employment. This will help to improve the sample power for the analysis, especially in the context of developing countries, where a considerable number of women do not participate in the labor market.

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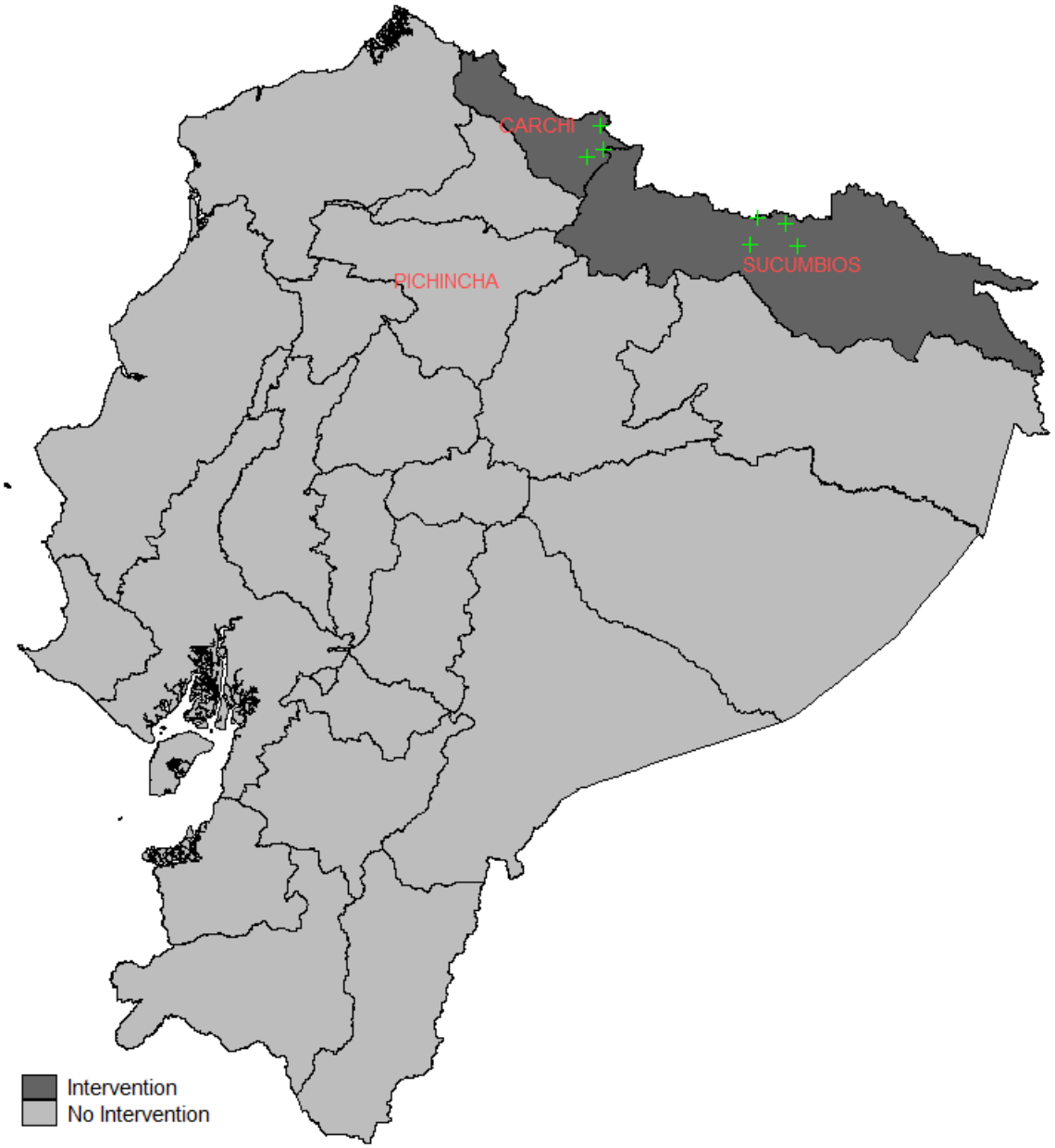
Appendix

AI. Descriptive Tables and Plots

Figure A.1: Map of Intervention Provinces



Notes: The plot shows the geographic distribution of the conditional cash transfer beneficiaries as well as the poverty rates measured via consumption and unsatisfied basic needs.

Table A.1: Descriptive Statistics of Household Characteristics by Intervention Arm

	Total Sample	Control[a]	Treatment[b]	Difference[a−b]
Male age	38.63	39.20	38.41	0.34
Female age	34.86	35.29	34.69	0.44
Couple age difference	3.77	3.91	3.72	0.70
Male hours on domestic work (day)	1.90	1.82	1.93	0.23
Female hours on domestic work (day)	7.31	7.52	7.23	0.41
Male hours on market work (day)	6.66	6.75	6.62	0.58
Female hours on market work (day)	5.22	5.68	5.05	0.13
Male wage ($ per hour)	1.65	1.74	1.61	0.55
Female wage ($ per hour)	1.60	1.29	1.72	0.35
Male private consumption	29.81	32.32	28.83	0.23
Female private consumption	30.64	32.02	30.10	0.52
Public expenditure (inc. children)	321.71	328.07	319.23	0.65
Female secondary education	0.39	0.38	0.39	0.86
Male secondary education	0.38	0.36	0.39	0.43
Married	0.42	0.42	0.43	0.82
Indigenous	0.04	0.03	0.04	0.53
Afro-Ecuadorian	0.07	0.06	0.07	0.65
Sole owner of house	0.05	0.04	0.05	0.44
No. children form 0 to 5	0.75	0.72	0.76	0.51
No. children form 6 to 15	0.92	1.02	0.87	0.05
Lifetime physical and or sexual violence	0.35	0.33	0.35	0.63
Controlling behaviors	0.17	0.17	0.17	0.87
Emotional violence	0.26	0.24	0.27	0.36
Physical and or sexual violence	0.16	0.12	0.18	0.05

Notes: The table shows a set of important characteristics of the households used for the analysis. A woman is a female head of household or spouse and similarly a men is a male head of household or spouse. P-values are reported from Wald tests on the equality of means of Treatment and Control for each variable. Standard errors are clustered at the cluster level.

