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Parental investment in their children´s education

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Abstract

This paper estimates for a sample of Mexican families a structural collective model of household labor supply with children and home production. The framework of Blundell, Chiappori, and Meghir (2005) is used to address how household allocations are affected by the intra-household decision-making process when both parents care for their children's welfare, particularly their education. In households with characteristics equal to the average of the sample, more household resources are directed toward children's education when the balance of bargaining power changes in favor of fathers instead of mothers. Moreover, in spite of mothers having a larger estimated marginal willingness to pay than fathers for resources associated with children's utility, more (less) expenditures and time would be dedicated to children when fathers' bargaining power increases (decreases) exogenously. These results draw attention to the design of targeting strategies which presumes that mothers care more for children than fathers, being possible to be less effective in some cases than if it had been focused on augment fathers' power.

Keywords: Collective household models · Children · Labor supply · Household production

JEL classification: D12 · D13 · J13 · J22

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1 Introduction

Does a change on the decision process between parents affect resources directed to children's welfare? A better understanding of the intra-household decision-making process could give us some lead on how differences in preferences between household members affect some individual outcomes, particularly those relevant for the welfare of specific individuals such as children's human capital. Trying to answer this question, a structural collective model of household labor supply with children and home production is estimated for a sample of Mexican families. After having recovered certain aspects of the decision process and of the production of children's utility, there is no evidence that mothers care more for their children than fathers for a household with characteristics equal to the average of the sample used. Indeed, there is a larger increase in the resources destinated to children's utility when the change in relative wage favors the father instead of the mother. Furthermore, there is an increase (reduction) on resources directed to children when the Pareto weight of the father (mother) increases via an exogenous change that does not influence the household budget constraint. This introduction motivates the analysis of household behavior when children are present in it discussing the possible role of bargaining between the parents to explain the outcomes chosen by a household, the scarcity of evidence of this decision process for Mexico, and how a collective labor supply model could address a setting in which both parents care for their children.

Numerous empirical studies have found evidence of a relation between factors that may influence the distribution of power between household members and intrahousehold allocations. Changes in favor of a household member are associated with consumption patterns in benefit of her/his preferences. The control over economic resources is considered in some studies as a cause of different observed household behaviors. Examples of variables used are the recipient identity of non-labor income (Thomas 1990; Browning, Bourguignon, Chiappori, and Lechene 1994), assets (Quisumbing 1994; Quisumbing and Maluccio 2003; Thomas, Contreras, and Frankenberg 2004), and shares of income earned (Hoddinott and Haddad 1995; Bittman, England, Folbre, Sayer, and Matheson 2003). Also, other factors that affect household's environment and opportunities outside of it have been considered such as marriage market and legislation (Gray 1998; Chiappori, Fortin, and Lacroix 2002; Park 2007) and relative skills and knowledge (Beegle, Frankenberg, and Thomas 2001; Rubalcava and Contreras 2000; Quisumbing and Maluccio 2003).

Moreover, quasi-natural experiments, such as targeted transfers and changes on welfare programs, have been used to analyze how household allocations respond to potential

changes in intrahousehold decision process. Lundberg, Pollak, and Wales (1997) and Duflo (2000) provide evidence in favor of targeting strategies that could improve child's welfare, the first ones exploited a change in the late 1970s in the UK child allowance policy and the second used a reform of South African old age pension program.

In general terms for Mexico, there is no evidence of household decision process that considers at the same time a) changes in bargaining power distribution in favor of either parent, and b) both parental time and expenditures on children's education. Various studies have analyzed household behavior through the conditional cash transfer program known as Oportunidades (previously Progresa). It was launched by the Mexican government in 1997 with the main objective of improve the educative, nutritional and health status of Mexican families with children in extreme poverty. According to the hypothesis that women are more willing to spend the money received in a more beneficial way for the children that other members of the household, the program is design to give directly a cash benefit to the mother (or the most senior woman in the family). Mixed results are reported in the literature about the effect of this additional money on consumption patterns of households or if it is spent differently than others household incomes (in favor of a change: Attanasio and Lechene 2002; Rubalcava, Teruel, and Thomas 2009; against: Handa, Peterman, Davis, and Stampini 2009). Also, household monetary expenses is not necessarily the unique factor used to enhance human capital of a child. It could give an incomplete picture on household allocation to children's human capital formation given that augments in children's expenditure may be accompanied by a reallocation of other factors dedicated to their education.

Since Oportunidades' recipient is always a woman in the house, it is not possible to compare what would happen if the additional money is given to a male member. Instead, Gutiérrez, Juárez, and Rublí (2011) study a program that has the characteristic of give an exogenous, non-labor aditional income to both sexes. They use a pension program for elderly people resident in Mexico city (PAAAM - Pensión Alimentaria para Adultos Mayores in spanish) to compare the impact on some children's outcomes of give the transfer to a male or to a female. While this extra money is associated with greater expenditures on children between 6 and 18 years old if the recipient is a female, it is related with a greater enrollment rate for this group of children if the recipient is a male. However because the family tie with the child is not analyzed, it limits the policy implications of giving a transfer to the person more interested in the welfare of children in the household.

Although some of the empirical evidence suggests that favorable changes in mothers' bargaining power (generally in terms of economic resources) benefit children welfare, the

lens used to interpret this type of observed behavior is crucial to policy issues. Design of policy interventions under presumptions such as "mothers care more for children than fathers" may fail to make children better off if it is unknown the channel by which parents' individual preferences and household decision process is reflected on children outcomes.

With this on mind, the theoretical framework in which most of this type of papers is based is the "collective" approach. Alternative to the "unitary" view, in which the household maximize a unique utility function (it can be thinking as its members act as a single rational individual), the resources allocated to the well-being of a specific household member under the collective model could vary depending on both the preferences of its members and the distribution of the bargaining power between them, even when total resources are kept constant. Therefore, intra-household allocation processes could mitigate or enhance public policies involving individual welfare.

It is possible to tackle the household behavior when children are present assuming that both parents obtain utility (although not necessary at the same degree) from the welfare of their offspring, so it is a public good for them. However, until Blundell, Chiappori, and Meghir (2005) -from now on BCM-, the collective approach had not adequately brought a theoretical framework to analyze households with children. The principal results under this approach have been obtained in the case of private goods but not when public consumption is also present.

Basically, the model of BCM is an extension of Chiappori (1992) collective model of household labor supply where both parents care about their children's welfare and also children's utility can be augmented by means of specific expenditures and parental time. One of the main results of BCM's model is that increments on the bargaining power of a parent result in more resources directed to children only when her/his willingness to pay for children's welfare is more sensitive to increases in her/his private consumption. Therefore, the key aspect is not that, for example, a mother cares more about their children than the father (i.e. she has a larger willingness to pay), but that she is more willing to spend in their children when the household budget share for her private consumption augment.