AII. Reduced Form Estimates of Household Allocation Decisions

Table A.2: Estimates of the Impact of the Program over the Allocation of Time

	(1)	(2)	(3)	(4)	(5)	(6)
	Home Hours	Home Hours	Work Hours	Work Hours	Leisure Hours	Leisure Hours
	Women					
Transfer						
Any	0.717***		0.0193		-0.624**	
	(0.261)		(0.487)		(0.295)	
Cash		0.658**		0.148		-0.636*
		(0.308)		(0.569)		(0.347)
In-kind		0.748***		-0.051		-0.618**
		(0.284)		(0.530)		(0.308)
	(7)	(8)	(9)	(10)	(11)	(12)
	Home Hours	Home Hours	Work Hours	Work Hours	Leisure Hours	Leisure Hours
	Men					
Transfer						
Any	0.216		0.282		-0.289	
	(0.155)		(0.190)		(0.194)	
Cash		0.094		0.185		-0.141
		(0.201)		(0.258)		(0.253)
In-kind		0.278*		0.332*		-0.366*
		(0.162)		(0.200)		(0.209)
Controls	✓	✓	✓	✓	✓	✓
Clusters	145	145	145	145	145	145
N	1,242	1,242	1,242	1,242	1,242	1,242

Notes: The table shows the estimated effect of receiving the program on time allocation to housework, paid work and leisure activities for women and men head or spouse within the household. All estimations control for baseline household characteristics as well as adult members characteristics. Tobit models are used to estimate impacts on time allocation due to the important fraction of adult members that have zero time devoted to certain activities. The sample includes two-parent households with children. The treatment effects are measured in hours per day. Standard errors in parentheses are clustered at the cluster level. *significant to 10%; **significant to 5%; ***significant to 1%.

Table A.3: Estimates of the Impact of the Program over Consumption

	(1)	(2)	(3)	(4)	(5)	(6)
	Private Consumption	Private Consumption	Private Consumption	Private Consumption	Public Consumption	Public Consumption
	Women		Men		Household	
Transfer						
Any	0.0230		-0.0392		0.359***	
	(0.0366)		(0.0419)		(0.112)	
Cash		0.00408		-0.0662		0.352**
		(0.0476)		(0.0500)		(0.137)
In-kind		0.0328		-0.0252		0.362***
		(0.0391)		(0.0456)		(0.121)
Controls	✓	✓	✓	✓	✓	✓
Clusters	145	145	145	145	145	145
N	1235	1235	1235	1235	1235	1235

Notes: The table shows the estimated effect of receiving the program on consumption. All estimations control for baseline household characteristics as well as adult members characteristics. Tobit models are used to estimate impacts on private consumption due to the important fraction of households that have zero adult private consumption. The sample includes two-parent households with children. The treatment effects are measured in hours per day. Standard errors in parentheses are clustered at the cluster level. *significant at 10%; **significant at 5%; ***significant at 1%.

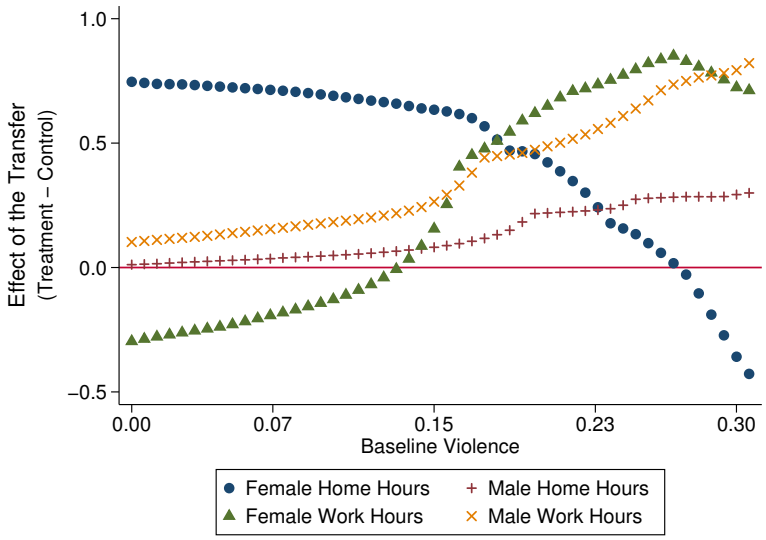
Table A.4: Decomposition of Time Allocation and Violence into Extensive and Intensive Margins

	(1)	(2)	(3)	(4)	(5)
	Housework	Labor Market	Housework	Labor Market	Violence
	Women		Men		Household
Total Effect	0.699***	0.006	-0.047	0.130	-0.057***
	(0.254)	(0.401)	(0.081)	(0.170)	(0.020)
Extensive Margin	0.065	-0.239	0.133**	0.080	-0.031**
	(0.045)	(0.310)	(0.059)	(0.065)	(0.013)
Intensive Margin	0.633**	0.245	-0.086	0.049	-0.026
	(0.248)	(0.576)	(0.065)	(0.153)	(0.016)
Treatment Effect Conditional on Decision	0.640**	0.691	-0.146	0.051	-0.067*
	(0.251)	(1.622)	(0.110)	(0.159)	(0.040)
Control Group Mean	5.806	5.181	1.817	6.789	0.245
Clusters	145	145	145	145	145
N	1235	1235	1235	1235	1235

Notes: This table reports decomposition of treatment effects of the cash transfer program into extensive and intensive margins. Standard errors in parentheses are clustered at the cluster level. *significant at 10%; **significant at 5%; ***significant at 1%.

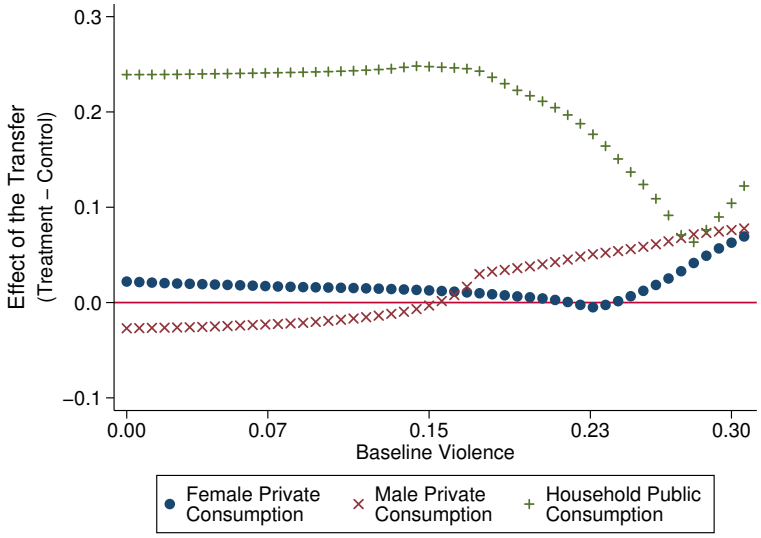
AII. Heterogeneous Effects over Violence

Figure A.2: Adult Time Allocation



Notes: The figure illustrates how the program influences the allocation of hours of adult household members at follow-up. These calculations come from the reduced form estimation that compare treated versus control households at different levels of baseline violence. The treatment effects are measured in hours per day.

Figure A.3: Monthly Consumption (Dollars per month/100)



Notes: The figure illustrates how the program influences consumption at follow-up. These calculations come from the reduced form estimation that compare treated versus control households at different levels of baseline violence. The treatment effects are measured in dollars.

Additional Estimation Results

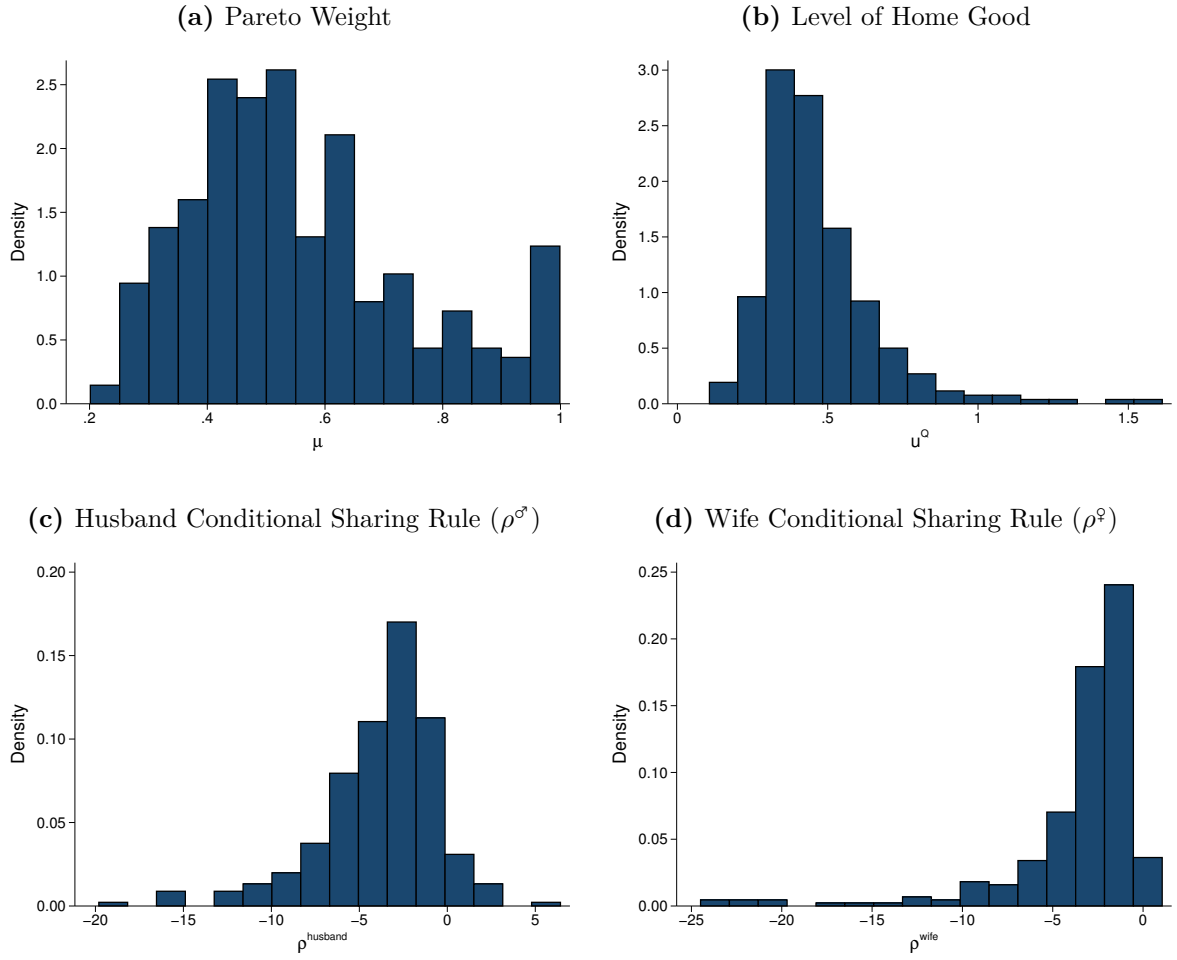
Table A.5: Structural Estimation Results