The objective of this paper is to examine the effects of changes in the distribution of power between parents over intra-household resource allocation directed to children's human capital, particularly education. For this, BCM's model is identified using a particular parametrization and an estimation strategy based on Cherchye, de Rock, and Vermeulen (2010) -from now on CRV-. The sample is drawn from the second wave of the Mexican Family Life Survey (MxFLS-2/ENNVIH-2 for its abbreviation in Spanish) and focused on

Mexican nuclear families with only children under 15 years and at least one school-age child, where both parents work. The impact of changes of some factors that influence the Pareto weights are used to assess how resources directed to children's education respond to it.

After this introduction, the structure of the remainder of this paper is as follows. Section 2 presents how the economic literature has analyzed household behavior. Section 3 presents BCM's theoretical model. In Section 4 is explained the estimation strategy applied, data set used, and empirical results. Finally, some final remarks are presented in Section 5.

2   Households in the economic literature

Traditionally, neo-classical consumer models are based on individual rational preference ordering over affordable consumption bundles. A first theoretical approximation to take into account the household in Economics is to transform the consumer's choice problem from an individual to a household perspective. The household members' utilities and budget constraints can be systematically added assuming that they have homogeneous preferences, an altruistic household head has all the power at home, or the weights of individuals within a household welfare function are fixed.

This type of approximation is commonly known as the "unitary" model. It has the advantage of imposing empirical restrictions on the household behavior, the demand functions depend on prices and fixed income and it has to satisfy individual preference's standard axioms. Moreover, because the fixed income of the household members is aggregated, the assignment is not affected by the identity of the recipient, a result known as the "income pooling" property/hypothesis.

Several authors have offered evidence against the main implications of the unitary framework. Contrary to the income pooling hypothesis, the distribution of income matters to the allocation of family resources in the studies of Thomas (1990); Bourguignon, Browning, Chiappori, and Lechene (1993); Browning, Bourguignon, Chiappori, and Lechene (1994); Lundberg, Pollak, and Wales (1997); Fortin and Lacroix (1997); among others. Also, the symmetry of the Slutsky matrix for demands of households with more than one member has been rejected by Browning and Meghir (1991); Fortin and Lacroix (1997); Browning and Chiappori (1998); among others.

In addition to the accumulation of empirical evidence against the unitary model, there are also questionings about the understatement of problems of poverty and inequality levels that do not consider intra-household distribution of resources (Haddad and Kanbur 1990), and the efficacy and consequences of policies under this framework (Apps and Rees 1988; Alderman, Chiappori, Haddad, Hoddinott, and Kanbur 1995; Beninger, Bargain, Beblo, Blundell, Carrasco, Chiuri, Laisney, Lechene, Longobardi, Moreau, Myck, Ruiz-Castillo, and Vermeulen 2006).

Some approaches look to overcome the previously mentioned critiques and seek to respect the theoretical foundations of individual preferences. It tries to explain the internal dynamics that may occur between individuals with heterogeneous preferences and the way of how disagreements between them are resolved. Among them, a fructiferous approach that is based on minimal assumptions is the "collective" model.[1] Applying the context of bargaining theory, household members with non-homogeneous preferences are trying to come to an agreement of how to assign the gains of belonging to the household. The outcome of this decision-making process depends on the relative bargaining power between them to "impose" their preferences.

Without assuming a specific bargaining concept, the collective model assumes that the intra-household decisions are Pareto efficient (i.e. it is not possible to increment the welfare of one member without a decline for the other). This assumption is supported in the idea that household members can be seen as playing a repeated game where there is symmetry of information.

This setting is characterized by a weighted utilitarian household welfare function where the Pareto weights of each household member depend on prices, total household expenditure and external factors that affect the decision process but not the individual preferences or the joint budget set (EEPs- Extrahousehold Environmental Parameters in the terminology of McElroy 1990, or DFs- Distributional Factors in the terminology of Browning and Chiappori 1998).[2]

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[1] Another approach to analyze household decision process is the Non-cooperative. Within this framework, household members maximize their utility relative to their budget constraint, taking as given the behavior of the other members. A drawback of this approach is that in the solution found for these models it is possible to improve the welfare of one member without worsen other members if the resulting intrahousehold allocation is changed (see Xu 2007 and Donni and Chiappori 2011 for a more extensive discussion about Non-cooperative models).

[2] Under the axiomatic bargaining theory, household decisions represent the outcome of some bargaining process between its members (represented by Nash or Kalai-Smorodinsky solutions). The individuals compare the utility level achieved if they cooperate (the gains of living together) with the level obtained if she/he doesn't cooperate. Therefore, the non-cooperative utility of a member serves as a threat point

Among the implications of collective settings is that it is not necessary to satisfy the income pooling hypothesis. Hence it brings the possibility of targeting a specific household member for a public transfer and take into account possible resource reallocations from non-beneficiaries to the beneficiary that could mitigate or enhance the transfer's effectiveness. Moreover it's possible to propose policies that affect directly the bargaining power such as the rules of eligibility of training programs or alimony rights to ex-wives or children of divorced parents (Alderman, Chiappori, Haddad, Hoddinott, and Kanbur 1995; Quisumbing and McClafferty 2006).

Two studies for Mexico that take into account some aspects of the collective approach are Martinelli and Parker (2008) and Bobonis (2009). In the former the authors try to isolate the substitution effect of Oportunidades' school subsidies from income and bargaining effects on the share of expenditure devoted to children's clothing. Instead, Bobonis test the Pareto efficiency assumption of collective models in household decisions. He uses as changes in distributional factors the exogenous variation in women's income due to Oportunidades and household income variation occasioned by localized rainfall shocks. The allocation of various household items are used as dependent variables, finding that income changes due to Oportunidades (rainfall shock) has a positive (negative) effect on household budget shares in adult female and children clothing and a negative (positive) effect on alcohol and tobacco shares, among other effects. He interprets these findings as evidence of how women control over a sum of money in households of low resources is used in a family friendly way (probably by social norm pressures) while income closer to the male sphere is used in his favor.

3   Introducing children in the Collective approach

When household behavior is studied, the presence of children generates particular dynamics that has to be considered. It's possible to model children's welfare as a nonmarket good that is produced within the household by reallocating (market and non-market) resources to its production (Bourguignon 1999).

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to obtain more power in the bargaining process. Thus, changes in DFs/EEPs shift the threat points and therefore the Pareto weights. Threat points can be interpreted as the utility of being divorced or remain single (Manser and Brown 1980; McElroy and Horney 1981), or a noncooperative equilibrium within marriage that reflects traditional gender roles and gender role expectations ("separate spheres" bargaining model of Lundberg and Pollak 1993).