	(1)		(2)	
Parameter	Coefficient	S.E.	Coefficient	S.E.
Preference Parameters				
$\alpha_{10}^{♂}$	0.784***	(0.031)	0.797***	(0.029)
$\alpha_{11}^{♂}\left[age^{♂}/10\right]$	-0.018**	(0.007)	-0.006	(0.007)
$\alpha_{2}^{♂}\left[\bar{u}^{Q}\right]$	-1.369***	(0.058)	-1.553***	(0.054)
$\beta^{♂}$	0.120***	(0.013)	0.130***	(0.014)
$\alpha_{10}^{♀}$	0.735**	(0.031)	0.787***	(0.029)
$\alpha_{11}^{♀}\left[age^{♀}/10\right]$	-0.010	(0.007)	0.006	(0.007)
$\alpha_{2}^{♀}\left[\bar{u}^{Q}\right]$	-1.672***	(0.078)	-1.670***	(0.075)
$\beta^{♀}$	0.100***	(0.023)	0.112***	(0.024)
Home Production Parameters				
κ	-0.379**	(0.125)	-0.703***	(0.114)
γ_1	0.260***	(0.009)	0.260***	(0.011)
γ_2	0.449***	(0.015)	0.400***	(0.014)
γ_3	0.291***	(0.010)	0.340***	(0.011)
ϵ_0^Q	0.022***	(0.000)	0.032***	(0.000)
ϵ_1^Q[children]	0.063***	(0.000)	0.003***	(0.000)
ϵ_2^Q[mean children age]	-0.013***	(0.000)	-0.007***	(0.000)
ϵ_3^Q[violence]	0.032***	(0.000)	-0.003***	(0.001)
Bargaining Power Parameters				
Λ_1	-1.176***	(0.092)	-1.150***	(0.089)
$\Lambda_2\left[w^{♂}/w^{♀}\right]$	1.000***	(0.041)	1.100***	(0.036)
$\Lambda_3\left[y\right]$	0.037***	(0.010)	0.059***	(0.014)
$\Lambda_4\left[age^{♂}-age^{♀}/10\right]$	0.336**	(0.162)	0.153	(0.324)
Λ_5[violence]	1.063***	(0.115)	-0.122	(0.076)
Λ_6[probability of receiving transfer]	-0.100*	(0.051)	-0.100**	(0.043)
Λ_7[husband's share of household assets]	0.000***	(0.000)	0.000	(0.001)
Violence Parameters				
δ_1	–	–	0.100***	(0.034)
δ_2[probability of receiving transfer]	–	–	-0.038*	(0.019)
δ_3[baseline violence]	–	–	0.400***	(0.061)
δ_4[violence in neighborhood]	–	–	0.000	(0.011)
$\delta_5\left[w^{♂}/w^{♀}\right]$	–	–	0.025***	(0.005)
$\delta_6\left[y\right]$	–	–	-0.035***	(0.003)

Notes: The table shows the estimated parameters obtained by the Feasible Generalized Non Linear Least Squares (FGNLS) estimator using the data from the random control trail transfer program. The expressions in brackets refer to the objects that are related to the respective parameters. Standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

Summary Statistics of Predicted Variables

Figure A.4: Predicted Distributions



Notes: The left panels depicts the distribution of the predicted Pareto weight, level of home good and the conditional sharing rules provided by the structural model.

Table A.6: Summary Statistics

	mean	s.d	min	max	median
μ	0.56	0.19	0.20	0.99	0.52
$\rho^{\male}$	-3.79	3.40	-19.81	6.43	-3.09
$\rho^{\female}$	-3.50	3.88	-24.94	1.06	-2.36
$\bar{u}^Q$	0.47	0.20	0.11	1.61	0.43

Notes: The table show the summary statistics of the predictions from the fitted structural model.

Patterns of Specialization

Effects of a Change in Husband's Wages

Figure A.5: Paid Work and Leisure

(a) Labor Market Hours

(b) Leisure Hours

Notes: The left panel depicts the effect of a change in husband's wage on the choice of adult members time allocation to the labor market. The right panel depicts the effect of a change in husband's wage on the choice of adult members time allocation to leisure activities. The wage increments go from the first decile to the tenth decile of the husband's wage distribution, while keeping the other explanatory variables constant at their corresponding means.