Collective household models with household production assume that households obtain utility not only of market goods but also of nonmarket goods produced within the household. Commonly these models concentrate in the labor supply of household members and how it's affected when agents divide their time between market activities, leisure and domestic production.[3]

Children's utility can be also interpreted as a form of household production. Taking the collective labor supply with children and home production model of BCM, the behavior of two-adult household with children can be modeled in the following manner. Suppose that there are two adult members in a household, the mother is denoted by m and the father by f. Three commodities are consumed in a household, individual leisures $\left(L^m, L^f\right)$ and a Hicksian composite good C that is used for private expenditures $\left(C^m, C^f\right)$ and some public consumption (K) used in the production of children's utility:

$$C = C^m + C^f + K \tag{1}$$

Individual time is allocated between leisure (L^i), market work (h_W^i) and production of children's welfare (h_K^i):

$$L^i + h_W^i + h_K^i = T \tag{2}$$

Children's welfare $\left(u^K\right)$[4] is produced using specific expenditure and parental time:

$$u^K = u^K \left(K, h_K^m, h_K^f\right) \tag{3}$$

The utility function of parent i depends on the consumption of her/his consumption of individual goods and children's utility (in some sense children are considered as a public consumption good to the adult household members, or equivalently the last ones have caring preferences about children's welfare):

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[3]Besides of avoiding omitted-variable problems, the introduction of household production has effects in the interpretation of intra-household welfare. Apps and Rees (1996; 1997) point out that if it is not consider, low or zero levels of market labor supply of one individual is interpreted as a larger leisure consumption and her/his share of household income is interpreted as a lump-sum transfer from the other members. When household production is included instead, it is considered the division of labor between household and market production. Therefore, it can happen that one member specializes in domestic production, so she/he exchanges it for market goods with the other members, there is a exchange instead of a transfer. Chiappori (1997) presents some identification basic points of the collective model when household production is included.

[4]This function has non-increasing returns and no joint production.

$$U^i = U^i \left(L^i, C^i, u^K \right) \quad i = m, f \tag{4}$$

All utility functions are strictly quasiconcave and increasing, and at least twice continuously differentiable.

Wages are denoted by w^m and w^f, the price of the Hicksian good is normalized to one. Given the household fixed income, y, the budget constraint is:

$$w^m L^m + w^f L^f + C^m + C^f + K = \left(w^m + w^f \right) T + y \tag{5}$$

Assuming that the decisions made by the household are Pareto-efficient, that parents share bargaining power and children do not have any, and considering the existence of a vector of Distributional Factors, $\mathbf{z}$, the household allocation problem can be represented as

$$\max_{L^m, L^f, C^m, C^f, K, h_K^m, h_K^f} \lambda U^m \left(L^m, C^m, u^K \right) + (1 - \lambda) U^f \left(L^f, C^f, u^K \right) \tag{6}$$

$$\text{s.t.} \quad \begin{cases} w^m L^m + w^f L^f + C^m + C^f + K = \left(w^m + w^f \right) T + y \\ L^i + h_W^i + h_K^i = T, \quad i = m, f \\ u^K \left(K, h_K^m, h_K^f \right) = u^K \end{cases}$$

where λ and $(1 - \lambda)$ are welfare weights. An interpretation of $\lambda^m = \lambda$ and $\lambda^f = (1 - \lambda)$ is that they represent respectively the bargaining power of m and f in the intra-household allocation process, $\lambda^i \geq 0$. In a collective model λ captures the decision process and can be a function of prices, non-labor income, and distributional factors, $\lambda \left(y, w^m, w^f, \mathbf{z} \right)$.

The efficiency assumption implies that the solution to the household problem (6) is equivalent to a two stage process:

1. parents agree on:

    (a) children's utility level and the resources directed to produce it.

    (b) how to allocate among them the residual non-labor income.

2. each parent separately chooses her/his private consumption subject to her/his corresponding budget constraint.

Let $L^{i*}\left(w^m, w^f, y, \mathbf{z}\right)$ and $C^{i*}\left(w^m, w^f, y, \mathbf{z}\right)$, $i = m, f$, $K^*\left(w^m, w^f, y, \mathbf{z}\right)$ and $u^{K*}\left(w^m, w^f, y, \mathbf{z}\right)$, be the solution of problem (6). There is a function $\phi\left(w^m, w^f, y, \mathbf{z}\right)$ such that each parent solves in the second stage of the decision problem:

$$\max_{L^i, C^i} U^i\left(L^i, C^i, u^{K*}\right) \quad s.t. \quad w^i L^i + C^i = w^i T + \phi^i \tag{7}$$

The function $\phi\left(\bullet\right)$ known as the sharing rule achieves the decentralization of the household problem, so ϕ^i is the fraction of total expenditure on nonpublic goods allocated to parent i. If $\phi^m\left(w^m, w^f, y, \mathbf{z}\right) = \phi\left(w^m, w^f, y, \mathbf{z}\right)$, then $\phi^f\left(w^m, w^f, y, \mathbf{z}\right) = y - e^{K*}\left(w^m, w^f, y, \mathbf{z}\right) - \phi^m\left(w^m, w^f, y, \mathbf{z}\right)$; where $e^{K*}\left(\bullet\right)$ is the cost function of producing children's utility.

Let $V^i\left(w^i, \phi^i, u^{K*}\right)$ be the individual indirect utility of agent i conditional on u^{K*} corresponding to the problem (7). The optimal choice of the sharing rule and children's utility can be obtained returning to the first stage problem:

$$(a) \quad \min_{K, h_K^m, h_K^f} e^K = w^m h_K^m + w^f h_K^f + K \quad s.t. \quad u^K(K, h_K^m, h_K^f) = u^K \tag{8}$$

$$(b) \quad \max_{\phi^m, \phi^f, u^K} \lambda V^m\left(w^m, \phi^m, u^K\right) + (1 - \lambda) V^f\left(w^f, \phi^f, u^K\right) \quad s.t. \quad \phi^m + \phi^f + e^K = y \tag{9}$$

From the first-order conditions, the Samuelson condition characterize the efficient production of children's utility:

$$\lambda \frac{\partial V^m}{\partial \phi^m} = (1-\lambda)\frac{\partial V^f}{\partial \phi^f} \quad \Rightarrow \quad \underbrace{\frac{\partial V^m / \partial u^K}{\partial V^m / \partial \phi^m}}_{MWP^m} + \underbrace{\frac{\partial V^f / \partial u^K}{\partial V^f / \partial \phi^f}}_{MWP^f} = \underbrace{\frac{\partial e^K}{\partial u^K}}_{MC} \tag{10}$$

The ratio $MWP^i = \left(\partial V^i / \partial u^K\right) / \left(\partial V^i / \partial \phi^i\right)$ is i's marginal willingness to pay for children's utility. Condition (10) states that the sum of parents' marginal willingness to pay must be equal to the marginal cost of the resources allocated to children's welfare (MC).