Figure A.6: Home Good Production

(a) Home Good Inputs

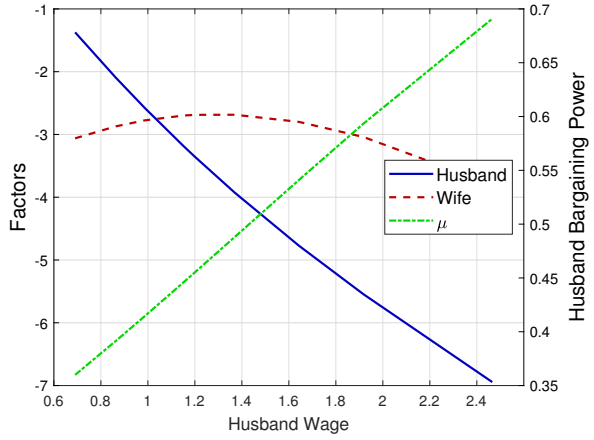
(b) Quality of Home Good

Notes: The left panel depicts the effect of a change in husband's wage on the choice of inputs of home production. The right panel depicts the effect of a change in husband's wage on the production of domestic good. The wage increments go from the first decile to the tenth decile of the husband's wage distribution, while keeping the other explanatory variables constant at their corresponding means.

Figure A.7: Consumption, Distribution Factors and Bargaining Power

(a) Private Consumption

(b) Distribution Factors and Pareto Weight

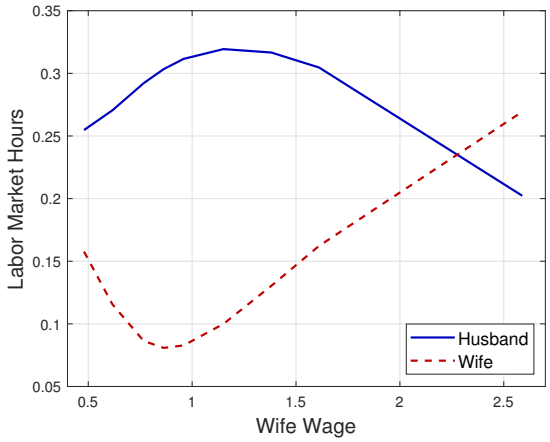


Notes: The left panel depicts the effect of a change in husband's wage on adult members private consumption. The right panel depicts the effect of a change in husband's wage on the distribution factors and husband's bargaining power. The wage increments go from the first decile to the tenth decile of the husband's wage distribution, while keeping the other explanatory variables constant at their corresponding means.

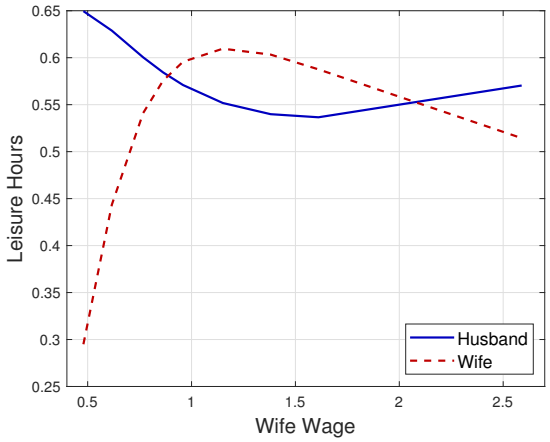
Effects of a Change in Wife's Wages

Figure A.8: Consumption, Distribution Factors and Bargaining Power

(a) Labor Market Hours



(b) Leisure Hours

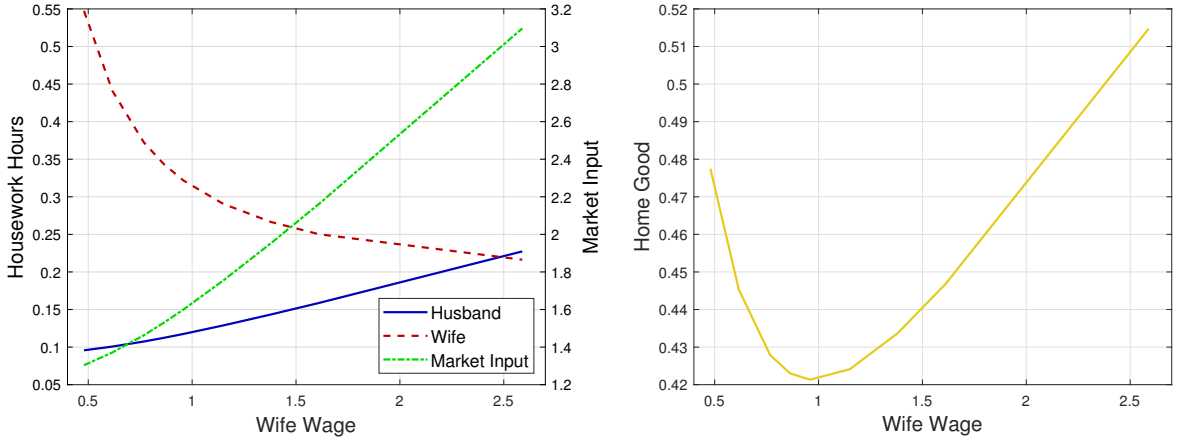


Notes: The left panel depicts the effect of a change in wife's wage on the choice of adult members time allocation to the labor market. The right panel depicts the effect of a change in wife's wage on the choice of adult members time allocation to leisure activities. The wage increments go from the first decile to the tenth decile of the husband's wage distribution, while keeping the other explanatory variables constant at their corresponding means.

Figure A.9: Home Good Production

(a) Home Good Inputs

(b) Quality of Home Good

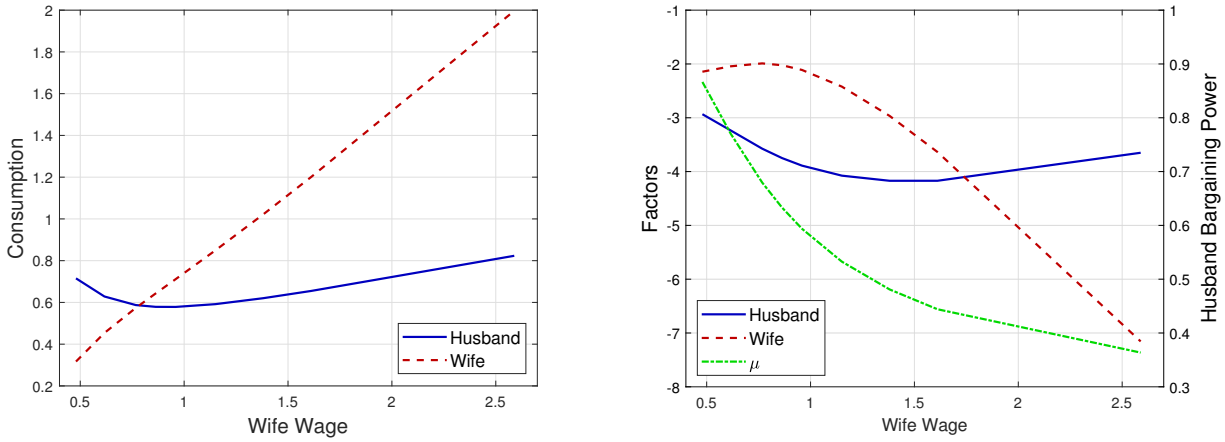


Notes: The left panel depicts the effect of a change in wife's wage on the choice of inputs of home production. The right panel depicts the effect of a change in wife's wage on the production of domestic good. The wage increments go from the first decile to the tenth decile of the husband's wage distribution, while keeping the other explanatory variables constant at their corresponding means.

Figure A.10: Consumption, Distribution Factors and Bargaining Power

(a) Private Consumption

(b) Distribution Factors and Pareto Weight



Notes: The left panel depicts the effect of a change in wife's wage on adult members private consumption. The right panel depicts the effect of a change in wife's wage on the distribution factors and husband's bargaining power. The wage increments go from the first decile to the tenth decile of the husband's wage distribution, while keeping the other explanatory variables constant at their corresponding means.

Labor Supply Elasticities

Table A.7: Labor Supply Elasticities

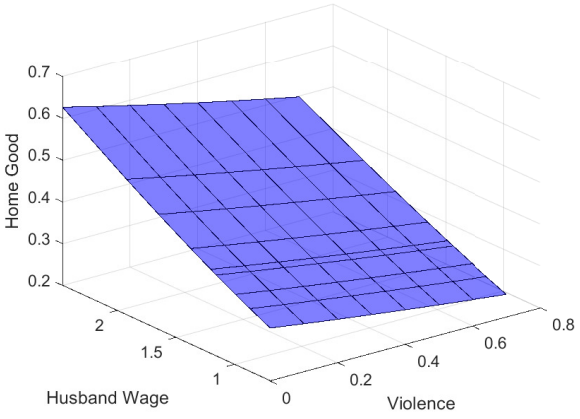
	Husband [♂]	Wife [♀]
Own wage elasticity	0.57	0.77
Partners wage elasticity	0.17	-1.07
Non-labor income elasticity	0.11	0.26

Notes: The table show the labor supply elasticities computed numerically for the sample median.

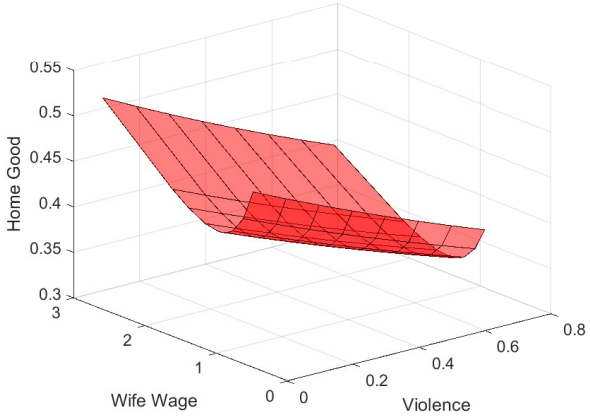
Effect of Violence on Home Good

Figure A.11: Effect of Violence on Home Good Production

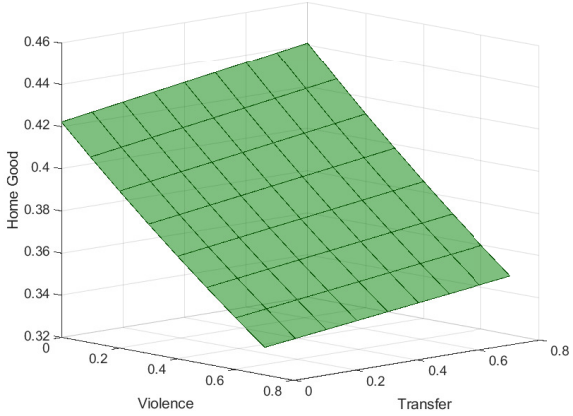
(a) Violence and Husband Wage



(b) Violence and Wife Wage



(c) Violence and Transfer



Notes: The figure shows how different levels of intra-household violence affect the home good production.