From Proposition 1 of BCM, is possible to state that if the preferences of both adult members are such that both private expenditures $\left(\phi^i\right)$ and children's utility $\left(u^K\right)$ are normal (i.e. an increase in household non-labor income raises both private and public consumption), an increase on i's Pareto weight increase household's expenditure on children's welfare if and only if i's MWP is more sensitive to changes in her/his share than

that of the other parent $\left(\frac{\partial u^K}{\partial \phi^i} > 0 \text{ } iff \text{ } \frac{\partial MWP^i}{\partial \phi^i} > \frac{\partial MWP^j}{\partial \phi^j}, j \neq i \right)$. In other words, the key aspect is not the comparison between MWPs but the change of it to a change on the shares, the difference in parents' MWP response to a change of shares.

4 Empirical application

4.1 Parametric specification

Using the model previously presented, BCM demonstrate that it is possible to recover model structure (individual preferences and Pareto weights) from observed behavior (individual labor supplies and the resources directed to children's human capital, as functions of wages and non-labor income). In general, it is not possible to recover preferences and the decision process from a reduced-form specification, different structural models could have generated the observed behavior. However, BCM show that identifiability requires 1) the availability of a distributional factor, or 2) that individual consumption and leisure are separable from children's welfare.

For identifying BCM's model, a particular parametric form is used. It's based on CRV, and it exploits the two-stage representation to derive the specification. Recurring to the second stage of the household decision process (7), the individual indirect utility of agent i conditional on children's welfare can be represented by means of a functional form of the price-independent generalized logarithmic (PIGLOG) class:[5]

$$V^i \left(w^i, \phi^i, u^K \right) = \frac{ln\left(w^i T + \phi^i \right) - \left(\alpha_1^i + \alpha_2^i u^K \right) ln w^i}{\left(w^i \right)^{\beta^i}}, \quad i = m, f \qquad (11)$$

Notice that in this specification, the parameter α_2^i tells us first if leisure and individual consumption are separable from children's welfare. If the separability assumption is correct $(\alpha_2^i = 0)$, the resources allocated to children's welfare do not have a substitution effect over the consumption-leisure decision, it is only present an income effect over the residual non-labor income devoted to private consumption. In that case, the distributional factors are not necessary to keep u^K in a particular level while wages and non-labor income varies. Also, the corresponding i's MWP under this specification is $MWP^i = -\alpha_2^i \ln w^i \left(w^i T + \phi^i \right)$, so according to Proposition 1 of BCM a marginal change in i's Pareto weight increases the resources directed to children if and only if $\alpha_2^i \ln w^i < \alpha_2^j \ln w^j$.

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[5]In contrast with CRV, children's welfare in level and not its logarithm is considered.

The corresponding leisure demand for each individual is:

$$L^i\left(w^i, \phi^i, u^K\right) = \left(\alpha_1^i + \alpha_2^i u^K + \beta^i\left(\ln\left(w^i T + \phi^i\right) - \left(\alpha_1^i + \alpha_2^i u^K\right)\ln w^i\right)\right)\frac{w^i T + \phi^i}{w^i}, \quad i = m, f \tag{12}$$

The corresponding income elasticity of leisure demand is $\eta_{L^i/\left(w^i T + \phi^i\right)} = 1 + \beta^i\left(\frac{w^i T + \phi^i}{w^i L^i}\right)$. Therefore, if leisure is a normal good, it would be a luxury good if $\beta^i > 0$ or a necessity good if $-\frac{w^i L^i}{w^i T + \phi^i} < \beta^i \leq 0$.

Returning to the first stage, where the optimal choice of the sharing rule and children's welfare is obtained, it is assumed that children's utility has a CES form with constant returns:[6]

$$u^K\left(K, h_K^m, h_K^f\right) = \left[\gamma^m (h_K^m)^\rho + \gamma^f\left(h_K^f\right)^\rho + \gamma^K K^\rho\right]^{1/\rho}, \quad \gamma^i > 0, \sum\gamma^i = 1, \rho \leq 1 \tag{13}$$

where the cost share of input i (proportion of total expenditure spent on children's welfare on input i) is γ^i and the elasticity of substitution is $\sigma = \frac{1}{1-\rho}$. To take into account the number of school-age children (N_K) in children's utility production, the function $\gamma^i = \frac{\exp\left(\tilde{\gamma}_1^i + \tilde{\gamma}_2^i N_K\right)}{1+\exp\left(\tilde{\gamma}_1^m + \tilde{\gamma}_2^m N_K\right)+\exp\left(\tilde{\gamma}_1^f + \tilde{\gamma}_2^f N_K\right)}$, $\gamma^i \in (0,1)$, $(i = m, f)$ is used in the estimation process, where $\tilde{\gamma}_1^i$ and $\tilde{\gamma}_2^i$ are estimated $(i = m, f)$. The condition $\gamma^i > 0$ is imposed with this function and γ^K is defined as the residual $\gamma^K = 1 - \gamma^m - \gamma^f$. The condition $\rho \leq 1$ is imposed in the estimation process by the function $\rho = 1 - \exp\left(-\tilde{\rho}\right)$, where $\tilde{\rho}$ is estimated.

Resolving problem (8), the parents' time and expenditure allocations to children's welfare $\left(h_K^m, h_K^f, K\right)$ are:

$$h_K^i = \left(\frac{\gamma^i}{w^i}\right)^\sigma A^{-1/\rho}u^K, \quad i = m, f \tag{14}$$

$$K = \left(1 - \gamma^m - \gamma^f\right)^\sigma A^{-1/\rho}u^K \tag{15}$$

where $A = (\gamma^m)^\sigma(w^m)^{1-\sigma} + \left(\gamma^f\right)^\sigma\left(w^f\right)^{1-\sigma} + \left(1 - \gamma^m - \gamma^f\right)^\sigma$. Also, the respective expenditure function becomes $e^K = A^{1/(1-\sigma)}u^K$.

Correspondingly, the solution to the first stage problem described in (9) is:

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[6]In contrast, CRV considered a less general function such as the Cobb-Douglas.

$$\phi^i = \frac{1}{\mu}\left(\frac{\lambda^i}{(w^i)^{\beta^i}}\right) - w^i T, \quad i = m, f \tag{16}$$

$$u^K = \frac{1}{A^{1/(1-\sigma)}}\left(y - \phi^m - \phi^f\right) \tag{17}$$

where μ is the Lagrange multiplier of this problem and can be written as:

$$\mu = \frac{-1}{A^{1/(1-\sigma)}}\left[\lambda\left(\frac{\alpha_2^m \ln w^m}{(w^m)^{\beta^m}}\right) + (1-\lambda)\left(\frac{\alpha_2^f \ln w^f}{(w^f)^{\beta^f}}\right)\right]$$

Finally, to complete the model is required to assume a functional form for the Pareto weight of the mother. Following CRV, the form selected is:

$$\lambda\left(w^m, w^f, y, z1, z2\right) = \frac{\exp\left(\Lambda_1 + \Lambda_2\left(w^m/w^f\right) + \Lambda_3 y + \Lambda_4 z_1 + \Lambda_5 z_2\right)}{1 + \exp\left(\Lambda_1 + \Lambda_2\left(w^m/w^f\right) + \Lambda_3 y + \Lambda_4 z_1 + \Lambda_5 z_2\right)}, \quad \lambda \in [0,1] \tag{18}$$

The resulting system consists of five equations $\left(h_K^m, h_K^f, K, L^m, L^f\right)$ as functions of $\left(w^m, w^f, y, z_1, z_2\right)$. So, substituting (16)-(18) in (12), (14) and (15), the specification of the system is:

$$h_K^i = \left(\frac{\gamma^i}{w^i}\right)^\sigma A^{-1/\rho}\left(\frac{y + \left(w^m + w^f\right)T}{A^{1/(1-\sigma)}} + \frac{C}{D}\right), \quad i = m, f$$

$$K = \left(1 - \gamma^m - \gamma^f\right)^\sigma A^{-1/\rho}\left(\frac{y + \left(w^m + w^f\right)T}{A^{1/(1-\sigma)}} + \frac{C}{D}\right) \tag{19}$$

$$L^i = \begin{pmatrix}\alpha_1^i + \alpha_2^i u^K + \beta^i\left(\ln\left(\frac{-\lambda^i\left(w^j\right)^{\beta^j} A^{1/(1-\sigma)}}{D}\right) - \left(\alpha_1^i + \alpha_2^i u^K\right)\ln w^i\right)\end{pmatrix} \\ \times \left(\frac{-\lambda^i\left(w^j\right)^{\beta^j} A^{1/(1-\sigma)}}{w^i D}\right), \quad i = m, f$$

where:

$$C = \lambda\left(w^f\right)^{\beta^f} + (1-\lambda)\left(w^m\right)^{\beta^m}$$

$$D = \lambda\left(w^f\right)^{\beta^f}\alpha_2^m \ln w^m + (1-\lambda)\left(w^m\right)^{\beta^m}\alpha_2^f \ln w^f$$

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Note that a sufficient condition for existence of L^i is that α_2^i is negative $(i = m, f)$. This condition is imposed in the estimation process by the function $\alpha_2^i = -\exp\left(\tilde{\alpha}_2^i\right)$, where $\tilde{\alpha}_2^i$ is estimated $(i = m, f)$. If α_2^i is negative, the utility of parent i augments with the level of u^K, all else equal. Nonetheless, the imposition of this condition in the estimation process does not eliminate the possibility that α_2^i is not statiscally different from zero.

The system is estimated using the Feasible Generalized Nonlinear Least Squares (FGNLS) estimator. Robust standard errors are used to guard against possible misspecification of the variance matrix.

4.2   Data

Estimation of the empirical model specified in the preceding subsection is information demanding. It requires principally data of labor market (labor supply of individual members and its respective wage rates), non-labor income of the household, and expenditures and time devoted to children's education. A survey that satisfies the information requirements is the Mexican Family Life Survey (MxFLS). It is a multithematic and longitudinal survey and it has been elaborated by researchers of the Universidad Iberoamericana (UIA) and the Centro de Investigación y Docencia Económicas (CIDE).

A subsample is extracted from the second wave of the MxFLS (2005-2006) in which are only present nuclear families with only children under 15 years and at least one school-age child, where both parents work. The reason for use only nuclear families is focus in households where the decision process is concentrated in the parents, reducing the possibility of interaction with other kin within the household. Also, the analysis will be concentrated in children in school-age (5-14 years) because 1) it is more possible that a child in this age has not bargaining power in household decisions, 2) the survey only registers child's education information in this range of age. Therefore, this study captures allocation decisions for children who can be attending school until secondary level.

There are 8,328 households (34,873 individuals) in the MxFLS-2, from which 3,990 (48.16%) are nuclear families, and 1,380 of it have only children under 15 years and at least one school-age child. After keeping families where both parents work and without missing information, a sample of 158 families is obtained. The sample is relatively small, a way to augment it could be to consider also families in which the nonparticipation in the market labor of a household member is present; however, this would involve both a theoretical and

an empirical model more complex than the presented here, and until now not developed yet.[7]

The time measurement unit is hours per week for those variables related with time allocations. Time devoted to children's education corresponds to helping offsprings with studies/homework. With respect to leisure time, it is computed as 112 h/week (16 h/day) less time allocated to market work and child's education. Education expenses in children of the household includes expenses on enrollments fees, exams, school supplies, uniforms, and transportation.

The measure of the wage rate is the average hourly earnings (labor income/hours worked in last year). Non-labor income is the average weekly household current income less labor income of parents. The distributional factors z_1 and z_2 considered in this study are respectively age and education differences between parents.

Table 1 presents descriptive statistics for the sample analyzed. On average, fathers spend more time on market work and mothers on helping their offsprings in their studies. There is not a significant difference in wage rates. Also, the male is on average the oldest in the couple, although he has less education than the female; this result is not surprising considering that in the sample both parents participate in the labor market.

4.3   Results

4.3.1   Estimation results

The structural collective model presented in (19) is highly nonlinear, so several local minima were found. The estimation results presented in Table 2 correspond to the minimum

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[7]The recovery of some elements of the decision process in collective models of household labor supply has been based basically on the observation of household's working hours, wages and nonlabor income. In the standard unitary model, the wage of one household member doesn't affect the labor supply of the other member. Opposite to this result, wages do affect bargaining position within the household in a collective context, then a change in the wage of one member can influence labor supply of her/his partner via the sharing rule of the nonlabor income.

Therefore, identification is not initially possible when nonparticipation is considered. However, there have been advances of collective labor supply models that include participation decision without public consumption and household production (Donni 2003; Blundell, Chiappori, Magnac, and Meghir 2007). Both studies consider the case where the working hours of wife vary continously, but they differ about the continuity of husband's labor supply (Donni assumes that it is continuous and Blundell et al. reduce the problem between not to work or work full time). In both models at most one member decides not to participate and the participation decision relies on explicitly postulate a reservation wage accompanied by certain assumptions.

Table 1. Descriptive statistics

	Mean	StdDev
Mother		
Time devoted to children's education (h/week)	2.981	4.552
Time devoted to market work (h/week)	33.576	17.818
Wage rate (MXN per hour)	36.200	64.025
Age	34.272	5.698
Years of education	9.949	4.072
Father		
Time devoted to children's education (h/week)	1.652	2.986
Time devoted to market work (h/week)	47.766	16.535
Wage rate (MXN per hour)	37.768	61.797
Age	36.994	7.627
Years of education	9.158	4.129
Education expenses (MXN per week)	85.563	193.294
Nonlabor income (MXN per week)	257.508	389.086
Age difference w.r.t. father	-2.722	6.237
Education difference w.r.t. father	0.791	4.261
Number of children in school-age	1.899	0.823

scaled RSS found. The estimated parameters are sorted in three panels. Panel A contains the parameters related with parents' preferences (11). Leisure is apparently a luxury good for the father since the estimate of β^f is positive, it is not estimated precisely for the mother. Because α_2^m and α_2^f are statistically different from zero, the consumption-leisure decision for both parents is nonseparable from the resources allocated to children's welfare. This means that children's welfare changes have not only an income effect but also a substitution effect on individual decisions such as labor supply.