Marginal Willingness to Pay (MWP) by Type of Household

Table A.8: Husband and Wife Marginal Willingness to Pay (MWP)

	$MWP^{\male}$	$MWP^{\female}$	Difference [p-value]
Overall			
	0.615	0.385	0.230***
	(0.012)	(0.012)	[0.000]
No Transfer and No Violence			
	0.593	0.407	0.186***
	(0.037)	(0.037)	[0.000]
Transfer and No Violence			
	0.609	0.391	0.220***
	(0.021)	(0.021)	[0.000]
No Transfer and Violence			
	0.637	0.363	0.273***
	(0.028)	(0.028)	[0.000]
Transfer and Violence			
	0.618	0.381	0.236***
	(0.020)	(0.020)	[0.000]

Notes: The table presents the average marginal willingness to pay for the public good for each member of the couple as well as the difference between husband and wife. Standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table A.9: Husband and Wife Marginal Willingness to Pay (MWP) using Alternative Specification

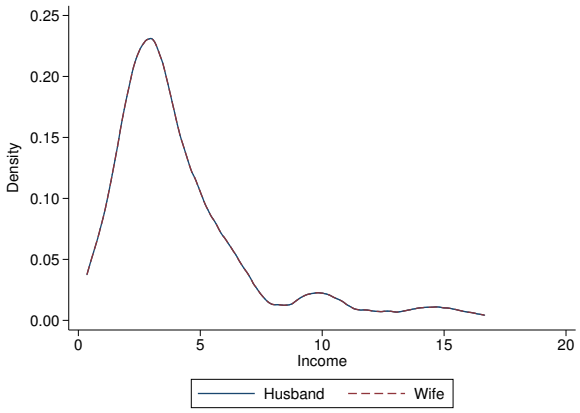
	$MWP^{\male}$	$MWP^{\female}$	Difference [p-value]
Overall			
	0.579	0.420	0.158***
	(0.012)	(0.012)	[0.000]
No Transfer and No Violence			
	0.561	0.438	0.122***
	(0.038)	(0.038)	[0.000]
Transfer and No Violence			
	0.564	0.435	0.130***
	(0.021)	(0.021)	[0.000]
No Transfer and Violence			
	0.600	0.400	0.200***
	(0.032)	(0.032)	[0.000]
Transfer and Violence			
	0.589	0.411	0.179***
	(0.021)	(0.021)	[0.000]

Notes: The table presents the average marginal willingness to pay for the public good for each member of the couple as well as the difference between husband and wife. Standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

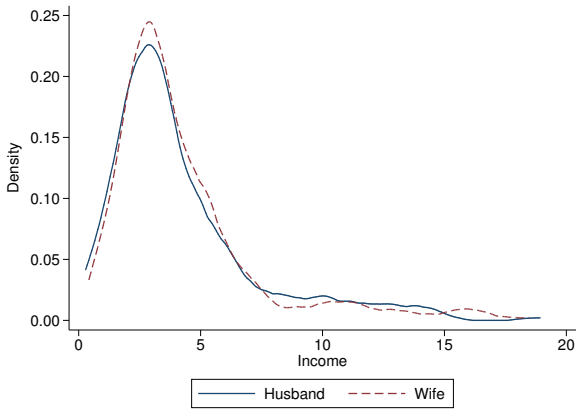
Distribution of Income (Different Measures)

Figure A.12: Distribution of Income

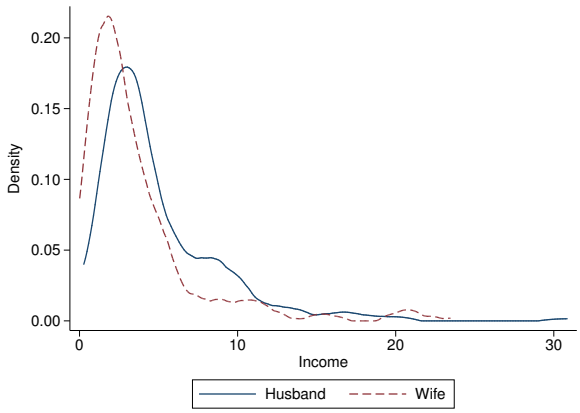
(a) Indifference Scales



(b) A la Barten (Equal Prices)



(c) Individual Prices (Individual MWP)



Notes: The figure shows the distribution of the income for husbands and wives using the different types of measures.

Poverty Measures by Type of Household

Table A.10: Individual Poverty by Household Type

	Equivalence scales	Equal prices	Individual prices
Overall			
Global	0.326	0.322	0.428
Husband [♂]	0.326	0.329	0.308
Wife [♀]	0.326	0.315	0.547
Difference	–	0.014	0.239***
No Transfer and No Violence			
Global	0.414	0.414	0.517
Husband [♂]	0.414	0.414	0.379
Wife [♀]	0.414	0.414	0.655
Difference	–	–	0.276**
Transfer and No Violence			
Global	0.306	0.311	0.408
Husband [♂]	0.306	0.316	0.338
Wife [♀]	0.306	0.306	0.479
Difference	–	0.010	0.143**
No Transfer and Violence			
Global	0.349	0.325	0.407
Husband [♂]	0.349	0.349	0.256
Wife [♀]	0.349	0.302	0.558
Difference	–	0.047	0.302***
Transfer and Violence			
Global	0.311	0.306	0.429
Husband [♂]	0.311	0.311	0.283
Wife [♀]	0.311	0.301	0.575
Difference	–	0.009	0.292***

Notes: This table shows the incidence of poverty at the individual level disaggregated by the types of households. These indicators are constructed using the definitions on Equation 35 and the model estimates obtained from the structural model. An individual is characterized as poor if her/his income share falls below the individual poverty line.