Panel B contains the parameters related with the children's utility production (13). With respect to the coefficients related with the input share γ^i, the fixed part of the share $\left(\tilde{\gamma}_1^i\right)$ is greater for the mother than for the father. In the case of the variable part $(\tilde{\gamma}_2^i)$, as it increases the number of children, all else equal, mother's time participation increases whereas the one of the father decreases. Therefore, considering these two estimates, average cost share of the father is always inferior to the one of the mother in the production of children's utility. Additionally, it seems that parental time and expenses on education are imperfect complements in children's utility production (the elasticity of substitution σ, although significant, its magnitude is low).

Finally, the estimated parameters of mother's Pareto weight (18) are showed in Panel C. All else constant, mother's relative wage has a significantly positive impact on her Pareto weight (Λ_2), so an increase in it could produce a greater influence of her preferences on household allocation. Also, an increase of mother's age difference with respect to father (Λ_4) seems to have a positive impact on mother's power. Non-labor income (Λ_3) and education difference (Λ_5) do not seem to have a significant impact on mother's power for the sample used.

Table 2. Estimation results

	Estimate	Robust Std. Err.
A. Parent's preferences [see (11)]		
Mother		
α_1^m	0.7703**	0.3550
α_2^m (Children's utility)[†]	-0.0027***	0.0004
$\tilde{\alpha}_2^m$	-5.9160***	0.1409
β^m	-0.0737	0.0544
Father		
α_1^f	-0.8844***	0.3076
α_2^f (Children's utility)[†]	-0.0033***	0.0008
$\tilde{\alpha}_2^f$	-5.7000***	0.2479
β^f	0.1577***	0.0399
B. Children's utility production [see (13)]		
γ^m (Mother's time)[††]		
$\tilde{\gamma}_1^m$	31.4583***	0.3463
$\tilde{\gamma}_2^m$	1.0956***	0.0118
γ^f (Father's time)[††]		
$\tilde{\gamma}_1^f$	29.5919***	0.1216
$\tilde{\gamma}_2^f$	-0.0012***	0.0000
σ (Substitution elasticity)	0.0499**	0.0242
ρ (Substitution parameter)[†††]	-19.0493*	9.7290
$\tilde{\rho}$	-2.9982***	0.4853
C. Pareto weight parameters [see (18)]		
Λ_1	-0.6434	0.5193
Λ_2 (Mother's relative wage)	0.4113***	0.0467
Λ_3 (Non-labor income)	0.0001	0.0001
Λ_4 (Age difference w.r.t. father)	0.0130*	0.0073
Λ_5 (Education difference w.r.t. father)	0.0061	0.0086

The expressions in braces refer to the objects that are related to the respective parameters

* p<0.1, ** p<0.05, *** p<0.01

[†] $\alpha_2^i = -\exp(\tilde{\alpha}_2^i), \ i = m, f$

[††] $\gamma^i = \frac{\exp(\tilde{\gamma}_1^i + \tilde{\gamma}_2^i N_K)}{1 + \exp(\tilde{\gamma}_1^i + \tilde{\gamma}_2^i N_K) + \exp(\tilde{\gamma}_1^j + \tilde{\gamma}_2^j N_K)}, \ i \neq j, \ i = m, f$

[†††] $\rho = 1 - \exp(-\tilde{\rho})$

4.3.2 Changing the distribution of power between parents: consequences for resources directed toward children's education

The purpose of this subsection is analyze how a change of parents' bargaining position is reflected in the intrahousehold allocation of resources, with emphasis on allocations made for children's welfare. Doing this exercise under a collective model that considers also public consumption is more appropriate that other empirical studies that assume implicitly that fathers do not derive utility from their children's welfare (i.e. it is a private good for mothers). With this idea in mind, Table 3 reports the partial derivatives of the sharing rule (columns 1 and 2) and the elasticities of some variables and functions of the model (columns 3 to 10) with respect to the factors included in the Pareto weight function. Calculations are evaluated at two school-age children, in the mean wage across both sexes, and sample means of the other covariates; this sets the baseline.

The impact of a marginal change in one variable on the residual non-labor income allocated to the mother and the father after expenses in children's welfare is provided in columns 1 and 2, respectively. While the non-labor income to share between parents is constant in the case of private goods only, so there is an exact trade-off between parents' shares, this condition does not have to be fulfilled when public consumption is also considered since the amount to share varies with the cost of producing children's utility. In this sense, a MXN \$1 increase in the mother's wage (which is equivalent to a weekly increase of MXN \$33 in her labor income, at the mean of hours worked by mothers), translates into a transfer of MXN \$45 to the production of children's utility and to the father. Moreover, the transfer amounts to MXN \$6 to the father, although this effect is not precisely estimated. A MXN \$1 increase in the father's wage (equivalent to a weekly increase of MXN \$47 in his labor income), translates into a transfer of MXN \$81, of which MXN \$26 are received by the mother. The outcome that ϕ^i is decreasing in w^i was expected in the sense that it is plausible that i's wage increase does not dramatically improve i's bargaining position, so that i is not able to keep all the direct gains and to extract in addition a larger fraction of household non-labor income conditional on public expenditures. Also, these results suggest that the fathers in the sample are more concerned about their children than mothers and that they behave in a more altruistic manner toward their partners than what mothers do. The next row indicates that the effect of a MXN \$1 increase in household non-labor income on parents' shares is not statistically significant. The impact of the distribution factors on the sharing rule are reported in the next couple of rows. In general their effects over the shares are imprecisely estimated at the baseline, although one year more of age difference of the mother with respect to the father induces an additional MXN \$22 of

income to the mothers.

Columns 3 and 4 show private consumption elasticities for mothers and fathers respectively. At the baseline, both own- and cross-wage elasticities of mothers' private consumption are positive and statistically significant (0.595 and 0.332, respectively). Fathers' own-wage elasticity is negative (-0.563) and cross-wage elasticity is positive (0.059), although both are not statistically significant. Both mothers' and fathers' private consumption elasticities with respect to non-labor income are positive (0.026 and 0.024, respectively), but only mothers' elasticity is statistically significant. These results imply for households in the sample that mothers benefit most from increments of household labor and non-labor income. Distribution factors seems to have a negligible effect on private consumption of both parents.

Columns 5 and 6 present various labor supply elasticities for the mother and father respectively. At the baseline, the own wage elasticity of mothers labor supply is positive and statistically significant, a ten percent increase in her wage would induce aproximately a 1.7 percent increase in the hours of market work. In contrast, a ten percent increase in her partner's wage would lead mothers to decrease their worked hours in approximately 3.1 percent. A standard labor supply model could also have accounted for mother's observed behavior when substitution dominates income effect, but it would not necessarily have explained the effect of father's wage over her supply. Father's own wage elasticitiy is negative but very small (-0.005) and not statistically significant. This insensibility of male's labor supply is commonly found in the literature. Instead, his labor supply is more sensitive to a change in mother's wage, it would be reduced in 2.8 percent when his partner's wage augments ten percent. Overall, the labor supply of the mother is more sensitive with respect to changes in own- and cross- wage rates than the labor supply of the father.

Columns 7 to 9 report elasticities of resources directed to children's utility production. When the wage rate of one parent increases, parental time dedicated to children's education augments for both parents accompanied by an increase in expenditure related with it. This was expected because both parents obtain utility of children's welfare (parameter α_2^i is negative for both parents) and the complementarity of factors related with children's utility production (magnitude of σ relative low). Therefore, if household labor income augments there would be more resources directed to children. However, contrary to the common presumption that mothers care more for children than fathers, the wage elasticities calculated in the baseline for resources directed to children's education are higher for changes in father's wage than for mother's. When mother's wage augments ten percent,

mother's time dedicated to children would augment 1.7 percent (although not significantly) and both father's time and expenses would increment 2.2 percent. Meanwhile, if father's wage increases ten percent, both mother's time and expenses would increment 6 percent and father's time 5.5 percent. From the perspective of the theoretical model, this would indicate that with an increase in father's bargaining power of the same magnitude as that of the mother's, his willingness to pay for children's welfare is more responsive to changes to increases in his resources for private consumption than hers. Consequently, the "amount" of children's utility (u^K) produced inside the household would be higher when father's wage augment than when mother's augment. This result is showed in column 10, in which (17) is computed in the baseline.

A change of non-labor income does have a positive impact on the resources directed to children. Because there is not a significant change on parents' share for private consumption when household non-labor income increases, more resources are directed to the production of children's utility. Indeed, a positive change of ten percent in non-labor income would induce an augment of aproximately 1.3 percent of resources directed to children's utility production. Moreover, the augment on parents' time dedicated to children is accompanied by a reduction on both labor supplies, an increase of ten percent in non-labor income would induce a decrease of aproximately 0.5 percent of both parents' time dedicated to market work.

Finally, due to its economically negligible influence on mother's Pareto weight in the sample used, the distribution factors, mother's age and education difference with respect to father, do not have an impact on household market work and resources directed to children's utility production.

Table 3. Partial derivatives of the sharing rule and elasticities

| Variable | $\partial\phi^i/\partial$Variable | | Elasticities | | | |
| | | | Private consumption | | Market work | |
	Mother (1)	Father (2)	Mother (3)	Father (4)	Mother (5)	Father (6)
Mother's wage	-45.386*** (9.280)	6.112 (4.382)	0.595*** (0.079)	0.059 (0.174)	0.169* (0.098)	-0.282*** (0.100)
Father's wage	26.609** (11.999)	-81.261*** (11.547)	0.332*** (0.071)	-0.563 (2.007)	-0.308*** (0.102)	-0.005 (0.069)
Non-labor income	0.139 (0.143)	-0.112 (0.111)	0.026** (0.013)	0.024 (0.051)	-0.047*** (0.012)	-0.052** (0.022)
Age diff. w.r.t. father	22.480* (12.511)	-18.113 (11.932)	-0.015 (0.010)	0.006 (0.025)	0.004 (0.006)	-0.038* (0.022)
Education diff. w.r.t. father	10.579 (14.706)	-8.524 (12.501)	0.002 (0.003)	-0.001 (0.004)	-0.001 (0.001)	0.005 (0.007)

* $p<0.1$, ** $p<0.05$, *** $p<0.01$. Delta-method standard errors are in parentheses.

Table 3. - *Continued*

| Variable | $\partial \phi^i / \partial \text{Variable}$ | | Elasticities | | | |
| | | | Children's utility production | | | |
	Mother (1)	Father (2)	Mother (7)	Father (8)	Expenses (9)	u^K (10)
Mother's wage	-45.386***	6.112	0.168	0.218*	0.218*	0.190
	(9.280)	(4.382)	(0.136)	(0.124)	(0.124)	(0.138)
Father's wage	26.609**	-81.261***	0.603***	0.553***	0.603***	0.580***
	(11.999)	(11.547)	(0.123)	(0.117)	(0.123)	(0.117)
Non-labor income	0.139	-0.112	0.127***	0.127***	0.127***	0.127***
	(0.143)	(0.111)	(0.015)	(0.015)	(0.015)	(0.018)
Age diff. w.r.t. father	22.480*	-18.113	0.006	0.006	0.006	0.006
	(12.511)	(11.932)	(0.010)	(0.010)	(0.010)	(0.010)
Education diff. w.r.t. father	10.579	-8.524	-0.001	-0.001	-0.001	-0.001
	(14.706)	(12.501)	(0.002)	(0.002)	(0.002)	(0.002)

* $p<0.1$, ** $p<0.05$, *** $p<0.01$. Delta-method standard errors are in parentheses.

The following exercise consists in an analysis of the impact of exogenous changes in Pareto weights on household allocations. According to the theoretical model, a turn in the balance of power between parents could change household outcomes even when the budget set does not change. With this idea in mind, Figure 1 presents the effect of an exogenous change on the range of 0 to 10% in favor of one of the parents (or equivalently a change on Λ_1 of approximately 28%) on some variables of the model. Calculations are evaluated again at two school-age children, in the mean wage for both parents, and sample means of the other covariates.

Changes of mother's Pareto weight in favor of herself are denoted by the symbol ● and in favor of the father by ◊. The upper left panel of the figure focuses on the change on parents' share with respect to their respective shares evaluated at the baseline. Mother's share responds more than the father's to changes in the distribution of power. The upper center panel shows mother's marginal willingness to pay for children's utility standarized by the marginal cost of producing it. Therefore, both MWPs must add up to one. At the baseline, mothers have a larger willingness to pay than fathers ($MWP^f/MC > 0.5$); situation that is maintained when her bargaining power shifts around 10%.

The upper right panel illustrates the percentage change on children's utility. Although mothers have at the baseline a larger MWP than fathers for resources directed to children's utility production, this feature is not translated into more (less) resources directed to children when mothers' Pareto weight increases (decreases), instead there is a reduction (increase) on it. This outcome is due to fathers' MWP being more income sensitive than that of mothers. Since in the baseline both parents have the same wage, the difference in MWPs income sensitivity depends on which parent has the lowest parameter $\hat{\alpha}_2^i$, being more negative fathers' than that of mothers'.