Table A.11: Individual Poverty by Household Type using Alternative Specification

	Equivalence scales	Equal prices	Individual prices
Overall			
Global	0.463	0.471	0.525
Husband [♂]	0.463	0.445	0.402
Wife [♀]	0.463	0.496	0.648
Difference	–	0.050	0.246***
No Transfer and No Violence			
Global	0.517	0.517	0.569
Husband [♂]	0.517	0.517	0.448
Wife [♀]	0.517	0.517	0.690
Difference	–	–	0.241*
Transfer and No Violence			
Global	0.397	0.408	0.520
Husband [♂]	0.397	0.387	0.448
Wife [♀]	0.397	0.428	0.591
Difference	–	0.041	0.143**
No Transfer and Violence			
Global	0.465	0.453	0.500
Husband [♂]	0.465	0.442	0.349
Wife [♀]	0.465	0.465	0.651
Difference	–	0.023	0.302***
Transfer and Violence			
Global	0.509	0.523	0.528
Husband [♂]	0.509	0.481	0.368
Wife [♀]	0.509	0.566	0.689
Difference	–	0.085	0.321***

Notes: This table shows the incidence of poverty at the individual level disaggregated by the types of households. These indicators are constructed using the definitions on Equation 35 and the model estimates obtained from the structural model. An individual is characterized as poor if her/his income share falls below the individual poverty line.

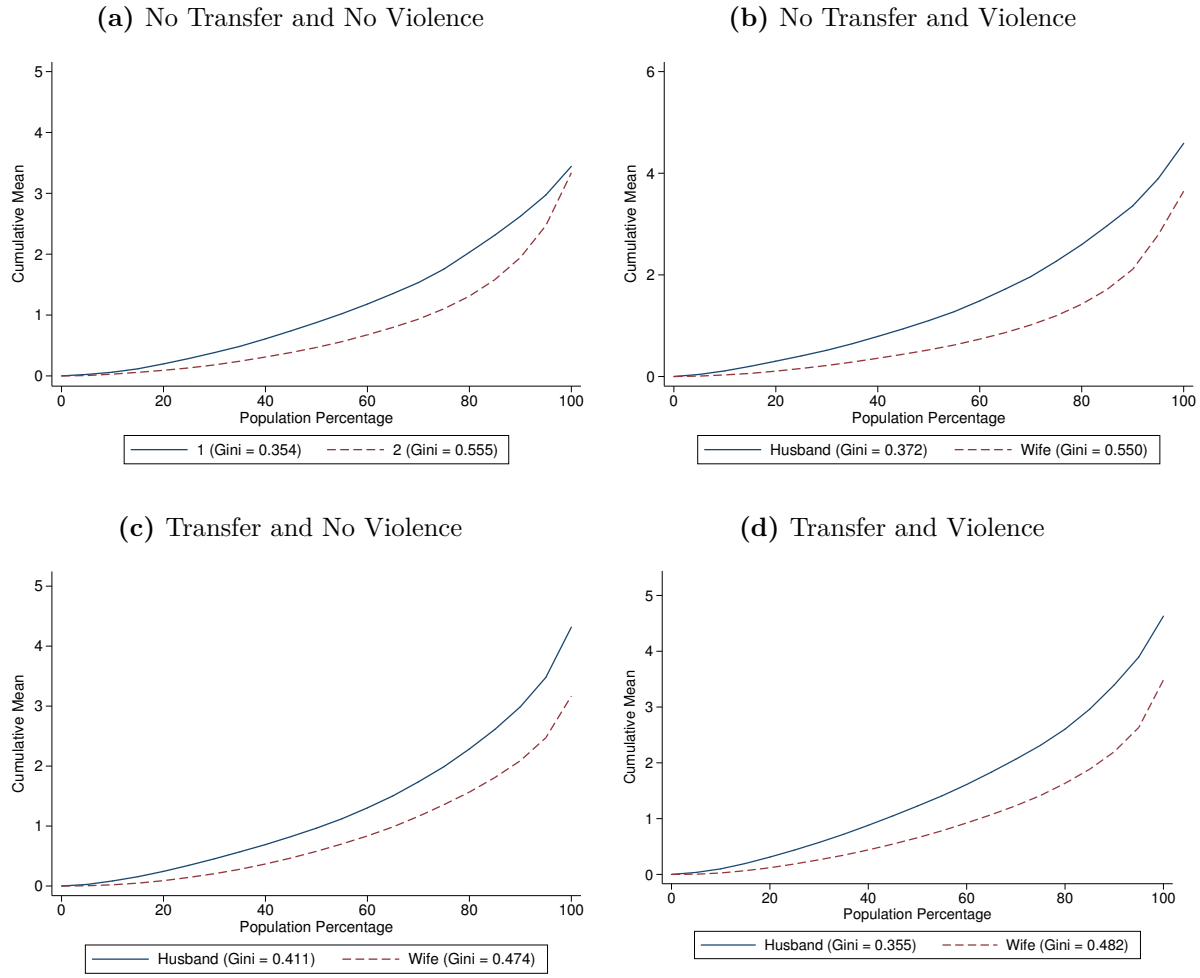
Table A.12: Measures of Income Inequality by Household Type

	Equivalence scales	Equal prices	Individual prices
Overall	0.367	0.368	0.454
No Transfer and No Violence	0.396	0.399	0.465
Transfer and No Violence	0.354	0.356	0.447
No Transfer and Violence	0.388	0.389	0.469
Transfer and Violence	0.350	0.352	0.446

Notes: This table shows the level of inequality measured by the Gini coefficient disaggregated by the types of household. These indicators are constructed using the income definitions on Equation 35 and the model estimates obtained from the structural model.

Inequality

Figure A.13: Generalized Lorenz Curves by Household Type



Notes: The figure shows the distribution of the marginal willingness to pay for husbands and wives.