The lower panels concentrate on outcomes in the individual domain for both parents, calculated as percentage change in the three panels. The lower left panel shows private expenditures, the lower center focuses on leisure, and the lower right displays labor supply. The beneficiary member of more bargaining power enjoys an increment on both private expenditures and leisure as a consequence of the increase on their share; meanwhile other member's consumption is reduced. Nevertheless, the reaction of mothers' private expenditure is larger than that of fathers' and in the case of leisure fathers' reaction is larger than that of mothers'. Regarding labor supply, one member's higher power is related with a reduction of their hours offered to the labor market and an increase of the hours offered by their partner.
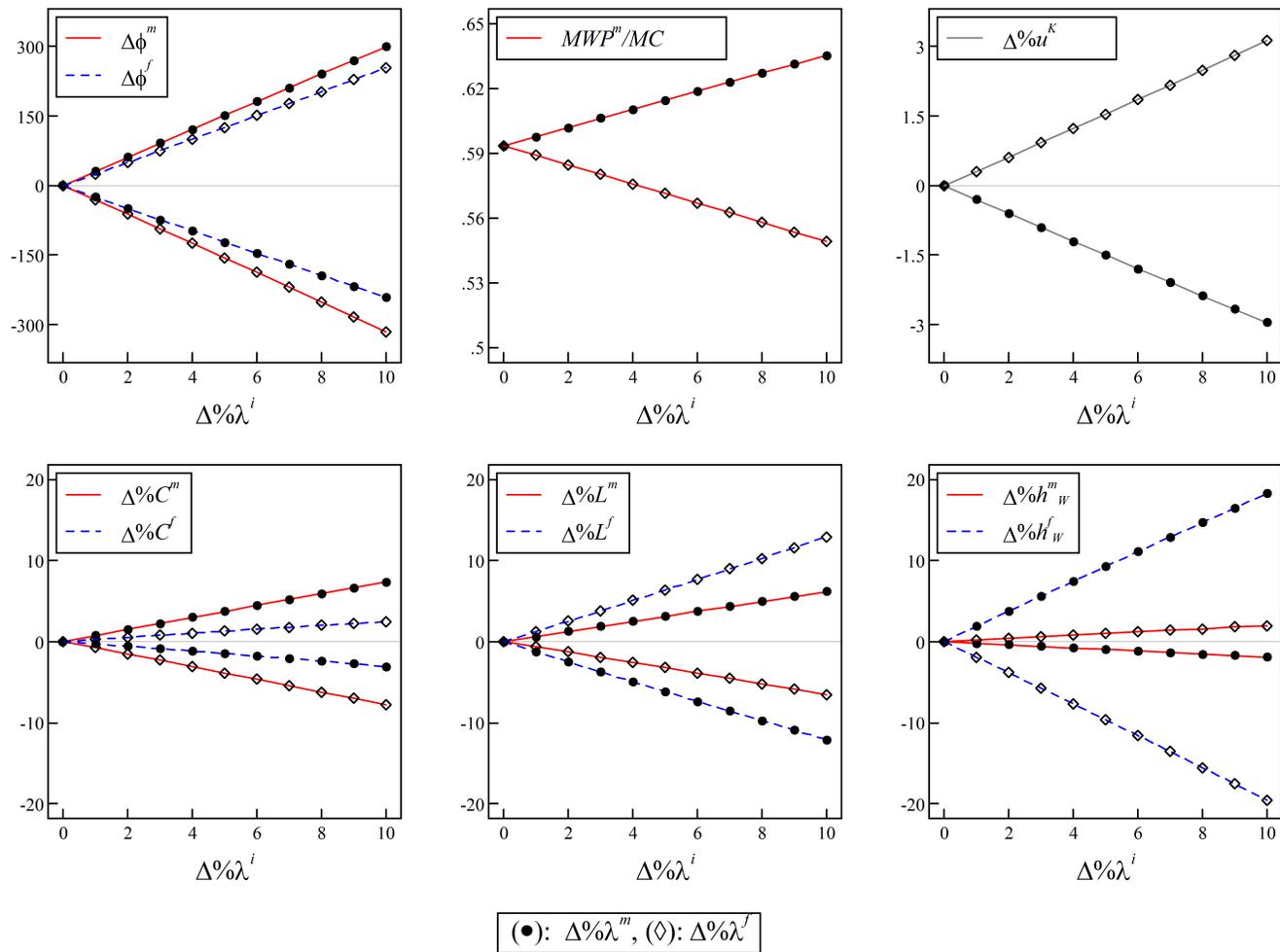
Figure 1. Effect of change in parents' Pareto weight

5   Final remarks

A consensus has been developed that households do not behave as a singular entity, but that the behaviors of each individual member should be considered as well. If a particular household member is subject of policy interest, to enhance the effectiveness of targeting her/him is important to comprehend in a better way how household decisions are taken.

The collective model has emerged as a more appropriate framework to analyze household behavior issues. Under this approach, resources invested in child's welfare depend not only on the household budget constraint but also on the parents' individual preferences and their relative position in the decision making. In this paper, an empirical application is used for the collective theoretical model of Blundell, Chiappori, and Meghir (2005). In the model, both parents derive utility from the production of children's utility by means of a public good and their time. This paper analyzes how household allocations respond to changes in the balance of power between the couple, particularly resources directed toward children's education.

The model is applied to a sample of Mexican nuclear families from the MxFLS-2, and focuses on couples in which both work, with only children under 15 years and at least one school-age child. Based on Cherchye, de Rock, and Vermeulen (2010), the estimation strategy takes advantage of the two-stage representation of the collective model to construct a flexible functional specification for the observables.

The estimation results highlight some interesting findings for this particular sample. In the production of children's utility by means of resources used in their education, parental time and expenditure are complementaries inputs, so it is not entirely possible to substitute time for expenditure or time between parents to augment children's wellbeing. Next, bargaining power distribution depends significantly of mother's relative wage and age difference with respect to father. Finally, parents' preferences are not separable from resources directed to children's welfare.

In order to analyze if a change on the decision process between parents affect resources directed to children's welfare, some elasticities are calculated with respect to factors that influences the decision process (as summarized by the Pareto weights). For families with average characteristics in the sample, evidence that mothers care more for their children than fathers were not found. Maintaining all else equal, there are more resources directed to children's education when a father has more power via his relative wage.

Since the set of options available for household allocations changes with wages and non-labor income, a clearer picture of the effect on a change on the balance of power between parents could be obtained if there is an exogenous change on the decision process that keeps unchanged household budget constraint. In this sense, graphical illustrations of an exogenous change in mothers' Pareto weight at the baseline are provided. Although mothers' have a larger marginal willingness to pay than fathers for children's utility, it is only when father's power increases, but not when mothers have more power, that more resources are directed to children's utility production.

The results discussed here highlight that in the design of policies focused in children is important to avoid presumptions about which household member cares more for children, instead, the knowledge of the internal dynamics between household members could improve the design effectiveness of this type of targeting policies.

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